SOUNDS OF POWER: MISSIONARY PIPE ORGANS AND ANDEAN RESISTANCE

by

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A DISSERTATION

Presented to the School of Music and Dance
and the Division of Graduate Studies of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Doctor of Philosophy

September 2021

DISSERTATION APPROVAL PAGE

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Title: Sounds of Power: Missionary Pipe Organs and Andean Resistance

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Degree awarded September 2021

DISSERTATION ABSTRACT

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In colonial Peru, the Spanish crown relied on religious orders, most notably Dominicans, Franciscans, and Jesuits, for accelerating processes of colonization. The dissemination of Christian art, architecture and music, and most of all the agency of indigenous people in their production played a key role in facilitating the acceptance of the new religious and political system. Previous research on Peruvian colonial music culture and its role as a vehicle for colonization focused on practices in urban centers. The lack of (written) primary sources seems to turn rural areas into a less attractive research territory for musicologists.

In this dissertation, I advocate for a more inclusive approach. By investigating seventeenth-century pipe organs as material remains of Franciscan missionary music culture, I will show how reactions to colonial forces and Christianization in rural Andean locations could follow tendencies different from those in urban areas. Indigenous musicians in cities tried to "fit" into the European system in order to be accepted by the ruling Spanish elite. By contrast, the indigenous-built pipe organs at my fieldwork-site in the Peruvian Colca Valley show distinctly native-Andean influences. I argue that this syncretism can be interpreted as a means of the colonized to advance reactionary politics and to create spaces for re-negotiation of indigenous identity. Not only does my dissertation show the necessity of considering rural Peruvian music history in modern scholarship for arriving at a more complete picture of colonial culture; it will also evidence the advantages of a mixed- methodology approach. Organology proves to be a useful tool in the absence or scarcity of written primary sources, but it is not sufficient by itself. The methodology I propose combines methods from historical musicology and organology with concepts and approaches from ethnomusicology, anthropology, and post-colonial studies. I have termed it *archeo-ethno-organology*.

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ACKNOWLEDGMENTS

I wish to express sincere appreciation to Professors Vanscheeuwijck and Wolf for their assistance in the preparation of this manuscript. In addition, special thanks are due to Professor Lowthorp, whose expertise on ethnographic fieldwork was very helpful during the writing phase of my dissertation. This dissertation was supported in part by grants from the Tinker Foundation and the SYLFF Foundation, as well as through two scholarships from the P.E.O. (Philantropic Educational Organization) International.

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CHAPTER I

INTRODUCTION – *STATUS QUAESTIONIS*

The aim of this dissertation is to investigate how historical religious music practices in the Peruvian Andes reflected power relationships between Spanish colonizers and indigenous people. In colonial Peru, the Spanish crown relied on religious orders, most notably Dominicans, Franciscans, and Jesuits, for facilitating and advancing processes of colonization. My study focuses on the presence of Franciscan missionaries in the *Valle de Colca* (ca. 100 miles North of Arequipa) in the seventeenth century. In the so-called *reducciones* and *doctrinas* – small missionary villages, originally founded to ensure enough workforce in the mines[1] – natives were instructed in building Christian churches, in producing Christian artwork and artefacts, and in music. I investigate historical pipe organs, the only material remains of colonial music culture in the Peruvian Colca Valley, to explore the vehicles that the indigenous Collagua and Cabana cultures used for reclaiming part of their authority. I am seeking to answer the question how native Andeans used music practices to retain and express their own identity within the new Christian framework, and how this could possibly fit into a broader agenda of passive resistance.

[1] The *encomienda* system forced indigenous people to pay tributes in the form of cheap labor in return for Christian education. Consuelo M. Vasquez, and Christian O. Estrella Canaza. *Fragmentos de la Historia del Distrito de Callalli* (thesis, Universidad Nacional San Agustín de Arequipa, n.d.), 29.

Current existing scholarship on Peruvian Baroque organs is scarce, if not to say non-existent. Easily accessible literature is limited to an article by Wolfgang Lindner,[2] and to one book, written and self-published in 1990 by Hans van Gemert. Titled *Órganos Historicos del Peru = Historic Organs of Peru,*[3] this 181-pages long work mainly discusses colonial organs of the Cusco region. The author considers these instruments as part of a preserved tradition – a tradition that continued from the sixteenth into the late eighteenth century, while organs in Europe changed in the meantime. Van Gemert's book contains factual errors; for example, he refers to a short octave as a keyboard "starting on E."[4] He also states that European organs before 1600 had drone pedal pipes,[5] while organs from that time period, even in Spain, often had independent pedals.[6] Also, van Gemert's approach to organ restoration is questionable. He considers modernizing the instrument by, for example, changing the key action and adding compound bellows.[7] Nevertheless, *Órganos Historicos del Peru* is significant, because it is the only publication so far that is devoted entirely to Peruvian colonial organs, and as such, it raises awareness about their uniqueness and supports the need for researching, cataloguing, preserving, and restoring these instruments.

Research on Peruvian colonial organs ends here; however, other work on Latin-American pipe organs does exist, and is relevant to my research, since pipe organs in any of the Spanish colonies might have been constructed under similar circumstances. Religious orders who played a role in colonization were moving around and spreading out through the

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[2] Wolfgang Lindner, "Órganos Coloniales e Históricos Del Perú y De La Región Del Cuzco," *Revista Andina* 42 (2006): 219–48, accessed April 2 2021, http://www.revistaandinacbc.com/wp-content/uploads/2016/ra42/ra-42-2006-08.pdf.
[3] Hans van Gemert, *Órganos históricos del Perú = Historic organs of Peru* (Hillbrow, Sudáfrica: H. van Gemert, 1990).
[4] Ibid., 110.
[5] Ibid., 90.
[6] Rudolf and Hannelore Reuter, *Orgeln in Spanien* (Kassel: Bärenreiter, 1986), 15.
[7] Gemert, *Órganos históricos,*107.

entire continent. Therefore, colonial pipe organs from other parts of Latin America might reflect similar issues of hybridity and power relationships. Guy Bovet, who specializes as a performer in Spanish Baroque organ music, catalogued Brazilian and Mexican organs in the 1980s. None of his research is available in published form; it does, however, live on in the work of members of the *Instituto de Órganos Históricos de Oaxaca (IOHIO)* in Oaxaca, Mexico, with which Bovet collaborated for years. David Warren Steel, for example, published an article on Oaxacan organs in the (currently offline) internet journal *Sapaan 3* in 2004.[8] Warren positions the Oaxaca region as one of the richest repositories of historical pipe organs in the world and acknowledges the distinct, regionally rooted style of the Oaxacan instruments. He does not go in depth, though, about the question of *why* these instruments are different, who their builders were, and under which circumstances they were constructed. Similarly, a magazine article by Sonya Valencia discusses the rich decoration of the organs in Tlacochahuaya, Zautla, Tamazulapan, and Yanhuitlán.[9] Valencia calls attention to the fact that the decorative elements constitute depictions of regional, tropical Oaxacan flowers and other plants.[10] Ryszard Rodys in *Órganos, Organeros y Organistas* traces the history of the organs in the cathedral of Oaxaca: from a 2-foot-portative brought over by the Spanish in the sixteenth century, through a blooming organ culture in the seventeenth and eighteenth centuries, up to neglect and beginning decay in the twentieth century.[11] Christopher Holman in 2018 published an interview with *IOHIO* director Cicely

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[8] David Warren Steel, "Historic Organs of Oaxaca," Instituto de Órganos Históricos de Oaxaca, A.C., accessed March 30, 2019, http://home.olemiss.edu/~mudws/oaxaca/.
[9] Sonya Valencia, "Oaxaca posea un tesoro en órganos tubulares históricos," *Actual* no. 99, (December 2001).
[10] Ibid., 110.
[11] Ryszard Rodys, "Órganos, organeros y organistas de la catedral de Oaxaca," Google Docs, last modified 2010, accessed March 30, 2019, https://docs.google.com/document/d/1uccl3ifAfUIPWMTAH6txt37rO2GRr062E-56fuO9pRc/preview.

Winter, which provides information about the Institute's preservation and restoration work.[12] Finally, Edward Pepe, co-founder of the *IOHIO*, in his article on organ builder Jorge De Sesma presents evidence that organists and organ builders in colonial Mexico City were aware of developments and trends among Iberian organ builders of their time. Pepe shows how importing organs and requesting organ builders from Europe for new organ building projects was a practice that continued throughout the seventeenth century.[13] While this article is not directly related to my field of research – organs in small, rural, missionary villages – it is still important to consider, as it demonstrates the differences between colonial music practices in bigger cities and those in small-scale environments. Comparing Pepe's findings to van Gemert's, we must conclude that the organ scene in Mexico City was a living, breathing organism that was subject to regular outside influences coming from Europe, while developments in organ building in rural Peru were more stagnant.

Since pipe organs were introduced to the Americas by Europeans, we, as scholars, are automatically inclined to draw comparisons with European organ culture. Upon doing so, we find that the instruments are similar to a certain extent: both Latin American and European Baroque organs work through the same simple, mechanical principles; both organ types are tracker organs; both types have cases and a layout of pipes in ranks; both have a wind system that requires human pumpers – as opposed to, for example, water, weight, or a spring. However, there is one very obvious difference: European organs were made by

[12] Cicely Winter and Christopher Holman, "Historic Organs in Oaxaca, Mexico," *Vox Humana,* last modified 2018, accessed March 25, 2019, http://bit.ly/vhwinter1-.
[13] Edward C. Pepe, "An Organ by Jorge De Sesma for Mexico City Cathedral," *Revista De Musicología* 29, no. 1 (2006): 127-62, accessed March 25, 2019, https://www.jstor.org/stable/pdf/20798165.pdf?refreqid=excelsior%3A476e6c7866ad3634a25e269eaad65e08.

Europeans. Many of the above-mentioned publications, on the other hand, present evidence that Latin American organs were built by indigenous people: Rodys mentions indigenous organists and organ builders as part of the organ culture of Oaxaca cathedral,[14] van Gemert even presents summaries of several contracts with indigenous organ makers in seventeenth- and eighteenth-century Cusco,[15] and Valencia concludes that the indigenous floral decoration on many rural organs in the Oaxaca region points to local Oaxacan artists and organ makers.[16]

Considering this fundamental difference between European and South American organs, one would also expect different scholarly approaches. It is therefore worth taking a closer look at the methodologies currently in use. European-rooted pipe organ studies have always focused on two aspects: history and organology. The mandatory outline of every final thesis written at the *LOTO,* the National Academy for Organ Consultants in the Netherlands, can be taken as representative here: it demands an overview on the history of the instrument and the archival situation first, then a technical description of its current state. These are the standard ingredients used in the writings of many pipe organ scholars. We find it across the globe, from Ralph Blakely writing about an organ in Collegedale Tennessee[17] to Oscar Mischiati's and Luigi Ferdinando Tagliavini's work about the organs of San Petronio in Bologna[18] to complete monographs of Dutch organs contained in *Het*

[14] Rodys, "Órganos".
[15] Gemert, *Órganos históricos,* 99-103.
[16] Valencia, "Tesoro," 110.
[17] Ralph Blakely, "A New Organ in Tennessee," *The Musical Times* 130, no. 1757 (1989): 431-35, accessed April 10, 2021, doi:10.2307/1193464.
[18] Oscar Mischiati, and Luigi Ferdinando Tagliavini, *Gli Organi della Basilica di San Petronio in Bologna* (Bologna: Pàtron Editore, 2013).

Historische Orgel in Nederland.[19] Sometimes the two components get intertwined and woven together in the argumentation, like in Hans Hulverscheidt's *Stumm-Orgel in Schwarzrheindorf;* and sometimes, they are present to very unequal extents, as in Speerstra's *The North German Research Project* at the Göteborg University, which almost exclusively focused on pipe and case measurements, metal alloys, and wood drying processes.[20]

The situation is similar in Latin American pipe-organ scholarship, in that history and organology are both present, and both represented to different extents. Some articles in the biyearly IOHIO bulletins, such as *El IOHIO Encuentra Otros Tres Órganos No Documentados* or *El IOHIO Descubre Más Órganos No Documentados*[21] focus on the technical, material and organologic investigation of organs. Other publications of the IOHIO, like *Referencias a los Órganos en los Archivos de Oaxaca,*[22] *Sor María Clara del Santísimo Sacramento,*[23] or the work of IOHIO-affiliated Ryszard Rodys, *Órganos, Organeros y Organistas de la Catedral de Oaxaca*[24] concern themselves almost exclusively with written sources and historical scholarship. Hans van Gemert's publication about Peruvian organs takes the classical approach and combines history and organology. He first presents a general overview on the archival situation and the history of the pipe organ in

[19] Jan Jongepier, P. van Dijk, et. al, *Het historische orgel in Nederland* (Amsterdam: Nationaal Instituut voor de Orgelkunst, 1999).
[20] Joel Speerstra, *The North German Organ Research Project at Göteborg University* (Göteborg, Sweden: Göteborg Organ Art Center, Göteborg University, 2003).
[21] "Publicaciones." Instituto de Órganos Histricos de Oaxaca Mexico, accessed April 10, 2021. http://iohio.org.mx/esp/publicaciones.htm.
[22] "Referencias a los Órganos en los Archivos de Oaxaca," *Boletín del Instituto de Órganos Históricos de Oaxaca, A.C.,* (March 2004).
[23] Cecily Winter, and Ryszard Rodys. "Sor María Clara del Santísimo Sacramento and her Family: A Dynasty of Organists and Organbuilders in 18th- and 19th-Century Oaxaca, Mexico," accessed April 10, 2021, http://iohio.org.mx/eng/engFIMTE-article-Sormariaclara.htm.
[24] Ryszard Rodys, "Órganos, organeros."

Peru, then gives details about his case studies: mostly organological facts and photographs, but preceded by historical facts if the archival situation allows for it. This corresponds greatly to the format that Rudolf and Hannelore Reuter use when describing Iberian organs from the same time period in their book *Orgeln in Spanien*.

In sum, European and Latin American approaches do not differ at all. Both are entirely concerned with history and organology, in varying proportions to each other. Latin American pipe organ scholarship does not make any attempt to expand its methodology beyond tried and proven concepts. This practice is very dissatisfactory. European organ studies can easily be conducted within their own contextual framework, using their regional and local history, culture, and organology as the standard reference points. However, organs in Latin America have an indigenous aspect to them that cannot be explained within a European cultural framework. Current scholarly approaches do not yet fully honor this aspect, though in the last few decades we have seen a significant increase in a more nuanced approach. In fact, by pointing towards indigenous involvement in the construction process of the organ, but neither explaining nor deeply investigating it, current publications on Latin American pipe organs often raise more questions than they provide answers.

I therefore contend that colonial pipe organs cannot sufficiently be researched under the criteria of some old-fashioned or conventional organology, but rather following some of the more recent developments. On the other hand, it is not only scholarly controversial, but also ethically questionable to examine the expressions of a colonized culture under the paradigm of the colonizer. Rather, I suggest to get my research in line with the newest developments in "New Musicology" that take a more interdisciplinary approach, which we could describe using such a term as "archeo-ethno-organology," since, compared to

Olsen's work, my research focuses more directly on organology.[25] Since the instruments in question are neither built nor played anymore, nor has any knowledge survived in the immediate area on how to play, build, or maintain them, they can therefore be regarded as quasi-archeological. They have to be examined in their proper cultural context. Therefore, my research has an ethnographic aspect. I consequently base my approach on Dale Olsen's methodological model for ethno-archeo-musicology, which consists of four interrelated and interacting components: "history," "iconology," "music archeology," and "ethnographic analogy."[26] The first two – searching in archives, transcribing documents, analyzing and conceptualizing the insights gained from looking at imagery in primary sources – are a musicologist's daily work. For my dissertation project, I focused my research on the *Archivo Histórico San Francisco de Lima* and the *Archivo Arzobispal* in Cusco in search of such primary evidence as correspondence, cashbooks, decrees, and travel reports. Imagery is present on the instruments themselves, primarily in the form of saints (e.g. Santa Cecilia) depicted while playing a keyboard instrument. "Music archeology" ideally draws on approaches from archeological research, and thus shows scholarly consideration for the site where the instrument is discovered. For instruments as complex as pipe organs, it also includes a substantial technical component of examining the material remains of the instrument. Here, researchers typically draw on synthesized knowledge about acoustics, sound properties, basic engineering principles, material science, measuring techniques, and quantitative methods for assessing the gained data. While Olsen's methods also include playing the preserved instruments, in the case of

[25] Dale Olsen, "Ocarinas for Call and Communication," in *The Music of El Dorado: The Ethnomusicology of Ancient South American Cultures* (University Press of Florida: Gainesville, FL, 2002), 100-127.
[26] Ibid.

deteriorated pipe organs, we often have to forego this idea. "Ethnographic analogy" refers to drawing conclusions based on the actions of both the descendants of the examined culture and other cultures that use similar instruments. In my case, it includes interviewing locals, observing their behavior, monitoring their attitude not only towards the organs, but more generally towards typically Christian-European elements in their daily life. During my fieldwork stays in Callalli, Chivay, Sibayo, and other Colca villages, I noticed customs and traditions that are rooted in both an indigenous and a European cultural background. Loosely drawing on Olsen's model, I hypothesize that a closer observation of present traditions could point me into the right direction about past customs, and therefore support me when drawing conclusions based on findings from the "history" and "music archeology" components of my research.

Latin American musicological scholarship would undoubtedly benefit from even more integration of history and ethnography. Fortunately, it has been happening for quite some time now in other disciplines that engage in Latin American studies. Art historian Tom Cummins for example, in an article about early colonial artifacts, offers fascinating insights on the role that early colonial artifacts played in the (re-)negotiation of culture.[27] Similarly, Rolena Adorno examines early colonial Peruvian literature under the angle of indigenous resistance.[28] My methodology therefore includes concepts from works by art historians, such as Cummins, Donahue-Wallace, Gauvin Bailey, or Dean and Leibsohn, and literary scholars, such as Rolena Adorno.

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[27] Tom Cummins, "'Let Me See!' Reading is for them. Colonial Andean Images and Objects 'como es Costumbre tener los Caciques Señores,'" in *Native Traditions in the Postconquest*, ed. Elizabeth Boone and Tom Cummins (Dumbarton Oaks, 1998): 94.
[28] Rolena Adorno, *Guaman Poma: Writing and Resistance in Colonial Peru: Second Edition* (Austin: University of Texas Press, 2000).

To avoid what Dean and Leibsohn call "freezing people in the past," talking about culturally mixed objects necessitates engaging with indigenous people and their culturally mixed life in the present. The work of anthropologist Michelle Bigenho has particularly guided me in this ethnographic part of my thinking process. Bigenho, in her study of songs of the Toropalca and the Yura communities (both in Potosí, Bolivia) writes about the fact that contact with other cultures raises more awareness about what is "different" in the own culture, and therefore can contribute positively to preserving the latter.[29] Other works of inspiration were Ferdinando Rios' article about *Andean Conjunto,*[30] Jorge Martinez Ulloa's *Indigenous music and identity,*[31] Tucker's *Permitted Indians,*[32] and Thomas Turino's *Somos el Peru.*[33] Each of these authors addresses some form of cultural dominance and consequently the adaptation of a musical tradition for facilitating the renegotiation of cultural identity.

Understanding Andean culture in general goes hand in hand with understanding Andean spirituality. In his ethnography about Kalinkira, Bolivia, ethnomusicologist Stobart shows that Andean people perceive strong connections between spiritual life, the seasonal-agricultural cycle, and cultural and musical practices.[34] Marisol de la Cadena's article about indigenous cosmopolitics contains explanations on the "conceptual reflections beyond

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[29] Michelle Bigenho, *Sounding Indigenous: Authenticity in Bolivian Music Performance* (Hampshire: Palgrave MacMillan, 2002).
[30] Fernando Rios, "The Andean Conjunto: Bolivian Sikureada and the Folkloric Musical Representation Continuum," *Ethnomusicology Forum* 21, no. 1 (2012): 5-29.
[31] Jorge Martinez Ulloa, "Indigenous Music and Identity: Musical Spaces of Urban Mapuche Communities," in *Views from the South: A Latin American Music Reader,* ed. Javier F. León and Helena Simonett (Urbana: University of Illinois Press, 2016): 356- 378.
[32] Joshua Tucker, "Permitted Indians and Popular Music in Contemporary Peru: The Poetics and Politics of Indigenous Performativity," *Ethnomusicology* 55, no. 3 (2011): 387-413.
[33] Thomas Turino, "Somos El Perú: 'Cumbia Andina' and the Children of Andean Migrants in Lima," *Studies in Latin American Popular Culture* 9 (1990): 15-37.
[34] Henry Stobart, *Music and the Poetics of Production in the Bolivian Andes* (Burlington, VT: Ashgate Publishing Co., 2006).

politics" and are an important complement to Stobart's book.[35] Both Stobart's and de la Cadena's ideas allowed me to draw conclusions about the cultural observations I made on my research trips to the Colca Valley.

In my theoretical approach, I draw on Homi K. Bhabha's concept of hybridity. In 1994 Bhabha theorized about hybridity as a device for intervening in the exercise of authority: the colonized introduce elements of their own customs and traditions into the colonizer's culture, resulting in an unsettling situation of unclarity for the colonizer.[36] By contrast, the idea of mimicry describes individuals who imitate the colonizer's customs without adapting them. While the practice of mimicry might help an individual to gain a higher social status, it often does not change the overall socio-political situation, but rather advances colonial processes. In the Colca Valley, the missionizing tactics of the Franciscans included preaching in Quechua and adapting Christian holidays and customs to fit into the set of native traditions. Primary and secondary literature points to a broad diversity of colonizing attitudes. Missionaries did not necessarily perceive themselves as imposing their culture on indigenous people, and some were occasionally genuinely interested in the native culture. Nevertheless, their practices accelerated acculturation by ensuring easier acceptance of Christianity by the indigenous population. While scholars in arts and architecture have already examined similar phenomena, my research leaves the purely visual realm by investigating musical instruments. Indigenous-built seventeenth-century pipe organs, the only material evidence of colonial music culture still present in the Colca Valley today, show particular Andean sonic, material, and decorative

[35] Marisol de la Cadena, "Indigenous Cosmopolitics in the Andes: Conceptual Reflections beyond 'Politics,'" *Cultural Anthropology*, 25(2) (2010): 334–370.
[36] Homi K. Bhabha, *The Location of Culture* (London; New York: Routledge, 1994).

characteristics that help explain the way indigenous people reacted to the new imposed culture.

Throughout this dissertation, I will address a broad spectrum of research questions, covering topics from organology, ethnomusicology, performance practice, and music history. Each chapter deals with a different aspect of Andean pipe organs and the (music) culture they belonged to, and attempts to answer a different set of questions.

The current chapter outlines my dissertation project and its significance for current scholarship. It has examined if the present scholarly approach to Latin American organs is appropriate and sufficient for understanding these instruments, their contextual background, and their implications. It has explained that it would be erroneous to examine pipe organs in Latin America with methodologies from classical organology or historical musicology. Rather, as their study belongs to the overarching discipline of ethno-organology or archeo-ethno-organology, scholars should study them using methodologies they share with other disciplines in the humanities.

Chapter 2 presents an overview on Peruvian pipe organs. The questions I ask are: where do we find organs in Peru, and what kind of organs? What is their relevance in current scholarship on Peruvian colonial music practices? What is the general *status quo* of this scholarship and where is its focus? The chapter is based on the only two extant publications on Peruvian organs: van Gemert's *Órganos Históricos* and Kloeckner's DMA-thesis on the post-colonial Peruvian organs, complemented by data I collected about preserved instruments. I outline the two main types of pipe organs in Peru (colonial/post-colonial), provide information about their location and accessibility. I also explain the scarcity of colonial organs in larger Peruvian cities through the economic situation and in particular through views on “national” culture and representation in the nineteenth and twentieth centuries. Finally, I juxtapose the facts that on the one hand, colonial musicological research so far has mostly been done in Peruvian urban environments, whereas on the other, data show that the biggest part of colonial organs are in rural environments. To this end, I discuss recent research by G. Baker, V. Rondón, V. Vera, and G. Tomlinson, among others. The chapter ends with the contention that, especially in lack of written evidence, investigating these instruments, which are the only material remainders of their past music culture, is long overdue.

In chapter 3, I introduce my research location, the Valle de Colca through its history and its current situation. How have past interactions between cultures shaped present-day traditions in the Colca Valley? How do Colca residents perceive their own cultural identity? How is that identity expressed? And what can we learn about past (music) culture by observing present-day customs? By reflecting on local traditions in the Colca, especially with regard to musical practices, I introduce and explain concepts of cultural mixing, identity, and authenticity and their potential as a tool for uncovering political, social, and spiritual-cultural contexts. I base my discussion on works by T. Turino, A. Weidman, H. Glassie, W. Mignolo, and others. The chapter will point out that, while historically, musicological scholarship often explored cultural influences in one direction (i.e., from the dominant culture towards the less dominant one), the other direction has often been overlooked. In the Colca Valley, traditional Andean cultural expressions, such as dances (the *wititi*, the *carnaval*, etc.) and festivities (the *tinkachi*, the *wilancha…*), exhibit a clear Christian-European influence. They, on the other hand, also actively exerted influence on

Christianity as it is lived by present-day Colca people. Colca pipe organs fit into this pattern of this multi-way cross-cultural exchange. Studying these organs potentially could not only contribute valuable information to our understanding of past processes, but also to our understanding of identity-forming in culturally mixed societies today. Conversely, understanding today's cultural identity of the Colca people could point us into the right direction about past interactions.

Chapter 4 presents an in-depth description of the pipe organs in three locations of the Colca Valley: Sibayo, Callalli, and Tisco. The leading question of this chapter is: does a distinct "type" of colonial Andean organ exist? And if so, what are its characteristics? The chapter asks in which way the three instruments are similar to each other, and what variations – if any – exist between them. Besides the results of sonic research (sound spectra and waveform of the sound produced by each pipe), this chapter will contain pipe scalings and other technical data of the three instruments. This will aid me in making inferences about the instruments' sonic properties at a time when they were still playable. This chapter will also contain an attempt to date the original construction of the instruments, as well as later applied changes. First discussed is the organ in Sibayo, the presumably most original organ of the three. My second case study describes the pipe organ in Callalli, an instrument that has experienced changes in the early twentieth century. My third and final case study concerns the organ in Tisco, sometimes claimed to be the oldest organ in the Colca Valley. My three case studies will allow me to establish a specific type of colonial Andean organ. I point out similarities between the three instruments and draw parallels in their constructional features, material use, and artistic characteristics. The conclusion of this chapter pleads for treating these organs in their own right, and not merely regarding them as European objects in a colonial environment.

Chapter 5 deals with repertoire questions. What music was possibly played on Peruvian colonial organs? And how was it performed? I work with a comparative approach – loosely drawing on Dale Olsen's methodological concept of ethnographic analogy – since there is no preserved sheet music extant in the churches of the Colca Valley. The chapter therefore examines the performance practice of relevant European organ music from the seventeenth century and compares it to the technical and musical properties of the Peruvian instruments described in my case studies. The music I use for this study are two organ pieces by Francisco Correa de Arauxo, who is regarded today as one of the primary Baroque composers of the Iberian Peninsula. Relevant sources include Francisco Correa de Arauxo's *Facultad Organica*, Juan Bermudo's *Declaración,* Adriano Banchieri's *L'Organo Suonarino,* Girolamo Diruta's *Transilvano* and Tomás de Santa Maria's *Libro llamado Arte de tañer Fantasía*. This chapter shows that the technical properties of Peruvian colonial organs are compatible with Spanish Baroque organ repertoire. However, it also argues that the music was most probably improvised, which might have left room for indigenous influences.

What role might Colca pipe organs have played in the local deceleration of processes of colonization? Chapter 6 attempts to answer this question by investigating how much indigenous identity is expressed in the Colca pipe organs. In Peru, the dissemination of Christian art, architecture and music, and most of all, the agency of indigenous people in their production played a key role in facilitating the acceptance of the new religious and political system. By discussing indigenous elements found in the three case studies of chapter 4, I show how the reactions to colonial forces and Christianization in rural Andean locations followed tendencies different from those in urban areas. Geoff Baker describes how indigenous musicians in Peruvian colonial cities tried to "fit" into the European system in order to be accepted by the ruling Spanish elite. By contrast, the pipe organs at my fieldwork sites could be interpreted as expressions of hybridity in Homi K. Bhabha's sense, as a means of the colonized to undermine the power of the colonizer and to advance reactionary politics, as I explain in the conclusions in chapter 7. In addition to Bhabha's theories, I base my thought process on works of other scholars who have addressed hybridity and indigenous resistance, most notably Tom Cummins, Gauvin Bailey, Carolyn Dean, Dana Leibsohn, and Rolena Adorno. In chapter 7, I furthermore provide an epilogue to the entire dissertation, in addition to the conclusions to chapter 6.

The appendix contains, besides images and scaling tables referred to in my chapters, also a glossary for terms both specific to organ building and specific to culture and spirituality in the Peruvian Andes. In addition, structural drawings of parts of organs and organ pipes, equally included in the appendix, will help the reader to better understand the discussion of technical properties and specific characteristics of Andean pipe organs.

This dissertation intends to contribute to a range of fields and disciplines within the humanities. It is relevant for current musicological scholarship by further filling an existing gap in historical (ethno-)organology. At this point, no significant research has been done on colonial Peruvian pipe organs, and existing sources on this subject are limited to a handful of non-peer reviewed publications. Instead of merely contributing to it, my work has the potential to change our current discourse about colonial music culture. Other musicologists, such as Geoffrey Baker and Tess Knighton, have researched Peruvian colonial music in urban centers, where the reaction of indigenous people to European music followed different principles than in non-urban areas. Research on colonial music in rural environments so far has been neglected, due to the lack of written primary evidence. However, this dissertation shows that welcoming small-scale missionary settings – and more generally rural areas of Peru – into current scholarship potentially changes our scholarly viewpoint by evincing a more resistant attitude of indigenous people than formerly assumed. Based on Bhaba's concept, I reevaluate the previously implied seeming compliance of indigenous people in Peru with Christianity's artistic and musical practices through the idea of silent activism. Tom Cummins has pointed out that it would not be right to automatically perceive post-contact Andean art and artifacts as mere "testimonials of oppression."[37] Therefore, instead of stereotyping indigenous people as the "passive" party after contact, hybrid pipe organs in the Colca Valley cast the spotlight on the indigenous agency that was at play. In that regard, my dissertation will hopefully be of general relevance for scholars of (post-)colonial studies, anthropology, history, and religious/missionary studies, since it provides new insight on cultural hybridity and indigenous identity.

From a methodological standpoint, this dissertation also illustrates the importance of studying material culture in musicological scholarship. It presents organology, especially its most contextual branch, critical organology, as a valuable, yet unfortunately often overlooked research tool in the absence of written source material. Lastly, this dissertation demonstrates the usefulness of Homi Bhabha's – sometimes opposed – concept of hybridity as a means of resistance against colonial power. Critical voices that refer to

[37] Cummins, "Let Me See!" 94.

hybridity as “condoning” colonization do not take into account that – in some cases – not considering hybridity can potentially contribute to condoning colonization even more. It depicts indigenous people as complying with foreign rules, as willingly accepting a new system, as mindlessly mimicking the colonizer’s customs. In the case of Peru, this leads to a distorted picture of colonial music culture – a picture that this dissertation tries to delineate and reimagine.

CHAPTER II

"WHERE NO MAN HAS GONE BEFORE": THE SEARCH FOR COLONIAL PIPE ORGANS IN PERU

2.1 Introduction

This chapter aims to provide a rough inventory of pipe organs in Peru and an overview of where to find those organs, in what approximate time period they were built, and how they are used today – if at all. It is not meant to supply detailed information about technical, organological, or sonic matters; an in-depth discussion of three case studies will be the focus of chapter 4. Nor will it present a history of organ building in Peru, as such scholars as Kloeckner and van Gemert have already provided such a historical overview. Rather, the intent of this chapter is to show what is available for pipe organ research *at present* in Peru, and to outline the two main types of instruments that scholars can expect to find. After providing this information, I will position Peruvian colonial pipe organs in the current scholarly discourse. A discussion of present-day colonial music scholarship in Peru will demonstrate how and why an increased consideration of these pipe organs will contribute to our understanding of Peruvian music history and will fill lingering gaps in our current state of knowledge.

Initially, I planned to base this chapter on two data sources: first, information collected through looking for organs in Peru during the months of July, August, and September 2020 – an endeavor that fell victim to the raging Covid-19 pandemic during that year. Second, a brief survey emailed to as many parishes in Peru as possible, containing questions about the possible (past or present) existence of a pipe organ in the respective parish. The support I would have needed from the Austrian Embassy in Lima to approach church authorities for organizing the distribution of my survey unfortunately suffered from both the effects of Covid-19 and several personnel changes at the Embassy. However, I believe that the sample size presented in this chapter is still substantial enough to allow for valid conclusions. It consists of the numerous organs I saw in the Lima, Cusco, and greater Arequipa regions on various field trips to Peru; data supplied to me by my Peruvian informants; and information from extant scholarship on Peruvian pipe organs.

2.2 Organs in Peru

2.2.1 Organs from the colonial period

The book *Historic Organs of Peru* lists fourteen places in southeastern Peru where the author, Hans van Gemert, discovered organs from the colonial period.[1] Among them is the city of Cusco, where not only the cathedral but also a few convents and parish churches still possess (the remains of) colonial organs. The other thirteen towns are all in rural areas. For most of them, it is impossible to obtain census information about their population since statistics are only available for the entire district. Even then, the highest population of all the places listed in van Gemert's book is only 5,768 individuals (the district of Lamay).[2] The smallest village that van Gemert visited is Maras, with a population of 1,730 in 2021.[3] In between those two population extremes, the numbers are quite evenly distributed: the mean is at 3,653 and the median lies close by at 3,643. The thirteen towns are not only

[1] Hans van Gemert, *Organos históricos del Perú = Historic Organs of Peru* (Hillbrow, South Africa: H. van Gemert, 1990).
[2] Census data for this entire section is taken from https://www.distrito.pe unless stated otherwise.
[3] *Wikipedia*, s.v. "Comunidad De Maras," last modified July 9, 2020, accessed April 2, 2021, https://es.wikipedia.org/wiki/Comunidad_de_Maras.

small, they are also difficult to reach: only two of them can be accessed by bus from Cusco. Of the other eleven, one necessitates the use of a private car or taxi for the entire trip from Cusco, while the other ten at least allow for part of the trip – often a small part – to be completed by public bus.

Wolfgang Lindner's article "Órganos coloniales e históricos del Perú y de la Región del Cuzco" is, regarding the examples it provides, mostly congruent with van Gemert's study.[4] The two organs in this article that are not part of van Gemert's book are in Oropesa and Yanque.[5] The district of Oropesa has a population of about 6,000 and is accessible from Cusco via a combination of bus and private car transporatation. Yanque, a small town of ca. 2,300 inhabitants in the greater region of Arequipa, can be reached by a (relatively comfortable) bus ride of several hours, followed by a half-hour ride in a three-wheeler taxi.

The website of the "Asociación Tomás de Herrera – para el Estudio y la Preservación de los Órganos Antiguos de la Región Andina" lists thirty-six places in Peru where colonial organs are present.[6] Only three are larger cities: Cusco (population: 118,316), Trujillo (population: 318,914) and Ayacucho (population: 113,380). Four are towns of between 10,000 and 50,000 inhabitants: Lampa (Puno region), Ayaviri (Puno region), Guadalupe (La Libertad region), and Pomata (Puno region), with Guadalupe being the largest (population: 43,965) and Lampa the smallest (population: 14,780). The rest consists of very small towns or villages, with populations between 980 in Mamara (Apurimac region) and 7,406 in Pitumarca (Cusco region).[7] Two of the villages mentioned

[4] Wolfgang Lindner, "Órganos Coloniales e Históricos Del Perú y De La Región Del Cuzco," *Revista Andina* 42 (2006): 219–48, accessed April 2 2021, http://www.revistaandinacbc.com/wp-content/uploads/2016/ra42/ra-42-2006-08.pdf..
[5] Lindner, "Órganos," 232, 235.
[6] "Asociación Tomás de Herrera: Para el Estudio y la Preservación de los Órganos Antiguos de la Región Andina," accessed April 10, 2021, http://asociaciontomasdeherrera.blogspot.com/.
[7] Population numbers for this paragraph are for the entire district.

on the website are so small that they are not searchable in Google; and some others, while yielding a general result in a Google search, seem not to exist in the Peruvian census.

All the organs listed by the sources above are small-scale instruments. Neither source provides any measurements, but judging from the occasional photographs, the organs are not much wider than one meter, and about two meters high. They feature only a few ranks of pipes, no pedals, and a single manual. This information aligns with my own experiences with colonial organs in both the Cusco and greater Arequipa region. All organs I encountered there between 2016 and 2020 were similarly small in size, featuring a simple, flat front; a single manual; and no pedals. Of the nine colonial instruments I visited, eight were in small towns or villages in districts of usually only a few thousand inhabitants; only one was in a parish church in the city of Cusco. To see most of these instruments, I had to hire a private driver, since there were hardly any bus connections and mostly no paved roads. The largest and easiest-to-reach town I visited was Andahuaylillas in the greater Cusco region, which also featured a famous church that is a tourist attraction. Andahuaylillas has a population of 5,465 and is easily accessible from Cusco by bus. The smallest village I visited was Sibayo in the greater Arequipa region; the district of Sibayo has a population of 675. Occasionally, a village was so remote that Google Maps could not even provide driving instructions and had difficulties placing an exact pin on the map, making it even more difficult for scholars to access. Tisco, for example, a small village (district population: 1,450) with a beautifully preserved colonial organ, can only be reached via a four-hour private car ride from Chivay, which in turn lies a five-hour bus ride from Arequipa.

To reduce the dizzying avalanche of facts and figures, population numbers, and travel times given above into one simple statement, we could say that the largest part of colonial organs in Peru can currently be found in small, rural communities. These communities are often located in remote areas and are difficult to reach by public transport. Some are so small that no census information is available for them, such as the village of Chuquinga near Apurimac, where an almost pipe-less instrument in a beautifully preserved case is located – a secret tip from my Peruvian friend and organ builder Alejandro Rodriguez. In sum, scholars intending to study Baroque organs in Peru have to follow the trail of colonial instruments that leads them away from the cities into small villages, through rural regions, and up the high mountains of the sometimes inhospitable, yet beautiful, Peruvian Andes.

2.2.2 Organs from the Republican Era

"Nineteenth-Century Organs in Peru" is a DMA thesis presented in 2002 at Rice University by Phillip Kloeckner.[8] The scope of Kloeckner's thesis is Peruvian organs after the colonial period, a time in which organs were usually imported and thus no longer built in Peru. Kloeckner's work contributes to Peruvian organology by focusing on the exceptional case of Innocente Foglia, an Italian immigrant organ builder who lived and worked in Peru in the late nineteenth and early twentieth century.

Kloeckner describes four organs built by Foglia: in Lima, San Francisco (1901) and Los Huerfanos (1901); in Cuzco, Santa Teresa (1898); and in Arequipa, San Francisco

[8] Phillip David Kloeckner, "Nineteenth-Century Organs in Peru and the Special Case of Innocente Foglia" (DMA thesis, Rice University, 2002).

(date unknown).[9] Foglia's organs are small, one-manual instruments in a rather eclectic style, and they demonstrate that their builder was acquainted with historic organs. For example, he uses spring chests exclusively,[10] which was a typical trade in southern-European Renaissance organ building. The stop nameplates and stop faces professionally engraved in porcelain,[11] on the other hand, are a typical nineteenth-century feature.

Even though Foglia built in Peru – and was probably the only person *living* in Peru at that time who engaged in organ building – his organs can still be regarded as European imports. After all, Foglia came from Europe, kept his Italian citizenship, and learned his trade in Europe, presumably passed down from previous generations of his family of organ builders in Bergamo in Northern Italy.[12] Foglia probably moved to Peru because of the immense popularity of European organs there during the early Republican era. Other Peruvian organs from the second half of the nineteenth century onwards listed by Kloeckner were all built by European organ makers as well. Some famous names come along, such as Karl Walcker, Aristide Cavaillé-Coll, and Hippolyte Loret. Of the thirteen organs on Kloeckner's list, eight are in Lima, three in Arequipa, one in Cusco, and one in Pisco. None is located in smaller towns or villages. Three of these organs were built in the 1850s, two in the 1910s, and two in the 1920s and 1930s; the most substantial part, however, originates in the 1870s or late 1860s.[13]

Lindner's account of post-colonial organs overlaps with Kloeckner's writings as much as it does with van Gemert's book for colonial instruments, containing only two

[9] Ibid., 16.
[10] Ibid., 17.
[11] Ibid.
[12] Ibid., 15.
[13] Ibid., 6.

organs that are not listed by Kloeckner. One, in the medical center Clínica Stella Maris in Lima, is a small, two-manual instrument with pedals, built by Gebr. Fleiter (Germany) in 1959.[14] The other one is in Huancayo, the capital of the province of Junín, a large city[15] with its own airport, located within driving distance (185 road miles) from Lima. This instrument was built by the Migliorini brothers from Italy in 1921.[16]

Through both my research and my work as a teacher and performer in Peru, I became acquainted with similar examples to the instruments presented by Kloecker and Lindner. The organ in the Roman Catholic church Maria Auxiliadora in Lima*,* for example, is a two-manual, late-Romantic instrument built by the Tamburini firm in Crema in the 1930s with electro-pneumatic transmission and stop action. The organ is currently in need of serious repair, but was upon my inspection still decently playable. It is a versatile instrument that accommodates repertoire from Bach to late-Romantic composers, and it is currently in use as an instrument for the liturgy.

Somewhat older, from the nineteenth century, is the organ in the Cathedral church in Arequipa. This typical early-Romantic Belgian (Flemish) instrument with three towers, hanging shoulders, and undivided flats, built by François-Bernard Loret, was inaugurated in 1854 and has undergone repairs and maintenance work several times since then.[17] It currently seems to be in good condition, although I was not able to verify this fact personally, since I only received permission to "inspect" the instrument from a distance of

[14] Lindner, "Órganos," 243.
[15] Sources are inconclusive about the population of Huancayo, and provide different numbers ranging from 116,953 (distrito.pe) to 845,615 (www.wikipedia.es)
[16] Lindner, "Órganos," 245.
[17] Janet Vizcardo, "El órgano de Loret, la Joya de la Catedral de Arequipa," RPP, last modified January 31, 2016, accessed April 2, 2021, https://rpp.pe/peru/actualidad/el-organo-de-loret-la-joya-de-la-catedral-de-arequipa-noticia-645927.

ten feet. However, the fact that there are concerts given on this organ shows that the instrument must be at least playable.[18]

Much newer than every other instrument mentioned so far is the organ in the German Lutheran Church in Lima, completed and inaugurated in 2016. Its maker, Orgelbau Klais from Bonn, Germany, followed a typical modern allrounder concept, primarily consisting of a neo-Baroque specification, to which additions (mainly borrowed from the French Romantic period) were made for increased sonic possibilities. This 21-stop instrument, with a swell in the second manual and sub- and super-octave couplers for every *Werk*, serves a wide range of repertoire. The organ is currently in use for worship services and concerts, and it has previously been used for pedagogical purposes as well. At the time of my last concert in the German Lutheran Church in 2017, the organ did not exhibit any deficiencies or damage. However, since then, repeated reports have reached me that the high humidity in the city and the way of controlling climate in the church have caused severe problems in the tracker action, resulting in stuck keys, howling pipes, and other ailments.

Building on the efforts of the German Lutheran Church to establish a modern pipe organ culture in Peru, consisting of concerts, festivals, and classes for young aspiring organists, the Conservatorio Nacional (now Universidad de Música Nacional) in Lima began to make plans in 2016 for buying a small instrument from Europe for one of their concert halls. Contact was initially established with the Dutch organ builder Klop.[19] Later on though, a lesser-known European organ builder became the preferred choice, as the

[18] "Concierto en la Catedral con el órgano de Loret," El Búho, last modified November 6, 2017, accessed April 2, 2021, https://elbuho.pe/2017/11/concierto-la-catedral-organo-loret/.

[19] Sergio Portilla Arriola, e-mail message to the author, December 19, 2017.

University's dean had seen one of his organs on a visit to France and was enchanted by the design of the case.[20] In the same year, the *Universidad* also planned to buy an electronic "organ," a three-manual Opus 370 by Johannus, as a practice instrument for its students.[21]

In conclusion, this section has shown that the presence of Peruvian colonial organs in mainly rural communities does not mean that there are no historical organs in urban areas. Imported instruments, or organs made by European builders in Peru, date back as far as the mid-nineteenth century. Even though they are much newer than their colonial counterparts, they, too, have considerable historical value. As we will see below, many of them are testimonials of a time in which Peru transitioned from a colony to an independent country, and notions of "nation," "national identity," and "cultural identity" were hotly discussed.

2.2.3 Historical context

The previous two sections have introduced two very different types of organs: a colonial type, built in Peru, maybe even locally by indigenous people, *criollos*, or *mestizos*[22] after an initial period in which Spanish organ builders introduced the trade in the country; and a post-colonial, Republican-Era type, built mostly abroad by distinguished European organ makers, then shipped to Peru and assembled there. In trying to locate specimens of these two categories, we recognize a clear trend: the colonial instruments are – with few exceptions, such as the cathedral organs in Cusco – in the countryside. The

[20] Carmen Escobedo, conversation with the author, Lima, September 2017.
[21] Sergio Portilla Arriola, e-mail to the author, November 8, 2017.
[22] See glossary in appendix A.

newer organs, on the other hand, are all in urban areas. Kloeckner explains the predominance of European-import organs in city churches through the fact that they were prestige objects that smaller countryside churches could not afford to buy. He also touches on the political and socio-economic context, explaining the tendencies of Peruvian authorities in the second half of the nineteenth century to "promote less restrictive trade with European countries" because of the rising importance of *guano* fertilizer as an export product.[23]

The tendency to replace older organs with state-of-the-art new ones was not limited to Peru; rather, it was a global trend that was initiated in the second half of the nineteenth century and lasted for almost a hundred years. Significant changes in organ building – the invention of the compound bellows, the swell chest, the Barker lever, and later the pneumatic and electro-pneumatic action – had created a completely new organ type that complied better with the artistic needs and the *Klangideal* of the time. In Europe, many organs from the Baroque era were discarded instead of repaired and maintained, in favor of their monstrous, ostentatious successors that projected the wealth of the parish, abbey, or monastery they were built for. So was, for example, the old Dupont organ of 1714 in the Cathedral of Nancy replaced by a Cavaillé-Coll instrument in 1861. Around the same time, Juan Roques built a new Epistle organ in the Cathedral of Burgos, where until then Juan Echevarria's organ from 1706 had served. In the St. Petri Dom in Bremen, the Arp Schnitger instrument from 1693/98 was given up in 1849 in favor of a new organ built by Johann Friedrich Schulze from Paulinzelle. The latter instrument was subsequently replaced in 1894 by Wilhelm Sauer's colossal Op. 951. In 1856, the original organ in the

[23] Kloeckner, "Foglia," 5.

Ulm Minster, dating back in part to the sixteenth century, was substituted with a new monumental instrument by E. F. Walcker from Ludwigsburg. Today's organ in the Salem Minster was built in 1901 by Wilhelm Schwarz, who inserted a completely new instrument into the case of the then-existing Baroque organ by Johann Dirr (1771), reusing solely Dirr's facade pipes.

The history of the organ in the Grote Kerk in Veendam, Netherlands, best exemplifies the influence of both a striving for prestige and the availability of funds for organ building in the late nineteenth and early twentieth centuries. The magnificent, late classical Timpe organ, built in a Baroque-influenced tradition rooted in the Schnitger School – via Timpe's teacher, Heinrich Hermann Freytag – was done away with in the 1920s, in favor of a then-modern pneumatic instrument by Faber and Dienes. The primary catalyst behind this development was the newly-arrived organist and music director of the church, Dr. Fried Schmidt-Marlissa, a young and determined German musician who strove to establish a vibrant organ- and church-music culture in the north of the Netherlands, "just like in Germany."[24] A new organ was obviously an indispensable requisite for achieving this ambitious goal. Some sixty years later, that same "modern" organ – now not so modern anymore – experienced the opposite fate: no longer fashionable, it was almost thrown out and replaced by a then-in-vogue neo-Baroque instrument;[25] the enduring historical value of a relic from the late-Romantic era was not recognized. However, lack of funds in the parish at that time prevented this valuable artifact from being dismantled and discarded,

[24] Henk de Muinck, "Veendamse musici en een uniek orgel," *Protestantse Kerkbode*, Leeuwarden, October 2018.
[25] Voorlopig rapport over orgel Veendam, March 25, 1988, *Hervormde gemeente Veendam*, 315-418, *Stukken betreffende de restauratie en het onderhoud van het orgel* (1944-2007), restauratie 1987-1993, Groninger Archieven, Groningen.

preserving it for future generations to learn about *Klangideal* at the turning point between *Spätromantik* and *Neue Sachlichkeit*.[26]

While we can cite hundreds of cases such as these for European organs, and while they, at first glance, seem to convey a perfect analogy between the pipe organ histories of Europe and Peru, we have to be aware of an additional political layer in Peru. In Latin American countries, nationalism first started to develop in the nineteenth century, usually after a country had achieved independence. In Peru, the end of the Peruvian War of Independence and the founding of the Republic of Peru on July 28, 1821, marked the beginning of a new era in Peruvian history. For the first time, there was a "Peruvian Nation," and national emblems had to be created to represent this nation and to project its legitimacy to the world. We, again, see a slight parallel here to developments in Europe, where such terms as "nation" and "nationalism" slowly changed their meaning over the course of the nineteenth century. As Thomas Turino points out, "the contemporary idea of the *nation* as a culturally and linguistically unified group with the right to its own state emerged slowly" in Europe in the second half of the nineteenth century, and fully established itself only after World War I.[27] Previously, "nationalism" had instead been related to "nation-building," expanding the nation's territory, establishing military strength, and ensuring sufficient economic productivity.[28] For Latin American countries, Turino describes the creation of musical emblems (e.g., national anthems) in the nineteenth

[26] Verslag gesprek Wiersema, July 14, 1988, *Hervormde gemeente Veendam*, 315-418, *Stukken betreffende de restauratie en het onderhoud van het orgel* (1944-2007), restauratie 1987-1993, Groninger Archieven, Groningen.
[27] Thomas Turino, "Nationalism and Latin American Music: Selected Case Studies and Theoretical Considerations," *Latin American Music Review/Revista De Música Latinoamericana* 24, no. 2 (2003): 172.
[28] Ibid., 171.

century as free from every effort to mark local distinctions, because "the idea of nation as a distinct *cultural* unit was not yet operative as a basis for political legitimacy."[29] Anthems were created to reflect cosmopolitanism, to project being equal to those who already had a legitimate nation-state. It is no surprise, therefore, that anthems of many Latin American countries sound like a mix of European military music and Italian opera. Additionally, as both Turino and Martin-Frost have observed, European music, composers, artists, and customs in general were a way for the white elite or Peruvian-born Spanish *criollos* of the time to mark their difference and maintain their distance from other demographic groups. Peruvian nationalism of the nineteenth century was not the nationalism of *mestizos* or indigenous people; the new nation "belonged" to the cultural and racial elite of the time.

The developments in Peruvian pipe organ building that began toward the end of the first half of the nineteenth century fit into the overall political circumstances of the time: the importing of European "prestige organs" reflects the striving of the (mostly urban) European-rooted elite to create "their" nation, to iconize urban, cosmopolitan, European Peruvian-ness. We see a continuation of this trend today: organ building in Peru is not an attractive profession, since the very few current organ construction projects in the country concern imported instruments from Europe. That in turn causes only very few organ builders to live and work in Peru, which consequently means that there is no way to train as an organ builder in that country, as there are no sizeable organ-building companies that would have the capacity to work with trainees. We recognize a cycle here, one that is rooted in the historical, post-independence perception of classical music – including pipe organs – as a marker of European-ness. "Having an organ built" in modern-day Peru is still mostly

[29] Ibid., 179.

a thing of the urban, often white, elite – the same elite that populates the auditorium for classical music performances in the *Gran Teatro Nacional*, for which ticket prices are a substantial 60 dollars or more.[30]

2.3 Scholarship on colonial music practices in Peru

Section 2.2 presented an attempted inventory of existing pipe organs in Peru. Even though it is far from complete, the sample size will be treated here as representative of the overall situation in the country. The findings provided in the previous section pointed to the plethora of colonial organs that are still in existence today and illustrated the fact that they can mostly be found in remote and rural locations in Peru. In light of this wealth of preserved evidence, one would expect much scholarship on colonial music to focus on non-urban areas. Starting from this assumption, this section briefly examines the state of scholarship on Peruvian colonial music practices. The following discussion is not meant as a literature survey, nor does it aim to provide a comprehensive history of Western art music in Peru. Rather, it is a rough overview of the issues and topics that scholars have focused on until now, based on commonly used and commonly cited, easily accessible literature. Anything else would blow up the scope of both this chapter and the dissertation as a whole, whose focus is Peruvian pipe organs – not Peruvian music history. The purpose of the following overview to demonstrate why the research on these pipe organs is important and long overdue.

[30] Peru's monthly minimum wage in 2021 is $294, according to www.minimum-wage.org, accessed February 15, 2021.

Scholarship tends to focus on areas where documentary primary sources are numerous and easily accessible. The archbishoprics of both Lima and Cusco have extensive archives. It is therefore unsurprising that much has been written about the cathedral music of those two cities. Early narratives of cathedral music in Lima and Cusco mostly focused on the succession of chapel masters,[31] occasionally interspersed with sheet music examples and analyses.[32] 1972 saw the publication of Andrés Sas's compilation of the biographies of several hundred cathedral musicians of the Cathedral in Lima,[33] showing a first shift away from focusing on "big masters" and increasingly acknowledging the contributions of "mid-level" musicians. Subsequently, the human factor came increasingly into play, and monographs on chapel masters were published, for example about Gutierre Fernandez Hidalgo in sixteenth-century Lima[34] or about Martínez Compañón in Trujillo.[35] The tendency to use sources other than sheet music is continued and amplified in later work, for example in the reconstruction of the performing forces of the *Capilla de Música* of the Cathedral of Arequipa and of the life of chapel master Cayetano Rodriguez through cashbooks, receipts, copybooks, and the like.[36] The music at the Cathedral of Arequipa is a relatively new playing field for scholars, with a comprehensive overview of its different

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[31] Robert Stevenson, *The Music of Peru: Aboriginal and Viceroyal Epochs* (Washington, D.C.: Pan American Union, 1960), 65.
[32] Gerard Béhague, *Music in Latin America: An Introduction*, Prentice-Hall History of Music Series (Englewood Cliffs, N.J.: Prentice-Hall, 1979), 5-56.
[33] Andrés Sas Orchassal, *La música en la catedral de Lima durante el virreinato* (Lima: Universidad Nacional Mayor de San Marcos, 1972).
[34] María Gembero-Ustárroz, "Música en la Catedral de Lima en tiempos del arzobispo Mogrovejo (1581-1606): Gutierre Fernández Hidalgo, la Consueta de 1593, la participación indígena," *Resonancias: Revista de investigación musical* 20, no. 39 (July-November 2016): 13-41.
[35] Samuel Claro Valdés, "Contribución musical del obispo Martínez Compañón en Trujillo, Perú, hacia fines del siglo XVIII," *Revista Musical Chilena* 34, no. 149-150 (January-June 1980): 18-33.
[36] Zoila Vega Salvatierra, "Siluetas en la oscuridad: el maestro de capilla Cayetano Rodríguez (Arequipa, Perú, Siglo XVIII). Ejemplo del uso de las fuentes no musicales en la reconstrucción de la historia de la música colonial de Sudamérica," *Resonancias: Revista de investigación musical* 21, no. 40 (January-June 2017): 33-46.

aspects – the *Capilla de Musica*; the ceremonies and festivities that this music was involved in; and the organs, organists, and organ builders – only published fairly recently (2011) by Zoila Vega.[37]

While much research on secular music in colonial Peru has focused on the first opera ever written in the Americas, "La púrpura de la rosa,"[38] and its composer, Tomás de Torrejón y Velasco,[39] scholars from the 1970s onwards increasingly began to explore and address the *function* of secular music in colonial society. Music was found to be an indispensable part of civic society and especially of civic festivities in the colonial cities of Cusco and Lima.[40] As a result, the connection between civic music and church music was increasingly addressed in scholarship, as well as the role of religious institutions in that process. Thanks to the studies of Samuel Claro Valdés and Juan Carlos Estenssoro, we know today that convents and monasteries would regularly join in the production of secular music.[41] We also have knowledge about the struggles of church authorities in their attempts to keep sacred music sacred. In 1675, for example, *romanzes*, *villancicos*, and *chanzonetas* were no longer allowed to be played in church on Easter and other high feasts.[42]

It was only in the early 2000s that scholars articulated the need for "urban musicology" in South America – meaning not only a broadening of the scholarly focus

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[37] Zoila Vega Salvatierra, *Música en la Catedral de Arequipa 1609-1881: fuentes, reglamentación, ceremonias y capilla catedralicia* (Arequipa: Universidad Católica San Pablo, 2011)
[38] Chad M. Gasta, "Public Reception, Politics, and Propaganda in Torrejón's *loa* to La púrpura de la rosa, the First New World Opera," *Latin American Theatre Review* 37, no. 13 (Fall 2003): 43-60. See also Andrés Sas, "La púrpura de la rosa," *Boletín de la Biblioteca Nacional* 2, no. 5 (October 1944): 9; Béhague, *Latin America*, 64-65; Juan Carlos Estenssoro Fuchs, *Música y sociedad coloniales: Lima 1680-1830* (Lima: Colmillo Blanco, 1989), 41-42; Stevenson, *Music of Peru*, 118-134.
[39] Samuel Claro, "La música secular de Tomás de Torrejón y Velasco (1644-1728): Algunas características de su estilo y notación musical," *Revista Musical Chilena* 26, no. 117 (January-March 1972): 3-23.
[40] Samuel Claro, "Música dramática en el Cuzco durante el siglo XVIII y catálogo de manuscritos de música del Seminario de San Antonio Abad (Cuzco, Perú)," *Yearbook of the Inter-American Institute for Musical Research* 5 (1969): 1-48.
[41] Ibid.
[42] Estenssoro, *Música*, 87.

beyond cathedral and court music, but also the application of a specific methodological toolset. Geoffrey Baker pointed out that cities have to be placed at the center of colonial music history because cities played a key role in imposing order on New World subjects.[43] This insight constituted an important step toward a more holistic Peruvian colonial music scholarship. It is not that colonial music in cities had never before been addressed in scholarship;[44] however, Baker and like-minded scholars, such as Tess Knighton and Leonardo J. Waisman, included a colonial, socio-political component in their research. They pointed out the role of music in the colonization of the country through parallels between European music and the order and organization that the Spanish expected from the colonized subject.[45] Scholars subsequently researched the city's reinforcement of social hierarchy through civic ritual[46] and the imitation of the (spatial and musical) organization of the city in missions, and thus the function of music to bring the "civilized spirit" to the entire country.[47] Consequently, evidence of segregational music practices was discovered and explored, practices in which non-white people were excluded by the white elite, for example through the use of class-specific language and music idiom in *villancicos*.[48]

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[43] Geoffrey Baker, "The Resounding City," in *Music and Urban Society in Colonial Latin America*, ed. Geoffrey Baker and Tess Knighton (Cambridge: Cambridge University Press, 2011), 1.
[44] See, for example: Samuel Claro Valdés, *La música virreinal en el Nuevo Mundo* (Santiago de Chile, 1969), in which the author gives an overview on colonial music in major cities of Argentina, Bolivia, Columbia, Peru, Ecuador, and Chile.
[45] Geoffrey Baker, *Imposing Harmony: Music and Society in Colonial Cuzco* (Durham, NC: Duke University Press, 2008), 44-45.
[46] Tess Knighton, "Music and Ritual in Urban Spaces: The Case of Lima, c. 1600," in *Music and Urban Society in Colonial Latin America*, ed. Geoffrey Baker and Tess Knighton (Cambridge: Cambridge University Press, 2011), 21-42.
[47] Leonardo J. Waisman, "Urban Music in the Wilderness: Ideology and Power in the Jesuit Reductions," in *Music and Urban Society in Colonial Latin America*, ed. Geoffrey Baker, and Tess Knighton (Cambridge: Cambridge University Press, 2011), 208-229. See also: Leonardo J. Waisman, "La música en la definición de lo urbano: los pueblos de indios americanos," in *Musica y cultura en la edad moderna*, ed. Andrea Bombi, Juan José Carreras, and Migual Ángel Marín (Valencia: Universidad de Valencia, 2005), 159-176.
[48] Geoffrey Baker, "La ciudad sonora: música, fiesta y urbanismo en el Cuzco colonial," in *La fiesta en la época colonial iberoamericana*, ed. Aurelio Tello (Santa Cruz de la Sierra: Asociación Pro Arte y Cultura, 2008), 58.

According to Baker, polychorality, too, had a function of class separation. Unlike in Spain, where simple polyphony was sung in city parishes while plainchant was sung in countryside churches, Baker assumes polyphony to have been the norm all over the country. He therefore argues that polychorality in Peru, instead of being a signifier for cathedral music, functioned instead as a sonic marker for the white elite.[49]

Exploring the political function of urban colonial music is closely related to researching Corpus Christi processions, for which scholars have discovered a wealth of primary sources. There is ample evidence of indigenous participation in those processions. Indigenous dances and music were generally sanctioned at Corpus Christi, but their inclusion also contributed to the legitimization of an unequal power structure.[50] Consequently, scholars discovered the importance of indigenous confraternities for music production and promotion of musical activity in the Spanish colonies, and the popularity of those confraternities especially among rural indigenous people.[51] Waisman even speculated about the function of the Corpus Christi celebrations to bridge different perceptions of city and countryside between Europeans and natives.[52]

Corpus Christi processions were probably one reason for the increased interest of scholars in the indigenous participation in colonial music and, consequently, in indigenous agency and the possibility of indigenous influences in European-rooted colonial music. However, the topic is not entirely new: early scholars of Latin American music had already explored indigenous music practices. The perspective of early writers could be, however,

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[49] Geoffrey Baker, "Polychorality, Ethnicity and Status in Colonial Cuzco, Peru," in *Polychoralities: Music, Identity and Power in Italy, Spain and the New World*, ed. Juan José Carreras and Iain Fenlon (Kassel, Hess: Edition Reichenberger, 2013), 261.
[50] Tess Knighton, "Music and Ritual," 42.
[51] Geoffrey Baker, "Music at Corpus Christi in Colonial Cuzco," *Early Music* 32, no. 3 (2004): 358.
[52] Waisman, "Urban Music," 225.

quite Eurocentric: Stevenson, for example, calls the early colonial writer Guaman Poma an "egoistic Andean"[53] and continues to say that "only as fanatical an Indian purist as he would perhaps have considered the folk music nurtured in his native soil sufficiently important to merit a full dozen pages."[54]

Since Stevenson's times, the inclusion of indigenous practices in colonial music research has been very diverse in its approach and scope. It ranges from generally mentioning the involvement of indigenous people in cathedral music[55] on one end of the spectrum to the detailed description of Inca rituals still in use in early colonial times on the other end.[56] Some work focuses on institutions, and on the role they played in producing and disseminating music. The importance of convents[57] and confraternities[58] for music production and promotion of musical activity in the Spanish colonies has already been mentioned earlier. Scholars such as Geoffrey Baker draw a connection between confraternities introduced by the Spanish and pre-colonial indigenous structures such as *ayllus*, which, after contact, adjusted to the newly imposed (music) culture and started sharing paid cantors.[59] Some scholarship on indigenous involvement focuses on the musician, the individual who makes music. Renegotiations of status and identity are discussed, for example the striving of the colonial individual to regain his pre-conquest

[53] Stevenson, *Music of Peru,* 140.
[54] Ibid.
[55] Gembero-Ustárroz, "Música en la Catedral," 25.
[56] Gary Tomlinson, *The Singing of the New World: Indigenous Voice in the Era of European Contact* (Cambridge and New York: Cambridge University Press, 2009): 124-168.
[57] Geoffrey Baker, "Music in the Convents and Monasteries of Colonial Cuzco," *Latin American Music Review/Revista De Música Latinoamericana* 24, no. 1 (2003): 1-41.
[58] Baker, "Corpus Christi," 358.
[59] Geoffrey Baker, "Parroquia, Cofradía, Gremio, *Ayllu: o*rganización professional y movilidad en el Cuzco colonial," in *Musica y cultura en la edad moderna*, ed. Andrea Bombi, Juan José Carreras, and Migual Ángel Marín (Valencia: Universidad de Valencia, 2005), 183-184.

noble status by working as a music teacher, musician,[60] or organ builder,[61] or by participating in higher-class social dances as a way to circumvent the *casta* system.[62] The consideration of the *casta* system in recent musicological work has moved beyond the limiting dichotomy between indigenous and white people to open up research areas for work about Black musicians and Black dance teachers in viceregal Peru.[63] Gary Tomlinson's work is one example of scholarship that does not simplify colonial dynamics to two opposing parties. His description of a ritual dance taking place in 1535 in the city of Cusco depicts an attempt of the youthful Inca Manco Capac to strengthen his crumbling political status before his own subjects – not in the eyes of white people.[64] Tomlinson's approach is one of the most ethnographic in colonial music scholarship: he includes thoughts on the "fundamental mythopolitics of the Inca empire stumbled into by the Spaniards";[65] explains the role of song in the political memory of the Incas;[66] and writes about the role of the dance in the indigenous harvest cycle, the indigenous spiritual belief system, and in the Inca relationship to the cosmos.[67]

Writing about indigenous music practices and the inclusion of indigenous musicians in colonial art music has initiated a discourse about possible hybrid music practices. Consequently, possible contributions of pre-Columbian music to post-contact music culture have been sought, especially in "popular religiosity," because it is thought to

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[60] Baker, *Imposing Harmony*, 56, 174-179.
[61] Geoffrey Baker, "Organ Builders in Colonial Cuzco," n.d., n.p., accessed March 3, 2021, https://geoffbakermusic.wordpress.com/music-and-society-in-colonial-cuzco-peru/organ-builders-in-the-diocese-of-cuzco-during-the-colonial-period/.
[62] Estenssoro, *Música*, 66.
[63] Ibid.
[64] Tomlinson, *Singing*, 155.
[65] Ibid., 127.
[66] Ibid.
[67] Ibid, 152.

have escaped ecclesiastic control,[68] and in dances as part of civic feasts, since indigenous practices were tolerated to a greater extent there.[69] Hybrid sheet music is almost non-existent; however, there are incidences in which preserved sheet music has helped scholars make inferences about influences of mestizo genres like the *yaraví* on church hymns[70] or on *villancicos*.[71]

Indigenous influences can be more readily assumed in the sacred music of rural communities, since their location was too far from urban centers and could more easily escape ecclesiastic control. Early scholarly treatment of music in the countryside was often limited to a general overview on music programs of religious orders and on music policy in missions,[72] or on music (education) policy in viceregal Peru in general,[73] or mentions of music collections that included indigenous dances from more remote areas.[74] Geoffrey Baker in the last two decades has explicitly pointed to the importance of doing research in the countryside, but so far, not many have followed his call, and most work is speculative or rudimentary. In addition, claims about music in rural colonial areas are often contradictory, ranging from music education in Indian parishes being limited to singing the epistle[75] to polyphony being the norm even in small villages.[76] An important step in researching Peruvian rural areas was the inclusion of iconographic evidence in the absence

[68] Víctor Rondón and Alejandro Vera, "A propósito de nuevos sonidos para nuevos reinos: prescripciones y prácticas músico-rituales en el área surandina colonial," *Latin American Music Review/Revista De Música Latinoamericana* 29, no. 2 (2008): 220.
[69] Estenssoro, *Música*, 68.
[70] Alan Durston, "Apuntes para una historia de los Himnos Quechuas del Cusco/Notes on the History of the Quechua Hymns of Cuzco," *Chungara: Revista De Antropología Chilena* 42, no. 1 (2010): 147-155.
[71] Bernardo Illari, "The Popular, the Sacred, the Colonial and the Local: The Performance of Identities in the Villancicos from Sucre (Bolivia)," in *Devotional Music in the Iberian World, 1450-1800: The Villancico and Related Genres*, ed. Tess Knighton (Aldershot: Ashgate, 2007), 433.
[72] Béhague, *Latin America*, 3-4.
[73] Stevenson, *Music of Peru*, 51.
[74] Béhague, *Latin America*, 68.
[75] Stevenson, *Music of Peru*, 53.
[76] Baker, "Polychorality," 261.

of sheet music, for example Guaman Poma's illustrations of indigenous church musicians, in combination with his claim that all children in the Kingdom, in "small and big places," should be educated in music.[77] Imagery of processions and *autos sacramentales* in Andean parishes around Cusco show that music in those rural areas probably sounded similar to music in the city, even if its associated values could be more complex.[78]

Written evidence in city archives can sometimes give clues about musical life in the countryside. A quote from Pablo José Oricaín, an eighteenth-century Spanish geographer, lets us speculate that in rural communities, indigenous religion was perpetrated through music and dance[79] which must have existed "disguised" as Spanish customs.[80] Similarly, written evidence exists that music teachers and chapel masters in rural areas were often indigenous people,[81] and they were often in charge of the entire education in their parish or village.[82]

Returning to the thought offered above, that in light of the wealth of preserved music instruments, we would expect that much scholarship is produced about rural colonial music, we stand disappointed. Of the twenty-five works used for the discussion of Peruvian music research above, only four, by Baker and Waisman, exclusively and explicitly deal with music in rural areas. Two of those four readings are redundant; they are reworked versions by the same authors and present neither new findings nor new arguments. The

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77 Gembero Ustárroz, "Música en la Catedral," 26.
78 Baker, "Fiesta," 65.
79 Reporting from Andahuaylillas, Oricaín wrote about music on sacred Christmas Eve: "….and to vary, they introduce profane *contradanzas,* minuets, *yaravís,* and lascivious songs." Baker, *Imposing Harmony*, 191.
80 Baker, *Imposing Harmony*, 193.
81 Geoffrey Baker, "La vida musical de las doctrinas de indios del obispado del Cuzco," *Revista Andina* 37 (2003): 186.
82 Ibid., 187.

remaining readings occasionally mention rural music practices, but do not present any original research and quickly leave the subject again. Thus, rural musicology in Peru is severely underrepresented. Scholars of Peruvian colonial music do not deny the importance of researching rural areas. Some lament or address the gap in scholarship explicitly, including Geoffrey Baker and Leonardo Waisman. Many others briefly touch on the subject of rural music practices, superficially engage in some speculative arguments, and reference each other's works, but often do not present any original findings or substantial conclusions. It almost seems as if musicologists feel uncomfortable with the topic of rural colonial music altogether, as if it is the hot cookie sheet of musicology that we, music scholars, are prowling around without really wanting to touch it.

2.4 Conclusions

The present chapter has shown that the most substantial number of still-existing colonial pipe organs in Peru are located in the countryside, mostly in small-scale, rural environments. It has also drawn attention to the fact that scholarship on colonial music in Peru has focused on larger cities thus far. The reasons for this imbalance might in part be practical: Peruvian cities have modern airports, are easy to reach by ground transportation as well, and have hotels and other accommodations that can be booked conveniently online in advance. Many locals in Cusco or Lima speak at least basic English and are used to slowing down their Spanish speech to accommodate the foreign ear.

However, we have to admit that, besides issues of practicality, there is another reason that prevents us scholars from venturing out into the countryside: we do not like stepping out of our comfort zone. Musicologists are used to dealing with written sources.

We look for documents in archives; translate and transcribe them; discover preserved sheet music and try to date, analyze, and interpret it. We know our way around libraries and collections, we know what to look for in museums and antique book stores. Organology, on the other hand, is often a neglected part of our methodological toolbox. In the case of colonial musicology in Peru, our lack of this one tool means that we are potentially missing out on substantial new knowledge. None of the villages I visited during my numerous field trips to Peru had any kind of preserved primary sources on past music practices, neither as sheet music nor otherwise. The only preserved evidence that testified to the obvious existence of a colonial music culture in a particular village was its pipe organ. If we rigidly stick to our tried-and-proven approaches, we are perpetuating – if not cultivating – a gap that has existed for far too long in our field. Ignoring pipe organs as primary evidence means neglecting colonial music culture in most places in Peru, and considering only the very few, big urban centers that present us with archival evidence today. Focusing our attention on mostly Lima and Cusco and neglecting the rest of this vast country cannot ever convey to us a complete picture of art music in colonial Peru. Talking about "Peruvian" colonial music at this point is therefore almost intellectually careless – after all, most of Peru has not even been researched yet.

Geoffrey Baker has repeatedly stressed the necessity for more research in rural Peru, and has even pointed out that during colonial times, rural areas could have had different music practices from cities. Doing this research is more feasible than we think. There is ample primary evidence and more original sources than there might seem to be at first glance. As music scholars, we just have to get used to the idea that evidence does not always come in either written form or from iconography, but instead can be the material remains of a particular music culture. Once we have accepted that fact, and once we are open to broadening our set of methodologies, we will have made a large step toward filling in the missing puzzle pieces in colonial scholarship today.

CHAPTER III

EL INGA CANTA CON SU LLAMA…[1]

COLCA CULTURE FOR BEGINNERS

3.1. Introduction

The previous chapter has shown that most colonial organs – or the remains thereof – in Peru are located in rural areas, and I have argued that those areas should be included in the current discourse on colonial music culture. Scholars need to leave the comfort zone of libraries, archives, collections, and museums in urban settings and venture out into the countryside. Upon doing so, they will find a completely different culture – or, more appropriately, a wide array of different cultures. Peru's population in 2017 was 31.44 million; however, only 8.6 million Peruvians lived in Lima in that year and 428,450 in Cusco. Limeño and Cusqueño culture therefore only accounts for a small part of the Peruvian experience and cannot be taken as representative of all of Peru. Talking about Peruvian-ness, in general, is difficult. As Thomas Turino has pointed out, Peru's national project has been less successful than that of other countries: "Peruvian nationalism lacks time depth and continuity and consequently it remains weak. National sentiment does not run very deep (…)."[2] If a researcher wants to study Peruvian culture outside of the urban

[1] "Fiesta de los Ingas (….): El Inga canta con su puca llama." (Felipe Guamán Poma de Ayala, *El primer nueva corónica y buen gobierno*, Ms. Gammel Kongelig Samling (GKS) 2232, 4, Royal Library, Copenhagen, Denmark, 318, accessed March 30, 2019, http://www.kb.dk/permalink/2006/poma/info/en/frontpage.htm.)
[2] Thomas Turino, "Nationalism and Latin American Music: Selected Case Studies and Theoretical Considerations," *Latin American Music Review/Revista De Música Latinoamericana* 24, no. 2 (2003): 201.

environment, then that researcher needs to spend time gaining an understanding the culture of that specific Peruvian region.

In this chapter, I will introduce my research location, the southern-Peruvian *Valle de Colca*, and explore how past interactions between cultures shaped present-day identity. By reflecting on local traditions in the Colca, especially with regard to musical practices, I investigate what Colca culture is and how it is expressed. I will introduce theories of identity, cultural mixing, modernity, and regionalism as necessary. Works of such scholars as Thomas Turino, Michelle Bigenho, Henry Glassie, Walter Mignolo, and Mary Hufford will help me interpret and contextualize this regional Andean culture. In my conclusion, I will argue for using knowledge about regional or local present-day culture to inform past events, and vice versa.

This chapter is not meant to present a comprehensive anthropological study of the Colca people. Rather, it will provide a first glance into Colca culture and supply the reader with pieces of information that will be necessary later on for a better understanding of the cultural context of Colca pipe organs. I also offer my initial thoughts on (post-)colonialism as it relates to Colca organs, showing the importance of understanding of what Pratt calls "cultural grappling" in the *contact zone* of the Colca Valley.[3] Colca pipe organs are part of this grappling; I will demonstrate the need to look at these instruments not only from an organologic and historic point of view but also from an ethnographic one.

3.2. Colca culture

3.2.1. The essence of Colca culture

[3] Mary Louise Pratt, "Arts of the Contact Zone," *Profession* (1991), 33-40.

The Colca Valley lies about 100 road miles (160km) north of Arequipa. Chivay is the largest town in the Valley, a "hub" of five thousand souls that connects Arequipa to Caylloma in one direction and to Cabanaconde and the Colca Canyon in the other. My main organologic field site, Callalli, can be reached from Chivay through a two-hour mini-bus ride. The ecclesiastic district of Callalli covers an area of about 2,700 square miles (7,000km^2) and is home to several colonial pipe organs that are preserved well enough for organologic examination.

The history of Colca culture is one of cultural interaction and amalgamation. At the time the Inca annexed the Colca region in the fifteenth century,[4] the Collagua and the Cabana lived concurrently in the Valley. Their umbrella culture, the Wari, was still present at that time as well.[5] The Spanish – Franciscan missionaries, to be exact – arrived in 1560.[6] Different colonizers in the past introduced new customs to the Valley, and new ways of disseminating them among the locals. For example, the Incas employed a top-down, yet conservative, approach, in which they introduced new deities – sun, moon, and stars – yet respected local Colca deities, as was their usual strategy of conquest.[7] While Christian missionaries required adults and children to follow catechism lessons several days a week and to believe in Christian saints and the Holy Family,[8] they, too, were careful to keep some of the old structures intact. Churches were built on the sites of traditional huacas,[9] and Easter celebrations were organized to reflect native Andean societal structure. These

[4] Walter B. Ramos Yucra, *Monografía y fuentes documentales sobre la historia del distrito de Callalli* (Arequipa, Peru: Publicont S.A.C., 2018), 26.
[5] Ibid., 25.
[6] Ibid., 32.
[7] Ibid., 26.
[8] Consuelo Milagros Vasquez Soto and Christian Omar Estrella Canaza, "Fragmentos de la historia del Distrito de Callalli" (thesis, Universidad Nacional San Agustín de Arequipa, 2010), 45.
[9] Ibid., 172. See also the glossary in appendix A.

measures served to ensure easier acceptance of new systems, but they also led to a continuous process of blending different cultural traditions.

As a result, present-day events and festivities in the Colca region, and the way they are executed, highly depend on the season of the year. Colca residents – before tourism emerged in the Valley – were an agricultural society. Camelids were domesticated six thousand years ago here, as evidenced by the *mollepunku* llama etchings.[10] Llama and alpaca husbandry was the livelihood of the Collagua, while growing crops and vegetables were the realm of the Cabana, who lived at a lower altitude. Their cultures were separate until the establishment of the *corregimiento*[11] in 1565,[12] however, both ethnicities had in common that their lives, their experiences, their culture, depended on nature and, therefore, on the flow of seasons. Plants need water to grow; alpacas need plants to eat. The alternation between "wet" and "dry" was – and still is – the heartbeat of the Valley.

The Chivay *tinkachi*, a ritual celebration still in use today, is one such example of the connection between humans and nature and of the existence of a pre-Christian calendar that was based on agricultural seasons. It is said that the roots of the *tinkachi* lie in a time when people still lived in caves in the rock walls of the Colca canyon.[13] However, this event nowadays is associated with Carnival – originally a European tradition. During the so-called *wilancha* part of the *tinkachi,* a llama or alpaca can be sacrificed. However, regularly, little alpaca and llama figurines made from llama fat, leaves and other parts of

[10] Ramos Yucra, *Monografía,* 20.
[11] See glossary in appendix A.
[12] Ramos Yucra, *Monografía*, 30.
[13] Charlitos1988, "TINKACHI – Rito," YouTube, uploaded August 20, 2014, accessed March 26, 2018, https://www.youtube.com/watch?v=EEig4FQrxH0.

plants, and corn cobs, substitute as offerings.[14] In such a case, each participant gets a ball of llama fat and parts of corn and coca plants. The plants are kneaded into the malleable fat, and before throwing everything into the fire, participants ask for forgiveness by blowing on it. The objective of the *tinkachi* is to bring offerings to *Pachamama,*[15] or "*Madre Tierra* (Mother Earth)," as she is often referred to in the Colca today. *Madre Tierra* is asked for protection in the future and thanked for everything she has given so far. Dancing takes place to quena and drum music in repetitive short motives; the girls participating in the dance have to be unmarried, because it pleases *Madre Tierra*. Carnival cannot begin before *Madre Tierra* is pleased. Singing takes place as well: old Collagua and Cabana songs, however, they are mostly sung Spanish, since many young people in the Valley are not fluent in Quechua anymore.

The *tinkachi* presents a conflation of pre-Christian and Christian elements; and it is not the only Colca event to do so. Patron saint day celebrations in the Valley exhibit a similar culturally blended character. By far the most popular is the annual *San Antonio* celebration on June 13 in Callalli, which includes a bullfight and features prominently in a number of YouTube videos. The official name of the village, "San Antonio de Callalli," is one of the many results of Christian missionizing practices. Franciscans renamed villages after saints to ensure locals asked Christian saints for protection; however, to avoid too much resistance from the locals, they left the indigenous names intact.[16] Nowadays, the celebration of patron saint days in the former Colca missionary villages are absolute highlights in the local calendar.

[14] See fig. 30 in appendix B.
[15] See glossary in appendix A.
[16] Vasquez and Estrella, "Fragmentos," 45.

The brass band, which is usually hired from outside, plays a role in each of the three parts of the celebration: the bullfight, the *saludo de toro* ("greeting of the bull") before the fight, and the *kachapari* ("farewell") after the fight. The *saludo de toro*, which takes place the evening and night before the fight, is a ritual in which the *Apus*[17] and *Pachamama* are "paid" in the form of sacrifices in the house of the torero, in the presence of family, neighbors, and the band. After the burning of the offerings, songs are played that refer to a patron saint.[18] On the day of the fight, a sacrifice is made to Mother Earth. Bullfights (and breeding bovines in the first place) are a tradition introduced by the Spanish; however, many of these elements in the Callalli bullfights are not European at all. Most notably, the bull in Callalli is not killed at the end of the fight, as it would be in the Spanish tradition. Instead, one source claims that an injured torero is seen as a good sign for the coming agricultural year.[19]

The band that is typically invited to play at the San Antonio Day celebration consists of standard Western orchestra trumpets and tubas. The music, however, exhibits the typical Andean repetition, heterophony, and steady rhythm.[20] During the bullfight itself, the band occasionally plays a simplified *paso doble* form.[21] However, the style and texture in which this traditionally Iberian/southern-French "taurine pasodoble" is executed is reminiscent of the style of the rest of the band's repertoire: most instruments play in a heterophonic fashion, and the intonation and embouchure at times get a bit "airy" or

[17] See glossary in appendix A.
[18] Vasquez and Estrella, "Fragmentos," 165.
[19] Ibid. A connection to blood sacrifice, *tinku* (compare the *tinkachi*, in which usually a camelid-type animal is ritually sacrificed), is plausible.
[20] Edgar quispe masca, "Fiesta San Antonio de Callalli 2015," YouTube, uploaded September 5, 2015, accessed March 26, 2018, https://www.youtube.com/watch?v=U11HTucNBaQ.
[21] PRIMIALCON, "Tradicional corrida de toros en Callalli," YouTube, uploaded January 20, 2015, accessed March 26, 2018, https://www.youtube.com/watch?v=9TazsQbRapw, time index 1:20.

breathy – similar to the timbre of a *quena* ensemble. Other music that can be heard during Callalli bullfights includes singing in Quechua, accompanied by guitar and percussion.[22] When there is no music being played during the fight, a solo trumpet sometimes bursts into a very short motive to accompany the action. Such motives are usually fanfare-like and sound very much like melodies that can easily be produced on a German post horn, or motives in European art music that hint at the hunting trope.

A comparison of the San Antonio custom in Callalli with the *tinkachi* in Chivay reveals remarkable parallels. Both rely equally on Christian and indigenous customs. The indigenous deities, *Apus* and *Pachamama,* having to be paid in the house of the torero – an inherently Spanish character – is very similar to *Pachamama* needing to be pleased at the *tinkachi* in order for Carnival to begin. The recurring element here is Christian-indigenous spiritual and cultural duality, rooted in historical missionizing practices and in colonialism at large. Spanish missionaries in sixteenth-century Colca Valley did more than introduce Colqueños to a new religion: they worked to deprive them of their own history. According to Moreno Fraginals, those in power act to "remove" knowledge and memories of a given human group (with the ultimate goal of economic exploitation).[23] Spanish missionaries and men of letters in the colonial Americas appointed themselves to write the history that Amerindians, according to the Spanish, did not have. As Henry Glassie notes, "history is not the past; it is an artful assembly of materials from the past, designed for usefulness in

[22] PRIMIALCON, "Tradicional corrida," time index 12:10.
[23] Walter D. Mignolo, "The Enduring Enchantment: (Or the Epistemic Privilege of Modernity and Where to Go from Here)," in *Enduring Enchantments*, ed. Saurabh Dube (Durham, NC: Duke University Press, 2002), 942.

the future."[24] In Peruvian missions like those in the Colca Valley, this history, from the missionaries' point of view, was the history of heathens, whose souls had to be rescued by the Franciscans. In the Peruvian *Crónica Franciscana*, indigenous people are usually referred to as "barbaric without letters"– although it is sometimes added that they are "capable of [Christian] faith."[25] In return, of course, the missionaries expected total submission: they were convinced that the indigenous people were indebted to them because the friars had gone through so much effort to introduce them to the gospel.[26]

These processes of removing and replacing knowledge, once initiated, will continue. Colca culture is changing and will continue to change. There are many global influences in Colca culture today, influences that European or North American people would call "Western" or "modern." It is important to recognize the connection between modernization and colonialism: as Walter Mignolo has pointed out, colonialism was "constitutive of modernity."[27] Modernity meant assuming European values as superior, thus considering the written more permanent than the oral, the mind and the body as separate entities, or nature and humans as unrelated. Europeans colonized, conquered out of their assumption of superiority, and had – in their eyes – the perfect excuse to do so. They came to bring culture to "primitive" people: a "modern" belief, a "modern" political system, a "modern" economic system. And they brought their own "modern" material culture: buildings, churches, artifacts, objects of daily use, musical instruments.

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[24] Henry Glassie, "Tradition," *The Journal of American Folklore* 108, no. 430 (1995): 395.
[25] Diego Córdoba Salinas, *Crónica Franciscana de las provincias del Perú*, ed. Lino Gómez Canedo (Washington, DC: Academy of American Franciscan History, 1957), 74.
[26] Ibid., 134.
[27] Walter D. Mignolo, "Coloniality: The Darker Side of Modernity," in *Modernologies: Contemporary Artists Researching Modernity and Modernism*, ed. Sabine Breitwieser, Cornelia Klinger, and Walter D. Mignolo (Barcelona: MACBA, 2009), 39.

Following Henry Glassie, we can examine Colca tradition as something that is constructed by individuals.[28] Of the different modes Glassie describes for the space in-between preservation and experimentation, two seem especially present in the Colca Valley: first, the preservation of essences (of dismembered entities); second, the preservation of "a general tone, a sound, a look, a certain spirit."[29] Colca traditions, as exemplified in here both by the *tinkachi* and the Callalli San Antonio Day, contain many preserved essences, looks, and spirit – from both Christian and (maybe several) pre-contact cultures: singing Quechua songs in Spanish accompanied by guitar, addressing *Pachamama* by her Spanish name, playing indigenous melodies on Western mainstream conservatory-type brass instruments in a hoarse Andean-style timbre, using *paso doble* forms in indigenous heterophony with typical Andean repetition; and, not to forget, the association of rain with Carnival season and with individual Carnival celebrations,[30] or even the overall notion that Carnival is an event of pre-contact spirituality.

Glassie defines tradition as the "motive force of culture,"[31] as a "dimension within every creative act."[32] Colca "tradition" (in Glassie's sense) could thus be seen as the "motive force" behind Colca culture. Colca natives have a history of rewritten histories; they responded by continuously re-creating their tradition. Scholars like Gloria Anzaldúa or Walter Mignolo have proposed ways of thinking in interstitial spaces that complicates the usual binary system and allows for thinking from epistemic points of view outside of colonial frameworks. This kind of *border thinking* will be useful for re-examining Colca

[28] Glassie, "Tradition," 398.
[29] Ibid., 407-408.
[30] *Tinckachis* and other Carnival events are considered the better the more it rains.
[31] Glassie, "Tradition," 409.
[32] Ibid., 408.

pipe organs as the material remains of a past, colonial, Christian-rooted music culture: how much evidence is present in these organs for tradition as a motive force? How much do they evidence border thinking? Chapter 6 will discuss how we can use Colca organs and their constructional and sonic characteristics to explore a negotiation between preservation and experimentation, a continuous re-creation and re-invention of indigenous Colca identity.

At this point, it is noteworthy that a mixed cultural heritage does not have to be labeled as such. Some of the oldest customs in the Colca are of Collagua and Cabana origin. Probably the most famous example is the *wititi* dance, which was declared intangible cultural heritage by UNESCO on December 2, 2009.[33] Colca residents are frank about the dance's pre-Inca roots, most famously exemplified by the *wititi* infomercial produced by the Peruvian Cultural Ministry, in which a young man says, "We have to cultivate the culture that we have as Cabana and Collaguas. So, I will go on dancing *wititi* until the day I no longer can, because it is part of me."[34] My experiences in the Colca Valley taught me that this is not just another attempt to market Peru to the global community by exoticizing it and equating its residents with mythic "relics" from the past. On the contrary, there seems to exist a rather strong present-day identification of Colca people with their pre-Incan cultural heritage. Cabana and Collagua dresses, for example, and headwear are very important on any kind of private or public event. The dresses are referred to as "traditional,"

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[33] New China TV, "Ancient dance Wititi of Peru elated to be UN intangible cultural heritage," YouTube, uploaded December 2, 2015, accessed April 10, 2021, https://www.youtube.com/watch?v=9H8RVFzgoPY. See also: Unesco, "Wititi Dance of the Colca Valley," YouTube, uploaded December 2, 2015, accessed April 10, 2021, https://www.youtube.com/watch?v=gWaNe05Lr90.
[34] Unesco, "Wititi," time index 5:50.

even though their current style is a quite recent. Formerly, Collagua and Cabana dresses featured much less embroidery, a characteristic that changed drastically with the invention of sewing machines. Referring to them as "traditionally" Cabana and Collagua plausibly indicates a special status that this pre-Incan part of Colca heritage occupies in the Valley.

Amanda Weidman's argument against separating (post-)colonial music practices into pre- and post-contact "ingredients" can be applied here.[35] Her approach to South-Indian music, which she bases on recognizing the mutual influences between Carnatic and British music traditions under British rule – rather than placing them in opposition – functions as a useful analogy for our case: Colca residents re-created their own customs around newly introduced Christianity, and by doing so, also influenced Christian culture in the Valley, thereby establishing a pattern of two-way exchange. The indigenous Colca calendar, for example, which was based on life cycles and harvest cycles, merged with the Christian calendar; it neither replaced it nor was replaced by it. As a result, Ash Wednesday, the beginning of Lent and one of the strictest days of fasting and contemplation in the Christian calendar, today does not have any meaning in the Valley. When I asked how a *wititiada* – a dance festival that also includes a contest – could take place on such a day, I was told that Carnival season lasts as long as it rains. There is no clear separation anymore between elements that originated in the pre-contact agricultural calendar and those originating from the Christian calendar, nor is such a separation an issue in other aspects of Colca life.

[35] Amanda Weidman, "Listening to the Violin in South Indian Classical Music," in *Theorizing the Local: Music, Practice, and Experience in South Asia and Beyond*, ed. Richard K. Wolf (Oxford, Oxford University Press, 2009): 49-64.

It is important to recognize at this point a certain dichotomy between insider views and touristic agendas – an issue that I will also circle back to later on. A Carnival celebration in Chivay that I once attended was co-organized by Colca Tourism, and consequently, I – as the only attending foreigner – was presented with a narrative about an allegedly one-hundred percent Inca heritage in the Valley. This routine is rooted early in the twentieth century, when folklorization as a result of *indigenismo*[36] movements promoted "Incaic" music, leading to the formation of companies and associations such as the *Misión Peruana* and the *Centro Qosqo*.[37] *Cusqueñismo*[38] and constructed Inca-ness developed in parallel to the search for a national Peruvian culture, and soon they became synonyms of rural indigenousness.[39] Cusco still to this day advocates for projecting Peruvian-ness – in the form of Inca-ness – to the global community. It is therefore not surprising that the only time I ever heard a stress on Inca-heritage in the Colca Valley happened in a touristic context. Any additional references to culture in the Valley referred to either Collagua and Cabana, or to an indirect description of it, like the "old way" or "our way." The fact that Colca culture is continuously changing does not seem to make it any less "old." Being in a state of change, adapting to outside influences, and adapting the elements coming from outside to their own culture seems to be one of the Valley's trademarks. In a way, we can say that, counterintuitively, change is one of the constant factors in the culture of the Valley, and that it would be the absence of change that would in fact change Colca culture.

[36] See glossary in appendix A.
[37] Zoila Mendoza, *Creating Our Own: Folklore, Performance, and Identity in Cuzco, Peru* (Durham, NC: Duke University Press, 2008), 18.
[38] See glossary in appendix A.
[39] Mendoza, *Creating Our Own,* 17.

We detect notions of “authenticity” in Turino’s post-Bendixian understanding here.[40] Turino writes about cultural cohorts nested within cultural formations that can create their own habits from “imported” habits of other formations, based on the identity and experiences of the cohort’s own members. Developing this thought further, we can posit that a cultural formation in its entirety can change its sets of habits, based on experiences that are dicent[41] for the formation at that very point in time. Any expression of these new habits will still be representative of the identity of the cultural formation. The Colca analogy to Turino’s example, in which the original custom, old-time dance music, experiences changes when taken out of its context and put into a setting of white middle-class suburbanites, are Christian rituals and objects that changed after being placed in the sixteenth-century Colca Valley context. It is important, however, to acknowledge one major difference between the Colca case and Turino’s study: his jug band and square dance group *chose* to learn a style that was not native to them. Indigenous people in the Americas, on the other hand, did *not* have a choice in being exposed to another culture. There is thus an additional layer present, an element of power dynamics that should not be overlooked. Looking at Christian artwork, architecture, and artifacts from the colonial period can help us understand these power processes as they were happening at the time. Applying Turino’s concept to colonial objects in the Colca, including Colca pipe organs, means that those objects are not only part of Colca culture, but even representative of it. Despite the fact that

[40] Turino explains identity as a set of habits that are dicent for an individual’s (or a group’s) experience. According to Turino, being true to one’s own experience in the representation of those habits constitutes authenticity. Merely copying habits of others, without relating that habit to the individual’s or group’s own experience, is therefore “inauthentic.” Thomas Turino, *Music as Social Life: The Politics of Participation* (Chicago: University of Chicago Press, 2008), 159-163.
[41] A dicent sign in Peircian semiotics is a sign that “is affected by what it stands for and is thus interpreted as causally linked to its object.” Turino, *Social Life,* 235.

pipe organs were introduced into Colca culture from another cultural formation, they are dicent of the experiences of the people who built and/or played them. Consequently, they can serve as a valuable primary source not only for music scholars, but also for colonial scholarship in general.

3.2.2 Some characteristics of Colca culture

Colca festivities and events are a good way to observe some characteristic traits and elements of Colca lifestyle. *Wititiadas,* for instance, are a good example for the highly participatory aspect of this culture. *Wititiadas* are events that feature the *wititi* dance, accompanied by Western standard symphonic brass and percussion instruments, and that often include a contest, in which usually the three *parcialidades*[42] of a town compete with each other through dancing. The set-up of the contest, however, appears rather party-like, and the line between performers and bystanders is often blurred. In addition, the rules for the contributions of the three contesting groups appear to be flexible as well and give way to great expressive variety.[43] Performers can dress in *wititi* costumes, which consist of Collagua and Cabana dresses and hats for the women, and skirts, white shirts, and headwear that partially covers the face for the men;[44] or they can perform in everyday clothes. The interpretation of the dance can follow a particular scheme, which includes walking straight for eight measures and then engaging in vigorous turning around the own axis for the next

[42] See glossary in appendix A.

[43] That does not mean that the *wititi* contest is not regulated at all. As Anthony Seeger points out, music competitions in the Andes usually comprise sets of many rules; however, those rules are often not visible to the Western outsider, who gets an impression of spontaneity. Anthony Seeger, "Social Structure," in *The Garland Handbook of Latin American Music*, ed. Dale A. Olsen and Daniel A. Sheehy (New York: Garland, 2000), 62. For the *wititiada,* one significance lies in prioritizing participatory over performative elements. Contests of a highly participatory character are something unusual for many Western observers, and can easily be mistaken for "randomness."

[44] See figs. 32 and 33 in appendix B.

eight measures, either alone or with a partner; or it can also just consist of walking straight to the beat. The musical introduction, before the actual dance starts, leaves most room to diversity: I have witnessed solo-quena playing, big-band-style music, dance choreographies of the band, and funny pantomime sketches of people in animal costumes. Most importantly, it appears that the performative aspect here is rather unimportant. The importance lies in participating. It is not unusual for bystanders to join the dance, or for a male dancer to break out of his line to chase a female dancer or bystander and spray her with party foam. Drinking from beer bottles while dancing, or texting and playing on one's phone are rather normal as well.

Colca events are also a good way to exemplify the importance of material culture in the Valley. Important – and mandatory – props during Carnival include big textile banners with saints, often Saint Mary,[45] or small amulets with depictions of saints on a ribbon. Rituality plays a strong role: the banner is carried in the very front of the *wititi* parade of each *parcialidad* and the charms are hung around the necks of guests of Carnival celebrations, to thank them for repaying the host for their food and hospitality. Oftentimes, while one of the hosts hangs the amulet around the recipient's neck, other wind paper streamers around the same guest, and people start touching the amulet, and sometimes kiss it.

Christian devotion in the Colca Valley is hard to miss.[46] People attend church on Sunday; they celebrate Saints Days; Carnival bands stop their procession around the *Plaza*

[45] See fig. 34 in appendix B.
[46] See also fig. 29 in appendix B. Notice the cross, a Christian symbol, on the mountain, an important entity in indigenous rituality.

in front of the church, bow their heads, and hold half a minute of silence. However, in such cases as the banner or the amulet, there seems to be an additional layer at play: the devotion is channeled into an object, a material item that symbolizes some non-material aspect of spirituality. It recalls the little ball of llama fat that was handed out at *tinkachis:* participants cannot not simply ask *Pachamama* for forgiveness; they have to put their sins into the ball and throw it into the fire. Objects, especially those with an associated symbolic meaning, generally seem to have great importance in the Colca. One example is the *cortamontes* that take place for almost a week around Ash Wednesday in Chivay. People dance around cut trees that are put up at the *Plaza* and are adorned with objects, mostly kitchen utensils.[47] When the tree is cut, people collect the presents. It is a tradition similar to putting presents under a Christmas tree or in a stocking, except that in the *cortamonte*, the presents have significant symbolic value: they represent food, and food plays an important role for Carnival. During rainy season, there is a Carnival event somewhere in town almost every day, and every time, lots of food is served. It is very impolite for the Carnival host not to serve every single guest individually, and very impolite for the guest to turn down an offered dish or not repay the host.

The system of giving and repaying and the importance and symbolic value of material culture are not limited to Carnival. Many religious feast days in the Valley feature carts, banners, costumes, and plants. It is customary for the *mayordomo,* the patron or person in charge of organizing, to give out food or beverages, and in return to be repaid by the community or receive follow-up invitations from community members. This might sound rather transactional on a first glance; however, it is not so much of a business deal

[47] See fig. 35 in appendix B.

than a ritual exchange, an action that is precisely scripted in the collective memory of the people who live in the Colca. As literature about other places in the Andes documents, the *act* of exchange is important, as well as the values that are associated with that act.[48]

To summarize the findings of this section, some of the many elements of Colca culture are: 1) participation and participatory practices, as evidenced particularly in Colca music culture and in the structure and setup of private and public events; 2) sharing and exchange to express the value of community; 3) ritual and ritualization, including both Christian and indigenous rituals; 4) music playing a key role in ritual practices, and community events; 5) material culture and the symbolic value that is associated with it. It is fascinating to observe how those elements are interrelated. Of special interest here is how indigenous culture has permeated and appropriated Spanish-rooted, Roman-Catholic culture over time to a certain extent: a picture of a saint or Carnival paper streamers become equally representative of Colca material culture as a ball of llama fat, a coca leaf, or a *manta.* Using Henry Glassie's insight that all objects are traditional, "in the sense that everything is created, however surprisingly, out of precedent,"[49] we have to study those objects in order to learn about those "precedents." In the Colca, this applies to present-day objects as much as to historical ones, including preserved artifacts and music instruments. Pipe organs occupy a special place in this regard, since they relate to many of the elements outlined above: they were part of both musical and material culture, and they belonged to

[48] For more context on ritual and ritual exchange in the Andes, Hans Buechler's book *The Masked Media* is a helpful source, especially his introduction to part II "The Structure of Fiestas." Hans C. Buechler, *The Masked Media: Aymara Fiestas and Social Interaction in the Bolivian Highlands* (Berlin/Boston: De Gruyter, Inc., 1980), 35-38.
[49] Glassie, "Tradition," 406.

a participatory, ritual worship practice. Their possible use for examining the interaction of past cultures has not yet been recognized in scholarship; this matter will be the focus of the discussion in chapter 6.

3.3. Conclusions

This chapter has presented a culture that seems to embrace a strong identification with its pre-Incan heritage, which might be addressed directly, calling it "Collagua" or "Cabana" or – more often – indirectly referred to as or "our way" (*nuestra manera*) or the "old way." It is a highly regionalized culture. As mentioned earlier, considering cultural micro-environments by themselves is important, especially in Peru, where national identity is a collection of distinct traditions. Raúl Romero has pointed to the strength of Peruvian regionalism in the absence of a national project,[50] and Thomas Turino seems to agree with Romero by stating that he does not consider Peru to be a nation-state.[51] However, I would like to point out here that the issue at hand, cannot be reduced to a simple, one-dimensional problem. In the Colca, regional and supraregional identities seem to be entangled and exist concurrently. People refer to themselves in very different ways, as Colca, Collagua, Cabana, Quechua, or Peruvian. At public events in the Colca, the MC usually praises the region *and* the nation throughout the event. The Colca does not seem to be exceptional in its fluidity between regional and national notions: festivals like the *Candelaria* in Puno, which features a collection of many different regional traditions, are highly popular, and are usually regarded as pan-Peruvian.

[50] Raúl Romero, *Debating the Past: Music, Memory, and Identity in the Andes* (New York: Oxford University Press, 2001), 33.
[51] Turino, "Nationalism," 201.

The matter at hand, at least in the Colca Valley, is thus more complex than Turino's simplification of "regional versus national." The important question is how Colca culture deals with an insider-outsider representation. Helpful in this regard is Hufford's approach to regionalism, in which she uses Bakhtin's *chronotopes*, linguistic signifiers of space and time of a given narrative. In the Colca Valley, some of the chronotopes that exist for the "old ways," for a representation from within, are alpaca, llama, *choclo*, *quena*, *pinkullu*, *chicha*, and coca.[52] To those add common words that appear in Colca stories,[53] which often feature animals and natural phenomena: stars, sun, moon, lightning, rain, wind, fox, *vizcacha*,[54] puma, and most prominently, condor and mountains. Chronotopes that are applied to the Colca from the outside are poverty, mining, lack of education, lack of comfort, underdevelopment, and backpacking. The latter gives rise to an interesting subset of chronotopes associated with Colca tourism: *chica*, llama, alpaca, condor, coca, mountain. There are thus chronotopes that exist in both the insider and the outsider representations. This overlap does not mean that the condor has the same signifiance for the Colca visitor as for the Colqueño: for the latter, it has a ritual association, while for the former, it is a tourist attraction. The same holds true for alpaca, coca, or mountain. In fact, I contend that, as outsiders, we are at risk here of engaging in what Hufford calls "monologizing away commons" that belong to a culture through our outsider views on that culture;[55] in this case, ironically, through using – and reinterpreting – insider chronotopes. However, if we are aware of this risk, we can proceed to use chronotopes to understand the

[52] See glossary in appendix A.
[53] A good source for Colca stories is the "Tradiciones del Colca" series by Zacarias Ocsa Ocsa, who collected stories (mostly told in Quechua) from Colca locals.
[54] See glossary in appendix A.
[55] Mary Hufford, "Interrupting the Monologue: Folklore, Ethnography, and Critical Regionalism," *Journal of Appalachian Studies* 8, no. 1 (2002): 75.

multiple layers of Colca culture better, as Colca people have adapted to some of their "own" being used in a touristic context. Some stores at the market have stuffed animals that look like llamas, and occasionally, pictures can be taken with a baby alpaca on the *Plaza*. When one talks to the ladies selling the stuffed animals or holding the alpaca's leash, they never mention the ritual context that the animal has for Colqueños. On the other hand, nobody would take alpaca toys to a *tinkachi* – let alone try to sell them. Notions of "inside" and "outside," of thinking "locally" and "globally," seem to be concurrently present in the Colca. The key, again, is adaptation.

The application of chronotopes to the Colca Valley can potentially contribute to understanding past processes, too. The chronotopes with which colonizers referred to the indigenous belief system in the Colca – barbaric, unfaithful, heathens, demons, devil – are evidenced in Salina's *Franciscan Chronicle of the Peruvian Provinces*, which contains a few pages on colonizing "the Collagua people."[56] The chronotopes of indigneous people for their own belief system included *Pachama*, *Ayllus*, llama, alpaca, and other natural deities, such as mountain or condor; and, from the Inca period onwards, also Inca deities such as the stars, moon, and sun. Christian churches, artwork, artifacts, and musical instruments were imposed by the colonizer upon the Colca people, but at the same time, the fact that mostly indigenous people produced them might also have created a space in between the insider and outsider views, a space to bridge the two realms of spirituality, and to include a notion of the "own" in Christian practices. The fact that on the one hand, the Franciscan's outsider chronotopes are gone, but on the other hand, the spiritual insider chronotopes still exist to this day, indicates that there was some flexibility in the

[56] Salinas, *Crónica*, 152.

missionaries' approach that allowed indigenous people to keep their own customs alive. This thought has to be applied carefully, so as not to allow a downplaying of the effects of colonialism. As Kofi Agawu has pointed out, forcing any expressive system on anyone *always* does damage.[57] However, if we do so with caution, we can utilize this idea to highlight the adaptive character of Colca culture, its ability to navigate the changes brought to the Valley, and the agency of colonial indigenous Colqueños – a matter that will be discussed in more detail in chapter 6.

When talking about regionalism and small-scale environments, it is important not to confuse "local culture" with "past culture." Colca culture is not frozen in time. Section 3.2.1 demonstrated that the Colqueño identification with Collaguas and Cabanas does not mean that the culture in the Valley has not experienced any outside influences. On the contrary, its distinctive set of traditions is in fact shaped by the interaction of Collagua, Cabana, Wari, Inca, and European cultures, especially Spanish Franciscan missionary culture. I contend that the fact that *several* religious orders operated in Peru during its colonization strongly contributed to regionalist culture in Peru. Different orders followed different philosophies and applied different approaches of Christianization, allowing for more or fewer indigenous traditions to survive in, flourish in, or even permeate Christian culture.[58] In addition, different peoples of Peru reacted differently to influences: Guaman

[57] Kofi Agawu, "Tonality as Colonial Force in Africa," in *Audible Empire: Music, Global Politics, Critique*, ed. Ronald Radano and Tejumola Olaniyan (Durham, NC: Duke University Press, 2016), 350.
[58] Some parts of Peru, where colonization happened through Dominicans, no longer show much of an overall influence of indigenous spirituality (Padre Franz Windischhofer, conversation with the author, Callalli, July 22, 2016). Jesuits, on the other hand, exhibited a remarkable leniency, especially when it concerned production of high-quality artworks; see Gauvin Alexander Bailey, *The Andean Hybrid Baroque: Convergent Cultures in the Churches of Colonial Peru* (Notre Dame, IN: University of Notre Dame Press, 2010), 48. Augustinians are occasionally referred to as the most liberal order; see Kelly Donahue-Wallace, *Art and Architecture of Viceregal Latin America, 1521-1821* (Albuquerque: University

Poma tells us about the *Collas*, who started fraternizing with Europeans earlier than other parts of Peru. "[They] praise Spanish overlords with new songs incorporating words borrowed from Castilian and inviting them to dance with Indian maidens."[59] Since Guaman Poma is specifying the location of the *Collas* "southwest of Cusco," he most likely is not referring to the *Colla* kingdom near Lake Titicaca, but rather to the *Collasuyu*, the quarter of the *Tahuantinsyuo* to which the Colca Valley belonged.

Lastly, the importance of acknowledging multidirectionality in cultural processes cannot be stressed enough. All too often, the discussion of (post-)colonial processes is limited to two opposing parties, and it is assumed that the stronger party influences the weaker. In the Colca Valley, there appears to have been – and there still is – cultural cross-fertilization that went not only from the stronger parties to the weaker, but also vice versa. In addition to the ideas by Weidman and Turino discussed earlier in this chapter, I would at this point also like to reference Michelle Bigenho's concept of modernity, which differs from Mignolo's in that it does not seem to establish as much of a dichotomy between the epistemology of "Western" and "non-Western" cultures. Bigenho contends that conscious contact with other cultures increases awareness about what sets one's own culture apart. She uses this concept to juxtapose two Bolivian communities, one succeeding in preserving its customs by showing less concern and anxiety about outside influences, the other having a more preservationist approach to their customs, which can, however, no longer be performed the way they used to be performed. Bigenho concludes that a kind of modernity that uses globalization to define one's own traditions can actually positively contribute to

of New Mexico Press, 2008), 49. Franciscans adapted actively to indigenous customs and learned Quechua or Aymara, mostly to facilitate Christianization (Vasquez and Estrella, "Fragmentos," 49).

[59] Quoted in Robert Stevenson, *The Music of Peru: Aboriginal and Viceroyal Epochs* (Washington, DC: Pan American Union, 1960), 144.

preserving them. What Bigenho calls “modernity” relates in a certain way to Mignolo’s border thinking, in that it opens up spaces for thinking and operating in different systems at the same time. Evidence of operating in different systems is present in today’s Colca culture; but I assert that border thinking existed in colonial times as well, and evidence for it is present in the form of colonial objects.

This chapter has shown that it is important for scholars of Peruvian colonial music to look at material evidence of past rural music cultures. While this evidence in fact exists in abundance, particularly in the form of historical pipe organs, it is presently not considered at all in scholarship, which results in missing pieces in the overall scholarly puzzle. I have demonstrated here that for the study of these organs, knowing the culture around them is important. The current chapter has revealed mechanisms of cultural exchange that not only fit within the tradition of exchange that is characteristic of Colca culture, but also represent the meta-history of this culture – the continuous negotiation and renegotiation of cultural identity. This dissertation considers pipe organs as one such outside influence on (past) Colca culture, and will examine how those organs fit within the essence, the meta-narrative of the Colca people. Guaman Poma’s above-cited quote potentially indicates that Colca people started to take up influences from the Spanish earlier than other tribes of the *Tawantinsuyu*.[60] It might therefore be equally plausible that the process of making changes to European customs happened earlier – and maybe even to a greater extent – there as well. Chapter 6 will investigate if and how there might be traces of visible and audible elements of Andean adaptations in pipe organs – adaptations that

[60] See glossary in appendix A.

were made in order to fit the organs into a framework of Colca identity and self-representation. The chapter will also show how this, in turn, can be related to concepts of hybridity and power dynamics.

Among colonial objects, which such scholars as Tom Cummins urge us to study, pipe organs hold a special place: not only are they one of the few examples of material culture that remains of colonial music in the Colca Valley, but they are also objects for worship – the very vehicle of European colonization that was used in the Colca. In that regard, they are similar to other, albeit non-tangible, pieces of evidence for European-rooted music practices in the Valley. This chapter described how Western standard orchestra brass instruments are adapted to accompany bull fights: the embouchure is adjusted so that the instruments sound breathy. French-Spanish pasodoble forms are played in Andean heterophony. Other examples include the use of big-band harmony at *wititi* contests or the use of guitar to accompany Quechua songs. The music-making I witnessed in the Colca Valley often showed a non-Andean element that was either profoundly altered or taken out of its context; and, like church organs, it was often used in a context of ritual or spiritual practices. While the present-day musical customs in the Colca show us the ongoing change and development of tradition that Glassie refers to, Colca organs – as chapter 4 will demonstrate – have not been significantly altered recently. As such, they can provide insights into processes that lie further back. Therefore, I close this chapter with the contention that an ethnographic aspect *must* be included in the study of Colca pipe organs. We need the insights gained in this chapter for adequately studying and understanding the instruments that will be discussed over the next few chapters, and conversely, this understanding will enable us to arrive at a more complete interpretation of Colca culture both past and present.

CHAPTER IV

THREE CASE STUDIES

As an example of the rich Colqueño organ culture, I will give an in-depth description of three organs of the greater ecclesiastic district of Callalli. The main reason for focusing my research on these instruments is purely practical: the very few currently playable organs from the Peruvian colonial period, like the organs in Andahuaylillas or in the cathedra in Cusco, are not in their original state anymore. Those in smaller towns or villages, however, which have not been altered, have decayed over time due to lack of financial resources, knowledge, and historical awareness, and are therefore often not in a state that would be useful for research. The organs in Sibayo, Callali, and Tisco are still relatively complete. They represent a workable compromise in that they are, though not playable anymore, still relatively well preserved.

Because of the scarcity of historical Spanish writings on organ building, I will resort to other European primary sources from the sixteenth to the eighteenth centuries, such as Michael Praetorius' *Syntagma musicum,*[1] Dom Bedos' *L'art du facteur d'orgues,*[2] Schlick's *Spiegel,*[3] and Werckmeister's *Orgelprobe.*[4] Secondary sources on historical

[1] Michael Praetorius and Wilibald Gurlitt, *Syntagma musicum* (Wolfenbüttel 1619; repr., Kassel: Bärenreiter, 1985).
[2] François Bedos de Celles, *The Organ-builder,* trans. Charles Ferguson (Raleigh: The Sunbury Press, 1977).
[3] Arnolt Schlick, *Spiegel der Orgelmacher und Organisten: Allen Stiften und Kirchen, so Orgeln halten oder machen lassen, hochnützlich, durch den hochberümten und kunstreichen Meister Arnold Schlick, pfaltzgräflichen Organisten, gewissenhaft verfasst*, ed. Ernst Flade (Kassel: Bärenreiter Verlag, 1951).
[4] Andreas Werckmeister. *Andreæ Werkmeisters ... eigentliche Beschreibung wie und welcher Gestalt man die Orgelwercke von den Orgelmachern annehmen/probiren/untersuchen und denen kirchen liefern könne; auch was bey ... alten Wercks; so da zu renoviren vorfallen möchte; nothwendig in acht ... übersehen; mit gründlichen Ursachen bekräfftiget; und zum Druck befördert* (Munich: Bärenreiter, 1927).

organ building, and studies on modern-day organ building have been good resources and helped me get a better overall understanding about this topic. In particular, the works of Oosterhof and Bouman,[5] George Ashdown Audsley,[6] and Klaus Ellerhorst[7] offer a very comprehensive treatment of the subject.

In this chapter, I provide technical information about the three instruments mentioned above. Based on in-depth organological examinations that I did in 2016-20, I describe the organs' exterior properties, their wind supply and tracker action, their pipework and sound.[8] The detailed narrative description below is complemented by tables of measurements in appendix C. The discussion of the sonic properties of my case studies is greatly based on wave forms, Fourier spectra, and plots and graphs that show trends in the progression of certain scaling properties throughout ranks. These are included in the appendices D and E. By pointing out communalities between my three case studies in their visual, aural, functional, and material properties, I will argue for the existence of a distinct "type" of Andean organ, and will define its characteristics.

The non-organist readers are referred to appendix A, where they will find diagrams of organ pipes and other parts of organs, as well as a glossary explaining additional terms used in organ building. In appendix B are photographs of particular characteristics of the organs described below. These images will be references explicitly in the text.

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[5] A.P. Oosterhof and Arie Bouman, *Orgelbouwkunde: Hand- en Leerboek voor Orgelbouwers, Adviseurs by Orgelbouw* (n.p: Spruyt, 1971).
[6] George Ashdown Audsley, *The Art of Organ-building: A Comprehensive Historical, Theoretical, and Practical Treatise on the Tonal Appointment and Mechanical Construction of Concert-room, Church, and Chamber Organs* (New York: Dodd, 1905).
[7] Winfred Ellerhorst, and Gregor Klaus, *Handbuch der Orgelkunde* (Buren: Knuf, 1986).
[8] For an explanation of common terms used in organ building, see the glossary and the diagrams in appendix A.

4.1 Sibayo

4.1.1 Introduction

The organ in the church of San Juan Bautista in Sibayo is the most original instrument of my three case studies. The pipes feel quite heavy and must contain a big percentage of lead, which was typical for pipe making before 1800. The organ case and other structural parts, and the pipes appear to be mostly unaltered, save for smaller repairs. The materials used for these repairs indicate that some of them must have happened within the last hundred years.

The keyboard range appears to be original as well, since the keys look uniform – and rather deteriorated. The organ has a range of C2 to G#5. Hans van Gemert describes colonial Peruvian organs as starting on E in the bottom octave.[9] This must be a misunderstanding – the instrument in Sibayo clearly possesses a "short octave." In a short octave, the keyboard does not extend down to the C2, but ends on what looks like an E2. However, this E2 in fact connects to the C2-pipe, next to it comes the F2, and the keys F#2 and G#2, notes which are not usually needed in the lowest octave, play the D2- and E2-pipes, respectively. While the short octave is a standard feature of Renaissance and Baroque keyboard instruments, a black key as the highest note is quite surprising and difficult to interpret with regards to dating the instrument.

4.1.2 Exterior design and location

The organ in Sibayo is a relatively small chamber-size instrument of only 1.05 meters in width (excluding the wind supply), situated on the west balcony of the church.

[9] Gemert, *Órganos Historicos,* 110.

The balcony is constructed in a way typical for Roman Catholic churches: heavy and stone-built, able to provide room for a small choir or instrumentalists. The upper end of the staircase leading to the balcony is situated directly next to the organ, which in turn spans almost the entire space between stairs and balustrade, leaving only a small space on the staircase-side of the instrument to access the back of the case.[10]

The wooden case is painted dark red, and pragmatically follows the length of the pipes: it is 2.70m in height on the left side, and 1.98m on the right side. The trapezoid shape of the upper case is reminiscent of late medieval or early Renaissance organs.[11] The lower case and the upper case are of equal width. The case can be closed with a shutter, which has a depiction of a female (most likely Saint Cecilia) playing an organ on the inside, and an indigenous flower motif on the outside. The inside of the upper case is lined at the back with two different kinds of thick fabric with a non-Andean flower motif. The fabric seems to be newer than the rest of the organ, but shows signs of deterioration as well. The back of the lower case is missing.

The built-in console, containing only one manual, can be closed with a wooden panel. The position of the organist must have a quite uncomfortable one: the fact that the kneeboard lies in one line with the console means that he would either have had to entirely round his back and stretch his neck to be able to reach the keys; or that he would have to sit in a sidewards position. Even in this position, the player might not have seen much of the keys while playing, since the console cutout is only 22cm in height. Above the console,

[10] See fig. 7 in appendix B.
[11] There are also some later Italian instruments (called *organi ad ala*), but those are positive organs. One example is the 1774 positive organ in Roccavione, Cuneo: https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DnVHbBHwMbgA&psig=AOvVaw2HvWyOoE5aA2I2hrMzV4iF&ust=1607743023458000&source=images&cd=vfe&ved=0CA0QjhxqFwoTCPjpmdT7xO0CFQAAAAAdAAAAABAJ

the Latin mass ordinary, handwritten on a piece of paper, is glued to the front panel of the lowercase, presumably as a mnemonic aid.

The keys are made from wood. Their visible part is 21mm wide, between 10 and 15mm high and only 10cm long. The tops of the upper keys are covered with a thin layer of black material, probably black paint. The bottom keys are coated with a thick layer of very hard bright-yellowish wood; their fronts are painted red. On the lower left of the front panel there is a narrow, vertical cutout. It must have been for a foot lever, most likely to activate accessories. The organ does not have any pedals, which justifies the absence of an organ bench. At present, there is no other seating available on the organ loft – neither for the organist, nor for eventual assistants, other musicians, or worshippers.

4.1.3 Wind supply

The two bellows of each 1.22m in length and 0.63m in width are situated beside the organ case on its left side. They are diagonal bellows with each five inverted folds and are held by a bellow frame, to which two long levers (each ca. 1.4m in total length) are fixed by means of strips of llama or alpaca leather. The bellows are made of thick leather – presumably either llama or cow. The levers, when pushed down on one side, pull the bellows open on the opposite side, to which they attach by thick braids made from alpaca wool and alpaca and llama leather. The upper part of the bellow frame is missing, the levers therefore lie directly on the bellows. This makes operating the bellows currently physically challenging, though still possible. The bellows connect to the organ through a wind trunk, which leads the air directly to the windchest. There is thus no compound bellows between the two wedge-bellows, which probably resulted – depending on the skill and experience of the pumper(s) – in more or less severe fluctuations in wind pressure.

The windchest at the front of the organ is made airtight with leather (probably llama), which double tasks as a closing mechanism for the plank that seals the windchest: since there are no screws or hinges, the plank is entirely held in place by the friction between the wood and the leather. The bottom of the windchest is made of thin leather (probably alpaca), as a replacement for the wooden plank that normally covers the grid in the pallet chamber.

4.1.4 Action

The mechanical action and tracker system of this organ are quite simple. Each key works through a so-called suspended action, thus the pivoting point lies at the very end of the 35cm-long key. The far ends of the keys are held down by a simple, about 12cm-wide strip of leather, which is glued onto the keys, but cut in, so that the keys can move independently. Near the middle of the keys, not far from the visible part of the keyboard, vertical trackers of between 28 and 35cm in length are attached to top of the keys through eyelets.[12] Through the chromatic arrangement of the pipes, the trackers lead directly into the windchest without any relays like rollers, roller frames or roller boards. As a result, the trackers towards the ends of the keyboard are askew, which probably made it necessary to exert a higher force on those keys in order to fully depress them.

The organ also has very basic stop-action: thin sliders just stick out on both sides of the case. Currently still present are one slider on the right side of the case and three on

[12] See fig. 12 in appendix B.

the left, which indicates that the organ had at least three independent ranks. The sliders cannot be reached by the organist while he is sitting at the instrument, so it can be assumed that either the pumper operated them, or that registration was not changed during pieces. The sliders are completely stuck and cannot be moved anymore.

4.1.5 Pipework, stops and accessories

In this section, I discuss technical and material aspects, and sound properties of the pipework in the Sibayo organ. The pipes are accessible and can easily be removed from the toe board. There are only two pipes that are not on the board; they are inside the case, lying on the windchest. Ranks 2 to 5 have a rack that holds the pipes in place. The front rank is entirely held in place by two thin rods of wood on either side of the pipes. The feet are not supported in any way, a pipe rack (or something similar) is missing. The front pipes are standing in an off-note rack, since their width does not allow fitting all pipes in one row next to each other. The borings in the toe board for the interior pipes seem to have been made by eye sight. These two circumstances cause the holes to not align property, making it impossible to determine which pipe belongs to which key.

Measuring different scaling properties did not pose a problem. The pipes are in a good enough condition to be extracted from the case and to withstand measuring procedures. Direct (aural) sound analysis is not possible in an organ whose wind supply and tracker system do not work properly anymore. I therefore will be using different methods – mainly visualizing scaling trends and analyzing sound properties by playing pipes individually – to make inferences about the original timbre and disposition of the instrument.

4.1.5.1 General overview

There are two kinds of pipes in this organ:

1) Metal flue pipes (201 total)

2) Wooden flue pipes (2 total)

Judging from their size of over 8 feet in length and their limited number, the two wooden pipes must have been used as drone pipes, providing sustained bass notes.[13] This kind of practice is indirectly described by Reuter for Spanish organs from the eighteenth century onward,[14] while in other countries, they were rather an occurrence of earlier centuries, partly as a predecessor of a full pedal board.[15] The cutout in the lower end of the kneeboard most likely contained an on-/off-switch for them, to be operated by the organist's foot. The mechanism unfortunately has become a victim of the destructive force of time. The fact that there is only *one* cutout (as opposed to two) means that the two pipes were used together. Their resonator lengths have a proportion of 1.23 (thus roughly 5:4), which corresponds to the interval of a major third. The drone pipes obviously showed leakage at some point in time, because someone made them airtight by gluing paper onto them. This is a commonly used measure in organ building when (financial) resources are scarce. The sheets of papers seem to be recycled letters or chronicles. There is handwriting on them, and some of them also contain dates and years. Unfortunately, they are partly glued on top of each other, so that thus far, it has not been possible to decipher a year.

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[13] See fig. 18 and 19 in appendix B.
[14] Rudolf and Hannelore Reuter, *Orgeln in Spanien* (Kassel: Bärenreiter, 1986), 15.
[15] Barbara Owen, and Peter Williams, "Organ," in *Grove Music Online,* 2001, ed. Dean Roote, accessed March 13, 2021.
https://www.oxfordmusiconline.com/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo-9781561592630-e-0000044010.

There is a "19..." visible on one of the papers, thus the repairs must have happened at some point during the twentieth century.

None of the sliders extending from the organ case on either side carries a stop name. In the following discussions on sound, foot number, and pitch, considerable thought is therefore given to scalings, but also to sound analysis of individual pipes. Combining data gained from scaling proportions, scaling progressions, waveforms and Fourier spectra[16] of individual pipes allows for drawing conclusions about the timbre of a rank and its foot number.

4.1.5.2 Completeness

Rank 1, the front rank, has seventeen pipes and seems to be complete. Rank 2 is split into a right and a left side – a practice which in Spain is called *medio registro*. The split in this organ happens at pipe number 18. The upper half is doubled. With only nine pipes missing, this rank is 87% complete. All missing pipes from the upper half belonged to the back row (five pipes). Interestingly, this rank has one extra pipe: a toe hole drilled approximately between the sixth and the seventh groove contains a sounding pipe, which in this study is referred to as "pipe number 6 ½." Rank 3 misses only seven pipes. It is a single rank stop, meaning that its toe board has forty-three holes. Thirty-eight pipes are still present, thus the rank is 84% complete. A single rank as well, rank 4 misses thirteen pipes – mostly in the lowest two octaves. The highest two notes are missing as well. This leaves the rank with twenty-nine pipes and 67% completeness. Stop 5 is a double-rank mixture

[16] A Fourier transform decomposes a signal into its individual frequencies. A Fourier spectrum of a sound wave therefore shows the individual frequencies (fundamental frequency and overtones) that the sound wave is composed of.

stop that is supposed to have two pipes per note throughout the entire stop. However, for the front row, pipes number 6 up to and including pipe number 25, are missing. Also, similar to rank 4, the highest two notes are missing entirely (front and back row). Together with occasional other missing pipes throughout the rank, the number of absent pipes adds up to twenty-nine, leaving only fifty-seven pipes (66%) instead of the expected eighty-six.

4.1.5.3 Constructional characteristics and material

All pipes are relatively heavy, indicating a high percentage of lead. The softness and malleability of lead also explains the great number of dents in the pipe walls. The wall thickness generally is quite thin, with an average of 0.52mm for the upper walls of the interior pipes and 0.76mm for the upper walls of the front rank. Measuring the wall thickness at the toe hole was in most cases technically impossible. However, given the big number of collapsed toes or even entire feet, it is safe to assume that most feet have thin walls as well.

All pipes in this organ are cylindrical in shape and most are open pipes. Only about half of the pipes or rank 2 are stopped. The latter do not have caps, but instead permanently soldered lids. Consequently, most of them have ears, which must have doubled as tuning devices, besides their usual function as a voicing aid. The fact that there are significant humidity changes between the dry and the wet season in the Colca Valley raises the question if ears were actually sufficient to tune the pipes in a satisfactory way. The shape of the ears is trapezoidal (sometimes close to triangular) instead of rectangular for most of the pipes. It is not clear at this point if this shape has any influence on the timbre of the pipe, if it was chosen to save material, or if there were aesthetic (visual) reasons. While pipes of other ranks do not have ears at all, some of the open pipes in rank 2 have ears as well. This might have been a measure to equalize the timbre within the rank.

This organ exhibits great variety in the shape of its pipe mouths: all ranks contain Roman-pressed and flatted upper lips. One third of all mouths in the organ are flatted, with variation across ranks (lowest occurrence 29% in rank 3; highest 45% in rank 2). The second-most occurring mouth is bay leaf-shaped, both in its pressed and scored variation. While scored bay leaf occurs exclusively – and very consistently – in the front rank, pressed bay leaf is present in ranks 3, 4 and 5. The least frequently occurring lip shapes are Roman-scored (one single pipe in rank 2) and bay leaf-scored-pressed (one pipe in the front rank). Remarkable are the occasionally double-scored round lower lips in the front rank. It is not clear whether this was done for decorative reasons, or whether it was the result of initial measuring errors, or whether the original mouth width of the rank was increased at some point. Equally uncommon is the fact that some pipes do not have lips at all. On those pipes, the metal below and above the cut-ups stands completely convex and is not pressed-in even to the slightest extent. The pipes, however, still sound. This kind of pipe occurs most frequently in rank 5.

It is unclear whether the pipework of this organ was made on location, or whether it has been imported from Europe. There is support for both theories. On the one hand, making metal pipes is a highly specialized task that requires not only knowledge and experience, but also the proper tools and facilities – especially when done from scratch, thus starting with melting the metal and casting the sheets. On the other hand, the pipework overall looks more pragmatic than one would expect in a comparable European organ. None of the pipes are polished, and many of them have a ribbed surface. This usually points towards a coarse plow used to even out the sheets of metal before they were rolled up into pipes. It might be an indication of limited access to sophisticated tools during the time of construction, and therefore point towards local origin of the pipes. Additionally, there is almost no languid beveling. All of rank 1, half of rank 3, and most of ranks 2 and 4 have languid fronts that stand in a 90-degree angle to the languid surface. This is not commonly found in European organs (of any time period), where an angle of 50-75% would be the norm.[17] Those languids that *are* beveled in the Sibayo-organ still have a quite steep angle, usually between 75 and 85 degrees, so it might be that they were originally 90 degrees and later slightly flattened out through decay. There are 45-degree angles in some pipes, however, it is not clear whether those bevels are original, or whether they are a result of later (unprofessional) intonation practices. Lastly, none of the pipes bears any name inscriptions – not even the lowest pipe of each rank or the very lowest pipe of the entire organ. Signing organ pipes, or at least initialing them, was something which usually happened in the workshop of every European organ maker.

However, to complicate matters, missing inscriptions and low quality do not entirely exclude the possibility that the pipe work was imported from Europe. It could just as well be that those pipes were rejects from the workshops of European organ builders who did not want to tarnish their reputation by using second-choice parts. The great variety of mouth shapes discussed earlier would be in support for a mix-and-match approach of second-hand pipe material. The quite homogenous sheet thickness throughout the ranks would speak against it. Comprehensive non-invasive materials research, combined with continued archival research, could shed light on this conundrum. An XRF spectrometer

[17] Oosterhof and Bouman, *Orgelbouwkunde,* 194.

could reveal the degree of homogeneity of the pipe material in the entire instrument, and could possibly also allow for inferences about the geographic origin of the specific materials used.[18]

4.1.5.4 Inscriptions

Most pipes in this organ bear note name inscriptions; those that do not are situated in ranks 4 and 5. Rank 5 is the least inscribed rank, with only one single pipe (the highest pipe, number 40) showing an inscription. All inscriptions are scratched into the metal in a relatively modern, probably twentieth-century, cursive hand. They specify the note name in Spanish and often additional information, like the number of the rank.

While inscriptions on organ pipes usually provide useful cues about the (original) function and location of individual pipes within the organ, or even about the origin of the pipe work of an organ at large, the inscriptions in the organ in Sibayo rather complicate the matter. The lowest pipe on rank 1, for example, is labeled "do." Under consideration of the short octave, one therefore would expect pipe number 11 to be a C as well. However, checking pipe number 12 (number 11 does not exist in the front rank), yields a "Sol." The next front pipe inscriptions are on number 17 and 20 and read "La#" and "Sy," respectively. In rank 3, pipe number 30 and 31 both read "my" and 41 and 42 are both labeled "sol#." While not all ranks are inscribed that erratically – rank 2, for example has three "do's" very correctly located exactly twelve pipes apart – these examples prove that the inscriptions in

[18] XFR testing is a non-invasive method for material research. It uses a technique that floods samples with x-rays, stimulating them to emit photons. The device detects and measures the emitted photons and references them with the characteristic photon emissions of known materials.

this organ are not reliable enough to be used for determining pitch names. It seems that too many pipes are not at their original place anymore, an assumption which gets support from the fact that the letters "de" (for "derecho," the right half of the *medio registro*) frequently appear on pipes in the left half of the organ.

The inscriptions in this organ, however, do allow us to solve one mystery: the function of the front rank. Ranks 1 and 2 both have the inscription "1er," thus "first" on most of their pipes, and rank 3, accordingly, is labeled "2do," "second." This means that the front rank and the rank behind it are one and the same stop. However, since rank 2 starts on the low C, it cannot merely be a continuation of the front rank. Rather, it seems that the front pipes double certain low notes of rank 2. The system for doubling is not entirely clear. The most logical choice – doubling the entire lower half of the *medio registro* – does not apply here, since pipe numbers 24 and 34 are both labeled do#, and there are only four pipes between them. However, if the front rank was to reinforce only selected notes, the question arises why there is a focus on altered pitches (do#, la#), instead of the more obvious diatonic notes.

4.1.5.5 Current state of the pipework

The two drone pipes seem to be in good condition. Their functionality could not fully be assessed since they are not connected to a working wind supply anymore and their weight and size does not allow for lifting them up and playing them by mouth. However, a visual inspection did not reveal any cracks or other serious material damage, and the paper that has been glued onto them to avoid leakage appears to be mostly intact.

The remaining pipe work, unfortunately, is in bad shape.[19] The combination between the soft, malleable pipe material and small wall thickness – presumably to save expensive metal – caused many pipes to collapse under their own weight. Most of the pipes in this organ are not straight anymore, but curved, bent or even kinked. A big number of feet are collapsed, sometimes so much that they remind one of crushed aluminum foil. As a result, many pipes do not sound anymore, since the air in the foot is not properly directed towards the languid, or because it leaks through tears in the pipe wall that were caused by the collapse. Even more than the feet, most toes are collapsed (resulting in the typical "pig's snout" shape), sometimes so severely that the toe hole is completely obstructed. Some toe tips have textile, leather, or synthetic tape wrapped around them, so there must have been some degree of awareness of this problem. A few pipes even have new foot tips. However, the material, similar to the metal used for occasional new pieces added to the upper ends of the resonators, does not differ much in color, texture and degradation from the main pipe material. This indicates that the addition of the extra parts must have happened a long time ago.

Besides feet and toes, cut-ups are the most vulnerable parts of organ pipes. Indeed, there are numerous collapsed mouth regions in this organ, especially on the pipes of rank 5. Some pipes have even broken in two at the mouth due to collapsed cut-ups.

Other damage on the pipework includes missing ears, descended languids, and dents and cracks in the pipe material. There is evidence of repair attempts on some of the pipes, mainly in the form of unprofessional soldering attempts. Big "blobs" of solder or

[19] See fig. 17 in appendix B.

shakily drawn soldering seams can be seen at the ears, around the cut-ups and mouths, at the cover plate, and occasionally at the back of the pipe.

4.1.5.6 Sound

It is always a delicate task to talk about sound properties of an instrument that does not sound anymore. Moving the bellows of the Sibayo organ works to some extent, but afterwards, most air is lost through leakage (of both bellows and wind conducts) before it even reaches the windchest. The small amount of air that does reach the windchest is too weak to produce an acceptable tone in the pipes. On top of that, the sliders and most keys are stuck, and the sliders are leaking. Playing this organ in a conventional way is therefore impossible. Inferences about the instrument's sound are nonetheless possible, using two different, but complementary, methods: first, removing the pipes from the toe board and blowing them by mouth one at a time makes it possible to at least get approximate sound samples for spectral analysis. Caution is advised though: many of the pipes show heavy damage and their sound should not be assumed to be the original sound; additionally, blowing into organ pipes with a different wind pressure than the original one always changes its sound slightly. Second, the sound of an organ pipe is largely determined by its shape. Therefore, looking at diameter scalings, measurements of different parts of a pipe, their proportions to each other, and their progression within a rank, can yield important data to supplement the insights gained from sonic analysis.[20]

[20] A complete overview on measurements, wave forms, and sound spectra can be found in appendices C and E. Furthermore, in appendix D are visualizations of all scaling progressions and scaling proportions referred to in this chapter.

The front rank mostly sounds hoarse and weak, possibly due to damage and deterioration in the pipe material. However, the pipes that do work have a truly *Prestant*-like sound, with the exception of the four lowest pipes, which tend more towards a *Gemshorn* or a strong, but not too wide Flute register. The Principal character of this rank is not surprising, given that two thirds of the pipes have a mouth-to-diameter proportion of over 75% and most cut-up-to-diameter proportions are over 20%, all typical for Diapason scalings.[21] Those cut-up heights that are less than 20% of the corresponding inner diameter all are among the lowest pipes of the rank, probably accounting for the more Flute-like sound there. The Fourier spectra (FFT – "Fast Fourier Transform") generated by the Logger Pro 3.0 software support this first aural impression. Most of the spectra are relatively "full," meaning they contain a lot of harmonics. The intensity of the harmonics does not always follow the ideal line for Diapason pipes,[22] which could however be due to dust in the pipes or low-quality (portable) recording equipment.

In the second rank, most of the pipes do not speak, or at least they do not speak properly anymore. As a result, the FFTs often show only noise, with one more-or-less clearly defined fundamental. Among those that do speak we hear a variety of timbres, from scratchy to hoarse to Flute-like to diapasonic.[23] About 10% of the spectra show harmonics that are stronger than the fundamental, resulting in a shrill, sharp sound. Besides big damage on the pipes of this rank, the most likely cause for this heterogeneity are the highly irregular proportions of the inner diameters to the resonator lengths. The most prevalent

[21] Oosterhof and Bouman, *Orgelbouwkunde*, 225 and 237.
[22] Colin Pykett, "The Frequency Spectra of Diapason Pipes," accessed March 3, 2021, http://www.colinpykett.org.uk/observations-on-organ-pipe-sounds-frequency-spectra.htm#Spectra-Diapasons.
[23] The Open Diapason or Principal is an organ stop that does not seek to imitate any other instrument. Its timbre and diameter scaling lie between the Flute-like and the String-like stops.

sound, though, is that of a forceful *Prestant*, which is in agreement with data in the scaling tables: most of the proportions mouth width to inner diameter are over 75% (or even over 80% for the pipes of the front row in the doubled part of this stop), and the cut-up proportions are almost all over 20%. Most importantly though, the progressions of diameters show a downwards trend that seems to roughly follow Töpfer's *Normalmensur,* a kind of Diapason scaling that was developed on the basis of the human equal loudness curve. [24] At the time when the organ was still functional, listeners most probably experienced every pipe of rank 2 at a similar volume.

Rank 3 shows irregularities in the diameter scalings as well, but not to the same extent as rank 2. The proportion of mouth width to inner diameter is rather stable throughout the rank, with a median value around 80%. The median proportion cut-up height to diameter is around 23% and relatively unfluctuating as well. Both would indicate a highly Principal-like sound, however, a first aural impression reveals a rather husky and thin timbre, which is confirmed by very noisy FFT spectra and often the absence of higher harmonics. Besides damages in the pipe material, the particularly dusty and dirty state of the pipes might be responsible for this. Overlaying the *Normalmensur* to the diameter progressions exposes a similar trend to rank 2. The lowest octave, however, shows a tendency away from the ideal line. The smaller diameters in that region indicate a thinner,

[24] The Töpfer scale, also "normal scale" or "standard scale" (in German: *Töpfersche Normalmensur*) describes a diameter scaling for Diapason/Prestant organ pipes that follows the human equal loudness curve. A deviation from the Töpfer scale is heard as a change in sound intensity within a rank of organ pipes. Flute-like organ pipes deviate in the plus-direction from the scale, are thus wider. Organ pipes that imitate string instruments are sharper, but less voluminous in sound, and deviate in the minus-direction from the Töpfer scale.

softer sound, which means that the organ maker intended to emphasize the descant region rather than the bass.[25]

A similar trend of emphasizing the higher octaves in terms of sound volume is present in rank 4, where the lowest two octaves are scaled narrower than Töpfer, the third octave is in accordance with the *Normalmensur*, and the highest octave shows an increase in diameter scalings to values above Töpfer. In addition, 20% of the pipes have a fundamental frequency that is weaker than the higher harmonics, which makes the sound shriller. A noteworthy meta-irregularity presents itself in this rank, as both the progressions of resonator length and inner diameter show some randomness, but never on the same pipes. The result is a very irregular progression of resonator length to inner diameter. Additionally, the relationships between mouth width and diameter, and cut-up and diameter are very unstable as well. All of this leads to an extremely heterogeneous timbre throughout the rank. In general, however, the median for the mouth width lies around 80% and for the cut-ups between 30 and 40%, which indicates that the intention of the pipe maker was to make this rank Principal-like in sound.

Rank 5 is a Diapason rank as well, with most mouth widths between 80 and 85% of their corresponding diameter and most cut-up proportions between 20 and 40%. The sound of this rank is very erratic, which is also reflected in the proportions between resonator lengths and diameters. The corresponding plot reminds of a star cluster rather than a progressive line. The FFTs and waveforms confirm this impression of randomness: 20% of the sound samples have a spectrum in which at least one higher harmonic is stronger than the fundamental. Over 30% of the spectra contain a significant amount of noise. And

[25] "Organ Flue Pipe Scaling," *Wikipedia*, last modified September 11, 2018, accessed March 3, 2021, https://en.wikipedia.org/wiki/Organ_flue_pipe_scaling.

over 55% of the spectra show either a fundamental frequency only, or a fundamental with one single, very weak upper harmonic. The waveforms reflect the heterogeneity of this rank. They range from sinusoidal simple (e.g. in number 33F) to very slightly irregularly complex (as in number 27B). Significant is a number of pipes (mostly in the back row) that have wave patterns whose envelope changes periodically in amplitude. It might be possible that these are frequency combs as described by Trommer et al., which are generated by additional tones formed at the mouths of the organ pipes. These frequency combs might also be responsible for the rough timbre of the pipes they belong to.[26]

The absence of a large number of pipes of this rank creates additional confusion. This stop is a mixture stop, which originally had two full ranks. From a plot of length progressions, we can easily determine that the breaks for the back row lie at pipe numbers 18 and 32. The front – where still present – goes in unison with the back row. However, its pipes are missing from pipe number 6 to number 25; therefore, we do not know whether the two rows were in unison everywhere (which would be very uncommon for a mixture stop) and if not, where the repetition points of the front row were.

In summary, this organ, while generally oriented towards a strong Principal-like sound, possesses a very wide range of timbres and lots of deviations from "ideal" Principal-pipe properties or related progression curves. It is unclear at this moment, whether the heterogeneity in timbres was intended by the builders, whether it is due to reused pipes, or whether unprofessional repair- or tuning attempts over the years, changes in the pipe-location on the toe board, or dust, debris and damage partly or entirely caused it. What we

[26] Thomas Trommer, J. Angster, and A. Miklós, "Roughness of Organ Pipe Sound Due to Frequency Comb," *The Journal of the Acoustical Society of America 131*, no. 1 (2012): 739-48.

know for sure is that this organ shows a penchant towards rather high, bright, or even sharp and shrill sounds, especially in the upper regions of the keyboard. Some of the ranks also sound stronger in volume in the upper octaves than in the lower ones, indicating a preference for higher frequencies. Unique are ranks 4 and 5, the former a very high stop, otherwise not found in Spanish organs, and maybe based on Dutch or North German influences, the latter a very high mixture that must have sounded the more "piercing" as it seems to have both of it ranks playing unison at times.

4.1.5.7 Pitch

Most pipes seem to not be in their original position anymore and some holes in the toe board do not clearly correspond to a particular groove above the pallet chest, both of which makes talking about the tuning pitch of this instrument a precarious and speculative endeavor. In addition, there are limitations to using the sound of the individual pipes in this organ for determining their pitch, since so many pipes show severe damage. However, we do know that the lowest pipes are supposed to be a C: the lowest key on the keyboard is a C2, and the lowest pipes of at least two ranks are labeled "do." We can measure the length of the resonator and use the formula $f=v/2L$, where L= equivalent length of an open pipe, v=speed of sound, f=frequency of pitch.

The lowest pipe of rank 2, a stopped pipe with permanently soldered lid, is 566mm long. The wavelength is therefore 2264mm. Assuming a speed of sound of 325 m/s (at an altitude around 4000m) yields a frequency of 144Hz,[27] which is a bit below a modern D3

[27] "Elevation - Temperature, Pressure and Speed of Sound," Engineering ToolBox, accessed March 13, 2021, https://www.engineeringtoolbox.com/elevation-speed-sound-air-d_1534.html.

(at A4=440Hz). The tuning pitch of this organ is therefore about a whole tone higher, yielding A4= ~493Hz.

4.1.5.8 Stoplist

This section presents an attempt to make a stoplist based on the preceding findings about pipe lengths, pitch, and sound. The organ in Sibayo corresponds to the Southern European Baroque organ tradition: all pipes seem to have a Diapason sound, and the principle of building up the sound like a pyramid (having a rank for every octave) is equally adhered to. In addition, the typical Spanish-baroque *medio registro* is present in rank 2.

The longest front pipe is an open pipe and almost exactly twice as long as the low C of rank 2 – a stopped pipe – thus it supposedly was to sound at the same pitch. The organ can therefore be assumed to represent a 4-foot instrument. [28] Rank 3 is very close in length to rank 2, but open, and was therefore certainly the 2-foot stop. Rank 4 presents difficulties: its proportion to rank 3 fluctuates between 0.3 and 2.7., i.e., some pipes are almost three times as long as the corresponding pipes in rank 3, some are only a third of the lengths of pipes in rank 3, and most of them are somewhere in between. Overall, the pipe lengths of this rank mostly resemble those of a 1-foot stop.

Assuming that Spanish was the working language in the mission, and that Spanish organ building conventions were the norm – e.g., stating the lengths of pipes in *palmos* instead of feet – a stoplist for the original, intact instrument could have looked as follows

[28] The foot number used to denote the "base" of the organ always refers to the lowest note of the lowest Principal rank.

Izquierdo	***Derecho***
Flautado de 6 ½	
Octava	*Octava abierta* *Octava tapada*
Quincena	
[Diapason 1'][29]	
Lleno	

Translated to English, this would be:

Rank		**Bass**	**Descant**
1 (front)		Prestant 4ft (17 notes)	
2		Octave 4ft	Octave 4ft (open) Octave 4ft (stopped)
3		Octave 2ft	
4		Octave 1ft	
5		Mixture II ½ft	

[29] 1-foot stops were not built in Spanish Baroque organs. I was therefore unable to find a possible original name for this stop in primary and secondary sources.

Accessories:		Drone pipes (2 notes)

4.1.6 Current state and use of the instrument

The organ in Sibayo is not playable anymore in the conventional sense. Attempts to move the bellows were successful, but leakage is too strong to be able to provide the chest with wind. The sliders and most of the keys are stuck and cannot be moved anymore. Deterioration is present on the wooden and leather parts of the instruments, and heavy damage affects the metal.

However, the organ is currently used once a year in Holy Week, during the so-called *tinieblas*. According to my interlocutor *in situ*, the light is turned off after the official Good Friday liturgy, as a sign that Jesus died. Then, the bellows of the organ are moved; the whining sound produced by the air running through random pipes whose pallets are stuck in an open position, expresses the power of the darkness. The intended (and achieved) event is a sound effect, not music in the conventional sense.

4.2 Callalli

4.2.1 Introduction

The second case study appears to be an atypical example at first glance: the organ in the church of San Antonio of Padua in Callalli. While the standard type of colonial organs in the Andes resembles European Renaissance positive organs, with a flat front, and a rather "static" design, this organ is different. Its salient front showcases pipes in a nonchromatic layout, featuring its lowest pipes in a rounded middle tower that stands out over the remaining pipes and draws the focus of the observer. However, upon closer look, the front appears to be newer than the rest of the instrument. Behind the dynamic three-dimensionality, which clearly strives to imitate a highly Baroque style, hides a second front with a simple, flat, chromatic layout, almost identical to that in Sibayo.

Dating this instrument – and the changes applied to it subsequently – is difficult. The keyboard range of C2 (full octave) to G6 compares to modern organs of the nineteenth or twentieth centuries; it is unlikely, though, that this range is original. The organ in Callalli is one of the few Andean instruments that has roller boards, something which is usually not necessary in organs with a chromatic pipe layout. These roller boards serve the highest and lowest pipes, which obviously would otherwise have necessitated a too steep tracker angle. They might therefore have been added when the corresponding keys on the keyboard were added. The paper wind ducts leading to the stood-off front pipes strongly remind of the practice of European organ builders of the late nineteenth and early twentieth century, who used similarly shaped lead conveyances. Furthermore, there is a first and last name and a year written in pencil on the front of the case, which is a common custom for organ builders after bigger repairs or rebuilding projects. Both are unreadable; however, the year seems to start with the numbers "1" and "9," indicating a time somewhere in the twentieth century. All in all, a safe assumption would be that the organ dates from a similar time period as the instrument in Sibayo (probably seventeenth century), thus not long after the construction of the church, and that it has been altered at some point in the twentieth century.

4.2.2 Exterior design and location:

As in Sibayo, the organ in Callalli is located on the gospel side of the west balcony, which can be reached through a similarly narrow staircase as in Sibayo.[30] However, in Callalli, the staircase is situated on the south side of the nave, so that the top of the stairs emerges on the balcony on the opposite side of the organ. This makes for a much easier access to the organ: repairs are possible without the craftsman risking a fall down a nine-foot gap when trying to access the back of the case. This could possibly be one reason for the organ having experienced more changes over the past than the organ in Sibayo or other organs in neighboring villages.

The case of the organ is integrated into the balustrade of the balcony. The case is made of two kinds of unpainted wood, a darker one for the posts and rails, and one of lighter color for the panels. The case is protruded: the lower case with its 1.73m width is significantly less wide than the uppercase of 2.075m. The connection between them has a curved, harp-like shape, conveying a more active and flowing impression than the usual colonial-Peruvian fixed-width organ cases. The organ front is divided into three round towers, each of about 0.7m width, the outer towers being of lesser height than the middle one. This alternative placement of the front pipes is made possible through wind ducts for the front pipes, which seem to be made of metal at first glance, but are actually crafted from cardboard covered with a thick layer of glossy paint. The upper part of the front pipes is hidden behind shades of scalloped shape, probably intended to be a simplified imitation of drapes. The back of the organ is entirely open towards the wall. The existing structure

[30] See fig. 6 in appendix B.

however – beams and studs – suggests that there were several smaller panels to cover the back of the case.

The completely built-in console is 0.81m wide and contains one manual. There is no indication of a previous presence of a lectern. As in Sibayo, the keyboard is situated so that even a player of short body length could not see his own hands while playing: the keys lie on a distance of only 65cm above the ground and inside the case. The keys are made of wood, the upper keys seem to be covered with black paint. The lower keys are plated with a 2mm-layer of glass, under which white paper is placed to provide the white color.[31] This is a practice ascribed by van Gemert to the lack of ivory in Peru – an explanation I do not entirely agree with, since many European organ builders used (and still use) bovine bone instead of ivory. The organ's compass goes from C2 to G6, with a full octave at the bottom. The latter was not common in Spain until 1800,[32] and must be a result of later change. As on the organ in Sibayo, this instrument does not have pedals and there is no organ bench or other kind of seating.

There are little cut-outs in the front of the case, which might have contained foot levers for activating and de-activating various accessories, as in the organ in Sibayo.

4.2.3 Wind supply

The wind supply of the organ in Callalli is remarkably similar to that of Sibayo. As in Sibayo, there are two diagonal bellows (1.55 in length and 0.91 in width) with several inverted folds, and a lever (2.48m in length) attached to each of them. There is no compound bellows, and the bellow levers, windchest, and pallet chamber show the same

[31] See fig. 11 in appendix B.
[32] Reuter, *Orgeln in Spanien*, 36.

use of alpaca and llama leather as in Sibayo. However, the pallets exhibit a more modern shape in that their cross section is triangular. Given the fact that this organ needed to have enough wind pressure for a reed rank of full-resonator length, pallets with a triangular cross section certainly work in favor of the organist. The pointed bottom edge reduces air resistance and makes the pluck less distinct and the keys easier to depress.

4.2.4 Action

With regard to the tracker action, the organ in Callalli exhibits one major difference towards the other two organs of my case study: It has two roller boards. While most of the action is set up in a very similar way as in Sibayo – suspended keyboard (44cm), vertical trackers (58-62cm), direct connection to pallets – the rather large keyboard range obviously made the highest and lowest key not playable anymore, or put too much stress on the material. Power translation into horizontal direction became necessary, and it was realized in the form of several small wooden long rollers that were made to rotate around their longitudinal axis. This feature, crude but effective, marks a clear difference towards my other two case studies, and towards other organs of the Peruvian colonial type in general, as described by van Gemert.

The stop action does not differ much from the organs in Sibayo and Tisco. It consists of five thin sliders sticking out on the left and right side of the case, presently being stuck and not operational anymore. One difference between them and the sliders of the others two organs are the holes that are cut into their ends.[33] This might have been done to have a way to more easily hold on to the sliders when moving them.

[33] See fig. 13 in appendix B.

4.2.5 Pipework, stops and accessories

This section presents a full inventory of the pipework of the organ in Callalli. As for the organ in Sibayo, sound analysis in Callalli was only possible by playing each pipe individually and by making inferences from scalings and scaling progressions. However, since the pipework in Callalli generally is in a better shape than that in Sibayo, determining the pitch level of the individual pipes was possible.[34] Also, since the bores in the toe board of this organ are less erratic than those of the Sibayo instrument, it is possible to ascertain the note that each pipe represents.

4.2.5.1 General overview

There are three kinds of pipes in this organ:

1) metal flue pipes: 292 total
2) metal reed pipes: 51 total
3) wooden flue pipes: 2 total

Of the 292 metal flue pipes, seventeen are not on the toe board, but instead lie loosely on the ground inside the organ case. Four of those seventeen pipes resemble the pipes in the organ front, the rest seems to come from other ranks. Seven of the fifty-one reed pipes are loosely lying around inside the organ, two of them no longer have a resonator. In addition, one lone resonator and one reed, shallot and wedge were found. Since it has so far not been possible to assign any of the loose pipes to a specific place

[34] The original wind pressure is not known; therefore, a systematic error (of unknown value) is very likely to occur when removing the pipes from the toeboard and playing them individually. If they are played by mouth, there will be an additional random error.

within a rank, they will not be considered in the following discussion of sound, scaling progressions, and the like.

The two wooden drone pipes are no longer connected to the organ: they are leaning against the wall in a corner behind the organ. They are not easily accessible, allowing for only limited measurements. As in Sibayo, the two pipes were probably not available independently from each other, since there are only two cutouts. The other one most probably contained the foot switch for the tremulant, which is located behind the organ in a wooden box on top of the main wind duct, and is currently not operable.

4.2.5.2 Completeness

Rank 1 contains twenty-three pipes, all of which are stood-off front pipes, with cardboard wind ducts leading up to them. The middle and right-hand tower are complete with seven and ten pipes, respectively; however, the left-hand tower has nine ducts and only six pipes. This rank is therefore only 88% complete. Rank 2 is a *medio registro*, doubled in the upper half. The breaking point lies between pipe number 27 and 28. It is with seventy-four pipes almost complete, going from F#2 to F#6 (doubled from D#4 onwards), with only pipes number 42 (F5, front row), 50 (C#6 back row), and 55 (F#6 back row) missing. Rank 3 consists of one single row of fifty open metal pipes. It is rather complete and goes from D#2 to F#6, missing only pipe number 6 (F2). Rank 4 also consists of fifty pipes, and is a single-rank stop as well. It starts on pipe number 5 (E2) and is almost complete up to number 55 (F#6), save for the missing one-to-last pipe (F6). Rank 5 is entirely doubled. Of the expected 110 pipes, 101 are still present. The rank starts on D2 (only back row, the corresponding pipe in the front row is missing). The most notable "gap" happens between B5 and D6, where five pipes in a row are absent. Rank 6 features forty-three reed pipes and one flue pipe (the lowest pipe in the rank, D#2). The reed portion of the rank starts on E2 and goes up to G6, missing seven pipes along the way, plus the supposedly highest pipe of the rank, G#6. There are seven loose reed pipes currently in the organ, of which one is clearly shorter than the others: its resonator measures only 80mm in length. This pipe fits into the length progression of rank 6 and is therefore most probably the missing G#6.

All in all, the pipework of this organ is remarkably close to complete. Besides the entirely complete front rank, four other ranks show completeness close to or over 90% (89% for rank 2, 93% for rank 3, 91% for rank 4, and 92% for rank 5), and only the reed stop, rank 6 shows a completeness rate of only 80%.

4.2.5.3 Constructional characteristics and material

The metal flue pipes (henceforth “flue pipes”) come in two different main types: front pipes and interior pipes. The flue pipes exhibit a broad range of characteristics in terms of pipe facture: different styles of upper lips, different materials, different scalings. However, all flue pipes have in common that their languids do not have a languid bevel. As in Sibayo, the front of the languids stand perpendicular to the top, with very few exceptions in the entire organ.

The front pipes are the largest pipes of the entire instrument; they are, however, noticeably light and their wall thickness is quite thin. Less weight usually points to a lower lead component. The front pipes also have a slightly yellowish color and therefore might contain a certain amount of brass or bronze. However, ticking against the pipe walls produces a dull sound, which rather indicates that they are made of zinc. Zinc was used in Europe as a cheap substitute for the usual lead-tin alloy especially in the late nineteenth and early twentieth centuries, which supports the theory that the organ was expanded around that time. The upper parts of the resonators of the entire rank show extensions. The metal of the added pieces is of a different sort – it has a more greyish tone to it, possibly indicating a higher percentage of lead. The length progression of the added pieces is not gradual, but rather very irregular. It very much seems like the new length of the prolonged pipes was determined empirically at location.

The quality of building of the entire front rank seems a bit more careless than is customary for front pipes. The mouths, for example, are flatted (scored-pressed in a few cases), instead of scored. This almost improvised approach is also apparent in the languids, none of which is homogenous in thickness, the toe holes, which are just open instead of slightly coned in, and the soldering seams, which are unequal in thickness and sometimes contain big drops of solder (especially inside the pipes around the languids). The material furthermore shows light striation. It is not a three-dimensional relief, as is sometimes the case in historical organs (caused by the instrument with which the metal was combed); rather, it is discoloration. The stripes run completely vertically or horizontally on the resonators and diagonally on the feet. Obviously, functionality was the biggest factor here: polishing or even foiling of front pipes as a purely cosmetic measure was not important, and even matters of durability (soldered seams) and refined voicing (languids, feet) were not of such a big concern.

The interior pipes are of silver-grey color and are heavier than the front pipes. A tin-lead alloy – the usual material for metal organ pipes up to the late nineteenth century – can therefore be assumed, which makes the pipes older than the current front rank. Interesting patterns (flat as well as relief) are present on ranks 2, 3 and 5. The material of the pipes of rank 2 features a honeycomb-like pattern, which, at first glance, could almost be mistaken for spotted metal[35] – upon closer look though, it is too three-dimensional.

Many pipes show evidence of the casting process of the metal. The inside of the pipe resonators in rank 2 shows a granular pattern, possible from casting on sand. Some pipes (e.g. the inside of the ears of pipe number 25 in rank 2, pipe number 20 in rank 3, or on number 15 of the back row of rank 5) have a different pattern, one that looks like the material was cast on rather coarse fabric. It is safe to assume that pipes or pipe parts that do not show the same pattern were not made by the same workshop, or at least not at the same time.

More evidence of the making process of the pipes present itself in the three-dimensional striation patterns present in a number of pipes. It was maybe caused by a too sharp comb, incompentent combing, or no polishing after combing. In addition, some pipes show parts with a darker color of metal "shining through." Those pipes might have a layer of paint on them, probably for protection from decay, since aesthetics did not seem of much concern.

The interior ranks show different degrees of consistency regarding their constructional features. Ranks 2, 4 and 5 are quite consistent. The pipes of the latter two all have flatted mouths, and do not have ears. The stopped pipes of rank 2 all have ears

[35] Spotted metal, also known by its German term "Naturguss," a 50% tin-50% lead alloy, is a very common material in pipe making.

(some of them quite thin, and sometimes very unprofessionally soldered). The upper lips are pressed and flatted (mostly flatted), though occasionally of Roman shape, and one single bay leaf. These three ranks can therefore be assumed to be mostly original; while some pipes might have switched places over the course of time, it does not seem as if many pipes were added or replaced.

The constructional characteristics of rank 3 are not as homogenous. Particularly striking are the very different shapes of upper mouths: mostly Roman pressed-scored up to pipe number 22; from number 3 onward, mostly flatted, but occasionally Roman or bay leaf. The lower mouths also show great variation. Up to pipe number 23 they are round pressed-scored, but above that we regularly detect no lower mouth at all, and occasionally we find a pointed lower mouth. Great variety in constructional characteristics within one pipe rank usually points to different provenience and often even different age of its pipes. Pipework in such ranks can be re-used remnants from previous instruments or re-used, no-longer-needed material from other organs. However, surprisingly, the scalings of rank 3 are relatively regular, which could mean either of the following: 1) the rank is still mostly in its original state, and the different pipe styles are the result of different artisans working on it; 2) the rank is still in its original state and was assembled from used pipework (maybe even brought over from Spain), 3) the rank is no longer original. In all three cases, though, the person working on the rank made sure that the diameter scalings fit into a more or less gradual progression.

A close examination of the reed pipes reveals an incredibly pragmatic approach and creative spirit. The very complex task of building a reed pipe in this case has been boiled down to its absolute necessary components, and unavailable materials, techniques, technical knowledge, and required tools were simply bypassed. The most striking feature of the reed pipes are the nuts. Besides metal-cast nuts (made in a very crude way), this rank contains nuts made of layers of fabric glued directly onto the lower end of the resonator, or used together with melted lead to form a nearly spherical shape. Other than a leaden or wooden nut, which has a thin channel drilled into it to put the tuning wire through, in these pipes, the tuning wire is simply routed via the outside of the nut, between the nut and the boot.[36] Using textile for reed pipe nuts is not documented for any other organs of the same time period.

Some of the remaining components of the reed pipes conform to a greater extent to global organ building conventions. So are, for example, the reeds and tuning wires from brass, which is standard in European and North American organs. Some reed pipes have entirely uncorroded (i.e., new) tuning wires, especially in the upper octaves, and some of the reeds look new as well. They might have been placed within the last 100 years.

4.2.5.4 Inscriptions

The flue pipes of this organ occasionally bear inscriptions. They are mostly note names in Spanish, though there are a few more elaborate inscriptions. The latter are mostly found on pipes where confusion about their location could arise, for example on nearly all front pipes and on interior pipes near the divide of the *medio registro*. Rank 1, for example carries inscriptions like “dext regs Sol#” or “...del primer registro.” Number 28 of rank 3, for example, is labeled “2do registro derecha” and number 28 of rank 5 says “al 3er

[36] See fig. 16 in appendix B.

registro," followed by "(...) la derecha (...)." The word in the first parenthesis is very probably "sigue" ("follows"), indicating that after this pipe, the right-hand side of the *medio registro* follows. The inscriptions are in a relatively modern hand, probably early twentieth century, and date probably from repair or restoration works.

4.2.5.5 Current state of the pipework

The pipes in this organ exhibit a wide range of damage. Damage is present in every rank, but the extent of it varies between ranks. The pipes of the front rank currently are in an undesirable, though easily repairable state. The pipes exhibit some material damage – dents, cracks, bird feces, a collapsed cut-up – compared to the pipes of the other ranks, though, they are in a relatively stable condition. The progression of the resonator lengths and diameters is very regular, which means that the front rank is probably still mostly original.[37] A mystery in this regard are the inscriptions: they state – besides note names – occasionally also a numbering. The latter, however, follows no apparent system, which usually indicates that pipes later on changed places, which in turn is contradicted by the very regular scaling progressions. Ranks 4 and 5 are generally in an acceptable state. Most pipes merely show the usual signs of corrosion, dents, breakage (especially on the top of the pipe) and rack-imprints. In rank 4, a few flatted lower mouths are too much pressed in or even pressed tight – probably through unprofessional tuning or voicing attempts – so the pipes do not speak easily. Unprofessional voicing is also evident in rank 5, where some pipes have vertical cuts next to the upper mouths.

[37] "Original" in this case refers to the same state since the last remodel of the instrument, thus probably the early twentieth century.

Ranks 2 and 3 are in a far worse state than the other flue ranks: here we find collapsed feet and tips, bad soldering, nearly detached ears, dents (even on the lower mouths), concave cover plates, descended languids, scratches (often in interesting patterns or in many directions), heavy damage from racks and on the upper end of the resonator (rank 3), and discoloration of the metal. Unprofessional repair attempts on rank 2 are present in the form of bad soldering, big solder "blobs" to correct small damages, and scotch tape to hold cover plates in place. However, professional maintenance work was done as well at some point on the pipes. It is apparent in a new foot tip, as well as in the above-mentioned inscriptions. It is not clear when exactly it happened, and if this was done incidentally or if the organ regularly underwent scheduled maintenance work.

The reed pipes, rank 6, exhibit a lot of damage. It manifests itself mainly in severe and frequent dents, holes, breakage, cuts, and corrosion on the resonators. Some resonators also have a whitish-transparent layer of paint on them, which might have been applied to protect them from corrosion. Other metal damage is present in the rack imprints on the feet, though the biggest issue of this rank are its missing parts: nuts, shallots, reeds, wedges, and tuning wires are absent from a number of pipes.

4.2.5.6 Sound

The same methods as for the organ in Sibayo (4.1.5.6.) were applied to the Callalli instrument. The following (careful) overview represents results of sonic and data analysis.

In rank 1, the proportion between mouth width and resonator circumference is approximately 78% for the biggest part of the rank, with a slightly lower value (75%) for only the last few pipes. This corresponds to a *Prestant* sound for most pipes.[38] The lower percentage for the higher pipes means a more Flute-like tone, which is in concordance with the proportion resonator length to inner diameter, which also decreases in the highest notes, though it seems that the organ builder wanted to compensate for a too Flute-like sound by making the cut-ups higher in the last octave: most of the proportions cut-up to inner diameter are above 20% in the highest octave, which indicates an intended *Prestant* sound rather than a Flute timbre.[39] We can therefore assume an overall *Prestant* function for this rank, with a slightly flute-like touch in the highest pipes.

A first aural inspection of rank 2 reveals a more Bourdon-like sound in the lower half of the rank, and a brighter sound in the upper half. This is consistent with the purpose of the *medio registro*. The front part of the upper half (from pipe number 28 onwards) sounds very Principal-like, the back part more like a *Gemshorn*, with occasionally the sound of a Principal, but in a raspier variety. The back part can therefore be assumed to be a complementary accompaniment to the front part. Sonic research confirms that the waveform of the lower part is much more sinusoidal in its pattern, similar to an orchestral flute. From pipe number 28 onwards, pipes of the front part exhibit a different, more composite waveform. The Fourier spectra for both the lower half and the back row of the doubled part spike less or at least less clearly in the higher ranges; the front part on the contrary has a nice Principal spectrum, with all harmonics present and progressively getting weaker.

[38] Oosterhof and Bouman, *Orgelbouwkunde*, 225.
[39] Ibid., 238.

In looking at diameter scalings, however, we can only partly confirm the sonic data. In the doubled part, the deviation of the back row from the Töpfer scale is indeed up to four semitones larger than that of the front row, indicating a more Flute-like sound. However, the overall trend of the diameter progressions in this rank is upwards, away from the ideal Töpfer line, and therefore away from a *Prestant* sound in the higher octaves.

This apparent discrepancy can be explained through looking at other scalings. Both the proportions cut-up to inner diameter and mouth width to inner diameter are relatively high, with the former frequently showing values in the 30 or even 40 percent ranges, which is higher than normal for Principal-like pipes. It seems that the intended sound of this rank was indeed a principal, but that the maker of the pipes did not have the access to a corresponding scaling table. Therefore, the diameter progression is too static, similar as in medieval instruments. Obviously, the pipe maker compensated for that by adjusting mouth width and cut-ups.

Rank 3 makes a Principal-like aural impression, and indeed, its FFT spectra are quite full. The diameter scalings in the lower half of the *medio registro* deviate from the Töpfer scale mostly between -2 and -5 semitones, pushing this rank into a typical narrow Diapason range. The higher pipes (from ca. number 35 onwards) speak very badly. At pipe number 28, the resonator length jumps up to two times its previous value, thus the pitch falls down by an octave. It is noteworthy that the diameter scaling changes less drastically, leading to a narrower scaling for the upper part of the rank. This results in a different sound quality: a brighter, less Flute-like tone, suitable for playing a solo melody. The deviation from the normal scale here lies at least at -5 semitones, which in modern organs typical for a *Salicional* or other string-imitation organ stop. In the Callalli organ, this can be interpreted as an attempt to make this stop a very distinct, bright Principal. Similarly to some ranks in the Sibayo organ, rank 3 in Callalli contains pipes that have a waveform with amplitude modulation, probably due to mouth tones. This effect is particularly pronounced in pipe number 54.

Two matters call to our attention in rank 4: first, the highly irregular diameter progression; second, the "dull" timbre of the upper half of the *medio registro*. As for the latter, one look on the sound spectrum confirms the aural impression: from pipe number 29 onward, the spectra show only the base frequency and one small spike for a higher frequency. Scaling proportions can offer an explanation here. The relative diameter of the rank gets progressively bigger towards higher notes, showing an even more "medieval" progression than rank 2. To avoid an overwhelmingly loud descant and a too soft bass (a comparison with the Töpfer scale for this rank shows an extreme upwards trend at the high end), the pipe maker chose to reduce the width of the mouth. Many mouths in this rank are only 60% of their corresponding inner diameter. Both features in combination though do not produce an acceptable tone anymore, giving the upper half of the rank the least character of the entire stop.

As is typical for a Mixture stop, rank 5 has a mostly *Prestant*-like sound. The lower part of the front row is slightly more Flute-like in its timbre. However, from pipe number 15 onwards, the difference between back and front row becomes less and less pronounced. In the scalings, this is reflected by less difference in the proportion of mouth-width to inner diameter between the two rows from about mid-rank onwards. In the high range, it is even often the front row that sounds more *Prestant*-like and shows a rather full Fourier spectrum. The sound of the back row gets squeaky in the last octave, which is visible on its spectrum through the presence of only one or two spikes (the second spike, if present at all, usually being quite small).

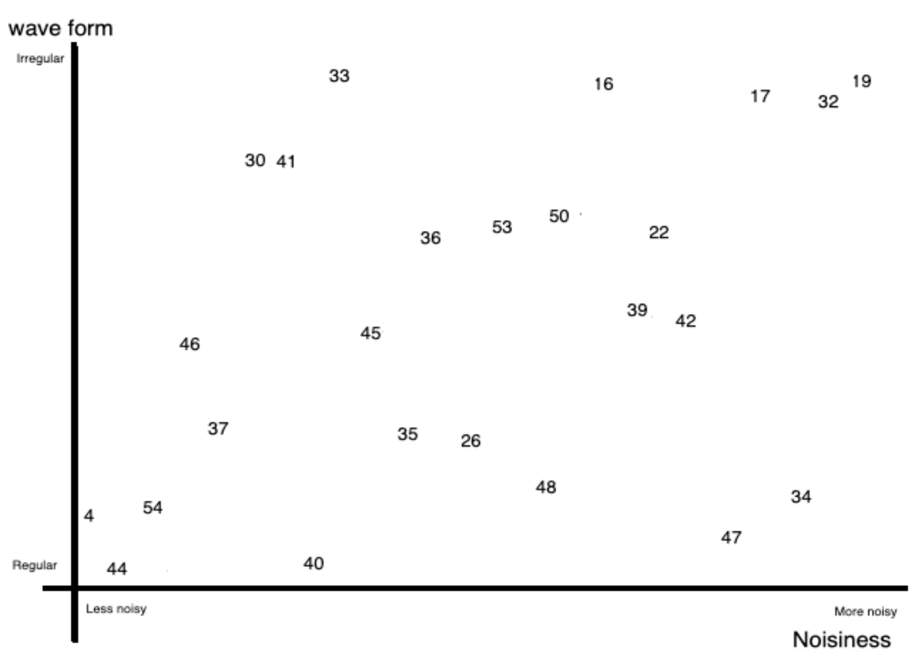
Many pipes of rank 6 do not speak anymore; reed pipes are much more delicate than flue pipes and even a small dust particle between reed and shallot or a minor displacement of the tuning wire can condemn a reed pipe to silence. In addition, timbre and tone of a reed pipe are very sensitive to different parameters of the pipe and their interaction with each other,[40] which explains why those Callalli reed pipes that do still speak are of varying quality. Most FFTs show clearly formed partials at every harmonic frequency, as it should be for a funnel-shaped full-length resonator.[41] However, half of the spectra are very noisy or even messy, and half of the wave patterns appear irregular. Twelve (out of twenty-seven) pipes show the typical trendlines for full-length reed pipes, in which the group of higher harmonics falls off in intensity quite abruptly.[42] The rest rather looks like a Principal spectrum, however, occasionally with an equal (instead of decreasing) intensity of all harmonics. Also noticeable is an occasional shift in the spectrum to frequencies that are not harmonics of the base frequency (see pipe number 16 for a particularly pronounced example). Non-harmonic frequencies are not normal for reed pipes.[43] This occurrence might be the result of a mismatch between reed and resonator lengths.[44] In general, the

[40] George Plitnik, "Vibration Characteristics of Pipe Organ Reed Tongues and the Effect of the Shallot, Resonator, and Reed Curvature," *The Journal of the Acoustical Society of America*, 107 (July 2000): 3463.
[41] Ibid.
[42] Colin Pykett, "Frequency Spectra."
[43] Plitnik, "Vibration characteristics," 3471.
[44] Bouman writes that the eigenfrequency of a funnel shaped resonator should be a minor third higher than the desired note (Oosterhof and Bouman, *Orgelbouwkunde,* 199). However, Plitnik says that the eigenfrequencies of the resonator and the reed are usually matched (Plitnik, "Vibration characteristics," 3469). Either way, the resonator-shallot system and the reed-system are connected via strong coupling (Péter Rucz, Judit Angster, et.al., "Modeling Resonators of Reed Organ Pipes," 283, accessed March 3, 2021, https://www.researchgate.net/publication/298965962_Modeling_resonators_of_reed_organ_pipes). Any disturbance of this coupling effect leads to reduced tone quality, or to no tone at all.

ratio of vibrating reed length and resonator length in this rank seems to be very arbitrary, so it can be assumed that the tuning wires slipped out of place over the course of time.

Those pipes that do produce a reasonable reed pipe-like sound, are all very loud and some have a somewhat nasal timbre. The strong sound intensity corresponds well to the typical expectations for Trumpet stops (especially Spanish ones) which this rank supposedly is, based on its resonator shape and length. The nasal timbre seems a bit French in character.

In the flue pipes of ranks 1 to 5, noisiness of the Fourier spectrum – thus the presence of inharmonic partials or even white noise – was often related to irregular wave patterns. Below is an empirical visualization of these two sonic properties for every pipe (represented by its number) of rank 6. As the diagram shows, there seems to be no significant connection between a noisy spectrum and an irregular waveform.



To summarize, the sound of this organ, similar to that of the organ in Sibayo, shows a general penchant towards a strong *Prestant*-character. In addition, this organ possesses a Trumpet stop, which is one of the loudest reed stops found in organs, and not often used in organs of chamber-instrument size. In spite of the obvious intention of making this organ a classical southern-European, Principal-based instrument, parts of certain ranks possess sonic properties that deviate from a classical Principal sound. This can partly be ascribed to static diameter scalings, as in ranks 2 and 4. In addition, sonic analysis shows a variety of irregular wave forms and Fourier spectra; these however, might be caused by debris, dust, and damage on the pipes. In general, the sound of this organ is more homogenous than that of the instrument in Sibayo. A visual inspection of the pipework confirms that it is indeed in a better state.

This organ must have provided much more diversity for registration than the one in Sibayo, since it exploits the possibilities of divided sliders (*medio registro)* much more. Noticeable here is the octave leap at the break, meaning that the two middle octaves of most ranks sound at the same pitch. Nevertheless, the upper octaves have a bright, sometimes even overly loud (think wide diameters!) timbre.

4.2.5.7 Pitch

The organ in Callalli theoretically has an 8-foot basis, however, the 8-foot-A4 sounds much higher than the today commonly expected A4=440Hz. Ranks 2, 3, 4, and 5 all sound a tritone higher. Determination of the pitch was roughly possible through blowing into the pipes, and was confirmed later on through referencing resonator lengths with scaling tables.[45] Added-on lengths at the top of the resonators were included in the calculations.[46] Rank 1 (the front rank) is not entirely consistent with the pitch level of the other flue pipes. The length of the resonator of the longest pipe is 1540mm (1500mm sounding length without tuning slide) and the associated wind duct connects this pipe to C.[47] 1540 mm lies somewhere between G and G#, making this rank almost an augmented fifth higher than A4=440Hz. The pitch level of the reed stop cannot be determined, because the pipes hardly play anymore.

A tuning pitch of A4=622Hz seems surprisingly high at first glance. However, we have to consider the possibility that this pitch is not original.

4.2.5.8 Stoplist

Rank 1 seems to function as an 8-foot stop. It consists exclusively of open pipes. Rank 2 consists of stopped pipes, doubled by open pipes of the same length in the upper part of the *medio registro,* presumably to emphasize the descant of a hymn. It has an 8-foot sound in the bass and an 8-foot and 16-foot sound in the descant. Rank 3 is a 4-foot stop (8-foot in the descant) and rank 4 functions as a 2-foot stop (4-foot in the descant). Rank 6, at the back of the organ, is a reed stop – presumably a Trumpet, given the long-tapered

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[45] Instead of using the formulas lambda=f*v and lambda=2L, I am relying on Bouman's scaling table (Oosterhof and Bouman, *Orgelbouwkunde,* 231) for numbers that take into account the fringing of sound waves at the open pipe ends.

[46] These additions vary from rank to rank and within ranks. For rank 1, they are usually less than 1/10 of the total resonator length, but can be as much as 1/5. In rank 3, added pipe-lengths appear more infrequently than in rank 2 and can be as large as 25% of the total resonator length, although they are typically much less (between 10 and 15%). The lowest pipe of rank 4 constitutes an extreme case, with the addition making up 28% of the entire resonator length.

[47] Interestingly, there is a second pipe that connects to the key C2. It seems that in this rank, some notes are doubled for extra strength.

resonators – on 8-foot pitch, and rank 5, directly in front of the reeds, is a Mixture in 2 ranks. The Mixture is composed as follows:

D2	D#2	C3	C#4	D4	A#4	G5	A5
--	½	1	1	2	2	4	4
¼	½	½	1	1	2	2	4

Besides very uncommon (and random) breaking points, the above table shows a very unusual wavering between unisons and parallel octaves. Almost the entire last octave of the stop progresses in unison. Both the arbitrarily chosen breaks and the striking absence of fifths, do not conform at all to the composition of a European Baroque Mixture, which in most European countries (including Spain) consisted of octaves and fifths, and sometimes even included thirds.

A plausible stoplist could have looked like this:

Izquierdo	***Derecho***
Flautado de 13	
Flautado de 13	*Flautado de 26* *Flautado de 13*
Octava	*Flautado de 13*
Quincena	*Octava*

Lleno
Trompeta Real

Translated to English, this would be:

Rank		**Bass**	**Descant**
1 (front)		Prestant 8ft (23 notes)	
2		Prestant 8ft	Prestant 16ft Octave 8ft
3		Octave 4ft	Prestant 8ft
4		Octave 2ft	Octave 4ft
5		Mixture II ½ft	
6		Trumpet 8ft	
Accessories:		Drone pipes (2) Tremulant	

4.2.6 Current state and use of the instrument

The instrument in Callalli is currently no longer playable. While individual parts of the organ, such as bellows, trackers, and some of the keys, can be moved, the instrument does not play when the keys are depressed. The bellows, wind ducts and windchest are leaking, and many keys are stuck. Evidence for repairs being performed at some point on this organ does not only come from the additions on top of the metal pipe work and from some wooden parts that look considerably newer than the rest of the organ, but also from spare parts that are lying around on the organ balcony, which were obviously removed from the organ during repair works. The latter includes part of the frame of the case, and what appears to be an old grid from the windchest.

Other than the organ in Sibayo, the organ in Callalli is no longer used at all, not even for sound effects during the *tinieblas.*

4.3 Tisco

4.3.1 Introduction

In the church of San Pedro Apostól in Tisco, a very small chamber organ-like instrument sits on the north side of the balcony. In terms of dating, this instrument provides a puzzle. The front presents a typical Renaissance flat surface: lower case and upper case lie in the same area; typical Baroque features, such as rounded shapes or protruding elements, are missing. Local informants claim that this is the oldest organ of the parish of Callalli.[48] The tonal range of this organ though is the same as for the organ in Sibayo: C2 (short octave) to G#5. The proportions of the organ front – lower and upper part of different

[48] Franz Windischhofer, conversation with author, Callalli, January 2020.

width, structuring into three (flat) pipe towers – support a date of origin that is posterior to the Sibayo organ.

Similar to the other two instruments, this organ has experienced some repairs over time. There is paper glued onto the drone pipes, and the case might bear evidence of years in which someone worked on the organ, though the latter is not certain. This matter is further discussed below.

Since this organ shows similar characteristics as the other two instruments, I will keep its description to the most essential elements.

4.3.2 Exterior design and location

The case of the Tisco organ[49] is made of unpainted bright wood that shows significant water damage. Parts of the case are extensively covered in bird feces. As the other two organs, this instrument is also missing its back panels. However, remnants of coarse fabric that is partly attached to the back of the case, suggests that the back of the case was originally closed with fabric.

The undercase of 1.23m width and 1.16m height resembles the instruments in Callalli and Sibayo very strongly: we can see the same "keyboard in a box," although the opening for the hands is higher than with the other two organs (36cm, versus 22cm in Sibayo and 17cm in Callalli). This fact probably made for a more relaxed playing experience, since the organist could see his own hands while playing. As in Sibayo, there is a wooden panel for closing the console. It shows substantial signs of deterioration, but it is still functional. As opposed to the other two organs, the keyboard is not complete, some

[49] See fig. 8 in appendix B.

keys are missing. The keys are similar to those in Callalli: a layer of glass on the lower keys over white paper, the upper keys painted black. Some of the glass plates are missing. Next to the keyboard box are three cut-outs (two on the left side, one on the right side) for operating the drone pipes.

The feet of the lower case stick out a bit more than with the other two organs. Prominent “feet” on furniture was a late-Renaissance/early-Baroque feature. The front shows an early form of towering with its three flat towers. The outer towers are lower than the middle tower, similar to the organ in Callalli. The upper parts of the towers have shades in a very simple ogee shape. Those appear to not be symmetric, though it does not look as if they broke off at a later moment; rather, they seem to have been made in this manner. Finally, this organ case is relatively austere, and does not show any kind of decoration, except for the six-petal geometric flower in a circle (known as the “flower of life,” among other designations), which is scratched into the wood of the front panel above the console, of which nobody knows whether it is original or not. Furthermore, several inscriptions adorn the case. It is not clear, however, whether all of them are signatures of organ builders or of other artisans who worked on the organ. Furthermore, five numbers are written on the case that at first glance seem to potentially represent years: 1736, 1776, 1936, 1999, and 2002. However, on a closer look, the numbers appear to have a different meaning: they are all written in the same hand. In addition, the state of the organ does not support the conclusion that someone worked in the instrument as late as 1999 or 2002. Lastly, the number 160 is inserted between 1776 and 1936; additional presence of horizontal lines suggests that someone was doing a simple subtraction or addition.

Other than the previous two instruments, this organ provides seating for the organist: a small stone stool is placed directly in front of the organ case. Despite the hard material, the stool, through its rounded shape, actually feels comfortable to sit on.[50]

4.3.3 Wind supply

Bellows and wind supply system work exactly the same way as in the other two organs. The bellows are of similar dimensions and specification, except that they have only four folds each. One of the levers is completely absent. Most importantly, the alpaca/llama component on the bellow system is by far the largest and most "showy" of my three case studies: ropes made of strips of alpaca leather are wound excessively around different parts of the lever – even parts that do not need it. The fur on the leather strips is more than 5cm long, revealing its origin even to those looking from a distance.[51]

As in the other organs, the panel that closes the windchest is held in place by leather. Leather was also used to repair and seal the main wind conduct. However, it was impossible to gain sufficient access to the windchest to determine whether the grid part of the chest is sealed off with llama leather as well, as in the other two organs.

4.3.4 Action

As the organs in Sibayo and Callalli, this instrument has sliders sticking out of the sides of the case. Three sliders are present both on the right and on the left side; they are, as in the other cases, stuck and can no longer be moved.

[50] See fig. 9 in appendix B.
[51] See fig. 20 and 21 in appendix B.

The key action is also very similar to the ones in Sibayo and Callalli, except for the fact that the suspended ends of the keys are held down by a strip of fabric and not by leather. The fabric naturally shows considerably more decay than the leather in the other two organs, and as a result, it is not able to hold the keys properly in place. This accounts for the missing keys mentioned earlier, as well as for keys that lie askew or even on top of each other.

As in Sibayo, the organ does not have any roller boards. The outermost trackers are connected to the pallets and keys at an angle.

The only one of my three case studies, this organ has remnants of the action for the drone pipes.[52] Two of the cutouts in the front of the case contain the front ends of two wooden square rods, each about 1.5 by 1.5 centimeters thick. They extend backwards over the entire depth of the case, their other ends being attached to the back framing. One of those rods has a tracker attached to it about halfway between the front and the back of the case. The tracker is of the same thickness as the other, key-activated, trackers.

4.3.5 Pipework, stops and accessories

4.3.5.1 General overview

There are two kinds of pipes in this organ: Metal pipes inside the organ case and wooden drone pipes situated behind the case. Most of the pipework is on the toe board, held in place by a pipe rack or, in the case of the front pipe, a wooden rod and a pipe rack. Some metal pipes are loosely lying in the case, and the drone pipes are leaning in one corner of the organ balcony. The off-note block of the drone pipes, however, is still present

[52] See fig. 10 in appendix B.

behind the case on the floor. It surprises through the proximity of the toe board holes. The drone pipes must have stood wall-on-wall while on the toe board.

During the examination of the organ, only some front pipes and the drone pipes were accessible, since most of the pipes are stuck in the racks or toe holes. This organ is similar to that of Sibayo in that it does not have a reed stop, and it is similar to both the Sibayo and the Callalli organ because of its split ranks and drone pipes. However, the organ in Tisco differs profoundly from the previous two case studies in that the drone pipes were obviously meant to be played separately. There are no traces of accessories, such as tremulants or the like in this instrument, so it can be assumed that the three cutouts in the front panel operated the three drone pipes. Since one of the cutouts is placed at a distance from the others, the corresponding drone pipe might be a later addition. Being able to play three bass pipes independently would not only mean technical superiority over the organs in Callalli and Sibayo, but also a big artistic step towards music with a more independent bass line.

4.3.5.2 Completeness

A full inventory of the pipework was not possible because the pipes could not be removed from the toe board. Upon looking into the case from the back it seems that the three front ranks are more or less complete, with occasional pipes missing. The drone pipes are complete as well. The stop closest to the back of the case – a mixture stop of two to three ranks – is missing the entire lower half. It was not possible to determine whether that half corresponds exactly to the lower half of the *medio registro* or not.

4.3.5.3 Constructional characteristics and material

The front pipes have bay-leaf-shaped lips, similar to those in Sibayo. The pipes are relatively light, which initially surprises, since the color of the metal indicates that the pipes contain a great percentage of lead. However, a closer examination reveals a relatively thin wall thickness (even under one millimeter at some places for the biggest pipes). A view inside the pipes reveals that the metal sheets were cast on rough material, probably coarse linen. The outside of the pipes shows the same ribbed surface as in Sibayo. These pipes could probably have the same origin, in the broadest sense: either the organ in Tisco was built by the same builder or the same "school" of organ building as the instrument in Sibayo, or the pipes come from the same organ, and were moved later on into this instrument, to replace older, missing, or damaged pipework. The inscriptions, however, are profoundly different in comparison to those of the other two organs.

4.3.5.4 Inscriptions

The front pipes bear inscriptions in the form of dotted lines that form symbols. As the little bulges are convex, i.e., higher than the rest of the pipe surface, these lines must have been applied already after casting the sheets, as there is no way to do after the pipe has been rolled up. According to locals, these inscriptions – mostly crosses and crosses with a circle on the lower end – are Jesuit symbols. Locals also insist that the architecture of the church, with its oval window over the main portal, is typically Jesuit. There has not been any Jesuit involvement in Tisco; however, the architectural style of the church is closer to the Cusco School than that of the other churches in the Colca region; it might be this fact that causes confusion and created the urban legend of Jesuits in Tisco. Regarding the pipes, I have not yet been able to verify if these inscriptions are indeed Jesuit symbols. If that is that is the case, it could mean that the pipes were not made in Tisco, but were imported from elsewhere.

4.3.5.5 Current state of the pipework

The drone pipes show more signs of deterioration than those in Callali or Tisco. There were only incidental repair attempts to seal cracks in the material through little patches and strips of leather, paper, and textile. A more integral solution, as in Sibayo, where the drone pipes are entirely covered in sealing paper, is missing. Water damage and damage through bird droppings is also extensively present on these pipes.

The drone pipes, however, still seem to be in a better state than the metal pipework of this organ. The metal pipes, especially the front pipes, show dents, cracks, breaking scoring lines or soldering seams, collapsed and bent feet, and collapsed toes in addition to the huge material damage due to bird feces. The front pipes appear to have more dents than the rest of the pipework, which leads to the conclusion that the interior pipes have thicker walls.

4.3.5.6 Sound

Since the organ is no longer playable and most of the pipework cannot be removed from the case, a discussion of sound is pure speculation. During my visit in Tisco, I was able to take scalings from three different front pipes. The pipes did not speak, but their pitches can be calculated through their lengths: the longest pipe of the front rank, which is situated in the center of the rank, measures 1298mm in sounding length. Assuming 325m/s as the speed of sound yields a frequency of f~125.3Hz, which equals approximately a B2. The Töpfer scaling for B2 would be 96.5mm, while the actual inner diameter of this pipe is 99.5mm. With a deviation from the *Normalmensur* of -1HT, this pipe should sound like a typical Principal. The proportion of the mouth width to the inner diameter (88%) seems to confirm that. On the other hand, the relationship between cut-up and inner diameter is (with 17.6%) rather Flute-like. The two other examined pipes are similar in that they are Principal-like in sound, although closer to a *Töpfer-Prinzipal*: one pipe corresponds to a quarter tone between E3 and F3 and as such should have an inner diameter between 74.4 and 77.7mm. In fact, this pipe is 75.4mm wide. The sound of the other pipe lies between F3 and F#3 and has a diameter of 73mm, halfway between the *Töpfer* scalings of these two pitches (71.3 and 74.4mm). As for the center pipe, the proportion of the mouth width to the inner diameter is Principal-like (86% and 82%), whereas the proportions between cut-up and inner diameter are under 21% (19.1% and 19.6%), and therefore under the standard value for Principal sound.

In sum, all three pipes exhibit the same tendencies in terms of scaling proportions, and as such show remarkable consistency. Three pipes constitute more than 21% of the entire front rank, which is why we can make a careful inference that the entire rank might consistently show similar characteristics of Principal-like sound with slight Flute-like tendencies in their the mouth scalings.

4.3.5.7 Pitch

Assuming the longest front pipe to be a C would yield a tuning pitch of A4=392Hz, which would be unusually low for pipe organs – the more so in regions where material resources were scarce. However, the front rank of this organ has only fourteen pipes; it might therefore be possible that the longest pipe is not played by the lowest key on the keyboard. Thus far I have not been able to determine the key that connects to the longest front pipe. Any discussion of pitch would thus be pure speculation.

4.3.6 Current state and use of the instrument

Of my three case studies, the organ in Tisco is the least maintained and most damaged. The organ is located in a very secluded village, which makes access to qualified artisans, furniture makers, organ builders, or other specialized craftsmen difficult. The organ is not playable anymore, and like the instrument in Callalli, it is currently not used for any liturgical or other events.

4.4 Summary and conclusions

The three case studies of pipe organs in Callalli, Sibayo, and Tisco exhibit notable resemblances. They are all small, chamber organ-like instruments without pedals and with only one manual. All of them must have been built before 1800, based on the pipe material. A time of origin in the seventeenth century is even more probable, given the layout of pipes on the toeboard and the keyboard range. All three organs have a simple chromatic basic layout for their interior pipes, and the organ in Sibayo even has a chromatic front.

Decorations are present on all three organs in some way – painted doors, decorative flower motives or simple architectural elements – however, the decoration is austere and not comparable to the rich ornamentation of, for example, Mexican colonial organs. That does not mean that no Peruvian organ is richly painted or ornate. While most organs are similarly austere as the three Colca instruments in this chapter, there are exceptions, such as the famous organs in Andahuaylillas, the oldest ones in Peru.

The three organs in my case studies not only share exterior and visual characteristics; they also function in very similar ways. Their wind supply systems, for example, are very much alike. Each wind supply consists of two diagonal bellows that are built in the French way with multiple folds. They are located outside of the organ case, always to the left of the instrument. Remarkable and, in fact, unique is the use of camelid leather and fur for the cables that pull open the bellows, and also for attaching the levers to the bellow frames. The tracker system and suspended keyboard action operates exactly in the same way in the three organs, with the only exception that the organ in Callalli has rollers for the highest and lowest notes.

With regards to their pipework, the organs show a remarkable resemblance in the metal sheets that were used for pipe making. Most of them were obviously cast on coarse fabric, some on sand. The timbre of all three organs leans towards a strong Diapason sound, sometimes with a remarkable penchant for making the upper registers more strong, voluminous, and/or bright. All three instruments are built as *medio registro,* meaning they have split ranks that can be activated separately for the upper and the lower part of the keyboard. In addition, these organs show a penchant for double-rank stops, thus stops that play not one, but two notes per key. These double ranks usually appear in the upper half of the *medio registro.* A remarkable item is the Mixture stop: it works entirely in octaves and unisons, which is uncommon for every kind of European Mixture stop in the history of organ building. The organs in Sibayo and in Callalli both have this kind of Mixture stop with absolute certainty. It is very probable that it exists in the organ of Tisco as well, and photos of the interior of the organ case and of the pipes on the toe board indicate that this is the case. However, since a systematic inventory of the pipework of this organ was not possible, this claim cannot fully be supported at this point.

In sum, there seems to be a distinct type of Peruvian rural Andean organ, at least in the Colca Valley, but judging from pictures of other Peruvian organs, provided in the sources listed in chapter 2, probably in other parts of the Andes as well. It is a type of organ that has well-defined characteristics which occur in all representatives of this type to some extent. We consequently have to cease regarding these organs in the Peruvian Andes as some kind of Spanish import product, but rather acknowledge them as part of their own, distinctive instrument category. We also have to think about the ramifications and consequences of acknowledging this distinct category of organ; of measures that can be taken to protect these instruments, and to maintain them. These organs, which are valuable historical artifacts and, as we will see in chapter 6, socio-political testimonials, have to receive special status as national or even international protected heritage. Awareness has to be raised of their existence, their need for conservation and repairs, and their artistic and cultural potential. Funds have to allocated regionally, nationally, and internationally to ensure professional repair- and maintenance work. It is to hope for that Andean pipe organs will not continue to lead a hidden existence of decay and disintegration, but that they will occupy their own space both in pipe organ studies, and in Peruvian culture at-large.

CHAPTER V

THE SOUND OF SILENCE:

PERFORMANCE PRACTICE ON "FORGOTTEN" INSTRUMENTS

5.1 Introduction

The previous chapter introduced three unique and exceptional musical instruments: the pipe organs of Callalli, Sibayo, and Tisco, exemplars of the many small Baroque organs tucked away in little villages high up in the Peruvian Andes. I discussed the technical and sound properties of these organs and their present state. However, I have not yet touched on their original use. The present chapter deals with the potential of repertoire suitable for these instruments.

Unlike in larger cities, primary sources in Peruvian rural areas are scarce, though not nonexistent. It is therefore no surprise that there is no sheet music in any of the three churches or in the parish center. Any kind of written documentation regarding organ performance and organ use is missing as well, and there is no collective historical memory among locals on the subject. Broadening the search to archives in larger cities has not been successful so far either: the archive of the archbishopric in Cusco (to which the parish of Callalli belonged in the seventeenth century) does not contain any organ sheet music. The scant collection of sheet music found in the archive of the Franciscans in Lima mostly concerns items not relevant for my purposes – music for other instruments and/or from a later point in time. A search in commonly-consulted primary sources on early colonial life in Peru did not yield anything either. Guaman Poma dedicates only a few images to music in the church in his 1189-page *Nueva corónica y buen gobierno* (1615). These images mainly contain choir singers and sometimes flute players.[1] Two of them depict a group of musicians with a single book on a music stand, which indicates possible plainchant and/or *cantare super librum* practice.[2] Garcilaso de la Vega mentions organ only when he compares indigenous cane pipes, *antaras*, to organs, because the pipes of both instruments are arranged according to length.[3] Other early Peruvian colonial writers and chroniclers, such as Titu Cusi Yupanqui or Joan de Santacruz Pachacuti Yamqui Salcamaygua, are not concerned with music, instead focusing exclusively on political issues and the history of the *Conquista*.

Many primary sources remain unstudied at present, and diligent research might unravel more specifics about the exact nature of colonial organ performance practice in the future. However, at this point, I suggest a comparative approach that uses European practices as a reference. As van Gemert has rightly pointed out, Andean colonial organs are a "frozen" tradition, a tradition that did not change for over two hundred years.[4] The colonial instruments found to this day in Peru must therefore all be modeled after late sixteenth- and maybe early seventeenth-century European prototypes. By examining relevant European primary sources from this period and beyond, I will distill and collate principles of European early-Baroque organ performance. At the same time, I will integrate the obtained insights with the organological data summarized in the previous chapter to

[1] Felipe Guaman Poma de Ayala, *El primer nueva corónica y buen gobierno*, Ms. Gammel Kongelig Samling (GKS) 2232, 4, Royal Library, Copenhagen, Denmark, 661, 666, 670, 686, accessed March 30, 2019 http://www.kb.dk/permalink/2006/poma/info/en/frontpage.htm.
[2] Guamán Poma, *Nueva corónica*, 666, 670.
[3] Robert Stevenson, *The Music of Peru: Aboriginal and Viceroyal Epochs* (Washington, DC: Pan American Union, 1960), 42.
[4] Hans van Gemert, *Organos históricos del Perú = Historic Organs of Peru* (Hillbrow, South Africa: H. van Gemert, 1990), 91.

find out which style of European organ music from around 1600 might fit Peruvian colonial pipe organs. Performers and scholars alike nowadays often reduce primary sources on performance practice to mere reference books for the correct execution of ornaments or phrasing. However, primary sources are so much more than that: they can provide insights about the technical function of musical instruments, shed light on the kind of music played in general, and educate us about the function of the musicians in their society and environment.

In this chapter, I will not deal with possible indigenous influence in colonial Peruvian organ music, nor with any issues of hybridity in works for organ by *criollo* or *mestizo* composers in colonial Peru. Instead, I will try to answer the following questions: what was the role of the Peruvian organist during the Mass? When and what did he play? How did he play: from a score, from a bass line, or was he improvising? Did he play solo or as an accompanist? And lastly, what kind of pieces might he have played? The latter question, again, will be based solely on the fact that these organs were built after European examples, and that a certain playing technique and body of repertoire was associated with those prototypes. The next chapter will treat possible elements of indigenous musical culture in colonial organ performance practice in Peru.

Besides the obvious sources for Iberian Baroque music – Correa de Arauxo's *Facultad Organica*,[5] Juan Bermudo's *Declaración de instrumentos musicales*,[6] and Tomás

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[5] Francisco Correa de Arauxo, *Libro de tientos y discursos de musica practica y theorica de organo intitulado Facultad organica* (Alcalá de Henares: Antonio Arnao, 1626), accessed March 30, 2019, http://conquest.imslp.info/files/imglnks/usimg/3/36/IMSLP292787-PMLP475113-parte1.pdf.
[6] Fray Juan Bermudo, *El libro llamado declaración de Instrumentos musicales* (1555), accessed March 30, 2019, http://imslp.org/wiki/El_libro_llamado_declaraci%C3%B3n_de_instrumentos_musicales_(Bermudo%2C_Juan)

de Santa Maria's *L'arte de Tañer Fantasia*[7] – I will also use other European treatises, especially southern European, whenever it is legitimate to do so. To determine the role of the southern European Baroque organist in general, the works of Adriano Banchieri are essential primary sources. Lastly, secondary sources on Baroque performance practice, such as the works of Frederick Neumann, Marie Cyr, Bruce Haynes, and – particularly important for organ performance – Jon Laukvik, provide valuable contextual information for my understanding of the above-mentioned primary sources. While I will not be able to provide a concrete set of compositions specifically conceived for the instruments in my case studies, I am confident that the parameters I set can at least broadly circumscribe a presumed body of repertoire and its associated performance practices.

5.2 The tasks and skill set of the Roman Catholic organist in the seventeenth century

A very good source for understanding the tasks of the southern European Baroque organist are Adriano Banchieri's treatises *L'Organo suonarino* and the *Conclusioni nel suono dell'organo.* They both hold unique places among early seventeenth-century music treatises. The former, as Banchieri points out in his *Discorso dell'Autore*, is not a counterpoint treatise, like the writings of "Zerlino [sic], Tigrino, Artusi, Pontio and other excellent musicians of our time."[8] Nor is it an organ method that teaches fingerings and other rules for playing, such as the *Transilvano* of the "sufficientissimo Diruta."[9] His intent is not to proclaim new findings or theories, but to summarize existing practices for those

[7] Tomás de Santamaría, "Arte de Tañer Fantasia," IMSLP, accessed April 10, 2021, https://imslp.org/wiki/Arte_de_Ta%C3%B1er_Fantasia_(Santamar%C3%ADa%2C_Tom%C3%A1s).

[8] Adriano Banchieri, *L'Organo Suonarino: With a New Introduction by Giulio Cattin* (Amsterdam: Frits Knuf, 1969), 2.
[9] Ibid.

who might not be aware of them. As such, *L'Organo suonarino* is an excellent source of information for our present purposes: the book is meant to be a true *vademecum,* a guidebook, for church organists, and the organs in the historic parishes of Callalli, Sibayo, and Tisco presumably had a mostly liturgical function. *L'Organo suonarino* tells the church organist what to do, when to do it, and how to do it. The *Conclusioni* take a similar approach, presenting an overview on the then-current state of knowledge in organ building, organ playing, church music, and liturgy, and will therefore be considered in the following discussion as well.

Both in the *primo registro* of *L'Organo suonarino* and in the ninth conclusion of the *Conclusioni*, Banchieri lists every single moment in which the organist has to provide music during the Sunday Mass, and also specifies the kind of music that has to be played. The most organized overview can be found in his *Tabella ordinata per gli Organisti Principianti, del tempo que devono suonare alle Messe di Canto fermo:*

> *Finito il Choro il Sicut erat del Introito si suonano gli Kyrie;*
> *Intuonata la Gloria in excelsis; à quella rispondesi alternativamente.*
> *Finita l'Epistola si suona un ripieno ò fuga brevemente.*
> *Immediatamente doppò il Versetto si risponde all'Alleluja; (occorrendo)*
> *Intuonato il Credo a quello rispondesi alternativamente (se però è in consuetudine)*
> *Detto Oremus suonasi un Mottetto, ò Ricercata Musicale sin tanto che il Sacerdote si volta dite Orate fratres;*
> *Suonasi due volte brevissimamente a gli Sanctus.*
> *Poi si suona alla Levatione, ma piano, & cosa grave che muovi alla devotione*
> *Doppò il Pax Domini, si suona l'Agnus Dei;*
> *Replicato il secondo Agnus Dei dal Choro, si suona un Cappriccio, overo Aria alla Francese, che sia vaga, ma Musicale.*
> *All'Ite Missa est, overo Benedicamus Domino, un poco di Ripieno.* [10]

[10] Ibid., 38; my translation. The information provided in the *Conclusioni* does not differ profoundly.

When the choir has finished the Sicut erat of the introit, one plays the Kyrie;
The Gloria is intoned; to which [the organist] responds *in alternatim* fashion.
When the epistle is finished, one briefly plays a ripieno or a fugue.
Immediately after the versets, one responds with the Alleluia; (when it happens)
The Credo is intoned, to which [the organist] responds *in alternatim* fashion (if it is common use)
After the Oremus is spoken, one plays a motet or an instrumental ricercar, until the priest turns around then says the *Orate fratres*;
One plays twice briefly at the Sanctus.
Then one plays at the elevation, but softly, and something serious, so that it moves to devotion;
After the Pax Domini, one plays the Agnus Dei;
After the choir has responded with the second Agnus Dei, one plays a capriccio, or maybe an *aria alla francese*, which should be beautiful, but musical.
At the Ite Missa Est, or Benedicamus Domino, one plays a bit of a ripieno.

The *tabella ordinata* seems to indicate that the involvement of the seventeenth-century southern-European organist in a Mass was quite intensive, and other evidence supports this. Michael Dodds distilled three specific tasks for the organist in the liturgy from the *Cæremoniale episcoporum*, a seventeenth-century source describing the church services performed by the bishops in the Latin Rite: first, to accompany the physical actions of the clergy; second, to alternate with the choir; and third, to substitute for otherwise sung items.[11] The front panel of the organ in Sibayo comes to mind. Onto it, a piece of paper is glued that contains the entire order of a Mass in Latin. We can thus assume that the typical seventeenth-century organist in Peru was just as busy as his Italian counterparts. Given how much the organist obviously had to do, the paper was most certainly to help the

[11]Michael Dodds, "Organ Improvisation in 17th-Century Office Liturgy. Contexts, Styles, and Sources," Philomusica On-line 11, no. 2 (2012), accessed May 19, 2016, http://dx.doi.org/10.6092/1826-9001.11.1450.

organist not to lose track in the middle of the Mass. This simple mnemonic aid shows immense practical thinking in the absence of a lectern.[12]

This "missing" piece in each of the three organs of my case studies, the lectern, points to improvisation, which is very much in agreement with what we know about seventeenth- and eighteenth-century organ playing in general. The second part of Diruta's *Transilvano*, the oldest Italian source that exclusively deals with keyboard playing – and the first to distinguish between harpsichord and organ performance practice – is dedicated in its entirety to learning improvisation. It is a counterpoint treatise that touches a bit on basso continuo at the end; as Diruta explains on one of the first pages, the organist needs these counterpoint skills for "imitating plainsong" on the organ.[13] Around the same time, Frescobaldi published the preface to his book of *Toccate* and *Partite*, in which he granted a certain freedom in terms of tactus and ornaments, thereby corroborating that even printed works were to be performed in a manner closer to improvisation than it is the case today.[14] In fact, even purely theoretical works could actually have been written for improvisers. According to Daniel Zager, Zarlino's discussion of modes was actually meant for the improviser, in that its aim was to establish basic parameters that created a framework for improvisation.[15] Much sheet music that we know today of seventeenth-century organ music was primarily meant as an example, as an aid for the learner, the aspiring composer/improviser/organist-to-be. They were practically written-out improvisations or

[12] See fig. 23 in appendix B.
[13] Girolamo Diruta, *Il transilvano*, ed. Edward J. Soehnlen and Murray C. Bradshaw (Buren: Knuf, 1983), 32.
[14] Girolamo Frescobaldi, "Avvertimenti al lettore," preface to *Il Primo libro di Toccate e Partite d'Intavolatura di Cimbal,* accessed March 3, 2021, https://storiadellamusicafiore.com/2012/04/14/frescobaldi-avvertimento-al-lettore.
[15] Daniel Zager, "Organ Improvisation: Historical Considerations from Theory and Practice" (unpublished manuscript), 7, accessed March 3, 2021, https://www.higgs25esm.com/s/Zager-Organ-Improvisation.pdf.

carefully crafted didactic tools included in treatises, and they exemplified the newest style and fashions.

Upon hearing the word "improvisation," the modern Roman Catholic church organist thinks of short introductions or brief modulations before or between hymns. However, improvisation practice in southern-European Baroque organ playing was far more extensive than that. Banchieri's *L'Organo suonarino* offers a very detailed description – not to mention abundant examples – of various kinds of music that the Italian organist regularly had to perform during a church service. We can roughly group them into two categories:

Plainchant	Soloistic playing
Mass Ordinary Psalms Hymns Magnificat Major Marian Antiphons	Sonate Ricercari Fantasie Toccate Mottetti Capricci (...) …solo or with other instruments

The above classification has its imperfections: the plainchant in the left column involved much solo playing, while, on the other hand, the solo performance in the right column could involve one or two instruments (usually a melody instrument and a bass instrument), thus ensemble playing. Evidence that the above table substantially refers to improvised music comes from Banchieri's *decima conclusione*, in which he distinguishes between several different playing styles:

Quattro maniere con le quali viene praticato il suono dell'Organo.
Fantasia, Intavolatura, Spartitura, & Basso.[16]

In modern musical vocabulary, this would roughly translate as "free improvisation, playing from score, and playing from the bass." The middle categories, *spartitura* (open score) and *intavolatura* (two-staff keyboard score) are not relevant for our present purpose, since they would have necessitated a lectern on the organs. More important is the confirmation that a large part of the church organist's tasks obviously involved improvisation of some kind. *Basso seguente* and *basso continuo* – Banchieri uses the two interchangeably – were used, for example, for playing the organ verses during *alternatim* performance with the choir, but also for improvising accompaniment along with plainchant. The relatively spacious balconies in the three churches of my case studies, large enough to hold a small choir, show that this *alternatim* practice might also have applied to Peru. In addition, there is primary-source evidence that, at least in the Bolivian Andes, plainchant psalms were accompanied by the organist.[17]

The organist's improvisational tasks in the "plainchant" category further involved playing little transitions between psalms or other musical parts of the liturgy to facilitate modal changes for the choir. He therefore had to be able to modulate *ex tempore.* A bass line was most likely not provided for these kinds of transitions, but with sufficient basso continuo skills, the organist could improvise his own bass line. Knowledge of Guido's

[16] Banchieri, *Conclusioni*, 24.
[17] Bernardo Illari, "Recreating the Music, Reviving the Liturgy," liner notes to *Roque Ceruti, Vêpres Solenelles de Saint-Jean Baptiste* (K. 617, 1998, compact disc), 33.

eight tones (as opposed to Zarlino's twelve modes, which Banchieri demands for free improvisation[18]) was mandatory.[19] To further complicate the seventeenth-century practice, singers did not always use reciting tones that matched the *repercussio* of the psalm tones, but rather their "sweet spot," a practice described by Dodds as *voce corale.*[20] Hence, the organist's skill to modulate was probably pushed to its limits.

Lastly, the *falsi bordoni*, which Banchieri uses for plainchant performance as well, are a crossover technique between free improvisation and playing from bass. These short bass lines are to a certain extent related to the vocal practice of *falsobordone*, from which they were loosened at some point during the second half of the sixteenth century, while the general form and style of the latter, featuring simple chords and often repetitive melodic lines, stayed intact.[21] We have proof that a similar technique was used in colonial South America as well: Bernardo Illari has discovered manuscripts that contain versicles for organ, using fauxbourdon as accompaniment to plainchant.[22] The *falsi bordoni* basses in eight different psalm tones that Banchieri provides in the *secondo registro* of the 1605 *Organo suonarino* seem to be meant as a basis for improvised transitions between psalms or psalm verses. Banchieri comments briefly that they can be used for "other" psalms, for which the music is not found in the *Organo suonarino*.[23] It seems that the organist was required to accompany plainchant and to play transitions and *alternatim* verses, even for

[18] Banchieri, *L'Organo suonarino*, 39.
[19] Lee R. Garrett, "Adriano Banchieri's *Conclusioni nel suono dell'organo* of 1609: A Translation and Commentary" (PhD diss., University of Oregon, 1972), 85.
[20] Dodds, "Organ Improvisation," 32.
[21] Murray C. Bradshaw, "Falsobordone," *Grove Music Online*, accessed April 10, 2021, https://www.oxfordmusiconline.com/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo-9781561592630-e-0000009273.
[22] Illari, "Recreating," 32.
[23] Banchieri, *L'Organo suonarino*, 18.

those chants that he did not know at all. Thus, his role in plainchant performance was apparently an important one. The omission of the organ part was not an option.

That this function of the organ as a "second choir" also applied to Peru, even as late as the nineteenth century, is evident from documents in the archives of the archbishopric in Cusco. A dossier from 1808 about hiring a new organist contains a letter by one of the applicants, who points out his having specialized in "canto llano" (plainchant) for many years. The letter specifically mentions that this knowledge is very "advantageous for playing the organ."[24] Since the author of the letter is applying for one of the highest positions for organists available at that time – the position of the main organist of the Cusco Cathedral – it is unlikely that he was merely talking about laying chords under a melody sung by the choir or cantor.

The sizable role of the organist in the liturgy indirectly becomes evident from the sheet music examples that Banchieri provides for the Mass Ordinary and Proper. They are printed in such a way that the organist can only see the *incipit* of the choir verse, and is given a bass note over which to hold a chord. The verses that the organist plays, though, have their melody written out, so that the organist knows the melodic material over which he has to improvise. The fact that Banchieri chose to include the text for those parts that are organ soli possibly indicates his engagement with the *seconda pratica*. Corroboration of this comes from the *Conclusioni*, where he argues for the importance of affect in music and praises musicians who follow the principles of "modern composition," among them Monteverdi, Gesualdo, and Cavalieri.[25] Consequently, we can assume that Banchieri

[24] Document about hiring a new organist for the Cathedral, 1808, *Epoca Colonial,* "Inventarios," C20-3-49, Archivo Arzobispal del Cusco, Cusco.
[25] Garrett, "*Conclusioni*," 107.

wanted his ideal organist not only to respond to the choir in the right mode, tone, and tempo, but also to respond *in kind*, in the correct affect. This pushes the role of the organist in the direction of a liturgist, or even a narrator, rather than a pure instrumentalist. In fact, the liturgical role of the organist was so important that the aforementioned three tasks of the organist according to the *Cæremoniale Episcoporum* did not even explicitly mention anything about accompanying tasks. The organist was an indispensable part of the main liturgy – not merely somebody who could hit the right keys and play along with a singer, but somebody who took responsibility for ensuring a smooth overall process during a liturgical service.

In the context of Peruvian colonial practice, this role might mean an additional layer of bridging spirituality or even language barriers. While the clergy in Europe certainly depended on the organ for making church services in Latin more accessible to the congregation, that dependence would have been even greater in missionary settings. The organist's improvisations in the right affect were able to "interpret" the gestures of the priest, the Latin prayers, and the verses of a psalm. Music as a means for Christianization did not necessarily have to involve hymns sung in Quechua. It could be as subtle as musically guiding the congregation through a Sunday Mass.

So far, I have mainly focused on plainchant improvisation; however, the other category, free improvisation, deserves a brief mention as well. Free improvisation was mainly used for what is referred to as "soloistic playing" in the above table. The pieces provided by Banchieri in the *Organo suonarino* – the *Sonate*, *Toccate*, and others shown above – are either fully composed examples (for the absolute novice) or involve filling in harmonic middle voices, which can be considered as partly improvisational. The usual practice in Banchieri's time, though, was to improvise those pieces *ex novo*, hence the importance of theory and counterpoint treatises – such as Diruta's *Transilvano* (part II) – for the seventeenth-century organist. Typical organ pieces in the *Organo suonarino* are monothematic, sometimes bi-thematic, and they feature motivic compositional techniques with imitative work, mostly as paired imitations. Sometimes imitation is contrasted with a few measures in chordal style, as in the *Quarto Capriccio* of book four of the 1605 edition.[26] Banchieri's ideal organist had to be able to do all of the above on the spot. In addition to his practical skills, he needed the knowledge of a composer and of a music theorist, for which – according to Banchieri – it was necessary to "study many compositions."[27]

Free improvisation could also involve playing along with other instruments, mostly melody instruments that improvised over a given bass scheme, but also additional accompanying instruments. We have evidence that this practice also applied to the music in the Peruvian Andes, since documents in the archives of the archdiocese in Cusco occasionally mention an additional instrument – mostly harp, but also drum – as part of the standard inventory of instruments present in the organ loft.[28] Several discoveries by members of the *Instituto de Órganos Históricos de Oaxaca* of (mainly brass) instruments

[26] Banchieri, *L'Organo suonarino*, 109. See also fig. 28 in appendix B.
[27] Garrett, "*Conclusioni*," 60.
[28] Several church inventories in the Archive of the Archbishopric of Cusco (Cusco, *Archivo Arzobispal del Cusco. Epoca Colonial*, "Inventarios") mention instruments:

- the inventory of San Juan Bautista de Tampampu (1824) mentions an organ and a drum (fol. 4v);
- the inventory of S. Francisco de Asís de Marcapata (1792) mentions an organ of six *palmos*, a harp, and a drum (fol. 7v);
- the inventory of Chinchaypuqio (1805) says "Falta el Harpa" under the header "Coro," which means that a harp was assumed to be present (fol. 2r).

in organ lofts prove that the combination of organ with one or more other instruments was customary in other parts of Latin America as well.[29] Of my three case studies in the Colca Valley, at least two contain pipe ranks that show a loudness curve that increases in the upper octaves. Since an organ with such a volume progression is very suitable for playing a semi-soloistic role in chamber music, it might indeed point to an – at least occasional – use of these organs in ensemble music.

5.3 Possible stylistic characteristics of the music

At this point, I have established that the music played on southern-European Baroque organs was mostly improvised, and that it could include a wide variety of techniques, styles, and affects. I have not yet addressed the question of what those improvisations might have sounded like. As mentioned, Peru, and the Peruvian Andes in particular, present us with a lamentable scarcity of surviving sheet music. The category of sheet music in the *Archivo San Francisco de Lima* contains several short pieces that could be played on an organ; however, those are clearly in galant or classical style. While some pieces in galant style can certainly be played on Baroque instruments, they are not the scope of our interest here. We cannot precisely date the instruments introduced in the previous chapters, but we know that their characteristics did not change after about 1600. We therefore want to know what kind of music this type of organ was originally built for.

[29] "Conservation and Protection of the Historic Organs," Institute of Historic Organs, Oaxaca, Mexico, accessed April 10, 2021, http://iohio.org.mx/eng/protection.htm.

Most Baroque compositions for organ known to us today are nothing but written-out improvisations, or examples to teach aspiring organists the principles of structure, form, and style, as mentioned before. Banchieri's quote about studying "many compositions" illustrates that written-out organ pieces were mostly seen as study material "in order to develop good understanding."[30] Looking at surviving European Baroque organ literature can therefore be conducive to our purpose. This approach also loosely fits into Olsen's archeo-ethnomusicology model that constitutes the foundation of my methodology. I am comparing European Baroque music tradition as it survived on the European continent to find out what kind of music was played on Peruvian organs during the time they were still operational. This is a very free interpretation of the "ethnography" part of Olsen's model, in which he proposes looking at musical instruments still in existence in cultures other than the one archeologically studied, learning about their present-day use, and applying the obtained insights in order to make inferences about the past culture one is studying. I wish to reiterate at this point that I am not speculating about possible indigenous influences in this chapter. A different way of using Olsen's ethnographic component will be presented in the next chapter, in which I will compare my organological findings to music that is (or was) played in roughly the same location, but at a different time. This will broaden our perspective and allow for a less Eurocentric approach.

European organ music of the sixteenth to eighteenth centuries mainly depended on the kind of liturgy in which it was used. Protestant areas, such as the northern Low Countries or northern Germany, developed a playing style that profoundly relied on pedals.

[30] Garrett, "*Conclusioni*," 60.

In France, even though the country was Catholic for the most part, pedals played a key role as well, since the choral melody was often played in the bass. Since Peruvian colonial organs generally do not have any pedals, we can exclude music from those countries as possible reference points. For southern European countries, we encounter the problem that much of what we play today on the organ was not in fact specifically composed as organ repertoire and can be performed just as well on a harpsichord, clavichord, or any other keyboard instrument. The many examples given in Barnchieri's *L'Organo suonarino* or Diruta's *Transilvano* fall into this category, together with works of famous masters such as Froberger, Kerll, or Frescobaldi. One exception would be Muffat's *apparatus musico-organisticus* – which, unfortunately, calls for an organ with pedals. Francisco Correa de Arauxo's *Facultad organica,* however, is one of the few sources that present us with music specifically dedicated to the organ, and its pieces are all *manualiter*. In addition, the composer's life conveniently coincides with our desired time frame: he was baptized in Seville in September 1584 and died in October or November 1654 in Segovia.[31] Correa de Arauxo can clearly be identified as a "child" of the seventeenth century: he not only introduces novel concepts in his compositions, he also addresses – and defends – them explicitly in his theoretical writings. Both the fact that he intensifies the relationship between meter sign and tempo of a piece[32] and the fact that he does not regard the interval

[31] There are debates about the exact time and place of his birth. I chose to use the year and place provided in Barton Hudson and Louis Jambou, "Correa de Arauxo, Francisco," in *Grove Music Online*, accessed June 15, 2017, http://www.oxfordmusiconline.com/subscriber/article/grove/music/06556. For a complete overview of different opinions and current research, see chapter II.1 of Hakalathi's dissertation on Correa de Arauxo: Iina-Karita Hakalahti, "Maestro Francisco Correa de Arauxo's (1584-1654) *Facultad orgánica* (1626) as a Source of Performance Practice" (PhD diss., Sibelius Academy Helsinki, 2008), 27-29.

[32] Francisco Correa de Arauxo, *Libro de tientos y discursos de musica practica y theorica de organo intitulado Facultad organica* (Alcalá de Henares: Antonio Arnao, 1626), fol. 1r.

of a fourth as a dissonance anymore[33] show that he is moving away from Renaissance music theory. Hudson and Jambou in *New Grove* call him "one of the chief composers to establish the Baroque style in Spain."[34]

All of Correa de Arauxo's surviving organ music is contained in the same volume: the *libro de tientos y discursos de musica practica, y theoretica de órgano intitulado Facultad Orgánica.* It was published in 1626 and contains a long preface with instructions, as well as sixty-nine compositions with individual explanations on how to play them. It can therefore be regarded as a combined theoretical work and music collection, which makes it an even more suitable source for the purpose of my investigation. I decided to choose two works from the *Facultad orgánica* that together cover a wide stylistic spectrum of organ music, and examine their suitability for the Peruvian colonial organ type. The two pieces – very different from one another –are a *tiento del quarto tuono* and *el canto llano de la immaculada concepcion de la virgen maria y tres glosas. Glosas* are a type of homophonic work that involves a cantus firmus and variations. A *tiento* is a thematically free work in imitative polyphonic style, similar to an Italian *ricercar*. Correa de Arauxo's *Tiento del quarto tuono*, as the title indicates, is written in the fourth mode; however, the regular use of the F# shows that Correa de Arauxo was in a transitional period between the traditional modal system and the new major/minor tonality. I will examine Arauxo's music in terms of keyboard range, required tuning or temperament, articulation, phrasing, and playing technique to determine if it would be a good "fit" for any or all of the organs described in chapter 4.

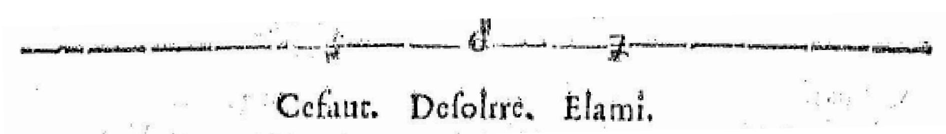
33 "…la quarta, no es falsa ni dissonancia…." Correa de Arauxo, *Facultad Organica*, fol. 7r.
34 Hudson and Jambou, "Correa de Arauxo."

5.3.1 Keyboard range

In determining the keyboard range necessary for Arauxo's two pieces, we first have to determine the ambitus of the compositions, which necessitates getting acquainted with southern European tablatures. The scores of the *Tiento* and the *Glosas* do not contain a single note, but instead have one joint four-line staff for both hands, with numbers representing the notes.

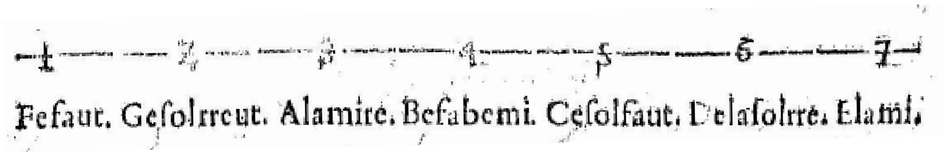
Banchieri demands that good organists be able to play from *intavolatura* and *spartitura*[35] – obviously, in a time when organ playing mostly involved improvisational practices, knowing how to play from score was not implied – however, he does not tell the reader how *intavolature* work. Correa de Arauxo himself explains tablature as "the art of playing numbers" in his chapter "El arte de poner por cifra": the four lines each represent one voice in the polyphonic fabric. The numbers on the staff lines, 1 through 7, specify the pitch, starting with F as number 1. Little strokes, called *rasguillos*, indicate the octave:[36]

Los signos, o teclas sograves son tres.



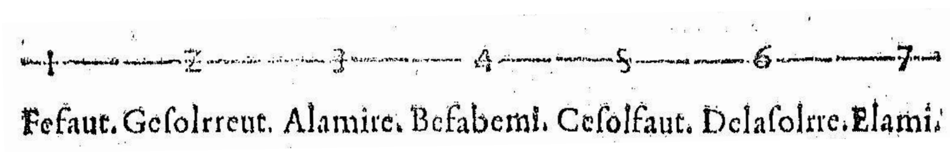
Los signos, o teclas graves son siete.

[35] Banchieri, *Conclusioni*, 24.
[36] Correa de Arauxo, *Facultad Organica*. The citations and *cifra* examples on this and the next page are a compilation of Correa's lengthy explanations about "cifras" (numbers, notes) on fol. 13r-v.



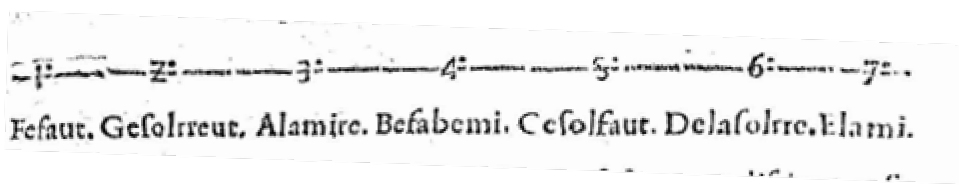
1 2 3 4 5 6 7
Fefaut. Geſolrreut. Alamire. Befabemi. Ceſolfaut. Delaſolrre. Elami.

Los signos, o teclas agudos son siete.



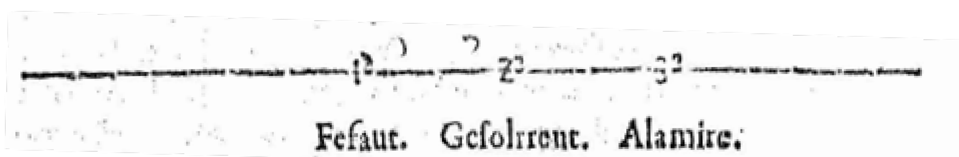
1 2 3 4 5 6 7
Fefaut. Geſolrreut. Alamire. Befabemi. Ceſolfaut. Delaſolrre. Elami.

Los signos sobre agudos son siete.



1: 2: 3: 4: 5: 6: 7:
Fefaut. Geſolrreut. Alamire. Befabemi. Ceſolfaut. Delaſolrre. Elami.

Los signos agudissimos.



1 2 3
Fefaut. Geſolrreut. Alamire.

The lowest of the three *sograve* notes corresponds to our C2. Consequently, the highest note, called *Alamire agudissimo*, corresponds to an A5. The numbers can also be endowed with alteration signs, thus flats and sharps, which are usually put after the number. Above the staff, Correa de Arauxo occasionally specifies the rhythm.

We can now determine the actual keyboard range of the two pieces by Correa de Arauxo. The lowest note in the *Tiento* is represented by a 7 with a double stroke on the lowest line, thus an *Elami sograve*, which translates to an E2. The highest note, a 3 with an apostrophe, is an *Alamire agudissimo*, an A5.[37] The *Glosas* have a similar range of D2 to A5.[38] In the lower range, Correa de Arauxo does not write in a very virtuosic manner, and he does not use an F# or G# in the bass range. The pieces are therefore suitable for instruments with a short octave, such as the ones in Sibayo and Tisco. In the highest octave, those two organs both come one half tone short. However, unlike the lower end of the keyboard range, the upper end does not matter much in this case, as an organist could simply adjust the melody to fit the keyboard. While a different use of notes in the bass range would change the harmonies of the piece, the exact ambitus of the melody in the descant range does not affect the harmony. We can therefore conclude that both pieces are suitable for the Peruvian instruments.

5.3.2 Registration

Correa de Arauxo scatters information for registration throughout the music-part of the *Facultad organica.* Other than Diruta, who gives a general discourse on how to registrate different affects in the twelve different tones,[39] Correa de Arauxo gives specific instructions for specific pieces in the form of little prefaces to his compositions. For the *Tres Glosas*, he specifies:

> *Van en forma de medio registro de tiple, u assi se podra echar el flautado a los contrabajos, y a los tiples la mixture que mejor vista le fuere al organista.*

[37] Max Polijakowksi, in his transcription of this *tiento*, writes a D2 as the first note in the left hand of m. 36. However, even though this seems plausible from a composer's point of view, I cannot detect a double stroke on that note in the original print. See also fig. 27 in appendix B.
[38] See fig. 26 in appendix B.
[39] Diruta, *Transilvano*, vol. 2, 153-154.

> They are composed for *medio registro*, and so one can do the Principal in the bass and in the descant a plenum that seems best to the organist. [40]

Playing a piece with two different registrations for the upper and lower parts of the keyboard was very typical for Spanish organs of the Castilian type, even for large instruments, which had many ranks and two keyboards. The very elaborate registration advice of Gilles Brebos for the organs he built at El Escorial in the late sixteenth century deals almost exclusively with *medio registro* registrations.[41] The much later instructions of Pedro II de Echevarría for the cathedral organ of Segovia[42] and the *Cartas instructivas* of Ferdinando Antonio de Madrid[43] equally assume *medio registro* as the standard manner of playing. While this kind of registration also existed in Italy, its use was different. Antegnati does not describe it for homophonic compositions, but rather for playing dialogues between the two hands, with a 4-foot stop in the bass and an 8-foot stop in the descant.[44]

Unlike the *Glosas*, the *Tiento* is not accompanied by an instruction on registration; other *tientos* in the *Facultad*, however, are. The *Tiento de medio registro de baxón de primero tono*[45] and the *Tiento de medio registro de tiple de quarto tono*,[46] for example, are

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[40] Correa de Arauxo, *Facultad organica*, 203r (my translation).
[41] Gilles Brebos, "Die Registrierungen für die vier Orgeln von Gilles Brebos 1579-86 im Kloster San Lorenzo el Real innerhalb des Escorial," trans. Roland Eberlein, n.d., accessed March 2, 2021, http://www.walcker-stiftung.de/Downloads/Registrierungsanweisungen/Registrierung_Escorial_1600ca.pdf.
[42] Pedro de Echevarría, "Die Registrierungsanweisung für die Orgel von Pedro de Echevarría 1772 in der Kathedrale Segovia," trans. Roland Eberlein and Rudolf Walter, n.d., accessed March 2, 2021, http://www.walcker-stiftung.de/Downloads/Registrierungsanweisungen/Registrierung_Segovia_Catedral_1772.pdf.
[43] Fernando Antonio de Madrid, "Fernando Antonio De Madrid: Cartas Instructivas Sobre Los Organos. Jaen 1790," trans. Roland Eberlein, n.d., accessed March 2, 2021, http://www.walcker-stiftung.de/Downloads/Registrierungsanweisungen/De_Madrid_Cartas_instructivas_1790.pdf.
[44] Constanzo Antegnati, "Constanzo Antegnati: L'Arte Organica. Brescia 1608. Kapitel: Modo Di Registrar Li Organi," trans. Roland Eberlein, n.d., accessed March 2, 2021, http://www.walcker-stiftung.de/Downloads/Registrierungsanweisungen/Antegnati_Arte_Organica_Modo_di_registrar_1608.pdf.
[45] Arauxo, *Facultad organica*, fol. 90v.
[46] Ibid., fol. 97r.

both played in *medio registro*, and for both, Correa de Arauxo demands a 4-foot Principal in the left hand and an 8-foot in the right hand. Plausible options would either be a solo 8-foot and 4-foot, a pyramid of octaves for each side of the keyboard, or Principal stops with additional 4-foot Flutes. The latter might sound unexpected to modern organists trained in Baroque performance practice. After all, the rule commonly adhered to is “no Flute stops together with Principals – ever.” However, Antegnati describes a registration specifically consisting of a 4-foot Octave and a 4-foot Flute.[47] It is therefore plausible that both the *Glosas* and the *Tiento* of our case study were commonly played in *medio registro.* The organs in Callalli and Sibayo (and presumably also Tisco) mostly consist of Principal ranks, and a 4-foot rank is present. Each of them has an equal number of sliders on both sides, which means that each stop must have a *medio registro*. The organs are therefore suitable for both of these works.

Spanish sources of the sixteenth to eighteenth centuries do not demand any registration changes within pieces. While in Italy, Antegnati praises variation in the form of frequent stop changes as early as 1608,[48] the first Spanish document mentioning registration changes is Fernando Antonio’s guidelines for the organ of the cathedral of Jaén of 1789.[49] Fernando Antonio describes this instrument as a great novelty:

> *Este organo tiene para exercicio de los pies y rodillas de el organista los cuatro movimientos, que por lo comun tienen otros muchos organos; pero en este producen efectos de mayor extension, por abrir, y cerrar los registros siguientes: Un flautado de treze, los llenos, nasardos, flautas, cornetas, y seis registros de lenguetería in cada mano, todos juntos ó separados á voluntad del organista, de*

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[47] Antegnati and Eberlein, “L’Arte Organica,” 5.
[48] Ibid., 3.
[49] Ferdinando de Madrid, “Die Registrierungen von Fernando Antonio de Madrid 1789 für die Orgel der Kathedrale Jaén,” trans. Roland Eberlein, n.d., accessed March 2, 2021, http://www.walcker-stiftung.de/Downloads/Registrierungsanweisungen/Registrierung_Jaen_1789.pdf. My translation.

> *modo que sin apartar los manos, ni variar de teclado, puede hazer quantas diferencias de musica es capaz de producir el organo con todos sus registros.*
>
> This organ has the four shifts operated by the feet and knees of the organist that many other organs commonly have; however, in this organ they produce more elaborate effects, for opening and closing the following stops: a Principal of 13 [palmos], the Mixtures, Nazards, Flutes, Cornets, and six reed stops in each hand, all combined or separated at the will of the organist, without having to take away the hands [from the keyboard] or changing keyboard; the organ is able to make so many differences in the music with all its stops.

This introductory paragraph is followed by several pages of registration changes that can be obtained through just the quick movement of a foot. Fernando Antonio's account seems to convey that foot- or knee-operated stop levers were an invention of the late eighteenth century, and that changing stops during a piece was not part of any Castilian performance practice before then. We can therefore conclude that the specifications of the Andean organs of my three case studies are perfectly in agreement with the common Spanish practice of their time. Their sliders are situated at the left and right side of the case, and the organist could not have reached them while sitting behind the console. The same timbre most likely sounded throughout an entire piece, which was apparently considered normal at the time.

5.3.3 Pitch level and tuning

Sources on the pitch level of European Spanish Baroque organs appear difficult to find. Rudolf Reuter, in his book *Orgeln in Spanien*, provides details about over one-hundred historical organs on the Iberian Peninsula; unfortunately, he makes no mention of pitch level.[50] Organ specifications for extant Spanish instruments mostly state A4=415Hz;[51] however, it is unclear whether this is the original pitch, or whether the pitch was changed to 415Hz in the course of restoration work. Common secondary sources on performance practice do not say much about pitch levels in seventeenth-century Spain either. Even for Italy, the situation is vague: all we know is that there were many different pitch levels around, with Venice probably having the highest and Rome having the lowest.[52] The organ in St. Peter in Rome was tuned as low as A4=384Hz.[53] In *The Story of "A"* Bruce Haynes does not deal with the Iberian Peninsula at all; however, he makes two brief mentions of the Spanish Netherlands. In the seventeenth century, the tuning pitch seemed to have been rather low there: A-1½ or even A-2 (thus A4=369.99Hz and A4=349.23Hz, respectively) for woodwinds, and A4=403Hz for the only surviving pipe organ of that period, the instrument in the Begijnhofkerk in Leuven.[54] In the eighteenth century, important woodwind instruments in the country came from the Brussels Rottenburgh family and typically ranged in tuning pitch from 387Hz to 405Hz for A4.[55] Since the Spanish Netherlands were ruled by the Spanish branch of the Habsburg crown, mutual influences were common. Reuter points out the Dutch influences on Iberian organ building up to around 1700.[56] Influences in pitch level are therefore plausible, and a low

[50] Rudolf and Hannelore Reuter, *Orgeln in Spanien* (Kassel: Bärenreiter, 1986).
[51] "Iglesia de Lerma, Colegiata de San Pedro," in *Historic Organs of Spain*, n.d., 78, accessed March 2, 2021, https://pipedreams.publicradio.org/tour/2013spain/2013pipedreams-posttrip.pdf. See also the following two sources: Greg Harrold, "The Spanish Baroque Organ at Oberlin," *Vox Humana*, accessed April 10, 2021, https://www.voxhumanajournal.com/harrold2019.html; Joaquín Lois Cabello, "Tordesillas, Valladolid," accessed March 2, 2021, https://www.joaquinlois.com/en/organs/historic-organs-restauration/santa-maria-organ-tordesillas/.
[52] Mary Cyr, *Performing Baroque Music* (Portland, OR: Amadeus Press, 1992), 64.
[53] Herbert Myers, "Pitch and Transposition," in *A Performer's Guide to Seventeenth-Century Music*, ed. Stewart Carter and Jeffery T. Kite-Powell (Bloomington: Indiana University Press, 2012), 380.
[54] Bruce Haynes, *A History of Performing Pitch: The Story of "A"* (Lanham, MD: The Scarecrow Press, 2002), 146.
[55] Ibid., 174.
[56] Reuter, *Orgeln in Spanien,* 11.

pitch level for Iberian organs of the seventeenth and eighteenth centuries cannot be excluded.

In chapter 4, we determined the tuning pitch of the organs in Sibayo and in Callalli at A4=493Hz and A4=622Hz respectively. For Tisco, the A4 might sound at 392 Hz, but this assumption rests solely on the condition that the largest pipe in the front corresponds to the lowest key. While raising the pitch by a whole tone, as in Sibayo, or lowering it by a whole tone, as (presumably) in Tisco, would not change the intended sound of a composition much, the difference of a tritone, as in Callalli, definitely gives the instrument a higher tessitura. We know from Praetorius that this mattered to seventeenth-century listeners; he says that the choice of pitch level for a specific instrument is commonly based on one of three factors: convenience, economic reasons, or timbre.[57] Human hearing is strongest between 2000 and 5000Hz, which means that harmonics (of otherwise lower fundamentals) are also perceived louder in this range. Playing a piece at a higher pitch level consequently changes the timbre of the piece. Compared to the other two organs, playing the *Glosas* and the *Tiento* on the organ in Callalli would therefore probably give them a shriller and more pervasive character than playing them on the Iberian organs of the same time period that they were originally intended for.

What matters more than the absolute pitch level is the relative size of the intervals, something noticeable even to musically untrained ears. A discussion of temperament and tuning therefore follows.

[57] Myers, "Pitch and Transposition," 377.

None of the Spanish treatises I examined describe the common temperament of the time. In general, we know that some kind of meantone tuning was in use everywhere in Europe throughout the Baroque era. Antegnati provides us with an indirect, but unmistakable description:

> *Le terze maggiori si tirano à tutta quella perfettione, che si può. Poi bisogna stabilire la cordatura, come si vuole Corista di tutto ponto, ò di mezzo, ò alta, ò bassa come si vuole, & è commoda.*
>
> The major thirds receive as much purity as they can. Then it is necessary to lay the temperament however one wants, in the *tutto punto*, *mezzo punto*, high or low, however one wants and how it is comfortable. [58]

Before Antegnati, Zarlino had already described a 2/7-comma meantone tuning in the *Istitutioni harmoniche* in 1558.[59] Mark Lindley says that the tempered fifths mentioned before Antegnati by Aaron, Gaffurius, Pereia, Lanfranco, and Schlick might perhaps also be interpreted as an early reference to meantone. According to Herbert Myers, meantone was the prevailing temperament in the sixteenth and seventeenth centuries; he asserts that the ¼-comma variant was the most popular.[60] Circular temperaments began to make a slow entrance towards the end of the seventeenth century, starting in Germany with Werckmeister's famous three temperaments in 1691.[61] Chaumont (1696) is an early French example of a non-meantone tuning.[62] However, unlike Werckmeister II, III, and IV, Chaumont's temperaments are based on the syntonic comma, as meantone tunings are. Werckmeister used the Pythagorean comma – the "gap" between twelve fifths and seven

[58] Costanzo Antegnati, *L'arte Organica Di Costanzo Antegnati (Brescia 1608)*, ed. Renato Lunelli and Paul Smets (Magonza: Rheingold, 1958), 72 (translation mine).
[59] Rudolf Rasch, "Tuning and Temperament," in *The Cambridge History of Western Music Theory*, ed. Thomas Christensen (New York: Cambridge University Press, 2008), 202.
[60] Herbert Myers, "Tuning and Temperament," in Carter and Kite-Powell, 371.
[61] Pierre-Yves Asselin and Marie-Claire Alain, *Musique et tempérament* (Paris: Jobert, 2000), 94ff.
[62] Ibid., 109.

octaves – which would dominate Western musical temperaments from the late eighteenth century until today. There is iconographic evidence for equal temperament for lute and viol players from the fifteenth century onwards.[63] However, players of fretted string instruments regarded equal temperament as an unavoidable – yet far from ideal – necessity, because of the nature of fretted instruments.[64] Some keyboard players were arguing for equal temperament[65] (Froberger, and possibly also Frescobaldi[66]); however, the fact that they were arguing for it shows that it was not commonly in use for keyboard instruments. Consequently, we can assume that meantone tuning was the prevailing temperament in seventeenth-century Spain, all the more so as surviving Spanish Baroque organs are all tuned in meantone. The temperaments of the cathedral organ in Lerma[67] and of the organ in Santa Maria de Tordesillas,[68] for example, are both meantone, and Greg Harrold based the specification of the Spanish Baroque organ at Oberlin College – a 415Hz, ¼-comma meantone instrument – on "the typical [Spanish] organs [he] studied."[69]

There is no direct evidence regarding the temperament of the organs in Sibayo, Tisco, and Callalli. While measuring pipe lengths can aid in determining tuning pitches, it is not a useful approach for determining temperaments. The differences in pitch that are caused by tuning are much smaller than a semitone. The variations in pipe lengths would be so small that many additional scaling properties would become relevant for the pitch,

[63] Mark Lindley, "Tuning and Intonation," in *Performance Practice*, ed. Howard Mayer Brown and Stanley Sadie (Basingstoke: Macmillan, 1989), 173.
[64] Myers, "Pitch and Transposition," 371.
[65] Lindley, "Tuning and Intonation," 175.
[66] See also: Frederick Hammond, "Frescobaldi's Instruments," Girolamo Frescobaldi: An Extended Biography, accessed April 10, 2021, https://girolamofrescobaldi.com/11-frescobaldis-instruments/#_ftn53.
[67] "Iglesia de Lerma," 78.
[68] Cabello, "Tordesillas."
[69] Harrold, "Oberlin."

such as the size of the foot hole, the height of the cut-up, and the shape of the rim at the upper edge of the pipe. We can, however, still make inferences about the temperament of these organs based on other factors, the first being the short octave in the organs in Tisco and Sibayo: since it omits F# and G#, it is safe to assume that pieces were played only in certain keys. Second, regional references: the still playable gospel organ in the Cathedral in Cusco is tuned in meantone.[70] Third, the drone pipes: since there are only a few of those pipes, it seems plausible that only certain harmonies were played, probably because the others were not as "useful." This fact on its own already points towards a meantone-type tuning. However, even more convincing is the fact that measurements on the resonator lengths of the two drone pipes in the Sibayo organ – which could not be played separately – show that the interval proportion between them must have been a major third.

We do not know the exact time of origin of the organs in the Callalli parish; however, we do know that the Franciscans were put in charge of the Colca reductions in the late sixteenth century, and that the exchange between them and the outside world was limited for logistical reasons. The distance between Callalli/Sibayo and the closest neighboring village, Chivay, was eight hours on foot, while Arequipa was a journey of at least two or three days. In addition, we know that there was no development in Peruvian organ building between the sixteenth and the nineteenth century. It is therefore unlikely that the organs in the Colca reductions were tuned in anything other than meantone tuning. Consequently, they must have been extremely suitable for performing Correa de Arauxo's music – a music written for meantone tuning, as we can see in the rich usage of major thirds and third progressions in many of his pieces, even at times in the left hand.

[70] Empirically determined June 20, 2016.

5.3.4 Playing technique

Diruta offers concrete guidelines on how to move the hand and touch the keys: in his chapter *Modo di incoppar la mano, & inarcar le dita* and the following sections, he advises the player to hold the hand in a relaxed way, in a cupped shape, with curved fingers.[71] A few chapters later, he writes about the keys having to be "pressed continuously." When the key is "struck," the sound would become "disjunct."[72] We can therefore assume that the ideal *toucher* was light and relaxed, not too abrupt, and not too forceful. The ideal articulation must have been somewhere close to legato. Diruta here agrees with Correa de Arauxo, who in his tenth subchapter on how to read the tablature, titled *Para perfectamente poner por cifra* ("On playing the notes perfectly"), points to the importance of "not raising the preceding note, until it is followed by the next note."[73] Fray Tomás de Santa Maria, in his *Libro llamado arte de tañer fantasía* (1565), demands similar:

> *La primera y principal, es que al herir de los dedos en las teclas, siempre el dedo q[ue] hiriere primero se leuante antes que hiera el otro que immediatamente se siguiere tras el, assi al subir como al baxar.*
>
> First and foremost, upon hitting the keys with the fingers, the finger that first strikes, lifts up before the next one strikes, which immediately follows after it, going up while going down. [74]

[71] Diruta, *Transilvano*, vol. 1, 53.
[72] Ibid., 54.
[73] Correa de Arauxo, *Facultad organica*, fol. 24v/25 (my translation).
[74] Hakalahti interprets this as contradictory to what Correa de Arauxo demands (Hakalahti, "Correa de Arauxo," 194). However, since Tomás de Santa Maria talks about immediately letting the next note follow, I contend that he basically means the same as Correa de Arauxo (i.e., an almost legato effect) and just uses different wording.

The organs in Sibayo and Tisco must have been suitable for this kind of playing. At this point, most keys are stuck and cannot be moved anymore, which makes a direct measurement of the necessary pressure on the key impossible. The tracker action, however, is still present, and sufficiently preserved for examination. Since the windchest is situated immediately above the keys, the trackers are very short, and no roller boards are necessary to reroute the tension force. The tracker action is thus as direct as it can possibly be. The pallets in the windchest, as well as the keys, are small and light. Overall, this indicates that the key action must have been light as well. Furthermore, a suspended keyboard allows for much higher control over the key than a balanced keyboard, and subsequently over the valve in the windchest. The depression of the keys in all three organs of my case studies is no more than 7 millimeters and therefore rather shallow, which facilitates achieving the *quasi-legato* effect demanded by the aforementioned sources even for fast passages.[75]

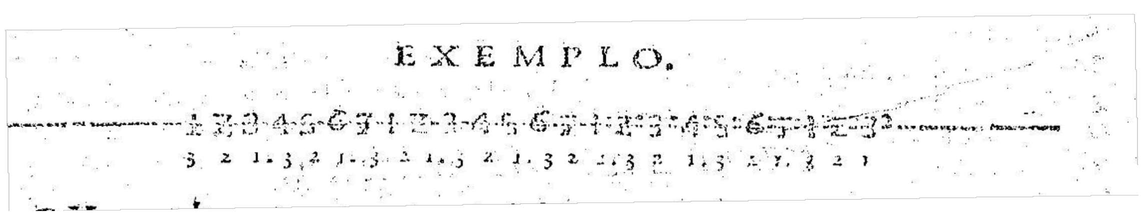
5.3.5 Fingerings

The topic of fingerings is strongly related to our discussion of *toucher* above. The first source probably any keyboard player today turns to for southern European fingerings is Girolamo Diruta's *Transilvano*. Diruta advises not to use the thumb and the fifth finger for scales, runs, and fast notes. The fifth finger is occasionally used for intervals; the thumb is to be avoided in general. Diruta stresses the importance of matching the "good notes" with the "good fingers."[76] He indicates the good, "strong" fingers, thus the ones that play

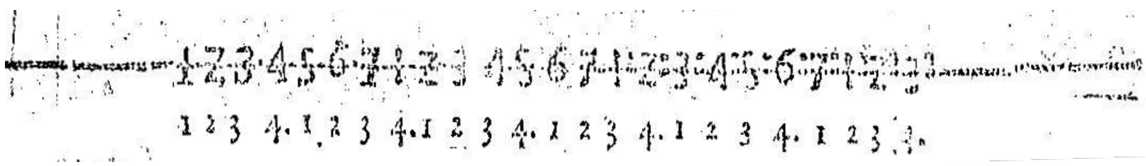
[75] A possible exception might be the outermost keys in the organs in Sibayo and Tisco. These could have needed a slightly higher downward pressure to depress the key, since the trackers are placed at an angle, which adds an additional force component in the horizontal direction.
[76] Diruta, *Transilvano,* vol. 1, 56.

the accentuated notes, as the index finger and the ring finger, yielding the following fingering for the right and left hands respectively:[77]

Correa de Arauxo also provides fingerings that alternate between the second and third or the third and fourth finger, but, unlike Diruta, he also uses the thumb in scales. For example, he instructs alternating between the thumb and the index finger for ascending left-hand scales. Also, he advises groups of four fingers (1 through 4)[78] for both hands and groups of three fingers (1 through 3) specifically for the left hand, especially for scales involving black keys.[79]



[77] Ibid., 56-57.
[78] All fingering numbers in this chapter correspond to present-day keyboard player fingering conventions. Thus "1" denotes the thumb of each hand, "5" the pinky finger.
[79] Correa de Arauxo, *Facultad organica*, fol. 23r.



The level of detail in Correa de Arauxo's guidelines is remarkable: altogether, he provides fourteen different fingerings for scales, depending on whether (and how many) upper keys are used in the scale, and which hand is to play the scale. He also gives fingerings for various kinds of intervals and chords, which involve all five fingers.

In the *Tiento*, most scales are what Arauxo calls "ordinary" scales. They are to be played 3-4-3-4 (ascending) and 3-2-3-2 (descending) in the right hand, and 3-4-3-4 (ascending) and 1-2-1-2 (descending) in the left hand. However, there are exceptions, for example in mm. 17 (F#, right hand) and 72 (F#, left hand), which have to be played 1-2-3-4-1-2-3-4 in the right hand and 4-3-2-1-4-3-2-1 in the left hand. Yet another case is m. 80 (F# and G# right hand), which starts on an upper key, and therefore would have to be played 2-3-4-2-3-4. The cantus firmus in the *Glosas* is always accompanied by three-part chords, in which Correa de Arauxo always includes either the fifth finger or the thumb, but most frequently both.[80]

The keys and tracker action of all three organs of my case studies are stuck, and consequently, trying out fingerings directly on the keyboard is not possible. However, we can make inferences on the basis of technical properties and other observations. As discussed in the previous section, all three organs allow for a high level of control over the

[80] Correa de Arauxo almost exclusively describes fingering on chords and intervals in words, without providing music examples. Fortunately, Hakalahti assembled a table of chord fingerings: Hakalahti, *Correa de Arauxo*, 212.

key and tracker action, because of the short length of the trackers, the absence of roller boards, and the small size of the pallets. This must easily have allowed for runs in fast 3-4-3-4 or 2-3-2-3 succession, and thus for Correa de Arauxo's "ordinary" scale fingerings. The organs have lower keys of between 10 and 12 centimeters in length, which would be just long enough for using the thumb. Shorter keys would make thumb fingerings difficult, since the other fingers would have to curl too much. In addition, the painting on the shutter of the organ case in Sibayo shows Saint Cecilia playing with all ten fingers[81] – and Sibayo is not the only organ in Peru with a depiction of full-hand playing. The epistle organ in Andahuaylillas has a similar painting on the outside of its right-hand shutter.[82] Consequently it can be assumed that playing with all ten fingers was a practice known and common in sixteenth- and seventeenth-century Peru. All in all, everything speaks for Andean organs being suitable for Spanish Baroque fingering, and therefore for the style of playing associated with Correa de Arauxo's compositions.

5.4 Conclusions

This chapter has brought us closer to answering repertoire questions for colonial Peruvian pipe organs. While, in the absence of surviving written primary sources such as sheet music or treatises, we cannot say anything with absolute certainty, we at least have been able to make inferences about possible styles and playing techniques on those instruments. We can conclude that imitative, non-cantus-firmus-based works, such as Correa de Arauxo's *Tiento del quarto tuono*, and cantus-firmus variations (his *Tres glosas*), are playable on the instruments in Callalli, Sibayo, and Tisco without too many constraints.

[81] See fig. 25 in appendix B.
[82] See fig. 24 in appendix B.

However, it is also important to recognize that the music of Correa de Arauxo was most probably never actually played on those organs. The organs did not have a lectern, and the common organ performance practice of the seventeenth and eighteenth centuries was improvisation.

We know that musicians in the Spanish colonies were interested in getting the "newest" music from home. Juan Bermudo, for example, writes in his *Declaración* of 1555 that he has included some sheet music in his treatise because of the "request from the New World."[83] We do not, however, have any evidence for how the music played on Peruvian organs in the seventeenth century really sounded. Factors that come into play here – especially considering the highly improvisatory practice of the time – were skill, talent, taste, and musical knowledge of the performer, but also subtle differences in the specifications of the organ he played on. Domenico Zipoli's famous *Pastorale*, for instance, is one example of a piece that would *almost* be suitable for the organs of my case studies. The piece needs drone pipes that are individually playable, such as the ones in the organ in Tisco. However, the instrument in Tisco is a 4-foot organ, while the *Pastorale* needs an 8-foot stop, or at least a 4-foot stop that is not as shrill and forceful as those in the Colca organs. Since Zipoli worked in Latin America, it can be assumed that many of his works were written for organs there, maybe even for teaching improvisation. Thus, a slight regional difference in the configuration of an organ can make a big difference for the performance style and (improvised) repertoire played on it. Something similar can be said for possible local indigenous influences – a topic I will discuss in chapter 6.

[83] Robert Stevenson, *Juan Bermudo* (The Hague: Martinus Nijhoff, 1960), 25.

This conclusion, which admittedly raises more questions than answers, might at first glance appear to be an unsatisfying result – especially when comparing the Peruvian case to other rural places in Latin America, where we do have sheet music. For instance, in 2012, Cecily Winter and her team from the *Instituto des Órganos Históricos de Oaxaca* found a wooden crate with sheet music in the church of the small (ca. 600-residents) village of San Bartolo Yautepec in southwest Mexico.[84] The organ in Yautepec is dated around 1800 – a time when improvisational practices had started to fade – and has a lectern. The sheet music, Mass books with plainchants, was most probably used on this very organ. The lack of a similar discovery in the Peruvian Andes almost seems like a failure, and the reliance on indirect evidence feels like "guesswork." Upon closer look, however, we realize that the results of this chapter push pipe organ scholarship a substantial step forward: previously, Peruvian colonial organs did not receive any attention nationally or internationally, neither from performers nor from scholars. In particular, the very small instruments in former missionary villages, which today account for a plurality of colonial organs in Peru (see chapter 2) were previously not given any consideration at all. They are mostly found in choir lofts that are not in use anymore, and they are covered in a thick layer of dust and show heavy decay. Being built in a very compact way, having no pedals or bench and not many pipe ranks, they can seem small and unimpressive, almost like "miniature" versions of "real" organs. Consequently, there is a lack of awareness and understanding not only of their cultural and historical value, but also of their artistic and musical potential. Every insight obtained by scholars about this organ type, its history, and

[84] Cecilia Winter, "Los baúles de San Bartolo Yautepec: Historia y presente entorno al patrimonio musical de una comunidad zapoteca," *El Comején (Boletín de las Bibliotecas y Salas de Lectura del estado de Oaxaca)* 2, no. 6 (July-September 2012).

its possible use brings us a step closer to giving it the attention and recognition that it deserves. In the case of repertoire questions, our obtained insight is that these organs were suitable for the performance of standard organ music of their time. This means that the organs, although small in size and austere in decoration, were fully functional, state-of-the-art instruments in their time. They were in no way lagging behind their larger counterparts in terms of functionality or expressive capability.

As scholars, we are used to focusing on examining sheet music when researching past music cultures; in the absence thereof, we are all too easily tempted to adopt notions of inferiority or incompleteness. However, at least in pipe organ studies, we have to acknowledge the prevalence of improvisatory practices as the norm, and instead regard the existence of surviving compositions in some places as the exception. Indeed, those compositions mostly constitute examples of an otherwise improvisational practice, and should therefore be regarded as a "bonus" in a researcher's work – not as the norm. In addition, when talking about colonial musical practices, we have to acknowledge the vast repository of additional possibilities that opens up through the prevalence of improvisational music practices. Chapter 3 has already discussed potential spaces for indigenous expression after contact. Recognizing the fact that indigenous Andean music is never written down, but always either improvised or learned by rote, we might be able to make inferences about a potential "space" opened up through the fact that organ music was improvised as well. The next chapter will speculate about indigenous influence in the music performed on Colca organs. A music culture that is largely based on improvisatory practices potentially provides space for a rich musical language and broad expressive variety. It is therefore in no way inferior, and neither are the instruments belonging to such a culture.

CHAPTER VI

INSTRUMENTS OF POWER:

MISSIONARY PIPE ORGANS IN THE INTERPLAY OF CULTURES

6.1 Introduction

So far, my study has established that there is a distinct type of organ in the Southern Central Andes which shares a set of well-defined features, and that we need to research these instruments to fill gaps in current music history and colonial musicological scholarship. In the previous chapter, I discussed the music that can be performed on these instruments; however, I have not yet touched upon a possible additional Andean element in the music. In chapter 3 I have argued that we need to examine these organs as early colonial objects, and that we can use present-day localized (music) culture in the Andes to place these pipe organs – and their historical local music culture – into the proper context. That chapter also touched on missionary culture and on the fact that different religious orders had different degrees of leniency towards and acceptance of indigenous cultures,[1] which could lead to different extents and types of space for indigenous post-contact expressions.

In what follows, I will examine the early colonial and possibly Andean aspects of my three case studies in Sibayo, Callalli, and Tisco. Through comparing my findings in

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[1] Kelly Donahue-Wallace, *Art and Architecture of Viceregal Latin America, 1521-1821* (Albuquerque: University of New Mexico Press, 2008), 5.

chapter 4 to European organs from the Baroque period, I investigate if and how Andean colonial organs are different from European organs of the same period. In particular, I am interested in whether those differences are due to indigenous influences, and if so, what the implications would be. Circling back to my third chapter, I will show the connections between our knowledge of historical organs in the Colca Valley, of past missionary culture there, and of the mixed cultural tradition today. Works by specialists in Andean culture, such as Henry Stobart and Marisol de la Cadena, will help me as much as existing scholarship on arts and literature in the colonial era, for example by Tom Cummins, Gauvin Bailey, or Rolena Adorno. I will also use general ideas on hybridity, hybrid culture, and hybridization processes by, among others, Homi K. Bhabha, Carolyn Dean, and Dana Leibsohn, to draw conclusions about possible ramifications for the inclusion of signifiers of one culture into objects of another culture. Lastly, I will also briefly reevaluate my findings from chapter 5 and speculate on possible consequences of indigenous influences in the organs on the music performed on those instruments.

6.2 An ethnological view on Colca organs

Upon revisiting my case studies from chapter 4, I will investigate the following three aspects: first, visible (decorative, aesthetic) elements; second, non-visible, aural, or hidden aspects; third, functional elements, thus clearly visible parts of the organ, that are, however, not intended for decorative or aesthetic purposes. Each of these three aspects will reveal a different set of insights, which, taken together, will allow for possible conclusions about latent power dynamics and negotiations of indigenous identity in the time those organs were built and played.

6.2.1 Visible, decorative aspects

In pre-contact Andean culture, visibility projected strength. Rebecca Stone describes how Wari culture – in which Collagua and Cabana culture in the Colca were rooted – was particularly bold: their buildings, artwork, and artisanry projected power.[2] Colonial authorities keyed into this visual culture and used it to their own ends. Kelly Donahue-Wallace points out that viceregal buildings could have an overwhelming effect on indigenous people and were consequently used to manifest the authority of the Spanish.[3] Colonial organs possibly operated in a similar way. Given that organs are among the largest musical instruments in the world, they were part of the colonizing party's means to project and assert European power display and dominance. However, the question arises of whether these organs contain elements that equally represented the visual culture of the Andes. Which – if any – of the organs' elements could possibly project the power of indigenous people, rather than that of European sovereignty?

European organ cases of the Baroque period follow common aesthetics: they are usually symmetric, consisting of towers and flats. In southern countries, we typically see a preference for flats, because the organs had to fit onto the *coro alto*,[4] while northern European countries often exhibit prominent, three-dimensional pedal towers. Spanish organ fronts were usually very architectural, containing pillars, columns, pediments, and other architectonic elements, often in a similar style to the rest of the church.[5] Older

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[2] Rebecca Stone-Miller, *Art of the Andes: From Chavín to Inca* (London: Thames & Hudson, 2002), 145.
[3] Donahue-Wallace, *Viceregal Latin America*, 76.
[4] See glossary in appendix A.
[5] Louis Jambou, *Evolución del órgano español: Siglos XVI-XVIII* (Oviedo: Universidad, 1988), 214.

European instruments, up to the late Renaissance, often had shutters, but Spanish organs rarely exhibit them; even older or smaller Spanish instruments (thus instruments that probably never had *chamades*[6]) commonly lack shutters. Spanish fronts could nevertheless be ostentatious – much more so than in the puritan northern countries of Europe. Front decoration in Spain would often consist of three-dimensional reliefs, featuring angel heads, protruding flowers, and the like. The wooden back panels of Spanish and Italian organs could contain imagery; a reason for that might have been their location on the *coro alto*, which made the backs of the organs visible to the congregation. Talking about European organ fronts usually includes a discussion of the organ bench. Here, regional differences depend on the importance of the pedals in the respective organ performance practice: more "normative" organ benches, thus simple, functional ones without a backrest, can be found in the North, where organists had to be able to reach two octaves of pedals without shifting their bodies too much. A wider variety of sizes and styles can be found in the South, where the pedal compass could vary and pedal playing was not necessarily of great importance. All European organ benches, though, are made from wood, with the occasional addition in the South of textile or leather for upholstery.

Comparing the above to the Peruvian organs of my case studies, we are immediately struck by the simple design and austere exterior of the Andean instruments. We do see some art on the shutter of the organ in Sibayo:[7] a painting of St. Cecilia on its inside, the side that is visible when the shutter is open and the organ is played. The other side, however, is more significant for our present case: it features a faint, line-drawn,

[6] See glossary in appendix A.
[7] Since the shutter is atypical for Spanish instruments, it might be a tradition introduced by Europeans from Italy, central or northern Europe, or it might have been a way to adjust to the dusty environment in the extremely dry climate that prevails for the largest part of the year in the Colca Valley.

repeating ornament in the shape of a simplified four-petal flower on grey background.[8] This is neither a motif nor a technique used in European organ case decoration. Sibayo is the only organ of my three case studies that has painted ornamentation, though it is not unique. While most Peruvian Andean organ cases generally do not contain a lot of embellishments, there are exceptions. The organs in Andahuaylillas, for example, are ostentatiously painted and are located in a similarly richly decorated church interior. The organ in Huaro, in the greater Cusco area, has a moon and clouds painted on the side of the case, something also uncommon in European organ building.

The case of the organ in Tisco presents us with another kind of unusual decorative feature: asymmetry. We occasionally find asymmetry in European Rococo organs[9]; however, the asymmetry in Tisco is less playful. The typical Rococo volutes, scrolls, and *rocailles* are missing; instead, we see roughly unequal sizes of wooden shades on the outer towers. The makers of this organ had sufficient craftsmanship and precise enough measuring devices to build pallets, trackers, and keys to fractions of millimeters precisely. The instrument otherwise would never have functioned. It can therefore be assumed that the organ builder also had the dexterity and tools to cut simple shades symmetrically, so the asymmetry does not appear to be the result of unprofessional or sloppy work. Even more striking in this instrument, however, is the stone stool for the organist, something not known in European organs (of any period) at all. There are thus definitely non-European visual elements in this organ, elements that must represent something other than the organ-building tradition brought to the Colca Valley by European Christians.

[8] See fig. 22 in appendix B.
[9] The asymmetry treated here concerns purely decorative features. Functional asymmetry, as it arises from chromatic pipe layouts, falls beyond the scope of this discussion.

To put this all into context, we should recall an insight from chapter 3: Colca culture is, and was, mixed. This cultural blending was not abnormal in colonial Peru. Donahue-Wallace describes how indigenous artisanry changed after contact. In addition to containing European tropes and motifs, it also started depicting indigenous rituals that could no longer be executed under Spanish rule.[10] The painting on a *quero* cup, for example, could substitute for an actual real-life experience. Let us be reminded here, however, that cultural mixing often presents a two-way or even multi-way influence, rather than a unidirectional one. Referring back once again to my observations in the third chapter, we need to remember a number of Andean elements in originally European-rooted customs: the postponing of Lent if the rainy season has not ended yet; *Pachamama* and the *Apus* as patrons for Carnival; the *wititi* as a mandatory dance on Christian feast days. This modern-day cross-fertilization in the Colca might be reflective of past interactions.

The church edifices themselves, which were all built or rebuilt between the sixteenth and the eighteenth centuries, further support these findings. The church of San Antonio in Callalli has a portal with cherubs and stars, and a sun as keystone. Not only were celestial bodies considered deities in pre-contact spirituality, but angels played an important role for Andean post-contact belief, because they functioned as a connection to the Inca deities sun, moon, and stars.[11] In addition, angels often wore feathers, which was an Andean symbol of leadership and an attribute of rulers.[12] Sibayo's façade similarly showcases cherubs, and a portal with typically Andean low-carved zigzag and spiral reliefs.

[10] Donahue-Wallace, *Viceregal Latin America*, 70.
[11] Gauvin Alexander Bailey, *The Andean Hybrid Baroque: Convergent Cultures in the Churches of Colonial Peru* (Notre Dame: University of Notre Dame Press, 2010), 312.
[12] Ibid., 311.

The double rows in the portals are what Gauvin Bailey points out as typical for the Andean Baroque; he draws a connection to Andean textile patterns (*pampas* and *palla*) and consequently to Andean spatial thinking in general.[13] The *cantuta* flower, an Andean plant that symbolizes love, death, and sexuality, and that represented Inca sovereignty,[14] features prominently on the church façade as well. The richest treasure trove of Andean elements is the almost Cusco School-like church of San Piedro in Tisco. Besides geometric patterns and zigzag columns, its base contains *parlante* masks; most prominent, however, are the gigantic corn stalks painted in ochre on its two towers. In addition to corn – "Tahuantinsuyu's quintessential religious and social crop"[15] – which is also present in the form of corncobs in the portals, the *cantuta* flower, feathers, and *vizcachas* represent Andean flora and fauna. Feathers have a special status in this regard, since they were a sign not only of Inca nobility[16] but also of ritual sacrifice;[17] furthermore, birds were important fertilizers in the agricultural practice.[18] In addition to church exteriors, the interiors of all three churches contain traces of indigenous culture as well: many of the saint statues wear indigenous clothing, and even the Holy Family is clothed in Andean-style ponchos and hats.

Gauvin Bailey calls the blended style of these churches "Andean Hybrid Baroque," and describes it as an architectural style that started in Arequipa, but would later spread as far as Bolivia and Argentina.[19] Its dissemination greatly depended on indigenous migrant

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[13] Ibid., 332.
[14] Ibid., 328.
[15] Thomas B. F. Cummins, *Toasts with the Inca: Andean Abstraction and Colonial Images on Quero Vessels* (Ann Arbor: University of Michigan Press, 2002), 39.
[16] Bailey, *Hybrid Baroque*, 321.
[17] Ibid., 322.
[18] Of particular importance here is the *Yucyuc* bird, the "Father of Potatoes" (ibid., 323).
[19] Ibid., 2.

workers from the Arequipa region, who – according to Bailey – mostly originated from the Colca Valley.[20] I dare speculate that the organs of my case studies, and presumably a number of other Andean colonial organs, were part of a similar tradition. The three organs described in chapter 4 show striking similarities in their material, functional, technical, and sonic properties. Their bellow systems are of almost equal size and make, their tracker systems function in exactly the same ways, and their timbre and stoplist follow similar sonic-aesthetic principles. They might therefore have been disseminated by migrant workers as well, although it is plausible that local people joined in the construction. Similar to the churches of the Andean Hybrid Baroque, these organs might have originated in the relatively permeable European missionary culture of the greater Arequipa area, and might have been introduced to other parts of Peru, or more generally other parts of the Andes, in the two centuries that followed.

Under these premises, I will revisit Colca organ fronts here. While we do not find the Inca's architectural approach to artisanry – which is surprising, given that Castilian organ fronts were very architectural – we do see an indication of the Inca's preference for stonework. There is no evidence for the time of origin of the stone stool in Tisco, and no proof that it was built at the same time as the organ. However, the mere fact that it is present today introduces a non-European, in this case Inca-rooted, custom into this instrument. Incas not only liked working with stone, but stone was also part of their belief system. They identified with stone and felt that humans were interchangeable with stones.[21] The fact that the church itself is a mixture between the Arequipa Hybrid Baroque style and the Cusco

[20] Ibid., 47.
[21] Stone, *Art of the Andes*, 202.

School supports possible Inca influences, since Cusco was the capital of the Inca Empire. The same organ in Tisco could potentially also reflect pre-Inca customs: the asymmetry in its towers is reminiscent of the pre-contact principle of *ayni*, which Stone describes for traditional Andean art as roughly, but not exactly two halves.[22] Of the many other aesthetic principles that Stone and other scholars on pre-colonial Andean art enumerate, the flower motif on the case of the organ in Sibayo represents at least two: the repetitiveness and the great number of small elements. Most important, however, is the fact that this flower was pointed out to me as indigenously Andean. While a search in botany books reveals a similarity to *monochaetum*, a plant native to Mexico and to the Andes, I was not able to find this exact flower motif in literature about pre-colonial Andean art, nor did I ever see it on other Andean artwork or artifacts. It therefore seems to be an atypical, not commonly used Andean motif, which does not, however, make it any less of a marker of indigenousness. The mere fact that my local interlocutor repeatedly stressed that this flower is a "traditionally Andean" motif shows a strong intention of claiming cultural ownership.

It is important to acknowledge different layers of mutual cultural influence in these organs. All too often, the discussion of culturally mixed objects is unrealistically limited to two "opposing" parties, an approach that does not adequately represent their complexity. Colca culture, as discussed in chapter 3, was already a mixed culture before the arrival of the Europeans, with Collagua, Cabana, Wari, and Inca elements all being present at once. The missionaries mainly introduced Spanish culture, but they originated from other parts of Europe as well. An African component is present in many creolized cultures in Peru. While I have so far been unable to find evidence of Black presence in the Colca Valley, I

[22] Ibid., 18f.

do not exclude the possibility that there could be traces of African heritage there. Future research will hopefully yield clarity in this regard. Lastly, when talking about organs, we should also consider the fact that the European prototype introduced to the colonies was, in itself, already a composite product of Italian (*Prestant* sound), Dutch and North German (reed pipes), and Flemish (split chests and sliders) elements.

While it might be possible to assign certain elements in Colca, or more generally Andean, organs to a particular cultural origin, it might not be possible to do so for *all* elements, nor might it be sensible to do so. In chapter 3, I discussed Weidman's approach to culturally mixed traditions, and her arguments against total dissection of South Indian Carnatic music into its cultural components. The same applies to Colca pipe organs. However, one meta-element of Andean culture has to be highlighted. Cycling back here to the research questions asked in the beginning of this section, I would like to address the significance of visuality and visual culture in Andean pre-Columbian society. Scholars of pre-colonial Andean and Mesoamerican art and culture point out the importance of *amantecayotls*, *quero* cups, *mantas,*[23] and tapestry and other fiberwork, not only for ascertaining status but also for visually recording events. My own experience with knotting *quipus* goes just as far as making a birthday calendar, but Andean communities were able to record the entire history of their *ayllu* on them. Acknowledging the various ways in which different cultures chronicle, remember, and record is necessary for arriving at a better understanding of the composite character of Andean pipe organs.

Tom Cummins has reminded us that we should not limit ourselves to reading

[23] See glossary in appendix A.

testimonies of suppression when studying post-contact culture.[24] He explains that post-contact objects, especially venerable objects, often functioned as a continuation of Andean self-representation.[25] They were bearers of a meta-history, a history told by indigenous people about pre-contact life, partly aimed at Spanish people – who, as pointed out in chapter 3, tried to impose their own version of pre-contact indigenous history on indigenous people. The imagery, decoration, and other visible elements on Colca pipe organs fit into these categories of objects operating in what Cummins calls "the nexus of exchange of representation,"[26] all the more so as music was itself a mode of storytelling. Not only has Tomlinson noted the importance of singing as a non-written form of Andean communication, but Stevenson earlier described the custom of the *amautas* in (pre-)colonial Cusco, who taught songs that preserved history.[27] Musical instruments, in their double role as artisan objects and as sounding objects, therefore presented a dual opportunity to preserve and protect history from within. Pipe organs, although European in origin, were very well capable of being adapted to these ends, and might have provided a space for indigenous border thinking in the Colca Valley. While they were originally introduced as vehicles for colonization, and intended to "overwhelm" through their sheer size, complex function, and sonic volume, there was also a space for adapting and appropriating them to protect the Colca people's own culture.

6.2.2 Non-visible, material, or aural aspects

[24] Tom Cummins, "Let Me See! Reading Is for Them: Colonial Andean Images and Objects 'como es costumbre tener los caciques Señores,'" in *Native Traditions in the Postconquest*, ed. Elizabeth Hill Boone and Tom Cummins (Washington, DC: Dumbarton Oaks, 1998), 94.
[25] Ibid.
[26] Ibid.
[27] Robert Stevenson, *The Music of Peru: Aboriginal and Viceroyal Epochs* (Washington, DC: Pan American Union, 1960), 39.

The previous section repeatedly pointed out that visibility and visual representation played a key role in pre-contact Andean culture. My intention to present non-visible aspects here might therefore seem almost contradictory. As a guide to my thought process, I need to introduce the Andean principle of *unkhu* here. *Unkhu* is that which is hidden, the interior, which nevertheless effects the exterior. Rebecca Stone posits *unkhu* as one of the core philosophies of Andean thinking. Consequently, not all things of importance always have to be visible in Andean culture, as long as they affect the exterior. In what follows, I will compare functional and sonic aspects of Andean organs to those of their European counterparts. I will determine if Andean materials or techniques were used in the making of the organs of my three case studies, and how the results of the sound analysis in chapter 4 might possibly fit into an Andean soundscape.

Organs of the Baroque Era in Europe were commonly built from three materials: wood, metal, and leather. They were tracker organs with mostly sliders for stop action, however, the Renaissance spring chest was still occasionally used (though not common in Spain at all). Rudolph and Hannelore Reuter describe Spanish tracker action as having short trackers and roller boards.[28] The pallet chest was usually closed with wood; however, in Spain, leather on the grid was regularly used as well.[29] Northern European organs usually had two manuals, sometimes three, but Spain, relatively early on, saw organs with up to four keyboards.[30] In this regard, Spanish organs differ greatly from their Italian counterparts of the same period, and tend more towards the French tradition. The number,

[28] Rudolf Reuter and Hannelore Reuter, *Orgeln in Spanien* (Kassel: Bärenreiter, 1986), 17-18.
[29] Ibid., 17.
[30] Ibid., 13.

compass, and use of pedals in Baroque organs depended greatly on the denomination for which the organ was built. Dutch (Protestant) organs were already equipped with independent pedals in the sixteenth century or earlier. Since the Spanish branch of the Habsburg family ruled the Netherlands from the mid-1500s onwards, Spanish organs from this time period – unlike other southern European organs –already show independent pedals. From the late seventeenth century onwards, however, only a few Spanish organs have more than one octave of pedals, which Reuter cites as one of several indications that an independent organ tradition had developed in Spain by that time.[31]

The sound of European Baroque organs can be divided into two primary types: flue sounds and reed sounds. In Spain, reeds were particularly popular beginning in the 1620s,[32] with usually one third of the stops being reed stops.[33] They could be executed as horizontal reeds in the front, or as vertical interior reeds. Italian organ culture, which equally took over reed pipes from the Dutch, never developed the Castilian enthusiasm for reeds. It instead exploited many registration possibilities through split Mixtures, thus enabling every Mixture rank to be activated separately. Spanish organs adopted the stop names from this Italian system – in translated form, e.g., *quincena*, *docena* – but left the Mixture ranks together (i.e., *lleno* and *cymbal* are stops that each consist of several ranks).[34] One particularity of Spanish Castilian organs was the *medio registro*, a split of the rank into an upper and a lower half, each of which could be activated separately, yielding additional possible registrations. In addition to their reed sounds, Spanish organs were very Diapason-

[31] Ibid., 15.
[32] Jambou, *Evolución del órgano*, 241.
[33] Reuter and Reuter, *Orgeln in Spanien*, 18.
[34] Example stoplists from an eighteenth-century source can be found in Reuter and Reuter, *Orgeln in Spanien*, 146.

focused, featuring many stops as *Flautado*, *Octava*, or *Quincena*, which once again recalls the general southern European, especially Italian, organ-building tradition.

The Andean organs of my case studies generally conform to their European ancestors with regards to material use. All three of them use wood, metal, and leather as their main materials. However, the organs in the Colca also contain a significant amount of textile. While in European organs, small pieces of cloth are occasionally used behind grillwork, in Sibayo, the entire back of the organ's case is closed off with fabric – something unusual for church organs beyond positive-size. Additionally, some reed pipes in the organ in Callalli have textile nuts, or nuts that are a combination of metal and textile – neither of which I have ever seen before in any other pipe organ. The supply chain for goods, materials, and resources might not always have been functional in places that were at least a day's travel away from the nearest larger village (Chivay); however, an inspection of the church interior reveals that all necessary materials for organ building must have been readily available. Wood must have been an easy-to-obtain import product, judging from the wooden statues, benches, and chancels in the nave of each of the three churches. There was thus no reason to close off the back of a case with fabric instead of wood. Metal must have been at the pipe maker's disposal as well, as almost the entire pipework is made from metal. Many of the reed nuts are in fact metal nuts. Besides that, nuts can also be made from wood; there is thus no material or constructional reason to make them from glue-hardened textile, wrapped around the pipe shaft. The technique is, however, vaguely reminiscent of the textile or fiber threads wound around Andean flutes, like *pinkullus*, *antaras*, and *quenas*.

In terms of their sonic characteristics, the three Colca organs at first glance present themselves in a typical southern European tradition: they are all built *medio registro*, and they show a typical Spanish combination of *Prestant* stops and Mixtures, although, unlike Spanish organs, they do not have a lot of reeds. As most colonial organs in Peru, they have only one keyboard. Looking closer, however, we detect differences, which manifest themselves particularly in the brightness and loudness of the organs' sound. The two organs in Tisco and Sibayo are 4-foot instruments, and the organ in Callalli seems to have been as well, before it was altered. In addition, as shown in the stoplists in chapter 4, the upper half of the compass in Callalli has a lower foot number than the lower half, because there is an octave leap at the transition point of the *medio registro*. This makes the upper octaves on the keyboard more prominent, and it also deprives the lower part of the keyboard of its bass function. The bass frequencies are generally neglected in Colca organs: the only "real" bass notes are drone pipes, which, judging from their manufacture, were probably rather soft in tone. The higher frequencies, though, were greatly emphasized, which was occasionally caused by a gradual relative increase in inner diameter values in those octaves. Besides the bright and sometimes even shrill timbres detected through FFT analysis (see chapter 4), we also have to consider the 1-foot stop in the organ in Sibayo – a stop not known in Spanish organs from the same period. The Mixture stops in Sibayo and Callalli are quite high as well (starting on 1/2-foot), and furthermore, they are often executed in unison, which makes their sound even more pervasive.

In addition to the above, other unique timbral qualities of the Colca organs are huskiness for significant portions of the pipework, interference, and non-homogeneous sound throughout individual ranks. In chapter 4 I mentioned double-ranked stops that combined a Flute-like rank with a more Diapason-like rank. Even though the diameter values of the Flute pipes are modeled after *Prestant* pipes, their actual sound, achieved by voicing techniques and adjustment of various scaling properties, is different. When playing both ranks together, the resulting timbre must have sounded more heterogeneously than we are used to hear in European Baroque organs, where *Prestant* sound was usually not mixed with Flutes. In addition, a number of pipes, especially in the organ in Sibayo, have interference beats in their own sound, probably caused by mouth tones. Those pipes almost sound like two different pipes played at the same time. Frequency beating in this fashion usually does not happen in European organs.

Interpreting the results of the findings above is a delicate task. It is difficult to talk about the sound of an organ that has not been maintained for at least decades, and probably for much longer. In this regard, it is imperative to distinguish timbral qualities that might have been original to the instrument from those that were probably not. Roughness or raspiness in timbre or an overly "airy" sound occurs a lot in my three case studies, and it may or may not have been original. During my examination of the instruments, I encountered much dirt and debris – ranging from dust to dead birds – in the pipes, and additionally, chapter 4 describes the many, sometimes severe damages to the pipe material. Consequently, we cannot draw solid conclusions about this possible intended roughness in timbre when the organ was originally built.

The static diameter scalings throughout entire ranks, on the other hand, can only be original. European organs last saw this kind of scaling in the early Middle Ages, before progressive diameter scalings were developed. Some of the ranks in Sibayo and Callalli have progressive diameter scalings, which supports the assumption that scaling tables were in circulation. Static scalings therefore could be a sign that pipe makers did not always adhere to tables and sometimes made pipes "by feel." This practice would be consistent with indigenous *quena* flute making in the Colca Valley. During my ethnographic fieldwork in Chivay, I asked a young Carnival musician where he got his flute. He replied that a *quena* player always makes his own flute, and subsequently supplied me with a complete step-by-step guide: look for a piece of pipe (usually PVC water pipe); cut it as long as you think you might need it; drill holes in it where it is comfortable for your fingers; make a notch where it is comfortable for your mouth.[35]

Other characteristics of *quenas,* and of Colca music in general, might also be relevant to Colca organs. First, the double-rank heterophony and interference through mouth tones discussed in chapter 4 bears a striking resemblance to the heterophonic texture of *quena* ensembles. Second, the shrill sound of many pipes in Colca organs is similar to the high-pitched flutes and singing I heard during Carnival. This trait is not specific to the Colca Valley; high-pitched nasal singing[36] or preference for high-pitched sounds in general[37] are habits frequently mentioned in ethnomusicological literature about Peru. According to Stevenson, no indigenous instrument was lower than the "violist's C" (i.e., the "4-foot" C) upon Spanish arrival, and the Spanish found the Peruvian vocal and sonic ideal "very high and strident."[38] Lastly, both Colca organs and Colca music ensembles are

[35] This practice might be specific to the Colca Valley, and/or specific to *quena* flute making, since Stevenson notes the existence of different schools of instrument making and assumes that pre-contact, instruments were fashioned according to exact plans (Stevenson, *Music of Peru*, 31).
[36] Raúl Romero, "Peru," in *The Garland Handbook of Latin American Music,* ed. Dale A. Olsen and Daniel A. Sheehy (New York: Garland, 2000), 369.
[37] Dale A. Olsen, "The Distribution, Symbolism, and Use of Musical Instruments," in *The Garland Handbook of Latin American Music*, ed. Dale A. Olsen and Daniel A. Sheehy (New York: Garland, 2000), 34.
[38] Stevenson, *Music of Peru*, 31.

loud: *carnaval* music kept me, and everyone else in Chivay, awake every night for an entire two weeks, and listening to *wititi* music without earplugs is a potential health hazard. Loudness is a general characteristic of Andean music. Eyewitnesses in colonial times described indigenous Andean instruments as "very loud and a bit disagreeable."[39] Before contact, Andean tribes already had trumpets made of clay, metal, skulls, gourds, and concha.[40] Romero states that brass ensembles, using European-style brass instruments, replaced traditional ensembles in the Andes rather quickly after contact.[41] He assumes the greater versatility and flexibility of brass as the reason;[42] I contend that the high volume that brass instruments are able to produce was a significant factor in this development as well. Seeger's explanation that Amerindian music groups have more recently adopted electric instruments to make their music louder and stronger[43] possibly supports my claim.

In sum, there is a significant degree of *unkhu* in these instruments: elements that are not visible, yet are essential. The organs in Sibayo, Callalli, and Tisco have Andean essence in them. While some typical aspects of Andean material treatment are missing, for example being "true" to the material (e.g., to the original shape of a log),[44] we still see an *overall* sense of being true to Andean material culture: textile and fiber art were, and still are, very important in the Andes. Andean culture, unlike other cultures, knew fiber art

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[39] Piotr Nawrot, "Lo autóctono y lo traído, fiesta en las misiones jesuíticas de guaraníes, moxos y chiquitos," in *La fiesta en la época colonial iberoamericana*, ed. Aurelio Tello (Santa Cruz de la Sierra, Bolivia: Asociación Pro Arte y Cultura, 2008), 242.
[40] Stevenson, *Music of Peru*, 13, 26.
[41] Romero, "Peru," 369.
[42] Ibid.
[43] Anthony Seeger, "Musical Dynamics," in *The Garland Handbook of Latin American Music*, ed. Dale A. Olsen and Daniel A. Sheehy (New York: Garland, 2000), 73.
[44] Gauvin Alexander Bailey, *Art on the Jesuit missions in Asia and Latin America, 1542-1773* (Toronto: University of Toronto Press, 1999), 166.

before ceramic art,[45] and to this day, Peruvian textiles, such as those made of *pima* cotton or alpaca wool, are world famous. In addition, sound analysis indicates a penchant towards Andean sonic ideals, which is all the more relevant considering the importance of music in Colca life charted in chapter 3. Local traditions and festivities reflect the function of music in spirituality and interhuman relationships in the Valley. Applying an Andean *Klangideal* and Andean way of flute making to instruments introduced by Europeans for serving European spirituality is therefore significant, and could be indicative of how Colca people were negotiating their post-contact (spiritual) identity.

In particular, the treatment of sound intensity deserves attention: organs as objects of the Roman Catholic Church were part of an institution whose goal was to project the authority of the Spanish towards indigenous people. Pipe organs project their power through their sound and especially their sound intensity. The pipes in the organs of Callalli and Sibayo are all either Diapason or Trumpet pipes; these are organ stops that can be voiced to sound very loud. The sound samples that I collected during my fieldwork point to a high sound intensity, especially compared to the small size of the instruments, and considering the small size and good acoustics of the Colca churches. However, Colqueño music culture is loud by itself. The loudness of pipe organs might therefore have been a welcome feature for indigenous organ makers, one that they might even have purposefully amplified.

The previous section (as well as chapter 3) discussed modern scholarship's acknowledgement of cultural flow in two (or more) directions – from weaker to dominant parties just as much as the other way around. However, this kind of thinking might still be

[45] Stone, *Art of the Andes*, 21.

too linear. Objects introduced into another culture can function as a reinforcement of the values of the target culture. Thoughts and ideas can operate similarly in various cultures, and processes of cultural blending can be more complex than simply a transfer of one or more clearly defined components from culture A to culture B. Some non-tangible examples in Peru include the parallels between Andean and Christian ideas of an afterlife, a paradise or Garden of Eden,[46] and a belief in a primordial couple. Christian missionaries who thought they were *introducing* those thoughts into Andean native culture were actually instead *reinforcing* the Andean indigenous belief system. Similarly, in the Colca, the sound volume of the newly introduced pipe organs in the seventeenth century might actually have contributed to promoting and strengthening indigenous culture, rather than weakening it in order to facilitate the acceptance of Christian beliefs.

Contextualizing all this necessitates a profound understanding of the missionization tactics of the Franciscans in the sixteenth to eighteenth centuries in Peru. Not only did the missionaries learn Quechua to have more control over the dissemination of the Bible and other Christian ideas,[47] but they specifically used music as a vehicle for Christianization. Using music as a teaching tool was common practice in the Peruvian colony,[48] and learning to sing or play a musical instrument was part of the Franciscans' mandatory education for natives.[49] In addition, music was used during Christian worship, especially through singing. While such strategies as these were commonly used to advance colonization, the example of Colca pipe organs shows that they potentially left room for the preservation of

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[46] Bailey, *Hybrid Baroque*, 337.
[47] Consuelo Milagros Vasquez Soto and Christian Omar Estrella Canaza, "Fragmentos de la historia del Distrito de Callalli" (thesis, Universidad Nacional San Agustín de Arequipa, 2010), 50.
[48] Virgilio Galdo Gutierrez, *Educación de los Curacas: una forma de dominación colonial* (Huamanga: Ediciones Waman Puma, 1982), 53.
[49] Vasquez and Estrella, "Fragmentos," 43.

indigenous culture. When friars introduced music and musical instruments as a European-Christian element into Andean culture, natives made this music culture – or at least parts of it – their own. A similar approach occurred in visual art and architecture. Early ecclesiastics in the Americas were charged with the task of countering indigenous polytheism and animal deities. As a result, the Holy Trinity was often represented as humans with sun, lamb, and dove imagery on their robes, even though it violated official church guidelines.[50] The eagerness of Christian missionaries to get Andean natives to accept Christianity at all costs was at the same time what enabled indigenous spirituality to survive. It ultimately resulted in entire traditions of culturally mixed art and architecture, such as the Cuzco School of Painting or Bailey's Andean Hybrid Baroque.

6.2.3 Visible, non-decorative aspects

In the present chapter I have thus far discussed visible and non-visible aspects of Colca pipe organs. The need for a third category arises, however, because the organs of my case studies contain non-decorative functional and material elements that are nevertheless executed and placed in a way that draws visual attention. The previous two sections have shown, firstly, that organs were part of an Andean culturally mixed Baroque tradition; secondly, that indigenous workers probably worked on them, since they also built churches and produced the artwork for those churches; and lastly, that there might have been applications of Native knowledge, and a (latent) struggle to retain their own native culture while positioning themselves within the new culture. The aim of the current section is to find examples that are more visible, more pronounced than the *unkhu* elements addressed

[50] Donahue-Wallace, *Viceregal Latin America*, 153.

in the previous section.

Earlier, I also talked about material use particular to Colca pipe organs. I did not consider the use of alpaca and llama leather much, since every organ-building tradition commonly uses the types of leather and other material resources that are locally and regionally available. Therefore, the use of Andean camelid leather in Andean organs instead of cow or goat skin seems a logical choice. However, it is worth noting that other parts of the organs contain alpaca and/or llama leather where European organs would use another material – not leather – in the first place. Particularly noticeable is the use of ropes of alpaca and llama materials for tying together parts of the bellow frame and lever system, and for attaching the levers to the upper part of the bellows. Those ropes consist of wool, hair, and braided or strung strips of leather, on which long fur (up to several centimeters) is visible.[51]

From an investigation of the remaining parts of the instruments, we can see that the people working on these organs must have been skilled artisans. They were skilled enough to make trackers, keys, and pallets, all of which, if not done entirely correctly, would lead to stuck tracker action or even leakage and "howling" pipes, making the instrument unusable. It can therefore be assumed that the makers of these organs would not have had any difficulties finding other means to connect parts of a bellow system, for example through hinges or bolts from wood or metal. In the previous section of this chapter I also established that there was no shortage of (imported) materials. If there had been a shortage of wood during the construction of the organs, the organs would not have wooden cases

[51] See figs. 20 and 21 in appendix B.

but instead feature freestanding pipework, as in many medieval or Renaissance positive organs. Even if we assume that there was no other material available at the time besides these braided leather cables, there was no need to leave fur on it. Chapter 4 provided an in-depth description of the four instruments, including their leather-made bellows and the leather used in the windchest, on wind ducts, and on the pallet grid. All of those pieces of leather are smooth and do not show even scintillas of hair. We can therefore assume that advanced leather tanning techniques were known and commonly in use at the time the organs were built. Finally, even untanned leather does not need to have three, four, or more centimeters of hair on it, as common knives and scissors can easily cut llama or alpaca hair. Instead, the organs are "showcasing" the fur in a way that jumps out at anybody the moment they enter the organ loft.

Pre-contact Andean people were used to assigning sanctity not only to location, but also to material.[52] In addition, they also assigned holiness to animals, plants, natural events, and objects. My own experiences during the *tinkachi* celebration in Chivay, in which parts of alpacas and llamas were symbolically sacrificed – in the form of little figurines made of llama fat – to the background of continuous flute playing in the rain, align with Henry Stobart's description of the importance of camelid-type animals for Bolivian Andean spirituality. In the Bolivian Andes, llamas are associated with the rainy season, with fertility and growth; they are also associated with flute playing, especially during their mating cycle. To come full circle, flute playing itself is associated with rain and with fertility – both fertile soils and human and animal fertility – as well.[53] A celestial

[52] Donahue-Wallace, *Viceregal Latin America*, 92.
[53] Henry Stobart, *Music and the Poetics of Production in the Bolivian Andes* (Burlington, VT: Ashgate Publishing Co., 2006), 199-232.

constellation of the llama is known among Colca people, and it, too, is associated with rain.[54] Lastly, the alpaca is the only animal still under patronage of *Pachamama* and the *Apus* to this day, while all other animals were assigned a Christian patron saint after conquest.[55] I therefore dare to posit that introducing alpaca and llama components into these organs was not purely coincidental. Quite to the contrary, doing so for the organs' bellow systems – the component that moves air through the instrument – might even establish a connection to *Kon*, the Inca god of rain and wind. It seems fitting that a ritual, spiritual animal – one that is noble enough to have *Pachamama* herself as a patron saint, to be associated with the fertile season, and to have its own star constellation (stars are, after all, deities as well in Andean spirituality) – is represented in an instrument of wind (bellows) and rain (pipes).

What do we make of the fact that an object representing indigenous spirituality was purposefully introduced into an object of Christian worship, and not just any object, but a musical instrument, thus an object that was an active vehicle in the complex apparatus of colonization? One possible interpretation would be mutual curiosity, a theory Bailey offers when he writes about Guaraní reductions in Paraguay. Bailey makes a case for the existence of a genuine interest between the involved parties. However, Colca history is not entirely comparable to that of the Guaraní. In Paraguay, the Jesuit missionaries helped the Guaraní evade slavery by fighting on their side in the Guaraní Wars. The choice, of course, was not a fair one: the alternative to being Christianized was being slaughtered off or captured by slave traders. However, the Jesuits at least left the choice to the Guaraní, who considered

[54] Walter B. Ramos Yucra, *Monografía y fuentes documentales sobre la historia del distrito de Callalli* (Arequipa, Peru: Publicont S.A.C., 2018), 28.
[55] Vasquez and Estrella, "Fragmentos," 50.

the missionaries the lesser evil and decided to partner up.[56] In the Colca, on the other hand, the Franciscan missionaries were the first Europeans to even come to the Valley.[57] Unlike the Jesuits in Chiquitos, who spoke the indigenous idiom exclusively (except for Latin Mass) until the twentieth century,[58] the Franciscans in the Colca even changed the names of places to include the names of Christian saints, thus robbing people of their own heritage. In addition, reduction villages in the Colca were founded in 1579 to provide enough labor for the mines through the quasi-slavery *encomienda* system.[59] The Franciscans were put in charge of these *reducciones* to manage supposed "problems with control."[60] There is primary evidence of at least three different indigenous upheavals in the Colca reductions.[61] Franciscans met natives with condescension, referring to them as "barbarians"[62] who "did not respect the doctrine,"[63] as "*infieles*" who believed in superstitions, demons, and the devil.[64] Significantly, the *History of the Franciscans in Peru*, a document in the Fransciscan Archive in Lima written in a nineteenth-century hand, talks about political power[65] and metal resources[66] just as much as about spreading Christianity. The friars were thus decently aware of their paramilitary function and of their contribution to the economic exploitation of the country. It would be unrealistic to assume that Franciscan monks were

[56] Bernardo Illari, "Myths and Realities of the Jesuit Reductions," liner notes for *Zipoli, San Ignacio Vespers* (K616, 1992, compact disc), 129.
[57] Diego Córdoba Salinas, *Crónica Franciscana de las provincias del Perú*, ed. Lino Gómez Canedo (Washington, DC: Academy of American Franciscan History, 1957), 152.
[58] Nawrot, "Lo autóctono," 235.
[59] Vasquez and Estrella, "Fragmentos," 29.
[60] Yucra, *Monografía*, 30. Donahue-Wallace describes something similar: the missions helped control the new territory, especially early on during colonial times – which is why most examples of early art and architecture come from missionary environments (Donahue-Wallace, *Viceregal Latin America*, 2).
[61] Yucra, *Monografía*, 33 and 93ff.
[62] "Diversos asuntos tocantes a la provincial," I-R-5, fol. 93v, Archivo San Francisco de Lima, Lima.
[63] Ibid., fols. 97r-v and 98r.
[64] Salinas, *Crónica Franciscana*, 152.
[65] "Crónica de la Provincia," MSF-111, fol. 15v, Archivo San Francisco de Lima, Lima.
[66] Ibid., fol. 8r.

present in the Colca Valley exclusively to do good and save the poor heathens' souls. Peru in this regard seems generally to have been different from the – much better known and researched – Jesuit missions in Moxos or Chiquitos. Guaman Poma's *Corónica* is full of examples of cruel Padres,[67] strict Christian music teachers, and terrifying church inspectors.[68]

The theory of mutual religious curiosity might thus be insufficient to explain the inclusion of llama and alpaca components in Colca pipe organs. Bailey considers depictions of Andean fauna the most important elements in churches of the Andean Hybrid Baroque, because of their mythological meaning for Andean natives. However, in the case of pipe organs, I would speculate that there was more than a purely artistic-spiritual intent. First, we must recognize that there was a relationship between animals and musical instruments in the Andes. Pre-contact instruments often included depictions of animals[69] or were made of animal parts, such as deer or dog skulls.[70] The act of working an animal into a musical instrument can therefore again be interpreted as an act of retaining Andean culture. Second, we have to acknowledge that alluding to the animal from which an instrument was made was very important in pre-contact Andean culture.[71]

Following this lead, we have to take a closer look at the animal that is alluded to in the Colca organs: the alpaca. Camelids – especially alpacas – are people's livelihood at altitudes of over 10,000 feet, where crops or vegetables hardly grow. This livelihood became severely threatened from the sixteenth century onwards, when imported animals

[67] Felipe Guamán Poma de Ayala, *El primer nueva corónica y buen gobierno*, Ms. Gammel Kongelig Samling (GKS) 2232, 4, Royal Library, Copenhagen, Denmark, 580, accessed March 30, 2019, http://www.kb.dk/permalink/2006/poma/info/en/frontpage.htm.
[68] Ibid., 689.
[69] See, for example, the depiction of a feline on the *Pucará* tubulars (Stevenson, *Music of Peru*, 14).
[70] Ibid., 16.
[71] Olsen, "Distribution," 35.

gradually destroyed the Colca ecosystem.[72] The post-conquest impact on indigenous people in Colca villages was thus more than solely political and cultural; it was environmental and consequently economic. Considering the alpaca's role in spirituality; the dependence on ritual action in traditional life in the Colca; and the fact that the traditional flora and fauna acted not only in key roles for those ritual actions but also as signifiers to structure daily, seasonal, and yearly life, the introduction of foreign fauna must have started to cause a complete breakdown of traditional systems. Introducing into a Christian object parts of an animal that signify indigenous spirituality, way of life, and livelihood all at once was therefore probably more than a pure hope to preserve native culture. Indeed, it seems like a latent statement – not an open revolt, but an action of silent protest similar to the writings of Guaman Poma: an affirmation of Andean ancestry by telling history the Andean way. In Poma's case, that history was told through images, and through structuring these images to conform to Andean principles of spatial perception.[73] In the case of Colca organs, it was told through an animal that gave food, clothing, rain, and fertility, and that was iconic for the pre-contact Colca way of life.

6.2.4 Revisiting repertoire questions

In chapter 5 I have discussed the music that could be played on the type of organ found in the Colca Valley. The emphasis here is on the word *type*: we do not have any evidence of a particular repertoire or playing technique that specifically relates to the instruments of my case studies, but we know that they are descendants of a European

[72] Yucra, *Monografía*, 20.
[73] Rolena Adorno, *Guaman Poma: Writing and Resistance in Colonial Peru* (Austin: University of Texas Press, 2000), 91.

prototype, one that, as we saw, had a lot in common with Castilian Baroque organs.

I have here established that these organs were part of a composite material culture that included Andean indigenous elements. Accordingly, the question arises of whether there could have been Andean elements in the music as well. I will therefore revisit some of my findings from the previous chapter and integrate them with the findings of the current chapter and chapter 3, in order to draw inferences about possible indigenous influences in Andean Baroque organ playing.

Geoffrey Baker has pointed out a possible shift in power dynamics in eighteenth-century Peru. According to Baker, rural areas in that period became more active and dynamic in terms of liturgical music, whereas cities during the same time period became less productive.[74] Oricaín's eighteenth-century quote[75] about indigenous influences in rural church music could be an indication of the existence of possible "forbidden" music practices and religious activity in the countryside at that time.[76] Baker subsequently stresses the importance of looking for evidence of creolized music practices in rural Peruvian areas.[77]

Rural archives, however, no longer exist. They have been destroyed, often burned down together with their respective churches.[78] In addition, mission music that was based

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[74] Geoffrey Baker, *Imposing Harmony: Music and Society in Colonial Cuzco* (Durham, NC: Duke University Press, 2008), 199-200.
[75] See chapter 2, footnote 78 for full quote.
[76] Geoffrey Baker, "La vida musical de las doctrinas de indios del obispado del Cuzco," *Revista Andina* 37, (2003): 199.
[77] Baker, *Imposing Harmony*, 236-237.
[78] Bernardo Illari, "The Popular, the Sacred, the Colonial and the Local: The Performance of Identities in the Villancicos from Sucre (Bolivia)," in *Devotional Music in the Iberian World, 1450-1800: The Villancico and Related Genres*, ed. Tess Knighton (Aldershot: Ashgate, 2007), 428.

on indigenous practices was mostly not written down.[79] In my previous chapter I have furthermore established that music played on organs in the Colca Valley was most likely improvised. The chance of ever finding organ sheet music in former Andean missionary villages is thus very small. However, the fact that organ music was improvised means that the early colonial organist must have had a certain degree of artistic freedom. It is very plausible that Colca organists were indigenous, since most musicians in rural areas were. Indigenous chapel masters and music teachers were very successful in the countryside, because they were supported through the indigenous system of communal sharing.[80] There is, furthermore, explicit evidence in secondary literature that indigenous people were instructed in organ playing.[81] Organs and harps existed not only in most parish churches, but even in remote haciendas or small chapels;[82] consequently, there must have been a significant need for organists – including indigenous people and mestizos.

In light of the fact that an improvised practice does not leave any paper trail, I again resort to variations on Olsen's ethnographic analogy, and will contemplate possible past music practices in the Colca through various comparisons: first, comparisons between the sound properties of the organs and present-day music practices that I experienced in the Colca Valley; second, reference with historical research done by music scholars in other Latin American missionary environments; third, reference with surviving sheet music of the same era from other places in Peru. I have to acknowledge some caveats here. In chapter 3, I argued for considering cultures regionally and locally. We have primary evidence from Guaman Poma and Bernabé Cobo attesting to the fact that music culture was already very

[79] Nawrot, "Lo autóctono," 257.
[80] Baker, "Vida musical," 195.
[81] Ibid., 194.
[82] Baker, *Imposing Harmony*, 200.

different throughout the *Tawantinsuyu* in pre- and early-colonial times.[83] In addition, different religious orders had different missionary approaches, resulting in different degrees of cultural freedom for the native population. We therefore cannot assume a general interchangeability of music traditions between missions. Rather, we should use known examples of such music to reflect on overall principles that might apply to mission music in general. With regards to sheet music written by known composers, we have to take seriously Bernardo Illari's cautioning against forcefully assigning indigenous traits to it, as that would mean perpetrating the "colonial difference." Following Illari's warning and regarding such composers as Juan de Araujo or Torrejón y Velasco mainly as good *Spanish* composers,[84] I will use colonial compositions to corroborate findings in this section or to provide concrete examples, but I will refrain from analyzing their style as an end in itself.

Kofi Agawu considers tonality, especially the introduction of the diatonic scale, to be one of the most impactful musical assertions of colonial power in Africa.[85] For Latin American music, the pentatonic scale is often assumed in scholarship for pre-contact tonality; however, I would like to warn about generalization here. Dale Olsen has debunked the South American "Pentatonic Myth" through his work on notch flutes and music vessels.[86] The tonal system of pre-contact Andean societies was, according to Olsen, much

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[83] Paúl Romero, "Music Research," in *A Latin American Music Reader: Views from the South*, ed. Javier F. León and Helena Simonett (Urbana: University of Illinois Press / Society for Ethnomusicology, 2016), 76.
[84] Illari, "Performance of Identities," 416.
[85] Kofi Agawu, "Tonality as Colonial Force in Africa," in *Audible Empire: Music, Global Politics, Critique*, ed. Ronald Radano and Tejumola Olaniyan (Durham, NC: Duke University Press, 2016).
[86] Dale A. Olsen, "Notch Flutes of Life and Transcendence," in *Music of El Dorado: The Ethnomusicology of Ancient South American Cultures* (Gainesville: University Press of Florida, 2002), 35-60. An analogous case presents itself in the so-called "Andean anacrusis," to which scholarly writing often refers, but which, according to Stobart and Cross, does not exist. Stobart and Cross explain that the entire concept is rooted in

more diverse and rich than the pentatonic system. In addition, arguing for or against pentatonics in the historic organ music of the Colca Valley would be an impossible endeavor, since the organs all have chromatic keyboards. There is no possible evidence indicating which keys were used and which were not. However, we do know general traits of Andean melodicity: short, repetitive, mostly stepwise motives, often descending with a slight decrescendo.[87] The music that I heard in Chivay during Carnival celebrations and *wititiadas* fits most if not all of those characteristics, and its melodies would theoretically be playable on pipe organs. Both the *carnaval* and the *wititi* melodies were diatonic, if the sliding notes between pitches are disregarded. A performance of those melodies on pipe organs would impoverish the musical language through the fact that only distinct, non-sliding pitches can be played on keyboard instruments; however, in such a simplified form, the melodies would be suitable for pipe organs.

While such a historic use of indigenous melodies on Colca organs is pure speculation, we do have evidence that indigenous melodies were occasionally used in other European-rooted colonial art music. According to Raúl Romero, the *Hanacpachap Cussicuinin*, which in its harmony and counterpoint is generally very European in style, is melodically based on an autochthonous theme.[88] The quick eighth notes, followed by a long, suspended note, could be an indication of that. Similarly, church hymns written in Quechua that are partly still in use in Cusco today show influences from eighteenth-century mestizo genres such as the *yaraví* and the *huayno*.[89] Torrejón y Velasco's *A este sol*

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a difference between Andean and Western understandings of the musical pulse. Henry Stobart and Ian Cross, "The Andean Anacrusis? Rhythmic Structure and Perception in Easter Songs of Northern Potosí, Bolivia," *British Journal of Ethnomusicology* 9, no. 2 (2000): 63-92.

[87] Dale A. Olsen, "Symbol and Function," in *Musics of Many Cultures: An Introduction*, ed. Elizabeth May (Berkeley: University of California Press, 1980), 364.

[88] Romero, "Peru," 355.

[89] See chapter 2, footnote 69, for full citation.

peregrino might not only have resonated with Andean spirituality in its title, but it also features a very repetitive melody line, akin to the repetitive music played in the Colca to this day. Roque Ceruti's *Hoy que Francisco reluce* has syncopated rhythms on the second beat of the measure, which resemble an augmentation of the lombardic rhythm often found in Andean music.

Missionaries might have used native melodies with evangelizing texts in native languages,[90] because indigenous people at first did not know how to read western sheet music.[91] The idea that indigenous dances and songs were used in church music, and even played on organs, is therefore not so farfetched. In fact, during one of my private "organ tours" around Cusco, a local Cusqueño church organist who accompanied me played traditional Andean melodies on every organ we visited. Often, he simply played the melody with both hands in unison, and sometimes he added more voices in the middle; but even in the latter case, the entire texture still mostly stayed parallel.[92] When I asked him about the melodies, his explanation was that this is what people here expect to hear.

An additional reference point for possible melodic indigenous influences on European music comes from one of the very few surviving rural Andean compositions: the anonymous villancico *Una pobra serranita.* A contemporary comment on it talks about its "sad" quality, "characteristic of Indios" – in opposition to the "happy" Spanish music – and describes the piece as being in minor mode and binary meter, with periods consisting

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[90] Víctor Rondón and Vera Alejandro, "A propósito de nuevos sonidos para nuevos reinos: prescripciones y prácticas músico-rituales en el área surandina colonial," *Latin American Music Review* 29, no. 2 (2008): 213.
[91] Ibid., 198.
[92] An interesting comparison can be drawn here to organum-like playing in today's indigenous music of Peru (Olsen, "Symbol and Function," 366) and to minuets and other European genres being played in parallel thirds in the missions of Chiquitos and Moxos in colonial times (Nawrot, "Lo autóctono," 240).

of two times eight measures that both end on the tonic.[93] The penchant for minor modes, rather than bimodality, is something that I noticed in the *carnaval* music in Chivay, and all music I heard in the Colca during my field trips was in binary meter. It is therefore conceivable that using minor modes and binary meter in improvisations would have been preferred by the colonial Colca organist as well.

While we do not have a direct link between indigenous tonality and the technical specifications of the Colca organs, the situation is different for sound production and timbre, as we have evidence of the organs' timbral qualities through the sonic analysis outlined in chapter 4. Tomlinson assumes that song in the Inca period was fully divorced from the spoken language around it. Inca singing could, for example, consist of imitating the sounds of llamas or rivers.[94] Guaman Poma's depiction of the Inca "singing with his llama" comes to mind.[95] Henry Stobart describes a related practice for instrumental music in the Bolivian Andes: the imitation of mating cries of llamas on *pinkullu* flutes.[96] The rough, hoarse tone production of the *quena* ensembles that I experienced during the Chivay *carnaval* aligns very well with the sonic qualities described in both Stobart's and Tomlinson's writings. Olsen describes "joined opposites" for some Andean instrumental ensembles: the whistling tone of flute as a symbol of sexual invitation and the buzzing sound of reeds as a symbol of male aggressiveness.[97] We should recognize the fact that in an organ, both reed and flue pipes are usually present, and that this might have contributed

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[93] Illari, "Performance of Identities," 433.
[94] Gary Tomlinson, *Singing of the New World: Indigenous Voice in the Era of European Contact* (Cambridge and New York: Cambridge University Press, 2009), 162.
[95] Guaman Poma, *Corónica*, 320.
[96] Stobart, *Bolivian Andes*, 223.
[97] Olsen, "Distribution," 33.

to linking organs to an indigenous understanding of music.

A part of the pipework in the organs in Sibayo and Callalli sounds hoarse, raspy, and "airy." As noted in section 6.2.2, it is impossible to say at this point if this sound is unintentional and unoriginal, or if the pipes might have been voiced in this manner on purpose to fit the Andean *Klangideal* better. A possible indication of the former is the debris found in the pipes and the many damages to the pipe material; a possible sign of the latter presents itself in the Sibayo *tinieblas* of Good Friday, in which the organ is used for making sound effects – not for producing "clean" pitches. There is thus a possibility that Colca organs, or Andean organs more generally, were used in an unconventional way, and at times produced sound effects rather than melodies. In addition, the breathy timbre of parts of the pipework could have been employed to better blend in with indigenous instruments. Piotr Nawrot reports the use of indigenous instruments for sacred music in Jesuit missions.[98] It might therefore be possible that ensemble playing with organ in the Colca included *quenas*, *pinkullus*, and the like, and that indigenous organ builders were striving for an organ timbre that harmonized with the sonic properties of those instruments.

The above-mentioned notion of male strength and power associated with loud Andean reed pipes can possibly be related to the general penchant for loud volume in music that I experienced in the Colca Valley. After all, instrumental music is entirely the domain of male Colqueños. Based on my sonic analysis, it can be assumed that Colca organs sounded loudly and forcefully as well. The way the Principal pipes are voiced precludes such genres as elevation toccatas or *pastorales*. The strong voicing of the Trumpet makes

[98] Nawrot, "Lo autóctono," 242.

its use as a solo stop (i.e., for a single melodic line with accompaniment) implausible, and points instead to chordal playing. Colca organ music must have had a powerful signaling effect, or at least certainly not a soothing one. For ensemble music, the organs were probably paired with other loud instruments. We find corroboration for loud volume in colonial mission music and the regular use of loud instrumentation in surviving sheet music. *Llamado a la fiesta*, for example, a composition preserved in one of the Jesuit missions in Paraguay, is one case of mission music featuring loud percussion instruments. Listening to this piece conjures up images of the Chivay *carnaval*, rather than reminding the listener of Christian worship.

So far, we have discussed raspiness and volume as possibly relevant sonic qualities for past mixed music practices in the Colca, but we have not yet talked about pitch. The organs of my case studies were, in their time, all instruments on a 4-foot base. Such instruments also existed in Europe, and pieces demanding 4-foot registration were not uncommon either, as we saw in registration advice from the primary sources referenced in chapter 5. Improvised polyphonic music might therefore have sounded like the 4-foot *tientos* of Correa de Arauxo or the *ricercars* of Diruta. However, a 4-foot organ for accompanying singers is not that common, at least not when there is no 8-foot flute stop present. In addition, the fact that some *medio registro* ranks do not really have a bass octave might indicate that there was an emphasis on the higher parts in congregational and choral singing. This would also align with the typical colonial South American configuration for sacred vocal works: two sopranos, alto, tenor, and two violins.[99] The particular feature of the *medio registro* reveals an additional possible characteristic of music that could be

[99] Norberto Broggini, "Baroque Pathways," liner notes for *Missa de Lima* (K617, 1999, compact disc), 28.

played on these organs. The octave leap on C4 made the two middle octaves sound at exactly the same pitch, and the organist could have used this feature for antiphonal playing. Polychorality was highly in fashion in Europe at the time these organs were built – and later on in colonial Cusco – but more importantly, antiphonal playing relates to the call-and-response principle I heard during the Carnival in Chivay, especially in *wititi* music. Although true anitphonality has definite European roots, call-and-response in Andean music is also often said to have African roots. However, it can be an inherently Andean trait as well: Guaman Poma describes two different kinds of antiphonal dance songs.[100] The "fake double-chorality" of the Colca organs would have enabled the organist to play a melody in one hand, and then echo it in the other hand on the same pitch, in a slightly different timbre. A similar echoing practice existed for organs in Italy with divided sliders,[101] and it is therefore not so farfetched to think that this playing style might also have applied to the Colca organs.

Scholars in the past have speculated about possible hybrid music practices in colonial Andean music: Baker, through iconographic evidence, assumes that while the music of rural Andean parishes around Cusco might have sounded similar to the music in the city, its meaning was different, because of complex Andean ideologies that the indigenous elite tried to control and transmit.[102] Based on a still-existing oral tradition, Nawrot assumes that there were just as many indigenous elements as European elements

[100] Romero, "Peru," 354.
[101] See chapter 5, footnote 44.
[102] Geoffrey Baker, "La ciudad sonora: música, fiesta y urbanismo en el Cuzco colonial," in *La fiesta en la época colonial iberoamericana*, ed. Aurelio Tello (Santa Cruz de la Sierra, Bolivia: Asociación Pro Arte y Cultura, 2008), 58, 66.

in the music of the Moxos and Chiquitos missions, even though there is no written evidence.[103] According to Nawrot, fugues and other European genres were played on indigenous instruments in the missions, sometimes using indigenous melodies.[104] Lastly, Rondon and Vera quote a letter by Jorge de Oliva, who visited Andean missions in 1717, to the Bishop of Concepción in Chile, reporting that the *Pater Noster* and the *Ave Maria* were "mixed" with indigenous tradition.[105] It is therefore reasonable to assume that there were indigenous influences in the colonial church music of the Colca Valley as well. However, we have no hard evidence. Throughout this section, I have presented cautious speculations and thought experiments, based on comparable cases and on the technical properties and timbral qualities of the pipe organs – the only proof that we currently have for the mere existence of a colonial music culture. That does not mean that Baker is incorrect in demanding that more research be done in the countryside. On the contrary, the current section has proven what chapter 2 suggested: that historical music research has to include rural areas, and that expanding our scholarly territory to those areas can help broaden our scholarly viewpoint. This section has also demonstrated that speculating about the music itself is only of limited usefulness in the absence of sheet music. We as music scholars have to find other ways of thinking about past music cultures than purely looking at written sources.

[103] Nawrot, "Lo autóctono," 257.
[104] Ibid., 240.
[105] Rondón y Vera, "Nuevos sonidos," 214.

CHAPTER VII

CONCLUSION – EPILOGUE

The previous chapter has set out to investigate if there are elements of Andean native culture in the pipe organs of the Colca Valley and, if so, what their possible ramifications are. At this point, it is safe to say that indigenous influences are present in those instruments, which in turn indicates indigenous people as their makers. There might have been a relationship to the architectural school that Bailey calls Andean Hybrid Baroque, or at least a similar tradition of indigenous migrant workers. It is therefore very probable that other Andean organs might show the same indigenous influences if the tradition was spreading in a similar manner to the architectural Andean Hybrid Baroque style. Comparing the historical findings to today's Colca culture as discussed in chapter 3, we recognize a similar mixture of habits and customs, and a continued survival of local traditions through blending and appropriating new currents. This seems to be the main Colqueño strategy of coping with outside influences: welcome them, use them, make them, and call them "Collagua."

Section 6.2.4 has furthermore dealt with speculations about a possible hybrid music culture related to the instruments of my case studies, or maybe to Andean pipe organs in general. In writing that section, I have joined with the work of other scholars who call for more research on colonial music practices, especially rural, and who believe there to be a certain traceable degree of hybridity in this music. It is questionable, though, if we will ever arrive at a point beyond pure guessing. Baker, in his article about "Indian Doctrinas," appeals to scholars to do more research in local archives, especially about the time after decentralization started in the eighteenth century.[1] However, I think we should acknowledge the fact that in many rural places, especially small villages or former missions, there are no archives, and often no written documents or sheet music at all. Combining the findings narrated in chapter 6, that colonial pipe organs in the Colca Valley contain indicators of Andean culture to a significant extent, with the conclusion of chapter 2, that there are still many colonial organs in rural areas in Peru, we must conclude that instead of continuing our unsuccessful search for colonial sheet music and archival documents, we should focus our efforts and time on finding and researching colonial organs, in the absence of other evidence.

Understanding early colonial Andean culture is key to recognizing this necessity: as Tom Cummins has noted, colonial objects were the meeting ground between Andean people and their colonizers.[2] These artifacts are what we as Latin American colonial scholars have to look out for, since traditional Andean cultures did not know or were not used to writing (in a European sense); their emphasis for the dissemination of information was on visual arts and material culture. Similar to the circulation of colonial objects that Cummins considers important,[3] pipe organs, while not being circulated themselves, were still part of a "circulatory" culture. Knowledge about building them was obviously disseminated, and most probably, the people who oversaw their construction were traveling, too. Pipe organs as colonial objects therefore are valid primary evidence, and to follow Baker's – and other scholars' – call for finding hybridity in rural colonial music

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[1] Geoffrey Baker, "La vida musical de las doctrinas de indios del obispado del Cuzco," *Revista Andina* 37 (2003): 199.
[2] Tom Cummins, "Let Me See! Reading Is for Them: Colonial Andean Images and Objects 'como es costumbre tener los caciques Señores,'" in *Native Traditions in the Postconquest*, ed. Elizabeth Hill Boone and Tom Cummins (Washington, DC: Dumbarton Oaks, 1998): 140.
[3] Ibid., 95.

cultures, we have to treat them as such. Freely taking up Christopher Small's "language of gesture," which performs "functions that spoken words cannot," I contend that these instruments might even tell us more about latent power dynamics than would ever be explicitly stated in written accounts.

Most of all, however, colonial pipe organs have the advantage that we know that they exist; we do not have to look for them anymore, wondering if we will ever find them or not. In section 6.2.4 I have not presented anything more than pure speculation: thoughts about music that possibly *could* have sounded in a particular way, thoughts about sheet music that we *might* find some day – but without any indication of where and when that might be. The organs studied in this dissertation, on the other hand, are at our disposal, and they do show signs of indigenous influences without a doubt. Other scholars have already made similar observations: Piotr Nawrot, for example, when writing about the Chiquitos missions, states that we cannot know to what degree indigenous people were included in writing the music or text for opera productions in the missions.[4] However, he points out that we do know from iconographic evidence that the indigenous *material* culture (flowers, fruits, birds) was present during opera performances.[5] Stevenson asserted in 1960 that the best way to research pre-contact music in Peru is to look at preserved instruments.[6] Over sixty years later, we still have not arrived at acknowledging the fact that this could also hold true for post-contact music.

[4] Piotr Nawrot, "Opera Production in the Jesuit Reductions," liner notes for *Mission San Francisco Xavier: Ópera y Misa de los Indios* (K617, 2000, compact disc), 48.
[5] Ibid., 46.
[6] Robert Stevenson, *The Music of Peru: Aboriginal and Viceroyal Epochs* (Washington, D.C.: Pan American Union, 1960), 30.

I previously referenced Baker's claim that Peruvian church music in the eighteenth century was flourishing in rural areas, where church authorities had less control over it, and that this fact might have weakened the power of the church and given more agency to indigenous people. I contend that if we want to follow Baker's call and unravel colonial music culture in rural Peruvian areas, we cannot avoid talking about the politics of hybridity. Homi K. Bhabha theorized that colonized cultures introduce elements of their own culture into that of the colonizer, which leads to an unsettling situation for the colonizer.[7] In the case of the Colca Valley, Bhabha's "strategic reversal of the process of domination"[8] could have included pipe organs, which contained sonic, decorative, material, and functional Andean properties, of which the Andean flower motif on the shutter in Sibayo and the alpaca/llama fur on the bellow systems are the most immediately noticeable. Both plants and animals are related to the agricultural cycle, and as such not only symbols of spirituality, fertility, (ritual) music, and rain, but markers of the traditional year cycle – a cycle that the new Christian system tried to replace with a *sanctorale* and a *temporale*, neither of which made much sense in the traditional Andean worldview. Marisol de la Cadena coined the term "Andean cosmopolitics" for an Andean philosophy of life, a way of living and thinking that is one with the cosmos, and in which spirituality, daily life, politics, and nature are all one category. De la Cadena reports how, even in our times, indigenous people in Bolivia demonstrate against plans to build a mine, as in their worldview it would alienate humans and the mountain. Similarly, historical Andean societies had no separate categories for politics, religion, and even art.[9] A flower and a

[7] Homi K. Bhabha, *The Location of Culture* (London; New York: Routledge, 1994), 159-160.
[8] Ibid.
[9] Rebecca Stone-Miller, *Art of the Andes: From Chavín to Inca* (London: Thames & Hudson, 2002), 201.

camelid fur that are markers for indigenous Andean worldview and spirituality are therefore at the same time signs of indigenous politics.

In addition, the voicing and timbre of these pipe organs might have allowed indigenous people to retain their own musical language. Kofi Agawu equates imposing a new musical language on a native musical language to forcing a culture to give up its own mother tongue, and therefore to losing part of its own heritage. Agawu points at the cultural and psychological harm done to groups and individuals in this process. He specifically addresses the impoverishment of the African musical language through the limitations that European music imposed on it, and through the deprivation of traditional, diverse ways of African tone production.[10] In the Colca, there might have been a space to retain parts of the traditional ways of tone production through organ pipes of rough, husky, or throaty timbre. Bhabha writes: "if discriminatory effects enable the authorities to keep an eye on [colonial hybrid objects], their proliferating difference evades that eye, escapes that surveillance."[11] In Colca organs, Andean adaptations might have been subtle enough to indeed escape surveillance, but nevertheless noticeable enough to create unsettlement, to do what Bhabha calls "making (…) objects at once disciplinary and disseminatory."[12] Adding on to this insight the fact that organs projected power through their loudness, and that loud volume, alongside other timbral characteristics, represented Colca native culture, we can come full circle. The speculation at the end of section 6.2.3 that pipe organs containing alpaca parts might be a "statement" can now be amended to say that those instruments might indeed have had a political component. We might be looking at

[10] Kofi Agawu, "Tonality as Colonial Force in Africa," in *Audible Empire: Music, Global Politics, Critique*, ed. Ronald Radano and Tejumola Olaniyan (Durham, NC: Duke University Press, 2016), 351.
[11] Bhabha, *Location of Culture,* 160.
[12] Ibid.

testimonials of possible indigenous passive resistance, or even of political activism.

Naturally, this is not to suggest that colonial Colqueños were planning a rebellion through organ building. Rather, I would like to paraphrase Joshua Tucker here, who, in turn, borrows from Sommer when writing about present-day hybridity in Peruvian popular music: exploring cracks in the existing regimes of representation can provide spaces for intervention.[13] Bhabha explains these cracks as a form of "subversion, founded on the undecidability that turns the discursive conditions of dominance into the grounds of intervention."[14]

I am aware of the issue that some recent scholarship has sometimes taken with the term and concept of hybridity: the fact that it might still function from a perspective of modernity (in Mignolo's sense), and therefore might still be indicative of colonial patterns of thinking. I fully support Ritter's claim that musical hybridity can be co-opted by the politically dominant group. A similar thought has been offered by Dean and Leibsohn for hybridity in visual art: that, while hybridity can be understood as a strategy for coping with dominant and dominating cultures, it can conversely also be a strategy utilized by the dominant cultures.[15] In the Colca Valley, we have evidence for both: the Franciscans' creation of hybrid spaces to facilitate colonization on the one hand, and on the other hand, the indigenous peoples' coping mechanisms by making these hybrid spaces their own and using them for appropriating colonial objects. I contend that, at least in the case of the

[13] Joshua Tucker, "Permitted Indians and Popular Music in Contemporary Peru: The Poetics and Politics of Indigenous Performativity," *Ethnomusicology* 55, no. 3 (2011): 407.
[14] Bhabha, *Location of Culture,* 160.
[15] Carolyn Dean and Dana Leibsohn, "Hybridity and Its Discontents: Considering Visual Culture in Colonial Spanish America," *Colonial Latin American Review* 12, no. 1 (2003): 24.

Colca Valley, thinking about hybridity is not necessarily incompatible with more recent scholarly approaches, like Anzaldúa's and Mignolo's "border thinking." The fact that indigenous people had their own spirituality in mind when they constructed and decorated pipe organs means that they were operating in an epistemic space that at least partly fell outside the European space.

Again, my intention is not to claim Colca pipe organs as testimonials for a glorious revolution in the seventeenth-century Colca Valley. Reducing the complex dynamics of (post-)colonial spaces into a simple, linear dipole that positions indigenous people on one side and colonizing power on the other would be as much a child of colonial thinking as Western modernity itself. Rather, I am using the concept of hybridity to advocate for simply acknowledging the indigenous agency that was at play in the colonial Colca Valley, and probably in other rural Andean areas as well. This is the important step that music historians have yet to take. We still all too often, and without questioning, deem the weaker party as the passive group after contact. Stevenson comes to mind, who wrote in 1960 that the "Indians immediately took to the music of their conquerors."[16] But even newer scholarship, scholarship that explicitly addresses power relationships and issues of colonialism, often casts the indigenous people as the receiving and compliant ones. Baker reports indigenous people eagerly taking over European music and aspiring to work as chapel masters and music teachers in order to ascend in status.[17] Estenssoro describes a similar strategy of non-white individuals rising to status through participating in high-class dance culture, or even working as dance teachers.[18] While it is true that individuals were

[16] Stevenson, *Music of Peru*, 43.
[17] Baker, "Vida Musical," 186.
[18] Juan Carlos Estenssoro Fuchs, *Música y sociedad coloniales: Lima 1680-1830* (Lima: Colmillo Blanco, 1989), 66.

able to reclaim some of their (ancestry's) authority by participating in colonial urban society, I will caution against too much enthusiasm here. After all, mimicry, while serving the individual, at the same time accelerates colonization rather than working against it.

A number of scholars, as mentioned above, may have considered hybridity to be a controversial concept. However, in describing Colca culture – past and present – it might be helpful. Dean and Leibsohn assert that recognizing hybrids is a political act, because hybridity is inherent to colonization.[19] I fully agree with their statement, and I think it is a *necessary* political act. I will note here that I do not want to "prescribe" hybridity as a necessary tool for every kind of colonial music research; very much to the contrary, I acknowledge its limitations, caveats, and pitfalls. However, it is important that we as musicologists start thinking about hybridity as a socio-political construct, no matter if we end up using it for our work or not. The important act here is the thinking process that leads us to decide for or against it, and the realization that the word "hybrid" is not simply a synonym for "eclectic in style" – a meaning in which it is still often used in musicological scholarship today. Issues of colonialism, postcolonialism, and decolonization in music research are commonly pushed into the realm of ethnomusicology. As Bhabha expresses it: "If the effect of colonial power is seen to be the production of hybridization rather than the noisy command of colonialist authority or the silent repression of native traditions, then an important change of perspective occurs."[20] If we, musicologists, on the other hand, prefer to stay away from hybridity, and instead focus on history, we are perpetuating on a history written by white men. Scholars in other historical disciplines, such as literature,

[19] Dean and Leibsohn, "Hybridity," 24.
[20] Bhabha, *Location of Culture,* 160.

arts, and architecture, have already been addressing colonialism for a long time. Kofi Agawu asks if musicologists are "perhaps too enamored with the aesthetic, reveling in the ostensible otherworldliness or 'nonlinguisticity' of music to confront the political and ideological work it does."[21] Thus, while critical voices claim talking about hybridity is condoning colonization – and when done from a "modern" perspective (in Mignolo's sense), this might be true – I contend that *not* talking about it in the Colca case is silencing people and their (historical) agency in keeping their culture alive: a culture whose essence is to adapt outside influences and make them its own.

What has largely stopped us in the past from unraveling musical hybridity in colonial Peru is the never-ending search for surviving sheet music or written accounts – a search that has mostly been unsuccessful so far. While I do not want to downplay the importance of written sources, I nevertheless think that we have to stop chasing ghosts. To respond to Agawu's call to action, we need scholars who are willing to follow in the footsteps of Baker, Knighton, Waisman, Rondon, and Vera; scholars who are not afraid of taking this work further and not limiting themselves to ideas of indigenous passivity; and scholars who do not shy away from broadening their views on approaches and methodologies. If we want to assess the harm done through music in the colonization of South America, but also understand the way that people reacted to it, coped with it, and countered it, we have to acknowledge that evidence for hybridity in rural colonial music culture is right in front of us. It comes in the form of a plethora of historical pipe organs, maintained to greater or lesser extents, but most of them preserved well enough for us to at least recognize their hybrid features. We owe it both to scholarship and to Andean culture

[21] Agawu, "Tonality," 350.

to recognize these instruments as valuable primary evidence and to start researching them thoroughly and comprehensively.

APPENDIX A: GLOSSARY AND DIAGRAMS

accessories (pipe organ). Parts of a pipe organ that are not stops, i.e., not connected to a specific rank of pipes, but nevertheless contribute to the organ's timbre. Examples of accessories are tremulants, swells, or ventils.

action (pipe organ). The mechanism that relays the force of the player (on the keyboard or stops) to the windchest of the organ.

amantecaoytl. Feather mosaic, mostly in Mesoamerican pre-colonial.

apus. Title given to deities in the Andean indigenous belief system.

barker lever. A pneumatic relay in a pipe organ to lower the pressure otherwise necessary to depress the keys.

bourdon. A soft-sounding, stopped Flute-type organ pipe.

caps (pipe organ). Also "canister." Endpiece of a stopped pipe that serves to close the pipe, and that can be moved up and down for tuning purposes.

carnival. A Christian tradition preceding the time of Lent. Carnival is traditionally the time of feasting and revelry. In some cultures, it is used to openly express discontent with the establishment.

chamades. Trumpet-type organ pipes that protrude horizontally from the organ case, mostly found in Castilian organs.

chicha. A type of alcoholic, beer-like beverage, brewed in the Andes from fermented maize.

choclo. Large-kernel corn typical for the Andean region. Also referred to as "Cusco corn."

compound bellows. Bellows that serve to stabilize wind pressure, usually situated between wedge bellows (or blower in modern instruments) and windchest.

coro alto. Also known as "rood screen" in English. A partition between choir and nave, or between nave (or choir) and aisle, on which an organ can be located.

corregimiento. In colonial Peru, administrative subdivisions to ensure districts were under royal control.

couplers (pipe organ). A mechanism that allows the organist to play stops on a certain keyboard that belong to another keyboard.

criollo. In the late colonial period Peruvian-born person with purely Spanish heritage.

cusqueñismo. Anti-Limeño socio-political cultural movement rooted in *indigenismo*. Cusqueñismo manifests itself in performances of "Inca pride" in Cusco.

diagonal bellows. Also "wedge bellows." Bellows that are used to pump air into the wind system of a pipe organ.

diapason (pipe organ). Also "Open Diapason," "Principal," "Prestant," or "Octave." A pipe organ stop that has a voluminous sound and overtone-rich timbre. It holds the middle between Strings and Flutes. It does not strive to imitate orchestral instruments.

doctrina. Literally "parish," this term also appears in primary sources for missionary villages and *reducciones*.

drone pipes, drone pedals. Organ pipes that provide a sustained bass note.

encomienda. A system that forced indigenous people in the colonial era to provide free labor (often as mine workers), in exchange for Christianization and "protection."

epistle side, gospel side. The south and north side (respectively) of a church nave.

flats (pipe organ). Sections of an organ front that are not towers, and not protruding.

gemshorn. A kind of organ stop that has a tapered resonator. Its timbre lies between that of a Diapason and a Flute.

heterophony. A style of playing in which each player roughly, but not exactly, plays the same melody.

huacas. Broad category of sacred places and objects that are worshipped in Andean culture.

independent pedal (pipe organ). Pedals that have their own stops. Pull-down pedals, on the other hand, are coupled to one (or more) of the organ's keyboards.

indigenismo, indigenista movement. Socio-political movement in the early twentieth century in Peru, which asserts a contemporary nationalism based on romanticized Inca past.

lent. The forty days before Easter in the Christian *temporale* (year cycle).

manta, manta andina. Andean fabric

mestizo. Until the early twentieth century, officially used in Peru to denote people and cultural artifacts of mixed ethno-racial origin, especially the product of European-indigenous encounters.

mixture (pipe organ). An organ stop consisting of several ranks of pipes. Each key plays several pipes at the same time.

normal scale. Also "Töpfer scale," or "standard scale" (in German: *Töpfersche Normalmensur*). Diameter scaling for Diapason/Prestant organ pipes that follows the human equal loudness curve.

nut (pipe organ). Another word for the block on a reed pipe (see diagrams in this appendix).

off-note block, off-note rack. A block or rack holding organ pipes that are not on the toe board.

pachamama. Also referred to as "Mamapacha" or "Madre Tierra." Andean indigenous deity, literally "mother earth."

pallet chamber. Another word for pallet box (see diagrams in this appendix).

parcialidad. Traditional cultural and geographic division of a town in the Colca region. The three parcialidades for each town commonly are *Hanansay, Urinsaya,* and *Ccapa.* (Compare also to the *hanan* and *hurin* principle of spatial perception mentioned in chapter 6.)

pinkullu. Andean notched flute. Often strongly connotated with male sexuality (the name of the flute relates to the Andean word for "penis.")

pipe rack. A rack to keep pipes in an organ from falling over; usually made of a wooden plank with holes in it.

pneumatic/electro-pneumatic transmission. A kind of force transmission in a pipe organ from the key or stop to the wind chest that works with long lead pipes filled with pressurized air (pneumatic transmission), or with a combination of pressurized components and electric wires.

portative. A small, portable organ, often containing reed pipes.

pumper. A person who pumps air into a pipe organ's wind system.

quena. Also "kena," "kenakena," or "quenaquena." Andean notched flute.

quero. Andean vessel (usually made of clay), often highly decorative and not (primarily) meant for drinking.

reducción. Lit. “reduction.” In colonial times, indigenous communities (often self-contained) under royal or ecclesiastic (missionary) control. “Reduction” refers to gathering more widely-scattered indigenous people(s) into a more-dense community of smaller area.

registration. Combination of organ stops.

salicional. An organ pipe or rank with a string instrument-like sound, soft in volume, with many overtones.

spring chest. A wind chest system in use in pipe organs until the late Renaissance/early Baroque era. The path of the wind is not opened and closed through a sliding board (as in the slider system), but through pallets that are situated on a so-called stop bar.

stood-off front pipes. Front pipes that are not on the main toe board, but positioned on a distance from it, and connected to the wind chest via conductors.

stop (pipe organ). A “voice” or timbre in which a pipe organ can speak. Also: the lever or knob that is pushed or pulled to activate that voice, which usually connects to one (sometimes more) ranks of pipes inside the organ.

stop face. The front of a stop knob, which may contain the stop name.

stopped pipe. A flue-type organ pipe that is closed at one end.

swell chest. A part of a pipe organ that is contained in a separate case that can be opened and closed, so that the pipes inside are heard louder or softer.

tawantinsuyu. The Inca Empire, consisting of four parts: Antisuyu, Chinchasuyu, Contisuyu, Collasuyu.

towers (pipe organ). Sections of the organ front that are higher than the other parts, and can, but do not have to be, protruding. Usually, these sections contain the longest front pipes (often pedal pipes).

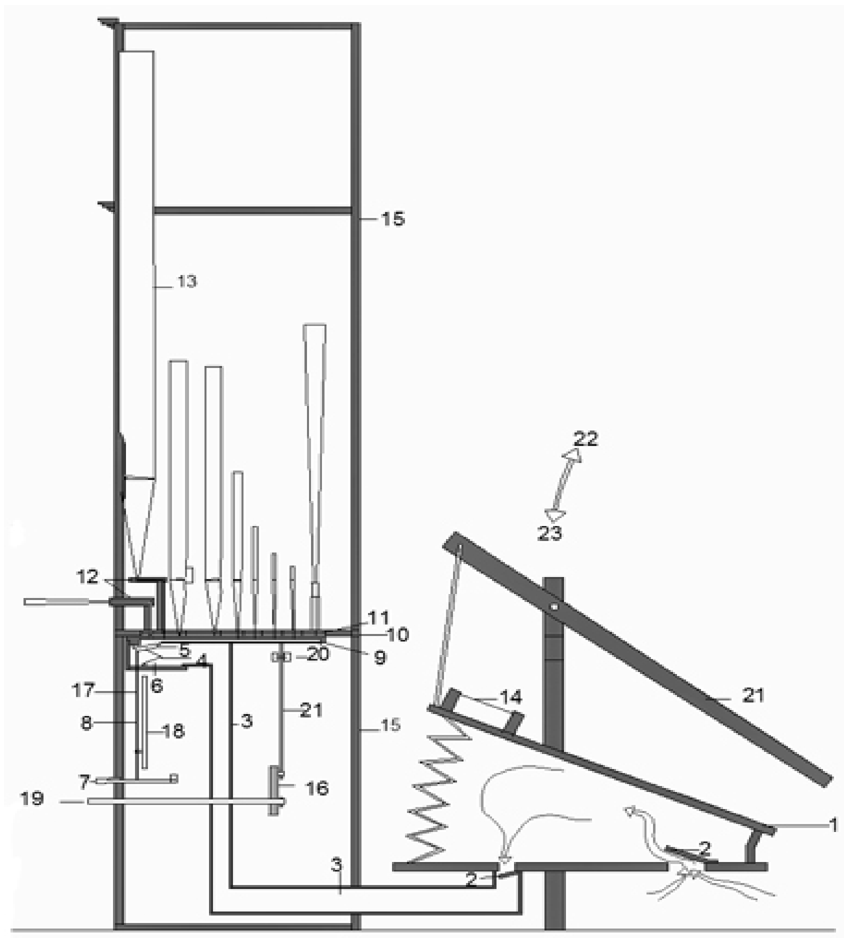
tremulant. An accessory in a pipe organ that produces a vibrato sound.

vizcacha. An Andean rodent of the chinchilla family.

wind (pipe organ). The air through which the pipe organ functions.

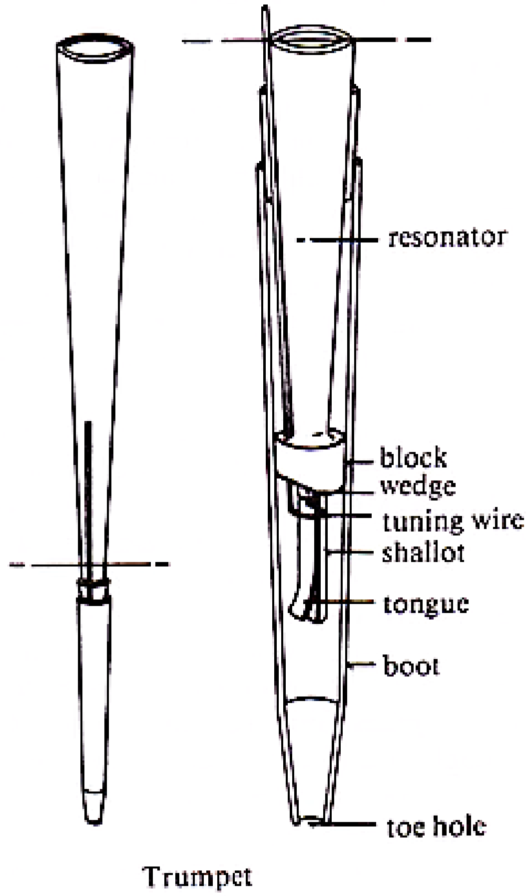
wititi. Traditionally Andean dance from the Arequipa (especially Colca) region. Traditionally associated with love, fertility, rain, and courtship. Wititi can also refer to the male wititi dancer.

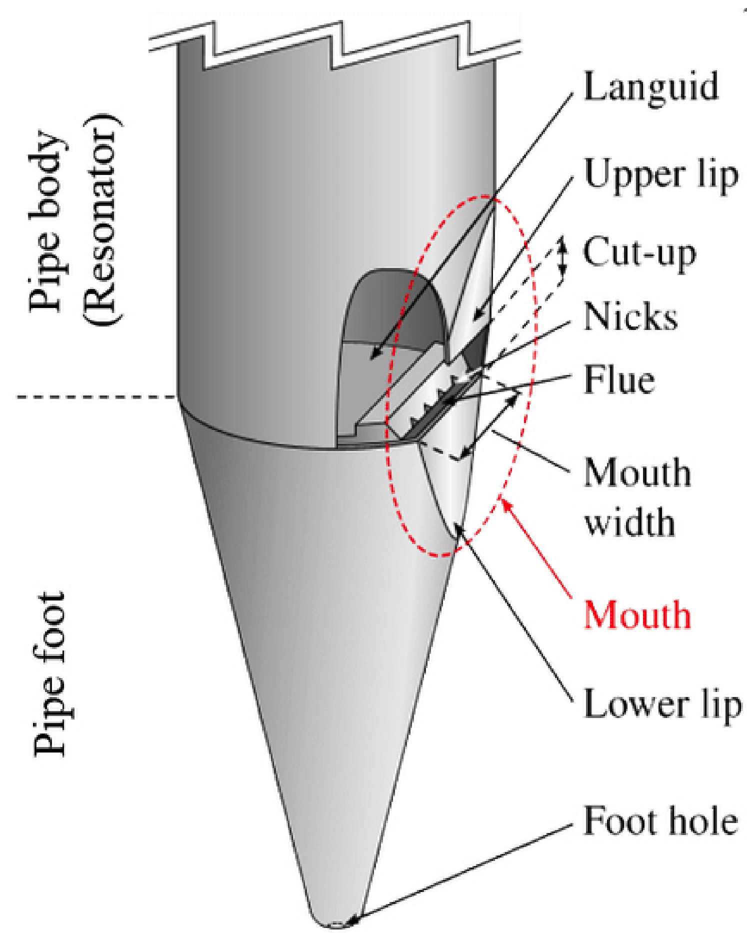
1 Bellows
2 Valve
3 Wind trunk
4 Spring
5 Pallet
6 Pallet box
7 Key
8 Tracker
9 Groove
10 Slider
11 Toe board
12 Grooved board



13 Pipe
14 Weight
15 Case
16 Trundle
17 Roller
18 Roller board
19 Stop knob
20 Pivot
21 Stop action backfall
22 Air enters bellows
23 Air enters organ

Diagram of pipe organ. (Image: IOHIO, https://iohio.org.mx/eng/howorganswork.htm.)





Left: diagram of a flue pipe. (Image: Angster et.al., "Acoustics of Organ Pipes," fig. 2).
Right: diagram of reed pipe. (Image: https://www.music-world.org/keyboards-organ).

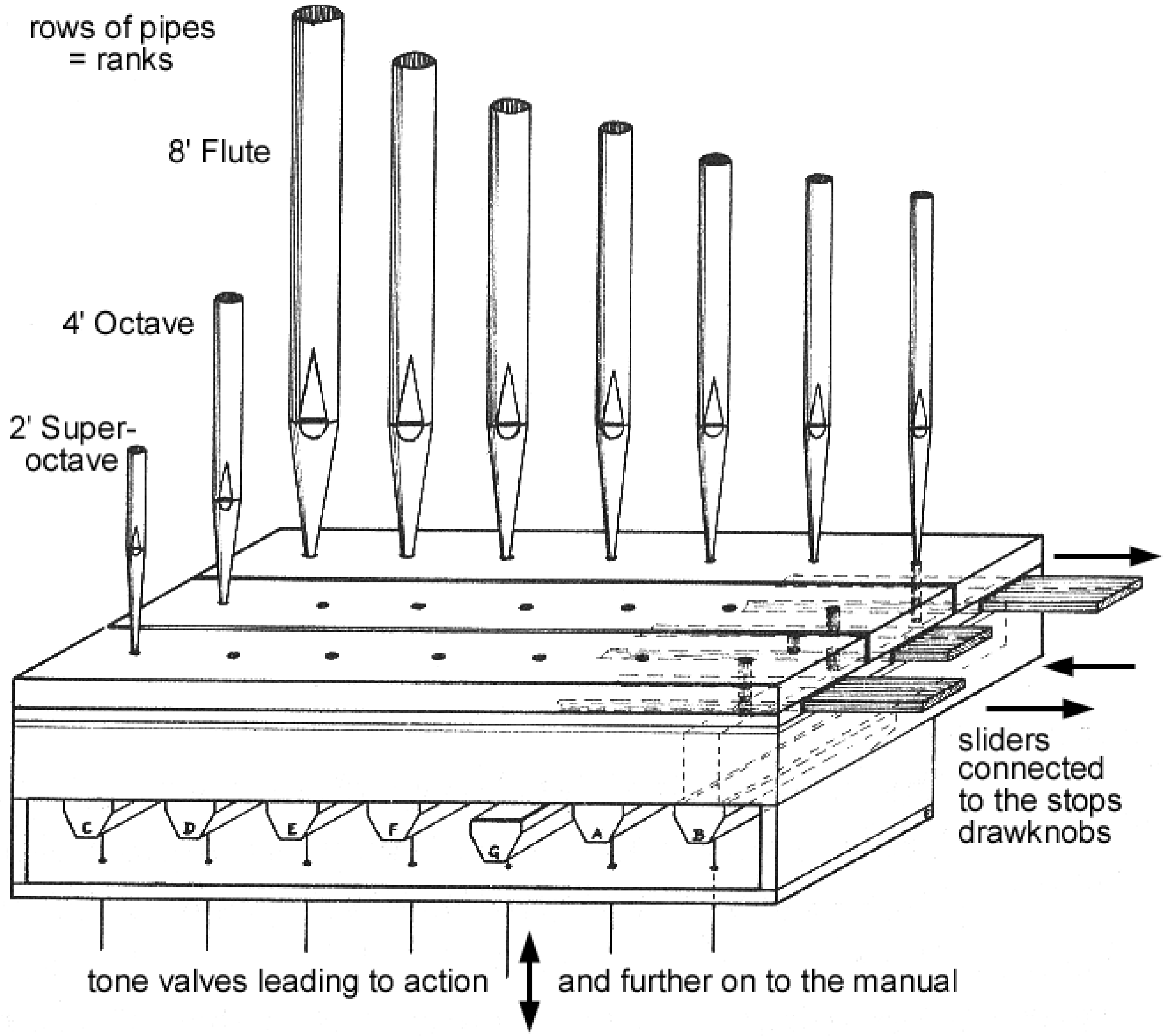
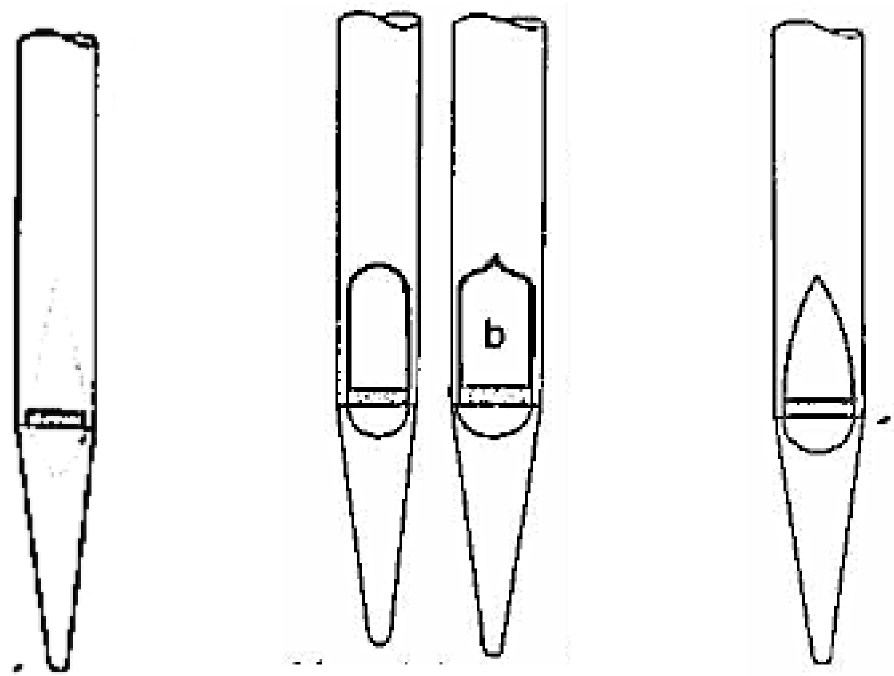


Diagram of a slider action windchest. (Image: http://www.die-orgelseite.de/funktionsweise_e.htm).



Shapes mouths (upper lips), from the left: flatted (pressed-in) mouth; Roman mouth, ogee mouth, bayleaf mouth. (Drawings from Praet, *Orgelwoordenbook*, 271).

APPENDIX B: PHOTOHGRAPHS

Fig. 1: Church of San Antonio de Callalli

Fig. 2: Church of San Juan Bautista de Sibayo

Fig. 3: Church of San Pedro Apostól de Tisco

Fig. 4: Church interior of San Pedro de Tisco

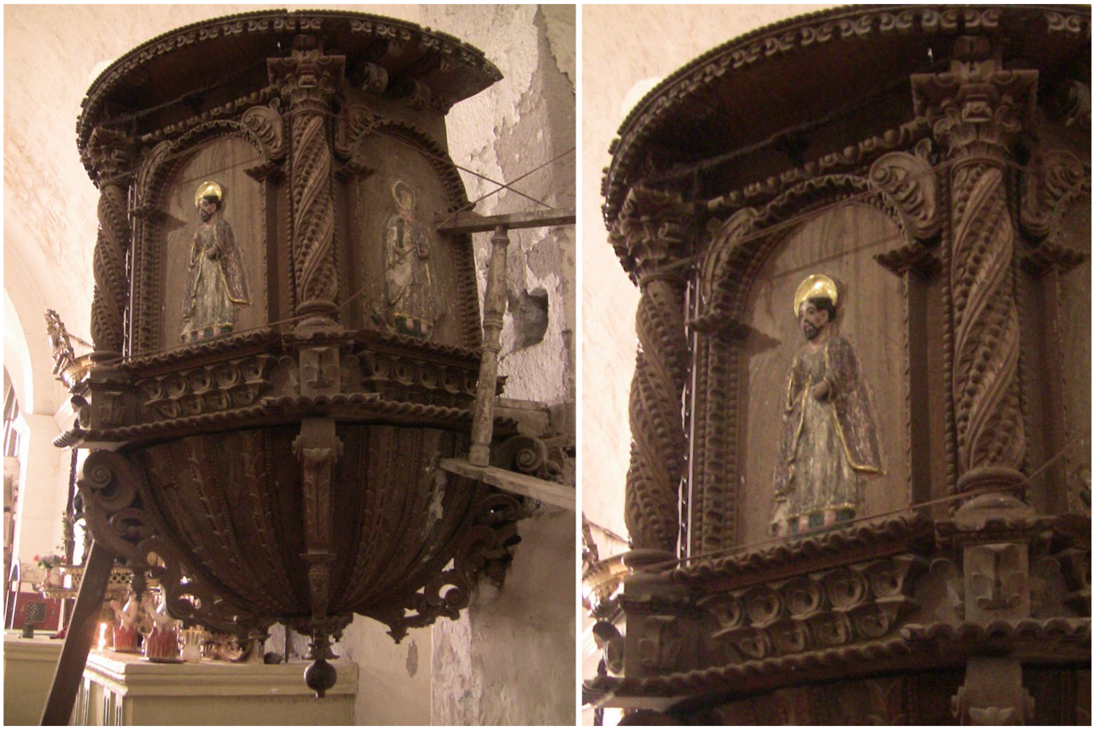


Fig. 5: Chancel in San Pedro de Tisco

Fig. 6: Organ front in Callalli

Fig. 7: Organ front in Sibayo

Fig. 8: Organ front in Tisco

Fig. 9: Stone stool for the organist in Sibayo

Fig. 10: Cutouts for drone pipe action in the organ in Tisco with remnants of action

Fig. 11: The keyboard of the organ in Callalli

Fig. 12: The tracker action of the organ in Sibayo

Fig. 13: The stop action of the organ in Callalli

Fig. 14: The pipework in the organ in Sibayo

Fig. 15: The trumpets rank in the organ in Callali

Fig.16: Combination of lead (invisible) and fabric for the nuts of the reed pipes in Callalli

Fig. 17: Common damage on pipework found in the organ of Sibayo

Fig. 18: Mouths of the drone pipes in the organ in Sibayo

Fig. 19: Drone pipes in the organ in Callalli

Fig. 20: Camelid leather and fur used in the wind system of the organ in Tisco

Fig. 21: Camelid leather and fur used in the wind system of the organ in Tisco

Fig. 22: Indigenous flower motive on the inside of the shutter of the organ in Sibayo

Fig. 23: Panel above the keyboard with the Mass Ordinary as a mnemonic aid for the organist (Sibayo)

Fig. 24: Shutter of the organ in San Pedro Apostol de Andahuaylillas: Saint Cecilia playing with all ten fingers

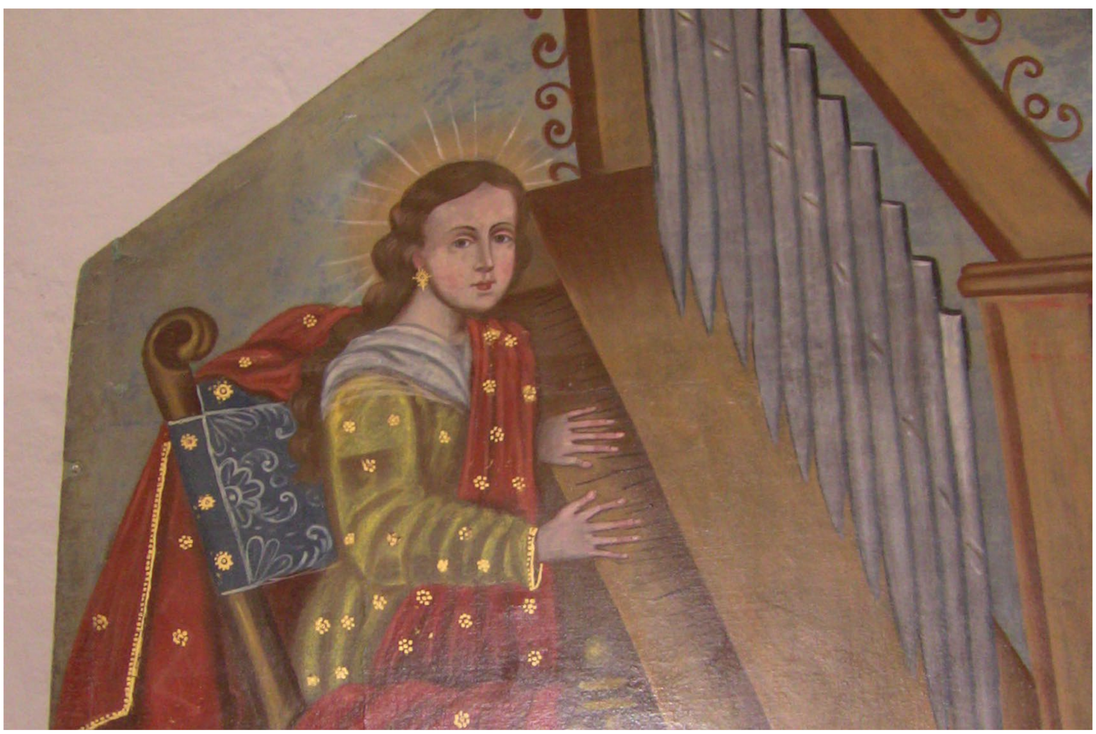


Fig. 25: Shutter of the organ in Sibayo: Saint Cecilia playing with all ten fingers

Fig. 26: First page of Corre de Arauxo's *Tres Glosas,* in the original print of 1626. The red circle indicates to lowest note, D2 (6 with a double stroke)

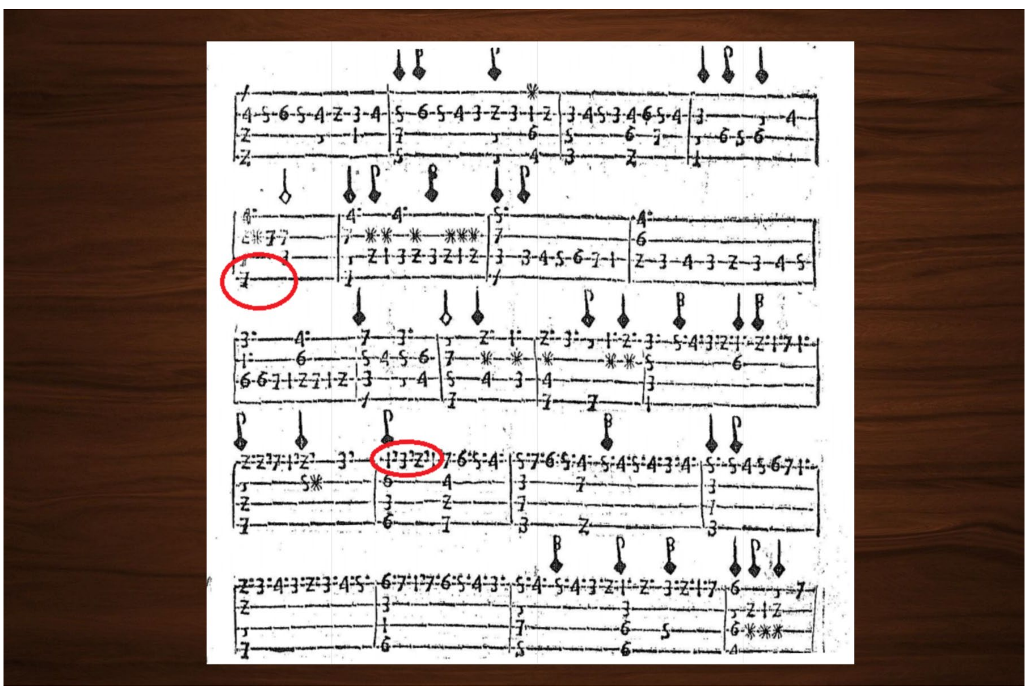


Fig 27: Second page of the Correa de Arauxo's *Quinto Tiento.* The red circles indicate the lowest note (7 with double stroke, E2) and highest note (3 with apostrophe, A3). In the second measure, the first note was interpreted by Max Polijakowksi as a 6 with double stroke (thus a D2)

Fig. 28: Adriano Banchieri, Quarto Cappriccio. The chordal part is given as two parts (upper voice and bass), the harmony has to be filled in by the performer

Fig. 29: Chivay Plaza. Notice the cross on the mountain behind the church

Fig. 30 Preparing the sacrifices for the Chivay *tinkachi*

Fig. 31: Girl in Chivay waiting for the *wititi* contest to begin

Fig. 32 Male *wititi* dancer

Fig. 33 *Wititi* couple
(Image source for fig. 32 and 33: https://ich.unesco.org/en/RL/wititi-dance-of-the-colca-valley-01056)

Fig. 34: Banner of the *parcialidad* Ccapa at the *wititiada* in Chivay

Fig. 35: Setting up the tree for the Chivay *cortamonte*

APPENDIX C: SCALING MEASUREMENTS

Sibayo, front rank (I)

17/17 pipes

pipe number	1	2	3	4	5	6	7	8
pipe number equivalent	1	4	7	9	12	15	17	20
circumference	274	279	273	242	234	192	189	169
diameter	87.2	88.8	86.9	77.0	74.5	61.1	60.2	53.8
inner diameter	85.0	86.8	85.3	75.6	72.9	59.9	59.0	52.0
surface area	5676.8	5918.5	5714.4	4492.5	4172.2	2819.5	2730.3	2123.3
resonator length:diameter	13.2	12.2	11.6	12.7	11.5	13.3	12.3	12.8
resonator length:surface area	0.20	0.18	0.18	0.22	0.21	0.29	0.27	0.32
width of mouth	66	67	64	59	60	49	47	42
width of mouth:innder diameter	77.6%	77.2%	75.0%	78.0%	82.3%	81.8%	79.7%	80.8%
cut-up	13.6	12.4	11.4	14.8	10.4	12.5	11.4	10.2
cut-up:inner diameter	16.0%	14.3%	13.4%	19.6%	14.3%	20.9%	19.3%	19.6%
height of upper lip	89	88	84	73	76	60	57	53
form of upper lip	bayleaf scored	bayleaf scored	bayleaf pressed-scored	bayleaf scored	bayleaf scored	bayleaf scored	bayleaf scored	bayleaf scored
diameter toe	16.2	14.6	15.4	20.5	21.6	16.2	12.7	7.9
diameter toe hole	5	8	12.4	51	8.4	5.8	5.9	5.7
length of foot	250	236	243	239	224	265	269	280
resonator length total	1150	1082	1010	982	856	815	741	687
resonator length without tuning slide etc.	1131	786	833	842	656	771	608	570
height of languid	1.7	1.7	2.7	2.4	1.2	1.5	2.3	1.6
angle of languid	90	90	90	90	90	90	90	90
nicks	0	0	0	0	0	0	0	0
flue	0.75	0.25	0.55	0.45	0.24	0.85	0.7	0.65
flue:toe hole	15.0%	3.1%	4.4%	0.9%	2.9%	14.7%	11.9%	11.4%
ear length	-	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-
thickness upper wall	1.1	1	0.8	0.7	0.8	0.6	0.6	0.9
thickness wall near mouth	0.8	0.9	1.4	1.9	1.9	1.9	1.9	1.4
thickness wall near foot hole	2	0.6	-	1.1	2.6	2.9	0.9	0.6
obervations								

Sibayo, scaling measurements rank I

Sibayo, front rank (I)

pipe number	9	10	11	12	13	14	15	16	17
pipe number equivalent	22	24	27	29	32	34	37	39	41
circumference	160	150	142	134	121	111	58.5	47.5	49
diameter	50.9	47.7	45.2	42.7	38.5	35.3	15.1	15.6	15.6
inner diameter	49.1	46.9	44.2	40.9	36.9	33.3	13.7	14.2	14.6
surface area	1895.7	1731.0	1534.4	1310.8	1070.3	872.6	147.8	158.3	167.4
resonator length:diameter	12.7	12.6	12.7	13.0	12.6	13.0	10.1	7.7	5.3
resonator length:surface area	0.34	0.35	0.37	0.42	0.45	0.53	1.03	0.76	0.49
width of mouth	37	32	31	28	26	25	18	12	12
width of mouth:innder diameter	75.3%	68.2%	70.1%	68.5%	70.4%	75.0%	131.2%	84.5%	82.2%
cut-up	10.4	10.4	10	9.1	8.6	8.6	4.6	4	3.8
cut-up:inner diameter	21.2%	22.2%	22.6%	22.3%	23.3%	25.8%	33.5%	28.2%	26.0%
height of upper lip	48	41	40	38	36	30	-	15	-
form of upper lip	bayleaf scored	bayleaf scored	bayleaf scored	bayleaf scored	bayleaf scored	bayleaf scored	-	Roman pressed	pressed (lightly)
diameter toe	11.6	10.8	12.3	10.3	9.4	8.6	7.7	6.6	5.6
diameter toe hole	7	6.8	6.8	7.6	8.8	5	4.7	4.7	4.5
length of foot	291	303	314	315	344	351	174	185	185
resonator length total	649	602	575	556	484	460	152	120	82
resonator length without tuning slide etc.	584	520	490	477	43	427	148	112	73
height of languid	2.8	2.3	2.4	2.2	2.6	1.5	1.1	1.1	1.1
angle of languid	90	90	90	90	90	90	90	90	90
nicks	0	0	0	0	0	0	0	0	0
flue	0.55	0.55	0.65	0.35	0.85	0.65	0.5	0.6	0.65
flue:toe hole	7.9%	8.1%	9.6%	4.6%	9.7%	13.0%	10.6%	12.8%	14.4%
ear length	-	-	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-	-
thickness upper wall	0.9	0.4	0.5	0.9	0.8	1	0.7	0.7	0.5
thickness wall near mouth	1.1	0.6	0.3	0.3	0.2	0.8	0.5	0.7	0.6
thickness wall near foot hole	0.6	0.4	0.6	0.5	0.6	0.9	1	0.5	0.6
obervations						foot collapsed			

Sibayo, scaling measurements rank I (contunued)

Sibayo, 2nd rank (II)

60/69 pipes

pipe number	0	1	2	3	4	5	6	6 1/2	7	8	9	10
circumference	209		162	203	137		128	192	131	124	181	166
diameter	66.5		51.6	64.6	43.6		40.7	61.1	41.7	39.5	57.6	52.8
inner diameter	65.3		48.2	63.4	42.4		39.3	57.3	39.9	38.7	52.0	50.6
surface area	3351.8		1822.1	3158.6	1412.5		1215.7	2580.1	1250.3	1174.5	2124.9	2014.0
resonator length:diameter	8.5		8.3	7.8	9.2		8.2	7.4	7.8	7.7	4.5	4.6
resonator length:surface area	0.17		0.23	0.16	0.29		0.27	0.18	0.26	0.26	0.12	0.12
width of mouth	47		39	50	32		27	44	30	30	45	40
width of mouth:innder diameter	71.9%		81.0%	78.8%	75.5%		68.6%	76.8%	75.2%	77.6%	86.5%	79.0%
cut-up	14.4		13.3	14.6	13		12.3	12.1	10.2	10.8	13	12.7
cut-up:inner diameter	22.0%		27.6%	23.0%	30.7%		31.3%	21.1%	25.6%	27.9%	25.0%	25.1%
height of upper lip	39		48	35	40		34	41	39	34	40	-
form of upper lip	Roman scored		Roman pressed	Roman pressed	Roman pressed		bayleaf scored	pressed	Roman pressed	Roman pressed	Roman pressed	pressed
diameter toe	16.3		17	12.7	13.5		12	14.2	12.7	14.2	-	13.8
diameter toe hole	8.6		-	-	4.7		-	10.1	5.3	7.9	8.5	7.1
length of foot	182		145	174*	165		185	179	163	164	142*	162
resonator length total	566		428	504	403		333	454	326	305	260	242
resonator length without tuning slide etc.	-		-	-	-		-	-	-	272	-	-
height of languid	1.9		1.7	1.5	1.4		1.4	1.9	1.8	1.4	0.9	1.6
angle of languid	80		90	90	90		90	90	60	90	90	90
nicks	20		0	0	0		0	0	0	0	0	0
flue	0.75		1	1.2	1.1		0.7	0.85	0.55	0.45	0.65	0.7
flue:toe hole	8.7%		-	-	23.4%		-	8.4%	10.4%	5.7%	7.6%	9.9%
ear length	34.4		25.1	37.2	26.3		27.7	33.9	28.4	28.1	27.4	38.4
ear width	23.6		19.1	22.1	21.6		19.6	22.3	23.5	17.1	21.2	24.2*
tuning slide height (stopped pipes)	soldered		soldered	soldered	soldered		soldered	soldered	-	-	soldered	soldered
thickness upper wall	-		-	-	-		-	-	0.9	0.4	-	-
thickness wall near mouth	-		-	-	-		-	-	-	-	-	-
thickness wall near foot hole	0.6		1.7	0.6	0.6		0.7	1.9	1.1	1.8	2.8	1.1
observations		pipe missing	toe hole almost pressed tight	foot collapsed		pipe missing	toe hole almost pressed tight				foot collapsed	

Sibayo, scaling measurements rank II

Sibayo, 2nd rank (II)

pipe number	11	12	13	13	15	16	17	18F	18B	19F	19B	20F
circumference	152		119		80	126	113	111	101	106		104
diameter	48.4		37.9		25.5	40.1	36.0	35.3	32.1	33.7		33.1
inner diameter	45.8		34.1		25.1	37.7	34.8	34.7	30.9	32.7		31.9
surface area	1646.3		912.1		493.4	1116.7	949.5	947.5	752.3	841.9		799.4
resonator length:diameter	4.7		6.0		7.4	4.8	4.9	10.4	5.2	9.8		9.6
resonator length:surface area	0.14		0.25		0.38	0.17	0.19	0.39	0.22	0.39		0.40
width of mouth	37		30		21	32	27	28	13	25		25
width of mouth:innder diameter	80.8%		88.0%		83.8%	84.9%	77.7%	80.6%	42.0%	76.4%		78.4%
cut-up	13		12.2		5.2	10.3	9.4	7.4	7.5	7.2		6.3
cut-up:inner diameter	28.4%		35.8%		20.7%	27.3%	27.0%	21.3%	24.2%	22.0%		19.7%
height of upper lip	-		29		24	-	16	26	-	26		30
form of upper lip	pressed		Roman pressed		Roman pressed	pressed	Roman pressed	Roman pressed	pressed	Roman pressed		Roman pressed
diameter toe	13.1		12.6		8.9	10.8	10.6	11.4	-	10.6		9.9
diameter toe hole	6.8		4.5		6.5	7.1	5.3	4.7	5.1	5.2		5.3
length of foot	159		162		165	161	162	158	159	164		157
resonator length total	228		228		188	191	176	368	167	332		319
resonator length without tuning slide etc.	-		-		-	-	133	315	-	309		296
height of languid	1.1		1		0.8	1.5	0.5	1.6	1.4	1.5		0.6
angle of languid	90*		90		90	90	90	75	90*	85		85
nicks	0		0		0	0	0	0	0	0		0
flue	0.65		0.6		0.65	0.65	0.65	0.6	0.7	0.75		0.9
flue:toe hole	9.6%		13.3%		10.0%	9.2%	12.3%	12.8%	13.7%	14.4%		17.0%
ear length	33.1		29.3		-	30.2	27.4	-	34.3	-		-
ear width	21.2		19.8		-	24.4	22.6*	-	21.8	-		-
tuning slide height (stopped pipes)	soldered		soldered		-	soldered	-	-	soldered	-		-
thickness upper wall	-		-		0.2	-	0.6	0.3	-	0.5		0.6
thickness wall near mouth	-		-		0.6	-	-	0.6	-	0.5		0.6
thickness wall near foot hole	1.3		1.9		0.6	1.2	0.6	0.8	0.6	0.6		0.7
observations	double angle on languid	pipe missing		pipe missing			only one ear				pipe missing	

Sibayo, scaling measurements rank II (continued)

Sibayo, 2nd rank (II)

pipe number	20B	21F	21B	22F	22B	23F	23B	24F	24B	25F	25B	26F
circumference	66	103	51.5	94	61	84	58	78	59	88	55.5	60
diameter	21.0	32.8	16.4	29.9	19.4	26.7	18.5	24.8	18.8	28.0	17.7	19.1
inner diameter	19.4	31.2	14.6	28.7	18.2	25.5	16.7	23.2	17.0	26.6	16.9	18.3
surface area	295.9	763.8	167.3	647.9	260.6	512.2	218.0	423.8	226.5	556.2	223.4	263.0
resonator length:diameter	7.9	9.2	4.3	9.5	6.9	9.4	6.7	9.8	6.4	8.4	6.5	11.5
resonator length:surface area	0.56	0.39	0.42	0.44	0.51	0.49	0.57	0.57	0.53	0.42	0.51	0.84
width of mouth	15	25	11	22	13	22	11.7	21	11.9	22	10.7	13
width of mouth:innder diameter	77.3%	80.2%	75.4%	76.6%	71.4%	86.1%	70.2%	90.4%	70.1%	82.7%	63.4%	71.0%
cut-up	7.1	6	5.1	6.7	7.4	6.1	6.4	5.9	6.3	6.6	5.7	5
cut-up:inner diameter	36.6%	19.2%	34.9%	23.3%	40.6%	23.9%	38.4%	25.4%	37.1%	24.8%	33.8%	27.3%
height of upper lip	-	25	-	25	-	31	-	25	-	28	-	8.1
form of upper lip	pressed	Roman pressed	-	Roman pressed	pressed	Roman pressed	-	Roman pressed	-	Roman pressed	pressed	Roman pressed
diameter toe	8.4	9.8	6.8	10.7	8.7	9	7.2	9.6	6.7	9.4	-	6.8
diameter toe hole	4.3	5.9	2.5	5.7	3.7	3.7	4.8	5.2	4.9	3.7	4.7	5.13
length of foot	157	162	161	167	159	171	156	164	156	162	155	190
resonator length total	165	301	70	283	134	251	124	243	121	235	115	220
resonator length without tuning slide etc.	-	266	-	249	-	239	-	228	-	21.3	-	-
height of languid	0.4	1.4	1.1	1.5	0.9	1	0.9	1.9	0.8	1.2	0.7	1.2
angle of languid	90	45	90	80	90	90	90	85	90	80	90	90
nicks	0	0	0	0	0	0	0	0	0	0	0	0
flue	0.5	0.55	0.75	0.75	0.4	0.5	0.4	1	1.15	0.55	0.25	0.45
flue:toe hole	11.6%	9.3%	30.0%	13.2%	10.8%	13.5%	8.3%	19.2%	23.5%	14.9%	5.3%	8.8%
ear length	30.8	-	-	-	-	28.9	20.5	-	20.1	-	29.5*	-
ear width	18.1	-	-	-	-	18.4	15.3	-	18.7	-	16.7*	-
tuning slide height (stopped pipes)	soldered	-	-	-	soldered	-	soldered	-	soldered	-	soldered	-
thickness upper wall	-	0.8	0.9	0.6	-	0.6	-	0.8	-	0.7	-	0.8
thickness wall near mouth	-	0.6	0.9	0.5	-	0.6	-	0.6	-	0.4	-	0.5
thickness wall near foot hole	0.8	0.8	0.2	0.5	0.6	1.9	0.9	0.4	0.9	1.8	0.4	0.4
observations											only one ear	

Sibayo, scaling measurements rank II (continued)

Sibayo, 2nd rank (II)

pipe number	26B	27F	27B	28F	28B	29F	29B	30F	30B	31F	31B	32F
circumference	58	76	49	75	52.5	72	52	68	53	71	52	57
diameter	18.5	24.2	15.6	23.9	16.7	22.9	16.6	21.6	16.9	22.6	16.6	18.1
inner diameter	14.7	22.8	14.4	22.3	14.9	21.3	15.6	20.0	16.1	21.2	15.4	16.3
surface area	168.8	408.0	162.8	389.6	174.6	356.9	190.0	315.6	202.8	353.0	185.1	209.8
resonator length:diameter	6.1	8.7	6.6	8.0	5.8	8.1	5.7	7.8	5.2	7.0	5.0	8.9
resonator length:surface area	0.67	0.51	0.63	0.49	0.56	0.52	0.49	0.53	0.43	0.45	0.45	0.77
width of mouth	14	21	11.7	18	10.9	17	9.4	18	9.7	17	10.4	13
width of mouth:innder diameter	95.5%	92.1%	81.3%	80.8%	73.1%	79.7%	60.4%	89.8%	60.4%	80.2%	67.7%	79.5%
cut-up	11.2	5.2	3.8	6.2	5.5	5.1	5.3	4.9	6.2	5	5.1	4.4
cut-up:inner diameter	76.4%	22.8%	26.4%	27.8%	36.9%	23.9%	34.1%	24.4%	38.6%	23.6%	33.2%	26.9%
height of upper lip	-	23	-	13.1	-	21.1	-	17.6	-	17.7	-	16.2
form of upper lip	pressed	Roman pressed	pressed	pressed	pressed	Roman pressed	pressed	Roman pressed	pressed	Roman pressed	pressed	Roman pressed
diameter toe	9.8	8.6	7.6	-	8.3	-	8	8.9	7.9	9	7.4	8.5
diameter toe hole	5.1	4.9	5.5	5.8	3.1	5.6	4.2	3.7	3.2	5	4	4.1
length of foot	156	171	187	165	155	165	154	171	157	164	154	170
resonator length total	113	210	103	191	97	186	94	168	88	159	83	161
resonator length without tuning slide etc.	-	196	86	186	-	176	-	161	-	-	-	147
height of languid	0.6	1.4	1.1	1.1	0.8	0.9	0.7	1.3	0.9	1.3	0.9	1.2
angle of languid	90	90	90	90	90	90	90	90	90	80	90	85
nicks	0	0	0	0	0	0	0	0	0	0	0	0
flue	0.55	0.2	0.35	0.65	0.35	0.75	0.35	0.75	0.4	0.75	0.35	0.4
flue:toe hole	10.8%	4.1%	6.4%	11.2%	11.3%	13.4%	8.3%	20.3%	12.5%	15.0%	8.8%	9.8%
ear length	19.5	-	-	-	26.4	-	21.3	-	21.1*	-	21.3	-
ear width	14.8	-	-	-	13.5	-	16.3	-	16.7	-	14.9	-
tuning slide height (stopped pipes)	soldered	-	-	-	soldered	-	soldered	-	soldered	-	soldered	-
thickness upper wall	-	0.7	0.6	0.6	-	0.8	-	0.8	-	0.7	-	0.9
thickness wall near mouth	-	0.9	0.5	0.4	-	0.7	-	0.9	-	0.5	-	0.8
thickness wall near foot hole	1.9	0.4	0.3	0.8	0.9	0.3	0.5	0.6	0.4	0.3	0.6	0.6
observations									only one ear			

Sibayo, scaling measurements rank II (continued)

Sibayo, 2nd rank (II)

pipe number	32B	33F	33B	34F	34B	35F	35B	36F	36B	37F	37B	38F
circumference	51	52	44	45	43	39.5		42		44.5		37.5
diameter	16.2	16.6	14.0	14.3	13.7	12.6		13.4		14.2		11.9
inner diameter	15.6	15.4	13.2	12.9	13.1	11.4		12.2		12.6		11.1
surface area	192.0	185.1	137.0	131.2	134.5	101.6		116.3		124.0		97.4
resonator length:diameter	4.7	9.1	4.9	9.8	4.3	10.1		9.3		8.5		9.7
resonator length:surface area	0.40	0.82	0.50	1.07	0.44	1.25		1.07		0.97		1.19
width of mouth	9.8	12	8.6	12	9.2	8.9		10.1		10.3		9.4
width of mouth:innder diameter	62.7%	78.2%	65.1%	92.9%	70.3%	78.3%		83.0%		82.0%		84.4%
cut-up	4.7	4.7	5	3.5	4.1	3.5		3.6		3.8		3.1
cut-up:inner diameter	30.1%	30.6%	37.9%	27.1%	31.3%	30.8%		29.6%		30.2%		27.8%
height of upper lip	-	14	7.8	14.7	-	9.5		9.9		10.7		8.9
form of upper lip	-	Roman pressed	pressed	Roman pressed	pressed	Roman pressed		Roman pressed		Roman pressed		Roman pressed
diameter toe	7.7	7.9	6.7	8.1	7	6		7.1		7.6		6.6
diameter toe hole	3.3	3.9	20	3.5	3.6	2.1		4.1		3.5		2.3
length of foot	157	173	158	171	158	168		171		173		173
resonator length total	77	151	68	140	59	127		124		120		116
resonator length without tuning slide etc.	-	142	70	-	-	-		116		112		106
height of languid	0.7	1.1	0.7	0.8	1.1	0.7		0.6		1		0.6
angle of languid	90	85	90	90	90	85		90		85		90
nicks	0	0	0	0	0	0		0		0		0
flue	0.75	0.7	0.75	0.7	0.35	0.4		0.5		0.65		0.35
flue:toe hole	22.7%	17.9%	3.8%	20.0%	9.7%	19.0%		12.2%		18.6%		15.2%
ear length	-	21.8	17.3	-	16.9	-		-		-		-
ear width	-	15.5	12.8	-	12.4	-		-		-		-
tuning slide height (stopped pipes)	soldered	-	soldered	-	soldered	-		-		-		-
thickness upper wall	-	0.6	-	0.7	-	0.6		0.4		0.6		0.4
thickness wall near mouth	-	0.6	-	0.6	0.4	0.2		0.6		0.2		0.4
thickness wall near foot hole	0.3	0.4	0.4	0.5	0.3	0.4		0.6		0.8		1.6
observations							pipe missing		pipe missing		pipe missing	

Sibayo, scaling measurements rank II (continued)

Sibayo, 2nd rank (II)

pipe number	38B	39F	39B	40F	40B	41F	41B	42F	42B
circumference	40.5	42	40	47	38.5	41.5	36	41	
diameter	12.9	13.4	12.7	15.0	12.3	13.2	11.5	13.1	
inner diameter	12.1	12.6	12.3	14.4	11.7	11.8	10.3	11.5	
surface area	114.8	124.1	119.4	162.0	106.7	109.5	82.7	103.0	
resonator length:diameter	3.9	8.1	3.8	6.4	3.5	10.8	8.0	6.1	
resonator length:surface area	0.44	0.87	0.41	0.59	0.40	1.31	1.11	0.77	
width of mouth	8.1	9.7	8.3	12	6.3	10.8	8.1	9	
width of mouth:innder diameter	67.0%	77.2%	67.3%	83.6%	54.1%	91.4%	79.0%	78.6%	
cut-up	3.9	4.1	3.6	4	3.6	3.5	3	2.7	
cut-up:inner diameter	32.3%	32.6%	29.2%	27.9%	30.9%	29.6%	29.2%	23.6%	
height of upper lip	-	8.6	-	8.1	-	10	10.6	8.7	
form of upper lip	pressed	pressed	pressed	pressed	pressed	Roman pressed	Roman pressed	pressed	
diameter toe	7.8	5.8	7.2	8	6.8	7.1	7.4	-	
diameter toe hole	3.6	3.4	3.4	5.7	4.2	4.7	3.8	4.4	
length of foot	157	167	157	187	158	141	164	154	
resonator length total	50	108	49	96	43	143	92	79	
resonator length without tuning slide etc.	-	95	-	90	0	-	-	-	
height of languid	1.5	0.8	1.1	1.1	0.8	0.3	0.7	0.8	
angle of languid	90	90	90	90	90	90	80	80	
nicks	0	0	0	0	0	0	0	0	
flue	0.4	0.2	0.25	0.7	0.15	0.55	0.2	0.15	
flue:toe hole	11.1%	5.9%	7.4%	12.3%	3.6%	11.7%	5.3%	3.4%	
ear length	16.9	-	16.9	-	15.7	-	-	-	
ear width	10.7	-	10.7	-	8.3	-	-	-	
tuning slide height (stopped pipes)	soldered	-	soldered	-	soldered	-	-		
thickness upper wall	-	0.6	-	0.3	-	0.7	0.6	0.8	
thickness wall near mouth	-	0.6	-	0.4	-	0.3	0.3	0.2	
thickness wall near foot hole	0.4	0.4	0.2	0.5	0.3	0.2	0.4	0.8	
observations			right ear almost broken off		right ear broken off				pipe missing

Sibayo, scaling measurements rank II (continued)

Sibayo, 3rd rank (III)

36/43 pipes

pipe number	0	1	2	3	4	5	6	7	8
circumference	152		117		122		113	108	61
diameter	48.4		37.2		38.8		36.0	34.4	19.4
inner diameter	47.2		35.8		38.4		35.4	34.0	18.6
surface area	1748.5		1009.0		1160.2		982.5	906.7	272.2
resonator length:diameter	12.0		12.3		10.4		9.5	9.5	8.4
resonator length:surface area	0.33		0.45		0.35		0.35	0.36	0.60
width of mouth	27		28.2		20.5		28.2	27.2	13.5
width of mouth:inner diameter	57.2%		78.7%		53.3%		79.7%	80.1%	72.5%
cut-up	9.1		8.1		8.6		8.1	6.2	6.3
cut-up:inner diameter	19.3%		22.6%		22.4%		22.9%	18.2%	33.8%
height of upper lip	50		35.4		46		34.8	28.7	-
form of upper lip	Roman pressed		Roman pressed		Roman pressed		Roman pressed	Roman pressed	pressed
diameter toe	13.4		13.9		12.7		10	14.4	7.2
diameter toe hole	6.9		4.1		5.7		5.7	4.6	5.9
length of foot	149*		162		154		153*	143	184
resonator length total	579		459		403		343	326	163
resonator length without tuning slide etc.	573		371		365		325	312	-
height of languid	2		1		1.7		0.9	0.9	1.7
bevel of languid	45		80		90		90	80	70
nicks	0		0		0		0	0	0
flue	0.35		0.85		0.95		0.75	0.4	0.4
flue:toe hole	5.1%		20.7%		16.7%		13.2%	8.7%	6.8%
ear length	-		-		-		-	-	-
ear width	-		-		-		-	-	-
tuning slide height (stopped pipes)	-		-		-		-	-	-
thickness upper wall	0.4		0.8		0.5		0.3	0.6	0.4
thickness wall near mouth	0.6		0.7		0.2		0.3	0.2	0.4
thickness wall near foot hole	0.4		0.8		0.4		0.1	0.4	0.3
observations	foot collapsed	pipe missing	collapsed toe; 78mm new on top	pipe missing	collapsed toe	pipe missing	foot collapsed+cotton	foot and toe coll.	totally different pipe

Sibayo, scaling measurements rank III

Sibayo, 3rd rank (III)

pipe number	9	10	11	12	13	14	15	16	17
circumference	105	90	99	99	97	61		73	74
diameter	33.4	28.6	31.5	31.5	30.9	19.4		23.2	23.6
inner diameter	32.2	26.8	30.3	30.3	30.3	18.8		22.0	22.6
surface area	815.5	566.1	721.7	721.7	719.9	278.1		381.4	399.6
resonator length:diameter	8.5	9.8	8.1	8.2	7.4	11.7		8.7	7.9
resonator length:surface area	0.35	0.50	0.35	0.36	0.32	0.82		0.53	0.47
width of mouth	25.7	21.4	24.1	26.8	24.6	12.7		19.7	17
width of mouth:inner diameter	79.8%	79.7%	79.5%	88.4%	81.3%	67.5%		89.4%	75.4%
cut-up	8.4	6.7	6.8	8.3	8.8	5.4		4.5	5.9
cut-up:inner diameter	26.1%	25.0%	22.4%	27.4%	29.1%	28.7%		20.4%	26.2%
height of upper lip	35.4	26.8	26.2	-	-	-		22.9	23.1
form of upper lip	Roman pressed	Roman pressed	Roman pressed	pressed	pressed	pressed		Roman pressed	pressed
diameter toe	9.9	8.9	9.9	8.9	10	7.6		9.3	7.8
diameter toe hole	5.9	5.8	4.5	5.1	5.5	4.1		5.2	4.3
length of foot	138	163	159	176	173	188		169	164
resonator length total	284	282	255	257	229	227		202	187
resonator length without tuning slide etc.	-	257	243	239	218	214		184	173
height of languid	1.4	1.3	1	-	1.1	1		1.5	0.7
bevel of languid	90	90	90	-	50	90		80	90
nicks	0	0	0	0	0	0		0	0
flue	1	0.75	0.85	1	0.75	0.75		1	0.6
flue:toe hole	16.9%	12.9%	18.9%	19.6%	13.6%	18.3%		19.2%	14.0%
ear length	-	-	-	-	-	-		-	-
ear width	-	-	-	-	-	-		-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-		-	-
thickness upper wall	6	0.4	0.2	0.6	0.8	0.7		0.4	0.6
thickness wall near mouth	0.6	0.9	0.6	0.6	0.3	0.3		0.6	0.5
thickness wall near foot hole	0.4	0.5	0.6	0.4	0.5	0.5		0.5	0.5
observations	foot bent and dented		foot bent and dented	foot bent and dented; languid descended	foot bent and dented	very narrow diameter	pipe missing		

Sibayo, scaling measurements rank III (continued)

Sibayo, 3rd rank (III)

pipe number	18	19	20	21	22	23	24	25	26
circumference	62	68	71	69		66	61	73	
diameter	19.7	21.6	22.6	22.0		21.0	19.4	23.2	
inner diameter	19.3	21.0	21.2	20.8		20.2	18.2	22.4	
surface area	293.6	347.8	353.0	338.6		320.7	260.6	395.4	
resonator length:diameter	9.6	7.5	6.5	6.6		6.1	6.4	4.3	
resonator length:surface area	0.64	0.47	0.42	0.43		0.40	0.48	0.25	
width of mouth	15.5	15.8	17.7	16.3		15.9	14.1	17	
width of mouth:inner diameter	80.2%	75.1%	83.5%	78.5%		78.7%	77.4%	75.8%	
cut-up	4.7	5.4	5.3	5.3		4.7	5.8	5.3	
cut-up:inner diameter	24.3%	25.7%	25.0%	25.5%		23.3%	31.8%	23.6%	
height of upper lip	15.8	20.5	17.9	25.2		15.2	21.2	23.9	
form of upper lip	Roman pressed	pressed	Roman pressed	pressed		Roman pressed	Roman pressed	Roman pressed	
diameter toe	8.3	8.2	8.6	8.9		8.6	12.9	9.9	
diameter toe hole	3.1	4.5	3.1	4.4		3.2	4.6	5.6	
length of foot	177	161	162	158		161	158	167	
resonator length total	189	162	148	144		128	124	100	
resonator length without tuning slide etc.	108	153	143	131		116	109	-	
height of languid	-	1	1	0.9		0.9	0.8	1	
bevel of languid	90	90	80	85		50	85	90	
nicks	0	0	0	0		0	0	0	
flue	0.7	0.75	0.25	0.4		0.55	0.7	0.35	
flue:toe hole	22.6%	16.7%	8.1%	9.1%		17.2%	15.2%	6.3%	
ear length	-	-	-	-		-	-	-	
ear width	-	-	-	-		-	-	-	
tuning slide height (stopped pipes)	-	-	-	-		-	-	-	
thickness upper wall	0.3	0.3	0.2	0.4		0.4	0.7	0.6	
thickness wall near mouth	0.2	0.3	0.7	0.6		0.4	0.6	0.4	
thickness wall near foot hole	0.3	0.4	0.3	0.3		0.4	0.7	0.4	
observations	languid descended; 67 mm new on top	8 mm new on top			pipe missing				pipe missing

Sibayo, scaling measurements rank III (continued)

Sibayo, 3rd rank (III)

pipe number	27	28	29	30	31	32	33	34	35
circumference	69	63	55	53	56	47	49	51	44
diameter	22.0	20.1	17.5	16.9	17.8	15.0	15.6	16.2	14.0
inner diameter	20.8	19.7	16.7	15.1	16.8	14.4	14.4	15.2	13.6
surface area	338.6	303.4	219.2	178.4	222.3	162.0	162.8	182.3	145.4
resonator length:diameter	4.0	4.1	4.8	4.7	3.5	4.9	4.7	3.9	3.6
resonator length:surface area	0.26	0.27	0.38	0.44	0.28	0.46	0.45	0.35	0.35
width of mouth	16.6	12.9	12.5	12.7	13.8	12.3	11.7	13	11
width of mouth:inner diameter	79.9%	65.6%	74.8%	84.3%	82.0%	85.7%	81.3%	85.3%	80.8%
cut-up	5.1	4.5	4.5	3.5	4.2	3.3	3.4	4.7	3.1
cut-up:inner diameter	24.6%	22.9%	26.9%	23.2%	25.0%	23.0%	23.6%	30.9%	22.8%
height of upper lip	17.5	-	18.9	14	14.9	11	10.9	15.1	14.7
form of upper lip	Roman pressed	pressed	Roman pressed	Roman pressed	Roman pressed	bayleaf pressed	bayleaf pressed	Roman pressed	Roman pressed
diameter toe	8.6	7.4	8.2	6.3	7.8	8.1	8	8	7.2
diameter toe hole	5.1	4.3	5.2	3.9	2.7	5.4	5.6	3.8	3.7
length of foot	158	165	161	164	161	187	185	171	164
resonator length total	88	83	84	79	62	74	73	63	51
resonator length without tuning slide etc.	-	-	-	-	-	68	61	-	-
height of languid	0.7	1.2	1	0.9	1	1.4	1	-	1*
bevel of languid	85	90	90	90	85	50	60	-	90
nicks	0	0	0	0	0	0	0	0	0
flue	0.35	0.35	0.75	0.4	0.35	0.2	0.35	0.75	0.4
flue:toe hole	6.9%	8.1%							
ear length	-	-	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-	-
thickness upper wall	0.4	0.6	0.3	0.9	0.3	0.3	0.6	0.6	0.4
thickness wall near mouth	0.6	0.2	0.4	0.9	0.5	0.3	0.6	0.5	0.2
thickness wall near foot hole	0.4	0.6	0.3	0.6	0.1	0.4	0.3	0.7	0.7
observations		material much more shiny than other pipes						languid descended	

Sibayo, scaling measurements rank III (continued)

Sibayo, 3rd rank (III)

pipe number	36	37	38	39	40	41	42
circumference	51	51	56		30	37	46
diameter	16.2	16.2	17.8		9.5	11.8	14.6
inner diameter	15.0	15.4	17.2		9.1	11.0	13.6
surface area	177.5	187.1	233.0		65.7	94.6	146.2
resonator length:diameter	3.1	3.4	2.2		4.9	8.2	6.1
resonator length:surface area	0.29	0.29	0.17		0.71	1.02	0.61
width of mouth	13	11.3	13.6		6.1	11.4	11.7
width of mouth:inner diameter	86.5%	73.2%	79.0%		66.7%	103.8%	85.8%
cut-up	4.4	4.6	1.8		4.7	-	4.7
cut-up:inner diameter	29.3%	29.8%	10.4%		51.4%	-	34.5%
height of upper lip	13	-	13.8		-	-	11.7
form of upper lip	Roman pressed	-	Roman pressed		pressed	pressed	Roman pressed
diameter toe	7.8	6.7	8.8		7.5	-	8.1
diameter toe hole	3.1	5.2	4.3		3.4	-	4.6
length of foot	164	159	165		172	171	163
resonator length total	51	55	39		47	97	89
resonator length without tuning slide etc.	-	47	-		-	-	-
height of languid	1.2	1.3	0.6		-	1.4	1
bevel of languid	90	90	60		-	90	90
nicks	0	0	0		0	0	0
flue	0.25	0.4	<0.0.5		0.55	0.35	0.2
flue:toe hole							
ear length	-	-	-		-	-	-
ear width	-	-	-		-	-	-
tuning slide height (stopped pipes)	-	-	-		-	-	-
thickness upper wall	0.6	0.5	0.4		0.2	0.4	0.3
thickness wall near mouth	0.6	0.4	0.3		0.2	0.4	0.5
thickness wall near foot hole	0.4	0.4	0.6		0.4	0.4	0.5
observations			narrow diameter	pipe missing	languid descended		

Sibayo, scaling measurements rank III (continued)

Sibayo, 4th rank (IV)

29/43 pipes

pipe number	0	1	2	3	4	5	6	7	8
circumference	59.0		60.0				61	55.5	52.5
diameter	18.8		19.1				19.4	17.7	16.7
inner diameter	17.4		18.1				18.2	16.5	15.5
surface area	237.2		257.3				260.6	212.9	189.0
resonator length:diameter	10.9		9.9				7.3	8.2	7.4
resonator length:surface area	0.86		0.73				0.54	0.68	0.66
width of mouth	12.8		14.9				13.10	15.9	15.9
width of mouth:inner diameter	73.6%		82.3%				71.9%	96.6%	102.5%
cut-up	6.2		4.6				4.6	4.5	5.8
cut-up:inner diameter	35.7%		25.4%					27.3%	37.4%
height of upper lip	-		-				-	11.6	11.7
form of upper lip	pressed		pressed				pressed	pressed	Roman pressed
diameter toe	8.5		7				6.8	7.1	7.4
diameter toe hole	6.8		5.3				5.2	4.2	4.2
length of foot	183		177				188	188	166
resonator length total	205		189				142	144	124
resonator length without tuning slide etc.	197		163				133	131	120
height of languid	1.3		0.9				1.2	1.3	0.7
bevel of languid	75		90				80	90	90
nicks	0		0				0	0	0
flue	0.4		0.75				0.4	0.4	0.15
flue:toe hole	5.9%		14.2%					9.5%	3.6%
ear length	-		-				-	-	-
ear width	-		-				-	-	-
tuning slide height (stopped pipes)	-		-				-	-	-
thickness upper wall	0.8		0.7				0.6	0.3	0.5
thickness wall near mouth	0.7		0.5				0.6	0.6	0.6
thickness wall near foot hole	0.3		0.5				0.6	0.8	0.6
observations		pipe missing		pipe missing	pipe missing	pipe missing		languid seems almost to be more than 90 degrees	lang. desc. 1 side

Sibayo, scaling measurements rank IV

Sibayo, 4th rank (IV)

pipe number	9	10	11	12	13	14	15	16	17
circumference	48.0	49.0		46.5				41.5	38.0
diameter	15.3	15.6		14.8				13.2	12.1
inner diameter	14.3	14.2		13.8				12.4	11.3
surface area	160.1	158.3		149.6				121.0	100.2
resonator length:diameter	8.4	7.8		7.4				9.7	10.3
resonator length:surface area	0.81	0.76		0.73				1.06	1.25
width of mouth	11.9	11.3		11.8				10.2	9.1
width of mouth:inner diameter	83.3%	79.6%		85.5%				82.2%	80.6%
cut-up	4.4	3.7		3.2				3.3	3.8
cut-up:inner diameter	30.8%	26.1%		23.2%				26.6%	33.6%
height of upper lip	10.2	8.4		9.7				12	8.1
form of upper lip	Roman pressed	Roman pressed		bayleaf pressed				Roman pressed	Roman pressed
diameter toe	7.8	7		7.7				6.5	5.8
diameter toe hole	3.7	4.6		6.2				3.5	3.5
length of foot	165	184		188				173	166
resonator length total	129	121		109				128	125
resonator length without tuning slide etc.	119	-		-				-	-
height of languid	0.8	1.2		1.1				1.1	0.8
bevel of languid	90	85		80				90	90
nicks	0	0		0				0	0
flue	0.35	0.4		0.35				0.15	0.3
flue:toe hole	9.5%	8.7%		5.6%				4.3%	8.6%
ear length	-	-		-				-	-
ear width	-	-		-				-	-
tuning slide height (stopped pipes)	-	-		-				-	-
thickness upper wall	0.5	0.7		0.3				0.4	0.4
thickness wall near mouth	0.5	0.7		0.5				0.4	0.4
thickness wall near foot hole	0.7	0.8		0.6				0.5	0.5
observations			pipe missing		pipe missing	pipe missing	pipe missing		

Sibayo, scaling measurements rank IV (continued)

Sibayo, 4th rank (IV)

pipe number	18	19	20	21	22	23	24	25	26
circumference	44.0	41.0	48.0	37.0		46.0	47.0	41.0	42.0
diameter	14.0	13.1	15.3	11.8		14.6	15.0	13.1	13.4
inner diameter	13.0	11.9	14.9	11.2		13.6	14.4	12.1	12.8
surface area	132.8	110.3	173.9	98.1		146.2	162.0	114.1	128.1
resonator length:diameter	8.4	8.9	6.4	9.1		5.8	5.3	6.0	5.4
resonator length:surface area	0.89	1.05	0.56	1.09		0.58	0.49	0.68	0.56
width of mouth	-	10.2	11.8	9.2		11.4	11.4	9.4	11.8
width of mouth:inner diameter	-	86.1%	79.3%	82.3%		83.6%	79.4%	78.0%	92.4%
cut-up	-	4.5	3.1	3.4		4.2	3.6	3.3	4.3
cut-up:inner diameter	-	38.0%	20.8%	30.4%		30.8%	25.1%	27.4%	33.7%
height of upper lip	12.9	11.1	10.5	-		8.7	-	12.9	12.3
form of upper lip	Roman pressed	Roman pressed	Roman pressed	pressed		Roman pressed	pressed	Roman pressed	Roman pressed
diameter toe	6.4	7.3	7.3	6		8.1	7.8	6.5	5.5
diameter toe hole	3.6	2.8	4.8	3.9		6.1	6.4	4.4	3.9
length of foot	162	161	164	166		188	187	161	183
resonator length total	118	116	98	107		85	79	78	72
resonator length without tuning slide etc.	111	108	94	-		81	69	71	63
height of languid	0.8	1.2	1.2	0.8		1.8	1.3	1.1	1
bevel of languid	90	90	90	90		90	90	85	90
nicks	0	0	0	0		0	0	0	0
flue	0.75	0.35	0.25	0.3		0.35	0.4	0.45	0.35
flue:toe hole	20.8%	12.5%	5.2%	7.7%		5.7%	6.3%	10.2%	9.0%
ear length	-	-	-	-		-	-	-	-
ear width	-	-	-	-		-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-		-	-	-	-
thickness upper wall	0.7	0.6	0.2	0.3		0.6	0.4	0.9	0.2
thickness wall near mouth	0.5	0.6	0.2	0.3		0.5	0.3	0.5	0.3
thickness wall near foot hole	0.4	0.7	0.4	0.3		0.6	0.6	0.5	0.4
observations	broken in 2 at mouth				pipe missing				textile on toe

Sibayo, scaling measurements rank IV (continued)

Sibayo, 4th rank (IV)

pipe number	27	28	29	30	31	32	33	34	35
circumference	43.0	33.5	39.0	30.0		31.0	32.5	26.0	27.0
diameter	13.7	10.7	12.4	9.5		9.9	10.3	8.3	8.6
inner diameter	12.5	9.9	11.6	8.5		9.5	9.3	7.5	7.8
surface area	122.5	76.4	105.9	57.4		70.4	68.6	43.9	47.7
resonator length:diameter	4.8	5.5	4.2	5.4		5.3	4.5	6.2	5.5
resonator length:surface area	0.54	0.77	0.49	0.91		0.74	0.69	1.16	0.99
width of mouth	9.7	8.3	9.1	5.7		8.1	8.1	6.2	7.4
width of mouth:inner diameter	77.7%	84.1%	78.4%	66.7%		85.6%	86.7%	82.9%	94.9%
cut-up	3.2	2.5	4.2	2.2		2.3	2.3	1.7	2.1
cut-up:inner diameter	25.6%	25.3%	36.2%	25.7%		24.3%	24.6%	22.7%	26.9%
height of upper lip	-	9.2	8.3	-		-	9.1	8.9	-
form of upper lip	-	pressed	Roman pressed	pressed		pressed	Roman pressed	Roman pressed	pressed
diameter toe	6.5	6.7	6.9	7.1		6.6	6.6	6.3	6.3
diameter toe hole	2.8	2.5	3.8	5.2		4.3	2.3	3.2	3.2
length of foot	166	160	164	172		167	162	163	165
resonator length total	66	59	52	52		52	47	51	47
resonator length without tuning slide etc.	56	58	-	-		46	42	45	-
height of languid	1.4	1	1	0.7		0.7	0.5	0.6	0.6
bevel of languid	85	90	90	90		80	85	90	90
nicks	0	0	0	0		0	0	0	0
flue	0.35	0.4	0.25	0.15		0.3	0.35	0.15	0.4
flue:toe hole	12.5%	16.0%	6.6%	2.9%		7.0%	15.2%		
ear length	-	-	-	-		-	-	-	-
ear width	-	-	-	-		-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-		-	-	-	-
thickness upper wall	0.6	0.2	0.3	0.3		0.2	0.3	0.2	0.4
thickness wall near mouth	0.6	0.4	0.4	0.5		0.2	0.5	0.4	0.4
thickness wall near foot hole	0.4	0.5	0.6	0.6		0.2	0.4	0.2	0.4
observations	pattern (foot); no upper lip			leather toe	pipe missing				

Sibayo, scaling measurements rank IV (continued)

Sibayo, 4th rank (IV)

pipe number	36	37	38	39	40	41	42
circumference		35.5	36.0		58.0		
diameter		11.3	11.5		18.5		
inner diameter		10.5	10.9		17.3		
surface area		86.6	92.6		234.0		
resonator length:diameter		5.4	6.2		7.1		
resonator length:surface area		0.70	0.77		0.56		
width of mouth		9.7	8.8		12.3		
width of mouth:inner diameter		92.4%	81.0%		71.3%		
cut-up		5.8	2.8		4.7		
cut-up:inner diameter		55.2%	25.8%		27.2%		
height of upper lip		5.4	9.7		19.3		
form of upper lip		Roman pressed	Roman pressed		pressed		
diameter toe		5.7	5.8		6.6		
diameter toe hole		3.7	4.1		4.8		
length of foot		166	162		164		
resonator length total		61	71		131		
resonator length without tuning slide etc.		51	62		116		
height of languid		0.8	0.9		0.8		
bevel of languid		90	90		85		
nicks		0	0		0		
flue		0.7	0.4		0.75		
flue:toe hole							
ear length		-	-		-		
ear width		-	-		-		
tuning slide height (stopped pipes)		-	-		-		
thickness upper wall		0.2	0.4		0.6		
thickness wall near mouth		0.4	0.3		0.6		
thickness wall near foot hole		0.4	0.6		0.5		
observations	pipe missing			pipe missing	pipe much bigger	pipe missing	pipe missing

Sibayo, scaling measurements rank IV (continued)

Sibayo, 5th rank (V)

57/86 pipes

pipe number	0F	0B	1F	1B	2F	2B	3F
circumference	46	44			37	41.5	43
diameter	14.6	14.0			11.8	13.2	13.7
inner diameter	14.0	13.2			10.8	12.0	12.7
surface area	154.9	137.0			91.2	113.3	126.4
resonator length:diameter	0.0	0.0			0.0	10.7	8.4
resonator length:surface area	0.00	0.00			0.00	1.24	0.91
width of mouth	11.4	11.5			9.3	12.1	9.1
width of mouth:innder diameter	81.2%	87.1%			86.3%	100.8%	71.7%
cut-up	4.1	3.7			-	4.2	3.4
cut-up:inner diameter	29.2%	28.0%			-	35.0%	26.8%
height of upper lip	15.2	15.1			-	13.4	-
form of upper lip	Roman pressed	Roman pressed			Roman pressed	Roman pressed	pressed
diameter toe	7.4	5.1			6.6	6	5.1
diameter toe hole	3.9	2.1			5.2	2.8	3.5
length of foot	158	166			154	165	170
resonator length total	151	159			134	141	115
resonator length without tuning slide etc.	125	142			123	-	104
height of languid	1.3	0.7			0.8	0.7	0.8
bevel of languid	75	90			90	90	90
nicks	0	0			0	0	0
flue	0.45	0.65			0.4	0.4	0.75
flue:toe hole	11.5%	31.0%			7.7%	14.3%	21.4%
ear length	-	-			-	-	-
ear width	-	-			-	-	-
tuning slide height (stopped pipes)	-	-			-	-	-
thickness upper wall	0.3	0.4			0.5	0.6	0.5
thickness wall near mouth	0.4	0.3			0.2	0.4	0.4
thickness wall near foot hole	0.5	0.4			0.3	0.3	0.4
observations	23mm new on top		pipe missing	pipe missing	collapsed mouth		

Sibayo, scaling measurements rank V

Sibayo, 5th rank (V)

pipe number	3B	4F	4B	5F	5B	6F - 25F front row missing	6B
circumference	47		41	39.5	53		43
diameter	15.0		13.1	12.6	16.9		13.7
inner diameter	13.8		12.5	11.4	16.1		13.3
surface area	148.7		121.8	101.6	202.8		138.7
resonator length:diameter	8.8		10.3	10.5	7.2		7.5
resonator length:surface area	0.89		1.10	1.30	0.60		0.74
width of mouth	11.7		10.9	10.9	10.8		10.7
width of mouth:innder diameter	85.0%		87.5%	95.8%	67.2%		80.5%
cut-up	4.8		4.1	4.1	4.2		3.3
cut-up:inner diameter	34.9%		32.9%	36.0%	26.1%		24.8%
height of upper lip	11.1		14.3	14.9	7.1		11.2
form of upper lip	Roman pressed		Roman pressed	Roman pressed	bayleaf pressed		Roman pressed
diameter toe	5.8		6.7	6	6.3		5.3
diameter toe hole	3.3		2.6	3.1	3.2		3.5
length of foot	165		165	168	175		166
resonator length total	132		134	132	121		103
resonator length without tuning slide etc.	126		130	112	108		95
height of languid	0.9		0.8	0.8	1		0.5
bevel of languid	90		90	85	85		90
nicks	0		0	0	0		0
flue	0.5		0.45	0.35	0.4		0.35
flue:toe hole	15.2%		17.3%	11.3%	12.5%		10.0%
ear length	-		-	-	-		-
ear width	-		-	-	-		-
tuning slide height (stopped pipes)	-		-	-	-		-
thickness upper wall	0.6		0.3	0.6	0.4		0.2
thickness wall near mouth	0.5		0.3	0.5	0.3		0.3
thickness wall near foot hole	0.4		0.4	0.4	0.4		0.4
observations		pipe missing					

Sibayo, scaling measurements rank V (continued)

Sibayo, 5th rank (V)

pipe number	7B	8B	9B	10B	11B	12B	13B
circumference	45.5	39	38	38	32.5	41	46.5
diameter	14.5	12.4	12.1	12.1	10.3	13.1	14.8
inner diameter	14.1	11.4	11.3	11.3	9.7	12.1	14.2
surface area	155.8	102.3	100.2	100.2	74.6	114.1	158.4
resonator length:diameter	5.7	8.0	8.4	7.7	11.9	6.5	6.0
resonator length:surface area	0.53	0.97	1.01	0.93	1.65	0.75	0.56
width of mouth	10.4	10.3	8.9	9.7	-	10.2	8.6
width of mouth:innder diameter	73.8%	90.2%	78.8%	85.9%	-	84.6%	60.6%
cut-up	4.1	3.2	3.7	3.5	-	3.2	4.7
cut-up:inner diameter	29.1%	28.0%	32.8%	31.0%	-	26.6%	33.1%
height of upper lip	-	-	11	6.9	-	14.6	8.2
form of upper lip	Roman pressed	pressed	Roman pressed	pressed	pressed	bayleaf pressed	Roman pressed
diameter toe	5.8	5.4	5.1	6.5	5.9	6.2	6
diameter toe hole	4.4	3.6	3.3	4.2	3.2	3.3	3.5
length of foot	164	153	163	169	166	168	166
resonator length total	83	99	101	93	123	85	89
resonator length without tuning slide etc.	-	80	95	85	119	84	-
height of languid	-	0.9	0.9	1	0.8	1	0.8
bevel of languid	80	70	-	90	85	85	90
nicks	0	0	0	0	0	0	0
flue	0.35	0.2	0.35	0.35	0.05	0.4	0.35
flue:toe hole	8.0%	5.6%	10.6%	8.3%	1.6%	12.1%	10.0%
ear length	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-
thickness upper wall	0.2	0.5	0.4	0.4	0.3	0.5	0.3
thickness wall near mouth	0.4	0.4	0.4	0.4	0.3	0.3	0.3
thickness wall near foot hole	0.2	0.3	0.4	0.3	0.3	0.3	0.5
observations	no upper lip		languid descended and front of languid damaged		collapsed mouth		

Sibayo, scaling measurements rank V (continued)

Sibayo, 5th rank (V)

pipe number	14B	15B	16B	17B	18B	19B	20B
circumference	51	42	44.5	31	30.5	47.5	33
diameter	16.2	13.4	14.2	9.9	9.7	15.1	10.5
inner diameter	15.6	13.0	13.4	8.9	8.9	13.9	9.9
surface area	192.0	132.1	140.3	61.8	62.3	152.2	77.0
resonator length:diameter	4.4	5.2	4.3	5.6	8.8	5.0	6.7
resonator length:surface area	0.38	0.53	0.43	0.89	1.36	0.50	0.91
width of mouth	8.2	10.4	8.1	7.9	7.1	9.6	10.9
width of mouth:innder diameter	52.5%	80.2%	60.6%	89.1%	79.7%	69.0%	110.1%
cut-up	-	3.5	4.8	3.9	3.1	3.9	-
cut-up:inner diameter	-	27.0%	35.9%	44.0%	34.8%	28.0%	-
height of upper lip	-	-	9.5	8.3	10	9.5	-
form of upper lip	-	pressed	Roman pressed	Roman pressed	Roman pressed	Roman pressed	pressed
diameter toe	6	5.3	6.5	5.7	5.7	7.6	5
diameter toe hole	4.8	3.5	4.3	3.4	3.4	3.5	2.4
length of foot	165	181	171	165	166	159	172
resonator length total	72	70	61	55	85	76	70
resonator length without tuning slide etc.	67	61	-	-	-	-	-
height of languid	1.2	1.3	0.9	0.7	0.7	1	1.4
bevel of languid	90	80	80	90	90	90	60
nicks	0	0	0	0	0	0	0
flue	0.75	0.4	0.35	0.25	0.3	0.25	0.75
flue:toe hole	15.6%	11.4%	8.1%	7.4%	8.8%	7.1%	31.3%
ear length	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-
thickness upper wall	0.3	0.2	0.4	0.5	0.4	0.6	0.3
thickness wall near mouth	0.3	0.2	0.4	0.4	0.4	0.4	0.4
thickness wall near foot hole	0.4	0.4	0.5	0.4	0.4	0.4	0.3
observations	almost broken in 2 at mouth; no upper lip	unprof. soldering at mouth				round lower lip	

Sibayo, scaling measurements rank V (continued)

Sibayo, 5th rank (V)

pipe number	21B	22B	23B	24B	25B	26F	26B
circumference	37	38	35	35	33	35.5	41
diameter	11.8	12.1	11.1	11.1	10.5	11.3	13.1
inner diameter	10.6	10.7	10.1	10.5	9.5	10.3	12.5
surface area	87.9	89.8	80.8	87.3	70.9	83.3	121.8
resonator length:diameter	6.2	5.3	5.8	5.0	5.8	4.4	4.1
resonator length:surface area	0.83	0.71	0.80	0.64	0.86	0.60	0.44
width of mouth	9.9	9.8	7.9	8.9	7.5	9.2	7.1
width of mouth:innder diameter	93.6%	91.6%	77.9%	84.4%	78.9%	89.3%	57.0%
cut-up	3.2	2.4	3.9	3.3	3.5	3.9	2.7
cut-up:inner diameter	30.3%	22.4%	38.5%	31.3%	36.8%	37.9%	21.7%
height of upper lip	-	13.7	0	9.1	9.6	5.7	10
form of upper lip	pressed	Roman pressed	Roman pressed	pressed	Roman pressed	Roman pressed	Roman pressed
diameter toe	6	7.5	6.4	5.6	5.4	6.8	5.7
diameter toe hole	3.5	3.5	3.3	2.7	3.3	3.6	4.4
length of foot	162	164	161	166	165	165	166
resonator length total	73	64	65	56	61	50	53
resonator length without tuning slide etc.	-	-	-	-	-	-	-
height of languid	-	0.9	1.2	0.9	0.7	-	0.8
bevel of languid	90	90	90	90	90	90	70
nicks	0	0	0	0	0	0	0
flue	0.4	0.35	0.25	0.35	0.35	0.7	0.25
flue:toe hole							
ear length	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-
thickness upper wall	0.6	0.7	0.5	0.3	0.5	0.5	0.3
thickness wall near mouth	0.5	0.2	0.5	0.4	0.4	0.4	0.3
thickness wall near foot hole	0.5	0.5	0.7	0.4	0.4	0.4	0.4
observations	pointed-shaped lower lip; languid descended	round lower lip				descended languid	round lower lip

Sibayo, scaling measurements rank V (continued)

Sibayo, 5th rank (V)

pipe number	27F	27B	28F	28B	29F	29B	30F
circumference	30.5	39.5	29	32	35.5	43.5	30.5
diameter	9.7	12.6	9.2	10.2	11.3	13.8	9.7
inner diameter	9.1	11.8	8.8	9.2	10.1	13.0	8.7
surface area	65.2	108.9	61.3	66.3	80.1	133.7	59.6
resonator length:diameter	5.2	3.8	4.9	9.2	3.5	3.0	4.2
resonator length:surface area	0.77	0.44	0.73	1.42	0.50	0.31	0.69
width of mouth	5.7	7.7	7.5	7.6	8.7	8.5	8.6
width of mouth:innder diameter	62.6%	65.4%	84.9%	82.7%	86.1%	65.2%	98.8%
cut-up	3.6	2.1	2.2	2.8	3.4	-	-
cut-up:inner diameter	39.5%	17.8%	24.9%	30.5%	33.7%	-	-
height of upper lip	2	11.9	9.3	8.5	8.9	9	8.6
form of upper lip	Roman pressed	bayleaf pressed	Roman pressed	Roman pressed	Roman pressed	pressed	Roman pressed
diameter toe	5.2	5.3	5.9	6	7.1	5.6	5.8
diameter toe hole	3.4	3.1	3.6	3.3	3.8	2.7	4.3
length of foot	171	164	165	164	172	166	164
resonator length total	50	48	45	94	40	41	41
resonator length without tuning slide etc.	-	-	-	-	-	-	-
height of languid	-	0.7	0.6	0.6	0.8	0.5	0.4
bevel of languid	-	90	90	90	90	90	90
nicks	0	0	0	0	0	0	0
flue	0.07	0.05	0.4	0.35	0.15	0.35	0.2
flue:toe hole							
ear length	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-
thickness upper wall	0.3	0.4	0.2	0.5	0.6	0.4	0.5
thickness wall near mouth	0.3	0.3	0.4	0.4	0.4	0.6	0.4
thickness wall near foot hole	0.5	0.4	0.4	0.4	0.5	0.5	0.4
observations	unprof. soldering at mouth; languid descended		round lower lip		upper lip bent outwards	pipe very much crushed	breaks at mouth

Sibayo, scaling measurements rank V (continued)

Sibayo, 5th rank (V)

pipe number	30B	31F	31B	32F	32B	33F	33B
circumference	29	29.5	31.5	35.5	33	33.5	27
diameter	9.2	9.4	10.0	11.3	10.5	10.7	8.6
inner diameter	8.4	9.0	8.8	10.7	9.7	9.9	8.0
surface area	55.8	63.5	61.2	89.9	74.0	76.4	50.2
resonator length:diameter	5.0	8.1	3.4	6.7	7.2	6.5	8.5
resonator length:surface area	0.82	1.20	0.56	0.85	1.03	0.90	1.45
width of mouth	8.1	8.1	7.9	9.1	8.1	8.8	7.9
width of mouth:innder diameter	96.1%	90.1%	89.5%	85.0%	83.5%	89.2%	98.8%
cut-up	2.5	2.9	2.2	3.1	3.8	2	2.4
cut-up:inner diameter	29.7%	32.3%	24.9%	29.0%	39.2%	20.3%	30.0%
height of upper lip	-	9.7	-	11	11.5	7.1	4.4
form of upper lip	pressed	Roman pressed	pressed	Roman pressed	Roman pressed	pressed	Roman pressed
diameter toe	5	5.6	5	6.6	6	5.7	6.9
diameter toe hole	2.1	4.1	2.5	4.7	3.3	3.4	4.2
length of foot	188	168	184	154	164	172	165
resonator length total	46	76	34	76	76	69	73
resonator length without tuning slide etc.	-	70	-	62	61	69	69
height of languid	0.9	0.9	1.2	1.4	1	1	1
bevel of languid	90	90	85	90	90	90	80
nicks	0	0	0	0	0	0	0
flue	0.55	0.15	0.2	0.4	0.3	0.4	0.2
flue:toe hole							
ear length	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-
thickness upper wall	0.4	0.2	0.6	0.3	0.4	0.4	0.3
thickness wall near mouth	0.3	0.4	0.5	0.5	0.4	0.4	0.3
thickness wall near foot hole	0.4	0.4	0.6	0.4	0.3	0.5	0.4
observations	new foot tip		new foot tip		rounded lower lip	new foot tip; unprof. soldering at mouth; dents!	

Sibayo, scaling measurements rank V (continued)

Sibayo, 5th rank (V)

pipe number	34F	34B	35F	35B	36F	36B	37F
circumference	30	31.5	37.5	26	29	32	24.5
diameter	9.5	10.0	11.9	8.3	9.2	10.2	7.8
inner diameter	9.1	9.2	11.3	7.5	8.2	9.4	7.0
surface area	65.7	66.9	100.9	43.9	53.2	69.2	38.5
resonator length:diameter	5.7	6.7	3.0	7.1	5.4	4.8	6.3
resonator length:surface area	0.82	1.00	0.36	1.34	0.94	0.71	1.27
width of mouth	7.8	7.8	7.2	6.2	7.1	7.3	-
width of mouth:innder diameter	85.3%	84.5%	63.5%	82.9%	86.3%	77.8%	-
cut-up	2.5	2.1	2.6	2.8	2.1	2.9	-
cut-up:inner diameter	27.3%	22.8%	22.9%	37.5%	25.5%	30.9%	-
height of upper lip	10.6	9.9	10.7	9	7.9	10	-
form of upper lip	Roman pressed	Roman pressed	Roman pressed	Roman pressed	Roman pressed	Roman pressed	Roman pressed
diameter toe	6.7	5.7	5.7	5.4	6.3	6.9	5.1
diameter toe hole	3.9	2.8	3.2	3.4	3.3	3.3	2.4
length of foot	180	164	166	165	179	159	164
resonator length total	54	67	36	59	50	49	49
resonator length without tuning slide etc.	-	58	54	52	-	-	-
height of languid	1.1	0.8	1.1	0.9	1.1	1	0.7
bevel of languid	70	90	90	90	90	90	-
nicks	0	0	0	0	0	0	0
flue	0.35	0.6	0.2	0.15	0.15	0.2	0.15
flue:toe hole							6.3%
ear length	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-
thickness upper wall	0.2	0.4	0.3	0.4	0.5	0.4	-
thickness wall near mouth	0.2	0.5	0.4	0.4	0.3	0.5	-
thickness wall near foot hole	0.6	0.4	0.5	0.2	0.4	0.5	0.4
observations	upper end completely pressed tight	round lower lip; upper lip bent outwards	upper end pressed tight	round lower lip; upper end pressed tight	upper end pressed tight	upper end pressed tight	upper end pressed tight; breaks in 2 at mouth

Sibayo, scaling measurements rank V (continued)

Sibayo, 5th rank (V)

pipe number	37B	38F	38B	39F	39B	40F	40B
circumference	31	40.5	32	30			38.5
diameter	9.9	12.9	10.2	9.5			12.3
inner diameter	9.5	12.5	9.4	8.9			11.3
surface area	70.4	122.6	69.2	62.9			99.5
resonator length:diameter	4.6	3.0	3.0	3.2			7.7
resonator length:surface area	0.64	0.32	0.45	0.49			0.94
width of mouth	5.7	10.2	7.4	6.5			9.2
width of mouth:innder diameter	-	-	-	-			-
cut-up	1.6	4.1	6.8	2.3			3.9
cut-up:inner diameter	-	-	-	-			-
height of upper lip	-	-	9.8	-			12.4
form of upper lip	pressed	pressed	Roman pressed	pressed			Roman pressed
diameter toe	7.5	-	5.2	7.2			5.5
diameter toe hole	5.2	3.6	2.8	5.1			3.8
length of foot	172	152	162	171			167
resonator length total	45	39	31	31			94
resonator length without tuning slide etc.	-	34	23	22			81
height of languid	0.6	0.9	0.7	0.7			0.8
bevel of languid	90	90	75	90			90
nicks	0	0	0	0			0
flue	0.2	0.65	0.15	0.2			0.45
flue:toe hole	3.8%	18.1%	5.4%	3.9%			11.8%
ear length	-	-	-	-			-
ear width	-	-	-	-			-
tuning slide height (stopped pipes)	-	-	-	-			-
thickness upper wall	0.2	0.2	0.4	0.3			0.5
thickness wall near mouth	0.4	0.3	0.3	0.3			0.4
thickness wall near foot hole	0.4	0.2	0.3	0.3			0.4
observations	upper end pressed tight; unprof. soldering at mouth	new foot tip; collapsed at mouth; dents!; toe squished	rounded lower lip		pipe missing	pipe missing	

Sibayo, scaling measurements rank V (continued)

Sibayo, 5th rank (V)

pipe number	41F	41B	42F	42B
circumference				
diameter				
inner diameter				
surface area				
resonator length:diameter				
resonator length:surface area				
width of mouth				
width of mouth:innder diameter				
cut-up				
cut-up:inner diameter				
height of upper lip				
form of upper lip				
diameter toe				
diameter toe hole				
length of foot				
resonator length total				
resonator length without tuning slide etc.				
height of languid				
bevel of languid				
nicks				
flue				
flue:toe hole				
ear length				
ear width				
tuning slide height (stopped pipes)				
thickness upper wall				
thickness wall near mouth				
thickness wall near foot hole				
observations	pipe missing	pipe missing	pipe missing	pipe missing

Sibayo, scaling measurements rank V (continued)

Sibayo, loose pipes (L) (2 pipes)

pipe number	L1	L2
circumference	48	47
diameter	15.3	15.0
inner diameter	14.7	14.0
surface area	183.3	175.8
resonator length:diameter	8.1	5.5
resonator length:surface area	0.67	0.47
width of mouth	10.6	11.6
width of mouth:innder diameter	72.2%	83.1%
cut-up	3.4	4
cut-up:inner diameter	23.2%	28.7%
height of upper lip	13.8	-
form of upper lip	Roman pressed	pressed
diameter toe	6.6	8.2
diameter toe hole	3.1	6.2
length of foot	160	185
resonator length total	123	83
resonator length without tuning slide etc.	-	-
height of languid	1.2	1.1
bevel of languid	90	90
nicks	0	0
flue	0.49	0.74
flue:toe hole	15.8%	11.9%
ear length	-	-
ear width	-	-
tuning slide height (stopped pipes)	-	-
thickness upper wall	0.7	0.7
thickness wall near mouth	0.3	0.5
thickness wall near foot hole	0.5	0.6
observations		was lying behind organ according to one of the kids; never seen it there before. Maybe kids removed it from the tow board.

Sibayo, scaling measurements, loose pipes

Sibayo, drone pipes (D) 2/2pipes

pipe number	D1	D2
length of resonator	276.5	224.5
width	170.0	150.0
depth	155.0	146.0
surface area	26350.0	21900.0
resonator length:surface area	0.01	0.01
width of mouth		
cut-up	3.5	3.2
Vorschlag height	100	100
Vorschlag thickness	13	15
observations		

Sibayo, scaling measurements drone pipes

Callalli, front rank (I)

23/23 pipes

pipe number	1	2	3	4	5	6
circumference	410	396	372	357	339	320
diameter	130.5	126.1	118.4	113.6	107.9	101.9
inner diameter	129.7	125.5	117.0	112.4	106.7	101.1
Töpfersche Normalmensur						
deviation from Töpfer	*130.5*	*126.1*	*118.4*	*113.6*	*107.9*	*101.9*
deviation from Töpfer (in semitones)						
surface area	13213.5	12360.5	10753.4	9929.0	8942.9	8021.2
resonator length:diameter	11.8	10.2	11.6	11.7	11.4	11.8
resonator length:surface area	0.12	0.10	0.13	0.13	0.14	0.15
width of mouth	101	96	93	90	85	80
width of mouth:inner diameter	77.9%	76.5%	79.5%	80.0%	79.7%	79.2%
cut-up	21	23.6	24.1	23.6	19.4	19.8
cut-up:inner diameter	16.2%	18.8%	20.6%	21.0%	18.2%	19.6%
height of upper lip	80	72	70	64	68	60
form of upper lip	Roman pressed-scored	Roman pressed-scored	Roman pressed in	Roman pressed in	Roman pressed in	Roman pressed in
diameter toe	18.4	18	18.4	18.3	17.7	18.4
diameter toe hole	16.4	15.7	15.1	15.3	14	14.7
length of foot	236	255	254	250	255	255
resonator length total	1540	1285	1370	1325	1230	1200
resonator length without tuning slide etc.	1500	-	1425	-	1265	1150
height of languid	2.4	1.7	2.9	2.5	2.3	2.3
angle of languid	90°	90°	85°	80°	90°	85°
nicks	-	-	-	-	-	-
flue	1	0.8	1	0.9	1	1.5
flue:toe hole	6.1%	5.1%	6.6%	5.9%	7.1%	10.2%
ear length	-	-	-	-	-	-
ear width	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-
thickness upper wall	0.4	0.3	0.7	0.6	0.6	0.4
thickness wall near mouth	0.6	1	1	0.8	0.8	0.9
thickness wall near foot hole	0.8	0.9	0.8	0.9	0.8	1.2
obersvations	top 20cm now on top	23cm new on top	25.2cm new on top	14.7cm new on top	15.3+7.5cm new on top	20cm new on top

Callalli, scaling measurements rank I

Callalli, front rank (I)

pipe number	7	8	9	10	11	12
circumference	305	284	274	261	253	229
diameter	97.1	90.4	87.2	83.1	80.5	72.9
inner diameter	95.9	89.2	86.4	81.9	79.7	71.7
Töpfersche Normalmensur						
deviation from Töpfer	*97.1*	*90.4*	*87.2*	*83.1*	*80.5*	*72.9*
deviation from Töpfer (in semitones)						
surface area	7220.8	6249.1	5865.3	5265.4	4993.0	4036.9
resonator length:diameter	11.5	11.6	11.4	12.0	11.2	11.7
resonator length:surface area	0.16	0.17	0.17	0.19	0.18	0.21
width of mouth	78	70	69	64	63	58
width of mouth:inner diameter	81.3%	78.5%	79.8%	78.2%	79.0%	80.9%
cut-up	16.4	17.2	15.8	15	13.4	14.2
cut-up:inner diameter	17.1%	19.3%	18.3%	18.3%	16.8%	19.8%
height of upper lip	62	55	50	48	50	44
form of upper lip	Roman pressed in	Roman pressed-scored	Roman pressed-scored	Roman pressed-scored	Roman pressed-scored	Roman pressed-scored
diameter toe	19.3	15.4	13.7	14.1	13.6	13.6
diameter toe hole	14.6	12.9	11.8	11.6	11.3	10.1
length of foot	257	273	280	308	308	370
resonator length total	1120	1050	993	994	900	855
resonator length without tuning slide etc.	1090	1030	933	-	-	-
height of languid	2	2	2	1.9	2.3	1.8
angle of languid	85°	90°	85°	90°	80°	90°
nicks	-	-	-	-	-	-
flue	1.2	1.5	1.5	1.2	1.3	0.9
flue:toe hole	8.2%	11.6%	12.7%	10.3%	11.5%	8.9%
ear length	-	-	-	-	-	-
ear width	-	-	-	-	-	
tuning slide height (stopped pipes)	-	-	-	-	-	-
thickness upper wall	0.6	0.6	0.4	0.6	0.4	0.6
thickness wall near mouth	0.7	0.8	0.8	0.6	0.7	0.7
thickness wall near foot hole	0.8	0.6	0.8	0.6	0.8	0.8
obersvations	11cm new on top	9cm new on top	9cm new on top; severely damaged	9cm new on top	9.7cm new on top, bad soldering seam	13cm new on top, bad soldering seam near languid

Callalli, scaling measurements rank I (continued)

Callalli, front rank (I)

pipe number	13	14	15	16	17	18
circumference	240	191	221	214	199	182
diameter	76.4	60.8	70.3	68.1	63.3	57.9
inner diameter	75.6	59.6	69.5	66.9	61.9	56.9
Töpfersche Normalmensur						
deviation from Töpfer	*76.4*	*60.8*	*70.3*	*68.1*	*63.3*	*57.9*
deviation from Töpfer (in semitones)						
surface area	4488.2	2789.6	3798.7	3517.1	3013.6	2545.7
resonator length:diameter	10.1	10.9	9.9	11.0	10.1	9.9
resonator length:surface area	0.17	0.24	0.18	0.21	0.21	0.23
width of mouth	58	46	54	52	49	44
width of mouth:inner diameter	76.7%	77.2%	77.6%	77.7%	79.1%	77.3%
cut-up	15.2	16.8	13.8	13.5	12.6	12.3
cut-up:inner diameter	20.1%	28.2%	19.8%	20.2%	20.3%	21.6%
height of upper lip	45	35	37	40	37	34
form of upper lip	Roman pressed-scored	Roman pressed-scored	Roman pressed-scored	Roman pressed-scored	Roman pressed-scored	Roman pressed-scored
diameter toe	13.4	13.7	14.2	14.1	12.1	12.5
diameter toe hole	9.4	11	10.5	11.6	10	10
length of foot	363	470	424	424	475	500
resonator length total	774	665	694	748	638	575
resonator length without tuning slide etc.	-	618	-	-	580	550
height of languid	1.6	1.8	2.5	2.1	1.7	2
angle of languid	90°	90°	90°	90°	85°	90°
nicks	-	-	3	-	-	-
flue	0.9	1.1	1	0.9	0.8	<1
flue:toe hole	9.6%	10.0%	9.5%	7.8%	8.0%	#¡VALOR!
ear length	-	-	-	-	-	-
ear width	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-
thickness upper wall	0.4	0.6	0.4	0.6	0.7	0.5
thickness wall near mouth	0.8	1	0.8	0.7	0.8	0.4
thickness wall near foot hole	-	1	1	0.6	0.8	1.2
obersvations	1.4cm new on top, bad soldering seam on foot	4.7cm new on top	1.7cm new on top; bad soldering seam resonator and languid	10.5cm new on top, bad soldering seam languid	seems to be original length of pipe	4.3cm new on top, bad soldering seam on extension, thick soldering seam languid, dent on front

Callalli, scaling measurements rank I (continued)

Callalli, front rank (I)

pipe number	19	20	21	22	23
circumference	190	176	152	136	125
diameter	60.5	56.0	48.4	43.3	39.8
inner diameter	59.5	55.2	47.6	42.5	39.2
Töpfersche Normalmensur					
deviation from Töpfer	*60.5*	*56.0*	*48.4*	*43.3*	*39.8*
deviation from Töpfer (in semitones)					
surface area	2778.5	2395.1	1778.3	1418.0	1206.2
resonator length:diameter	9.3	8.9	9.3	9.5	8.8
resonator length:surface area	0.20	0.21	0.25	0.29	0.29
width of mouth	46	44	35	32	28
width of mouth:inner diameter	77.3%	79.7%	73.6%	75.3%	71.4%
cut-up	11.5	11.4	10.6	9.1	8.7
cut-up:inner diameter	19.3%	20.6%	22.3%	21.4%	22.2%
height of upper lip	34	39	26	25	21
form of upper lip	Roman pressed-scored	Roman pressed in	Roman pressed in	Roman pressed in	Roman pressed-scored
diameter toe	11.9	13.5	13.5	10.8	12.1
diameter toe hole	9.7	10.3	9.7	8.4	7.6
length of foot	507	520	568	541	595
resonator length total	560	496	448	410	350
resonator length without tuning slide etc.	530	440	422	360	344
height of languid	1.8	1.6	0.7	1.2	1.9
angle of languid	90°	85°	90°	90°	80°
nicks	-	-	-	-	-
flue	1	<1	1.6	1.2	<1
flue:toe hole	10.3%	#¡VALOR!	16.5%	14.3%	#¡VALOR!
ear length	-	-	-	-	-
ear width	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-
thickness upper wall	0.5	0.4	0.4	0.4	0.3
thickness wall near mouth	0.4	0.6	0.3	0.3	0.3
thickness wall near foot hole	1	0.8	0.4	0.5	-
obersvations	seems to be original length of pipe	visible that pipe is painted	very light; bad soldering seam languid	very light; bad soldering seams	bronze color next to soldering seam

Callalli, scaling measurements rank I (continued)

Callalli, 2nd rank (II)	74/83 pipes											
pipe number	1/C2	2/C#2	3/D2	4/D#2	5/E2	6/F2	7/F#2	8/G2	9/G#2	10/A2	11/A#2	12/H2
circumference							163	170	174	175	174	169
diameter							51.9	54.1	55.4	55.7	55.4	53.8
inner diameter							49.9	52.3	53.8	53.7	53.8	52.0
Töpfersche Normalmensur							*54.9*	*52.6*	*50.4*	*48.2*	*46.2*	*44.2*
deviation from Töpfer							*-5.0*	*-0.3*	*3.4*	*5.5*	*7.6*	*7.8*
deviation from Töpfer (in semitones)							*-2HT*	*0*	*1.5HT*	*2.5HT*	*3.5HT*	*4HT*
surface area							2114.3	2299.8	2409.3	2437.1	2409.3	2272.8
resonator length:diameter							11.0	10.1	9.4	8.7	8.2	8.2
resonator length:surface area							0.27	0.24	0.22	0.20	0.19	0.19
width of mouth							39.8	42	43.8	42.4	42.6	42.2
width of mouth:inner diameter							79.8%	80.3%	81.4%	79.0%	79.2%	81.2%
cut-up							12.2	14.9	16.7	17.6	21.3	20.2
cut-up:inner diameter							24.5%	28.5%	31.0%	32.8%	39.6%	38.9%
height of upper lip							-	-	60.3	-	-	-
form of upper lip							pressed in	pressed in	Roman pressed in	pressed in	pressed in	hardly pressed in
diameter toe							12.5	14.8	13.5	12.7	14.1	11.5
diameter toe hole							5.8	11	5.7	9.8	-	6.8
length of foot							217	215	219	230	220	225
resonator length total							573	544	520	485	456	440
resonator length without tuning slide etc.							-	-	-	-	-	-
height of languid							1.5	1.9	2	1.5	1.6	1.9
angle of languid							85°	80°	80°	85°	90°	90°
nicks							-	-	-	-	-	-
flue							1	0.5	1	0.5	1	0.5
flue:toe hole							17.2%	4.5%	17.5%	5.1%	-	7.4%
ear length							33.8	34.1	33	29.6	40	39.4
ear width							17.2	20	16.6	23	17.1	20
tuning slide height (stopped pipes)							-	-	-	-	-	-
thickness upper wall							-	-	-	-	-	-
thickness wall near mouth							1	0.9	0.8	1	0.8	0.9
thickness wall near foot hole							-	1	-	0.5	0.6	-
obersvations	pipe missing	pipe missing	pipe missing	pipe missing	pipe missing	pipe missing	10.9cm new on top; damages with strange structure	5cm new on top;	concave cover plate on top; shows signs of manipulation	19cm new on top; imprint of rack on foot	3.2cm new on top; tip collapsed; imprint of rack; cover plate concave	3cm new on top; imprint of rack; cover plate concave

General observations: up to #27 all stopped, after that, only back row

Callalli, scaling measurements rank II

Callalli, 2nd rank (II)

pipe number	13/C3	14/C#3	15/D3	16/D#3	17/E3	18/F3	19/F#3	20/G3	21/G#3	22/A3	23/A#3	24/H3
circumference	162	159	153	149	144	137	133	119	118	115	109	105
diameter	51.6	50.6	48.7	47.4	45.8	43.6	42.3	37.9	37.6	36.6	34.7	33.4
inner diameter	50.4	49.0	47.3	45.8	44.0	41.8	40.5	36.9	36.4	35.4	33.9	32.2
Töpfersche Normalmensur	*42.3*	*40.5*	*38.8*	*37.2*	*35.6*	*34.1*	*32.6*	*31.3*	*29.9*	*28.7*	*27.4*	*26.3*
deviation from Töpfer	*8.1*	*8.5*	*8.5*	*8.6*	*8.4*	*7.7*	*7.9*	*5.6*	*6.5*	*6.7*	*6.5*	*5.9*
deviation from Töpfer (in semitones)	*4HT*	*4.5HT*	*4.5HT*	*4.5HT*	*5HT*	*4.5HT*	*5HT*	*3.5HT*	*4.5HT*	*5HT*	*5HT*	*5HT*
surface area	2088.4	2011.8	1862.8	1766.7	1650.1	1493.6	1407.6	1126.9	1108.0	1052.4	945.5	877.3
resonator length:diameter	7.8	7.6	7.1	7.1	7.0	6.9	6.8	7.2	6.8	6.6	6.6	6.2
resonator length:surface area	0.19	0.19	0.19	0.19	0.19	0.20	0.20	0.24	0.23	0.23	0.24	0.24
width of mouth	39	38	37.8	35.9	34.7	33.4	31.1	27.7	27	27.6	25.7	23.9
width of mouth:inner diameter	77.4%	77.5%	79.9%	78.3%	78.8%	79.9%	76.7%	75.1%	74.3%	78.0%	75.8%	74.2%
cut-up	19	17.9	14.9	17.6	7.1	14.6	16.5	12	14.7	14.6	13.4	10.1
cut-up:inner diameter	37.7%	36.5%	31.5%	38.4%	16.1%	34.9%	40.7%	32.5%	40.4%	41.2%	39.5%	31.3%
height of upper lip	-	-	31	-	27.3	35	-	49.8	-	22.4	-	21.1
form of upper lip	hardly pressed in	hardly pressed in	Roman pressed in	pressed in	Roman pressed in	Roman pressed in	pressed in	Roman pressed in	pressed in	Roman pressed in	pressed in	Roman pressed in
diameter toe	12.7	12.7	11.6	11.6	11.1	11.2	11	11.1	11	10.2	10.8	11.2
diameter toe hole	6.3	6.3	6.4	6.2	7	7.3	7.9	6.5	6.2	5.5	6.5	6.6
length of foot	220	220	221	222	220	220	220	215	215	217	218	215
resonator length total	403	385	348	335	320	303	286	271	255	241	228	207
resonator length without tuning slide etc.	-	-	-	-	-	-	-	-	-	-	-	-
height of languid	1.4	2.3	2.2	2	1.7	1.8	1.7	-	2	1.9	1.1	1.3
angle of languid	90°	90°	90°	90°	90°	90°	90°	90°	80°	85°	90°	90°
nicks	-	-	-	-	-	-	-	-	-	7	-	-
flue	1	1	0.5	0.5	0.5	0.5	1	1	1	1	1.5	1
flue:toe hole	15.9%	15.9%	7.8%	8.1%	7.1%	6.8%	12.7%	15.4%	16.1%	18.2%	23.1%	15.2%
ear length	40.2	40.1	40.6	37.3	31.9	31.8	32.2	30.5	30.4	30.4	30.2	31.6
ear width	19.2	19	22	17.6	18.3	17.9	19.2	18.2	17.6	18.1	16.4	18.1
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-	-	-	-	-
thickness upper wall	-	-	-	-	-	-	-	-	-	-	-	-
thickness wall near mouth	0.6	0.8	0.7	0.8	0.9	0.9	0.9	0.5	0.6	0.6	0.4	0.6
thickness wall near foot hole	-	-	-	-	-	0.5	-	-	-	-	-	-
obersvations	1.5cm new on top; bad soldering seam ear	imprint of rack; cover plate concave; bad soldering seam ear	cover plate concave	imprint of rack; cover plate concave	almost detached; imprint of rack; cover plate	lower lip dented in		hole closed with solder; scotch tape on cover plate; low position languid	dent on backside foot	ears very thin; Rotbolus on whole cover plate top		

Callalli, scaling measurements rank II (continued)

Callalli, 2nd rank (II)

pipe number	25/C4	26/C#4	27/D4	28/D#4-front	28/D#4-back	29/E4-front	29/E4-back	30/F4-front	30/F4--back	31/F#4--front	31/F#4--back	32/G4-front
circumference	105	98	96	110	109	99	104	96	109	94	96	90
diameter	33.4	31.2	30.6	35.0	34.7	31.5	33.1	30.6	34.7	29.9	30.6	28.6
inner diameter	32.2	30.0	29.2	34.2	33.3	30.3	31.7	29.6	33.1	28.7	29.6	27.2
Töpfersche Normalmensur	*25.2*	*24.1*	*23.1*	*22.1*	*22.1*	*21.1*	*21.1*	*20.2*	*20.2*	*19.3*	*19.3*	*18.6*
deviation from Töpfer	*7.0*	*5.9*	*6.1*	*12.1*	*11.2*	*9.2*	*10.6*	*9.4*	*12.9*	*9.4*	*10.3*	*8.6*
deviation from Töpfer (in semitones)	*6HT*	*5HT*	*5.5HT*	*10HT*	*9.5HT*	*8.5HT*	*8HT*	*9HT*	*11.5HT*	*9HT*	*10HT*	*9HT*
surface area	877.3	764.3	733.4	962.9	945.5	779.9	860.7	733.4	945.5	703.1	733.4	644.6
resonator length:diameter	5.8	5.8	5.7	9.6	9.9	10.1	10.3	9.5	8.8	9.5	9.8	9.2
resonator length:surface area	0.22	0.24	0.24		0.36		0.40		0.32		0.41	
width of mouth	25.3	23.5	24.3	26	26	23.2	26.8	12.6	24.4	20.9	24.4	20.4
width of mouth:inner diameter	78.5%	78.3%	83.3%	76.0%	78.1%	76.5%	84.5%	42.6%	73.7%	72.8%	82.6%	74.9%
cut-up	9.8	8.7	9.5	7.8	12.3	8.6	12	7.1	11.2	6.6	12.6	6.9
cut-up:inner diameter	30.4%	29.0%	32.6%	22.8%	36.9%	28.4%	37.8%	24.0%	33.8%	23.0%	42.6%	25.3%
height of upper lip	-	25.6	33.3	30.1	-	15.1	-	-	-	-	-	23.5
form of upper lip	pressed in	Roman pressed in	Roman pressed in	Roman pressed in	pressed in	bayleaf scored-pressed in	pressed in	pressed in	pressed in	pressed in	pressed in	Roman pressed in
diameter toe	10.7	9.6	9.4	11	9.2	10.6	9.6	11.1	9.8	11.4	10	9.9
diameter toe hole	5.1	6.3	6.5	6.7	4.6	514	4.1	5.5	4.6	5.7	5.1	6.3
length of foot	214	206	212	195	205	194	208	194	208	193	209	197
resonator length total	195	182	173	335	345	319	340	290	305	285	300	263
resonator length without tuning slide etc.	-	-	-	-	-	-	-	-	-	-	-	255
height of languid	1.6	1.4	1.9	1.3	1	1.3	1.2	1.3	1.3	1.3	1.6	1.5
angle of languid	90°	85°	90°	90°	90°	85°	90°	85°	85°	90°	85°	90°
nicks	-	-	-	-	-	-	-	-	-	-	-	-
flue	0.5	1	0.5	0.5	1	1	0.5	0.5	0.5	1	0.5	1
flue:toe hole	9.8%	15.9%	7.7%		21.7%		12.2%		10.9%		9.8%	
ear length	27.3	19.6	22	-	29	-	32.3	-	31.2	-	30.5	-
ear width	15.7	13.9	14	-	17	-	15	-	17.7	-	15.4	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-	-	-	-	-
thickness upper wall	-	-	-	0.3	-	0.8	-	0.8	-	0.8	-	1.2
thickness wall near mouth	0.6	0.6	0.7	0.4	0.7	0.6	0.7	0.5	0.8	0.6	0.5	0.7
thickness wall near foot hole	-	-	-	-	-	-	-	-	-	-	-	-
obersvations	[illegible] with solder; interesting structur inner side of ears	toe tip soldered onto rest	vertical stripe on foot	7.5cm new on top	many scratches in all directions		many scratches in all directions		many scratches in all directions		hole filled with solder; cover plate concave	

Callalli, scaling measurements rank II (continued)

Callalli, 2nd rank (II)

pipe number	32/G4-back	33/G#4-front	33/G#4-back	34/A4--front	34/A4-back	35/A#4--front	35/A#4--back	36/H4-front	36/H4-back	37/C5-front	37/C5-back	38/C#5-front
circumference	105	83	99	79	106	77	91	75	87	66	89	68
diameter	33.4	26.4	31.5	25.1	33.7	24.5	29.0	23.9	27.7	21.0	28.3	21.6
inner diameter	32.0	25.6	30.3	24.1	32.3	23.7	27.8	22.7	26.5	19.8	26.9	20.2
Töpfersche Normalmensur	*18.6*	*17.8*	*17.8*	*16.9*	*16.9*	*16.3*	*16.3*	*15.6*	*15.6*	*14.9*	*14.9*	*14.3*
deviation from Töpfer	*13.4*	*7.8*	*12.5*	*7.2*	*15.4*	*7.4*	*11.5*	*7.1*	*10.9*	*4.9*	*12.0*	*5.9*
deviation from Töpfer (in semitones)	*12.5HT*	*8HT*	*12HT*	*8HT*	*15HT*	*8.5HT*	*12HT*	*8.5HT*	*12HT*	*6.5HT*	*13.5HT*	*8HT*
surface area	877.3	548.2	779.9	496.6	894.1	471.8	659.0	447.6	602.3	346.6	630.3	368.0
resonator length:diameter	8.0	9.7	8.1	9.5	7.4	9.2	7.8	8.9	7.6	9.6	7.3	8.7
resonator length:surface area	0.31		0.33		0.28		0.34		0.35		0.33	
width of mouth	23.8	18.9	12.8	17.9	22.4	18	20.5	16.7	20.7	15.3	22.1	15.7
width of mouth:inner diameter	74.3%	73.8%	42.2%	74.1%	69.3%	75.9%	73.8%	73.7%	78.1%	77.2%	82.1%	77.5%
cut-up	11.2	6	11.1	5.9	10.7	6.1	8.8	5.6	10.2	5.2	11.4	5.5
cut-up:inner diameter	35.0%	23.4%	36.6%	24.4%	33.1%	25.7%	31.7%	24.7%	38.5%	26.3%	42.3%	27.2%
height of upper lip	-	12.5	-	18.5	-	13.7	26.6	14.8	18.7	-	-	13.4
form of upper lip	hardly pressed in	Roman pressed in	hardly pressed in	Roman pressed in	hardly pressed in	Roman pressed in	Roman pressed in	Roman pressed in	Roman pressed in	hardly pressed in	hardly pressed in	Roman pressed in
diameter toe	11.6	11	11.8	10	10.8	10.1	11.6	10.5	10.4	10.1	9.6	10.9
diameter toe hole	4.9	5.8	6	5.6	5.5	5.2	5.1	5.1	4.5	4.9	7.7	5.7
length of foot	218	198	220	200	217	200	212	203	217	205	194	205
resonator length total	268	255	254	238	248	225	225	213	210	201	208	189
resonator length without tuning slide etc.	-	-	-	-	-	-	-	-	-	-	-	-
height of languid	1.5	1.3	0.6	1.3	0.9	1.2	1.3	1.5	1.6	1.4	1.6	1.2
angle of languid	90°	90°	90°	80°	90°	90°	90°	90°	90°	90°	80°	90°
nicks	-	-	-	-	-	-	-	-	-	-	-	-
flue	1	1	1	1	1	1	0.5	1	1	1	1	1
flue:toe hole	20.4%		16.7%		18.2%		9.8%		22.2%		13.0%	
ear length	30	-	30.5	-	27.7	-	27.9	-	25	-	28.8	-
ear width	15.8	-	13.5	-	13.8	-	12.1	-	14.4	-	14	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-	-	-	-	-
thickness upper wall	-	0.5	-	0.3	-	0.4	-	0.6	-	0.5	-	-
thickness wall near mouth	0.7	0.4	0.6	0.5	0.7	0.4	0.6	0.6	0.6	0.6	0.7	0.7
thickness wall near foot hole	-	-	-	-	-	-	-	-	-	-	-	-
obersvations	6cm new on top; imprint of rack		top; top cover plate convex; imprint of rack; material damage		5.6cm new on top		3.2+1.2cm new on top; cover plate concave; rack imprint		3cm new on top; very convex top cover plate;			

Sibayo, scaling measurements rank II (continued)

Callalli, 2nd rank (II)

pipe number	38/C#5-back	39/D5-front	39/D5-back	40/D#5-front	40/D#5-back	41/E5-front	41/E5-back	42/F5-front	42/F5-back	43/F#5-front	43/F#5-back	44/G5-front
circumference	80	76	78	86	78	62	78		72	52	70	54
diameter	25.5	24.2	24.8	27.4	24.8	19.7	24.8		22.9	16.6	22.3	17.2
inner diameter	23.7	23.4	23.6	26.6	23.4	18.5	23.4		21.7	15.4	20.9	15.8
Töpfersche Normalmensur	*14.3*	*13.7*	*13.7*	*13.1*	*13.1*	*12.6*	*12.6*		*12*	*11.5*	*11.5*	*11*
deviation from Töpfer	*9.4*	*9.7*	*9.9*	*13.5*	*10.3*	*5.9*	*10.8*		*9.7*	*3.9*	*9.4*	*4.8*
deviation from Töpfer (in semitones)	*15HT*	*12HT*	*12HT*	*16HT*	*13HT*	*9HT*	*14HT*		*13.5HT*	*7HT*	*14HT*	*7HT*
surface area	509.3	459.6	484.1	588.6	484.1	305.9	484.1		412.5	215.2	389.9	232.0
resonator length:diameter	7.5	7.2	7.6	6.0	6.8	8.0	6.2		6.3	8.5	6.2	7.6
resonator length:surface area	0.38		0.39		0.35		0.32		0.35		0.36	
width of mouth	18.8	15.1	18.3	17.9	17.6	14.2	14.9		15.6	12.1	15.8	11.7
width of mouth:inner diameter	79.4%	64.6%	77.4%	67.4%	75.1%	76.6%	63.6%		71.8%	78.8%	75.7%	74.1%
cut-up	7.2	5.4	8.1	5.2	7.8	4.6	6.9		6.3	4.4	6.1	3.8
cut-up:inner diameter	30.4%	23.1%	34.3%	19.6%	33.3%	24.8%	29.5%		29.0%	28.7%	29.2%	24.1%
height of upper lip	-	10.9	-	-	-	13	-		-	-	-	-
form of upper lip	hardly pressed in	Roman pressed in	hardly pressed in	hardly pressed in	hardly pressed in	Roman pressed in	hardly pressed in		hardly pressed in	hardly pressed in	hardly pressed in	hardly pressed in
diameter toe	11.7	10.7	11.9	11.1	11	9.2	11.6		11	10.1	11.1	10
diameter toe hole	4.2	6.1	5.3	5.7	4.4	5.2	3.7		5.1	5.3	6.1	5.2
length of foot	195	206	196	208	198	210	200		206	210	200	212
resonator length total	191	175	188	163	170	158	154		145	141	139	130
resonator length without tuning slide etc.	-	173	-	-	-	-	-		-	138	-	125
height of languid	0.7	1.3	0.6	1.2	0.8	1	0.7		0.7	0.7	0.9	0.9
angle of languid	90°	90°	90°	90°	90°	90°	90°		90°	90°	90°	90°
nicks	-	-	-	-	-	-	-		-	-	-	-
flue	1	1	0.5	1	0.5	1	0.5		0.5	1	0.5	0.5
flue:toe hole	23.8%		9.4%		11.4%		13.5%		9.8%		8.2%	
ear length	21.6	-	22.4	-	27.4	-	21.8		20.3	-	21.1	-
ear width	11.3	-	11.3	-	11.9	-	9.3		8.8	-	9.6	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-		-	-	-	-
thickness upper wall	-	-	-	0.5	-	0.5	-		-	0.5	-	-
thickness wall near mouth	0.9	0.4	0.6	0.4	0.7	0.6	0.7		0.6	0.6	0.7	0.7
thickness wall near foot hole	-	-	-	-	-	-	-		-	-	-	-
obersvations	2.4cm new on top; color changes on upper lip (lighter color)		2.5cm new on top;		1.8 cm new on top; top cover plate very concave	rack imprintken; toe tip slightly collapsed	two holes filled with solder near lower lip	pipe missing			top cover plate very convex	

Callalli, scaling measurements rank II (continued)

Callalli, 2nd rank (II)

pipe number	44/G5-back	45/G#5-front	45/G#5-back	46/A5-front	46/A5-back	47/A#5-front	47/A#5-back	48/H5-front	48/H5-back	49/C6-front	49/C6-back	50/C#6-front
circumference	65	51	63	54	60	51	60	47	56	51	49	41
diameter	20.7	16.2	20.1	17.2	19.1	16.2	19.1	15.0	17.8	16.2	15.6	13.1
inner diameter	19.3	15.2	18.7	16.0	17.7	15.2	-	14.0	15.8	15.2	-	12.1
Töpfersche Normalmensur	*11*	*10.5*	*10.5*	*10.1*	*10.1*	*9.7*	*9.7*	*9.3*	*9.3*	*8.8*	*8.8*	*8.5*
deviation from Töpfer	*8.3*	*4.7*	*8.2*	*5.9*	*7.6*	*5.5*	*9.4*	*4.7*	*6.5*	*6.4*	*6.8*	*3.6*
deviation from Töpfer (in semitones)	*13HT*	*8HT*	*13HT*	*10.5HT*	*13HT*	*10HT*	*16HT*	*11HT*	*12HT*	*14HT*	*13HT*	*8HT*
surface area	336.2	207.0	315.8	232.0	286.5	207.0	286.5	175.8	249.6	207.0	191.1	133.8
resonator length:diameter	6.2	7.7	6.1	6.7	6.1	6.8	5.9	6.8	5.8	5.9	6.2	6.9
resonator length:surface area	0.38		0.39		0.40		0.39		0.42		0.50	
width of mouth	14.2	12.1	14.4	12.7	13.9	11.4	13.2	10.5	12.5	9.4	11.5	8.9
width of mouth:inner diameter	73.6%	79.4%	77.2%	79.4%	78.5%	74.8%	69.1%	75.2%	79.0%	61.7%	73.7%	73.9%
cut-up	6.1	4.1	6.7	3.7	5.5	4	6	3.5	6.4	3.4	5.4	3.4
cut-up:inner diameter	31.6%	26.9%	35.9%	23.1%	31.1%	26.3%	31.4%	25.1%	40.4%	22.3%	34.6%	28.2%
height of upper lip	11.6	6.5	-	12	14.6	11.5	-	-	12	10.8	12.2	-
form of upper lip	Roman pressed in	pressed in	pressed in	Roman pressed in	Roman pressed in	Roman pressed in	pressed in	pressed in	Roman pressed in	Roman pressed in	Roman pressed in	hardly pressed in
diameter toe	10.6	9.9	11	10.8	10.5	11.5	8.9	11.4	10.5	10.8	10.7	9.8
diameter toe hole	5.1	5.3	4.1	5.5	5.5	5.4	5	5.1	7.8	55	4.6	4.6
length of foot	194	210	195	215	197	215	203	215	208	212	214	223
resonator length total	129	125	123	115	116	110	113	102	104	95	96	90
resonator length without tuning slide etc.	-	-	-	-	-	100	-	-	-	90	-	-
height of languid	0.6	1.2	0.9	0.9	0.8	0.7	0.7	0.9	0.7	1	0.8	0.6
angle of languid	90°	85°	90°	90°	90°	90°	90°	80°	90°	70°	90°	90°
nicks	-	-	-	-	-	-	-	-	-	-	-	-
flue	0.5	1	1	1	0.5	1	1	1	0.5	1	1	0.5
flue:toe hole	9.8%		24.4%		9.1%		20.0%		6.4%		21.7%	
ear length	22.1	-	21.6	-	12.7	-	19.4	-	22.1	-	19.6	-
ear width	11.8	-	10.1	-	9.4	-	8.8	-	9.3	-	10.1	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-	-	-	-	-
thickness upper wall	-	0.4	-	0.3	-	0.3	-	0.7	-	-	-	0.5
thickness wall near mouth	0.7	0.5	0.7	0.6	0.7	0.5	-	0.5	1	0.5	-	0.5
thickness wall near foot hole	-	-	-	-	-	-	-	-	-	-	-	-
obersvations	top cover plate very convex		imprint of rack on foot									

Callalli, scaling measurements rank II (continued)

Callalli, 2nd rank (II)

pipe number	50/C#6-back	51/D6-front	51/D6-back	52/D#6--front	52/D#6-back	53/E6-front	53/E6-back	54/F6-front	54/F6-back	55/F#6-front	55/F#6-back
circumference		39	49	41	46	40	45	37	44	32.5	
diameter		12.4	15.6	13.1	14.6	12.7	14.3	11.8	14.0	10.3	
inner diameter		11.6	-	12.1	-	11.7	-	10.6	-	9.5	
Töpfersche Normalmensur		*8.1*	*8.1*	*7.8*	*7.8*	*7.4*	*7.4*	*7.1*	*7.1*	*6.8*	
deviation from Töpfer		*3.5*	*7.5*	*4.3*	*6.8*	*4.3*	*6.9*	*3.5*	*6.9*	*2.7*	
deviation from Töpfer (in semitones)		*8HT*	*15HT*	*10HT*	*13.5HT*	*10HT*	*15HT*	*9HT*	*15.5HT*	*7.5HT*	
surface area		121.0	191.1	133.8	168.4	127.3	161.1	108.9	154.1	84.1	
resonator length:diameter		6.7	5.4	6.3	5.7	6.1	5.6	6.1	5.5	6.6	
resonator length:surface area			0.44		0.50		0.50		0.50	0.81	
width of mouth		8.6	11.3	9.1	11.4	8.9	9.7	7.6	9.5	7.7	
width of mouth:inner diameter		74.0%	72.4%	75.5%	77.9%	75.9%	67.7%	71.9%	67.8%	80.7%	
cut-up		3.4	6	4.1	4.7	3.9	5.3	3.7	4.7	2.6	
cut-up:inner diameter		29.3%	38.5%	34.0%	32.1%	33.2%	37.0%	35.0%	33.6%	27.2%	
height of upper lip		-	11.7	-	-	-	-	-	-	77	
form of upper lip		hardly pressed in	Roman pressed in	pressed in	pressed in	pressed in	pressed in	none	pressed in	pressed in	
diameter toe		10.7	10.2	10.5	9.4	10.7	10.6	9.1	10.1	9.5	
diameter toe hole		5.1	4	4.7	5.1	4.5	4.8	5.1	5.1	5.4	
length of foot		220	210	209	206	209	207	210	208	202	
resonator length total		83	85	82	84	78	80	72	77	68	
resonator length without tuning slide etc.		75	-	76	-	70	-	?	-	64	
height of languid		0.5	0.8	1.3	0.6	1.3	0.6	1.3	-	1.2	
angle of languid		90°	90°	90°	90°	90°	90°	90°	-	90°	
nicks		-	-	-	-	-	-	-	-	-	
flue		1	0.5	1	1	1	1	1	0.5	1	
flue:toe hole			12.5%		19.6%		20.8%		9.8%	18.5%	
ear length		-	18.9	-	13.2	-	13.5	-	13.3	-	
ear width		-	9.1	-	8	-	8.4	-	6.8	-	
tuning slide height (stopped pipes)		-	-	-	-	-	-	-	-	-	
thickness upper wall		0.5	-	0.5	-	0.5	-	0.4	-	0.4	
thickness wall near mouth		0.4	-	0.5	-	0.5	-	0.6	-	0.4	
thickness wall near foot hole		-	-	-	-	-	-	-	-	-	
obersvations	pipe missing	raised/wavy languid						nicks? (not easy to see); whole pipe bent and collapsed	languid collapsed in middle		pipe missing

Callalli, scaling measurements rank II (continued)

Callalli, 3rd rank (III)	51/55 pipes						
pipe number	1/C2	2/C#2	3/D2	4/D#2	5/E2	6/F2	
circumference				170	144		
diameter				54.1	45.8		**General observations:**
inner diameter				52.5	44.2		nr. 7 t/m 23 rond geritst-gedrukt onderlabiu
Töpfersche Normalmensur				*62.6*	*59.9*		nr. 24 t/m 31 none rond onderlabium
deviation from Töpfer				*-10.1*	*-15.7*		nr. 32 t/m 36 rond geritst-gedrukt onderlabi
deviation from Töpfer (in semitones)				*-4HT*	*-8HT*		nr. 37 t/m 55 geen rond onderlabium
surface area				2299.8	1650.1		
resonator length:diameter				11.2	13.2		
resonator length:surface area				0.26	0.37		
width of mouth				41	32.6		
width of mouth:innder diameter				78.1%	73.7%		
cut-up				14	10.5		
cut-up:inner diameter				26.7%	23.7%		
height of upper lip				-	7.8		
form of upper lip				pressed in	Roman pressed-scored.		
diameter toe				11.3	12.5		
diameter toe hole				5.3	4.9		
length of foot				222	202		
resonator length total				605	605		
resonator length without tuning slide etc.				-	-		
height of languid				2	1.4		
bevel of languid				90°	90°		
nicks				-	?		
flue				0.5	0.5		
flue:toe hole				9.4%	10.2%		
ear length				32.2	-		
ear width				17.7	-		
tuning slide height (stopped pipes)				-	-		
thickness upper wall				-	0.5		
thickness wall near mouth				0.8	0.8		
thickness wall near foot hole				-	-		
obersvations	pipe missing	pipe missing	pipe missing	7.5cm new on top; left ear very thin; foot kinked; stopped	pointed lower shape of lip; inscription "fa"; rack imprint on foot	pipe missing	

Callalli, scaling measurements rank III

Callalli, 3rd rank (III)

pipe number	7/F#2	8/G2	9/G#2	10/A2	11/A#2	12/H2	13/C3	14/C#3
circumference	137	124	126	134	129	122	119	117
diameter	43.6	39.5	40.1	42.7	41.1	38.8	37.9	37.2
inner diameter	42.2	38.7	38.7	41.5	39.7	37.8	36.5	36.0
Töpfersche Normalmensur	*54.9*	*52.6*	*50.4*	*48.2*	*46.2*	*44.2*	*42.3*	*40.5*
deviation from Töpfer	*-12.7*	*-13.9*	*-11.7*	*-6.7*	*-6.5*	*-6.4*	*-5.8*	*-4.5*
deviation from Töpfer (in semitones)	*-5HT*	*-7HT*	*-6HT*	*-3.5HT*	*-3.5HT*	*-2.5HT*	*-4.5HT*	*-3.5HT*
surface area	1493.6	1223.6	1263.4	1428.9	1324.2	1184.4	1126.9	1089.3
resonator length:diameter	13.3	13.7	13.0	11.0	10.9	10.8	10.6	10.1
resonator length:surface area	0.39	0.44	0.41	0.33	0.34	0.35	0.35	0.35
width of mouth	30.5	29.7	29.5	31.7	31.1	29.8	27.4	26.6
width of mouth:innder diameter	72.3%	76.8%	76.2%	76.5%	78.4%	78.8%	75.1%	73.8%
cut-up	10.6	9.6	9.1	10.4	9.3	7.5	9.1	8.3
cut-up:inner diameter	25.1%	24.8%	23.5%	25.1%	23.4%	19.8%	24.9%	23.0%
height of upper lip	25	21.8	14	23.5	24.7	23.2	21.4	22.9
form of upper lip	Roman pressed-scored.	Roman scored	Roman pressed-scored.	Roman pressed-scored.	Roman pressed-scored.	Roman pressed-scored.	Roman pressed-scored.	Roman pressed-scored.
diameter toe	11.5	9.6	10.8	12	11.9	12.4	11.6	11.2
diameter toe hole	6.3	5.3	5.3	6.7	6.6	4.6	6.4	6.4
length of foot	200	209	204	205	205	205	206	207
resonator length total	580	541	520	471	449	418	400	377
resonator length without tuning slide etc.	555	536	505	463	445	405	-	-
height of languid	1.4	1.7	1.6	-	1.6	1.4	1.7	1.7
bevel of languid	90°	85°	90°	90°	85°	90°	85°	80°
nicks	-	-	-	-	-	-	-	-
flue	1.5	1	1	1	0.5	1	0.5	0.5
flue:toe hole	23.8%	18.9%	18.9%	14.9%	7.6%	21.7%	7.8%	7.8%
ear length	-	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-
thickness upper wall	-	0.4	0.5	0.7	0.8	0.5	0.4	0.8
thickness wall near mouth	0.7	0.4	0.7	0.6	0.7	0.5	0.7	0.6
thickness wall near foot hole	-	-	-	-	-	-	-	-
obersvations	7cm new on top; foot collapsed; top very dented; round shape of lower lip	very dented upper lip; dent on side with discoloration; "little dots"	7cm new on top; rack imprint	damage through rack; languid collapsed;	light rack imprint	languid "aangefaast"; rack imprint on foot	light rack imprint	languid inside collapsed; cut on top

Callalli, scaling measurements rank III (continued)

Callalli, 3rd rank (III)

pipe number	15/D3	16/D#3	17/E3	18/F3	19/F#3	20/G3	21/G#3	22/A3
circumference	110	107	104	100	96	95	90	88
diameter	35.0	34.1	33.1	31.8	30.6	30.2	28.6	28.0
inner diameter	33.6	32.9	31.7	31.2	29.4	29.2	27.4	26.8
Töpfersche Normalmensur	*38.8*	*37.2*	*35.6*	*34.1*	*32.6*	*31.3*	*29.9*	*28.7*
deviation from Töpfer	*-5.2*	*-4.3*	*-3.9*	*-2.9*	*-3.2*	*-2.1*	*-2.5*	*-1.9*
deviation from Töpfer (in semitones)	*-3.5HT*	*-3HT*	*-3HT*	*-2HT*	*-2.5HT*	*-1.5HT*	*-2HT*	*-1.5HT*
surface area	962.9	911.1	860.7	795.8	733.4	718.2	644.6	616.2
resonator length:diameter	10.0	9.8	9.7	9.4	9.2	8.8	8.6	8.4
resonator length:surface area	0.36	0.37	0.37	0.37	0.38	0.37	0.38	0.38
width of mouth	25.8	26	24.8	24.4	22.2	23.7	21.5	20.5
width of mouth:innder diameter	76.8%	79.1%	78.2%	78.1%	75.6%	81.1%	78.3%	76.5%
cut-up	8	8.3	9.2	7	6.7	6.1	6	6
cut-up:inner diameter	23.8%	25.3%	29.0%	22.4%	22.8%	20.9%	21.9%	22.4%
height of upper lip	20	19.1	8.4	20.4	18.3	18.4	17.2	16.4
form of upper lip	Roman pressed-scored.	Roman pressed-scored.	Roman pressed in	Roman pressed in	Roman pressed-scored.	Roman pressed-scored.	Roman pressed-scored.	Roman pressed-scored.
diameter toe	11.7	10.8	10.3	10.7	11.7	10.9	10.2	10.6
diameter toe hole	5.9	6.8	6.1	4.3	4.9	6.1	4.3	6.1
length of foot	205	207	210	210	206	208	208	209
resonator length total	351	335	320	298	280	265	246	235
resonator length without tuning slide etc.	-	323	-	290	-	-	-	230
height of languid	1.6	1.5	1.9	1.4	1.6	1.1	1.6	1.4
bevel of languid	85°	90°	90°	90°	90°	90°	90°	85°
nicks	-	-	-	-	-	-	-	-
flue	1	1	1	1	0.5	1	0.5	1
flue:toe hole	16.9%	14.7%	16.4%	23.3%	10.2%	16.4%	11.6%	16.4%
ear length	-	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-
thickness upper wall	0.5	0.6	0.4	0.5	0.3	0.6	0.5	0.5
thickness wall near mouth	0.7	0.6	0.7	0.3	0.6	0.5	0.6	0.6
thickness wall near foot hole	-	-	-	-	-	-	-	-
obersvations	"little dots" on foot	rack imprint	dented in on top	corrosion on foot	diagonal corrosion on foot; dents on foot (rack?)	light dent from rack	interesting structure on material of resonator, see picture	interesting structure on material of foot

Callalli, scaling measurements rank III (continued)

Callalli, 3rd rank (III)								
pipe number	23/A#3	24/H3	25/C4	26/C#4	27/D4	28/D4	29/E4	30/F4
circumference	89	77	72	66	61	94	97	84
diameter	28.3	24.5	22.9	21.0	19.4	29.9	30.9	26.7
inner diameter	27.3	23.7	21.7	19.8	18.6	28.7	30.1	25.7
Töpfersche Normalmensur	*27.4*	*26.3*	*25.2*	*24.1*	*23.1*	*37.2*	*35.6*	*34.1*
deviation from Töpfer	*-0.1*	*-2.6*	*-3.5*	*-4.3*	*-4.5*	*-8.5*	*-5.5*	*-8.4*
deviation from Töpfer (in semitones)	*0HT*	*-2.5HT*	*-3.5HT*	*-4.5HT*	*-5HT*	*-6HT*	*-4HT*	*-6.5HT*
surface area	630.3	471.8	412.5	346.6	296.1	703.1	748.7	561.5
resonator length:diameter	7.8	8.4	8.7	9.0	9.1	10.8	10.9	11.4
resonator length:surface area	0.35	0.43	0.48	0.55	0.60	0.46	0.45	0.54
width of mouth	18	17.8	15.9	14.7	14.2	21.5	23.4	19.1
width of mouth:innder diameter	65.9%	75.1%	73.2%	74.2%	76.3%	74.9%	77.8%	74.2%
cut-up	5.3	5.3	4.9	4.6	4.3	7.1	7.8	5.8
cut-up:inner diameter	19.4%	22.4%	22.6%	23.2%	23.1%	24.7%	25.9%	22.5%
height of upper lip	-	-	-	-	-	25.7	28.5	-
form of upper lip	pressed in	pressed in	pressed in	pressed in	pressed in	pressed in	pressed in	pressed in
diameter toe	11.2	10.5	11.6	11.1	11	10.4	10.6	10.6
diameter toe hole	6.5	5.9	5.8	6.5	5	5.2	6.3	5.2
length of foot	205	205	209	210	203	220	204	205
resonator length total	220	205	200	190	177	323	336	306
resonator length without tuning slide etc.	-	190	-	178	172	270	327	-
height of languid	1.1	1.4	1.2	0.9	1.6	1.1	1.1	1.2
bevel of languid	90°	90°	90°	90°	90°	90°	90°	90°
nicks	-	-	-	-	-	-	-	-
flue	1	1	1	1	0.5	1	0.5	1
flue:toe hole	15.4%	16.9%	17.2%	15.4%	10.0%			
ear length	-	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-
thickness upper wall	0.7	-	0.7	0.4	0.3	0.6	0.5	0.4
thickness wall near mouth	0.5	0.4	0.6	0.6	0.4	0.6	0.4	0.5
thickness wall near foot hole	-	-	-	-	-	-	-	-
obersvations		light rack imprint foot	2.3 cm new on top	2.7 cm new on top		6.5 cm new on top	3.2 cm new on top; rack imprint; horizontal stripes on insde of new part	7.5 cm new on top

Callalli, scaling measurements rank III (continued)

Callalli, 3rd rank (III)								
pipe number	**31/F#4**	**32/G4**	**33/G#4**	**34/A4**	**35/A#4**	**36/H4**	**37/C5**	**38/C#5**
circumference	**84**	**81**	**77**	**74**	**69**	**68**	**67**	**64**
diameter	**26.7**	**25.8**	**24.5**	**23.6**	**22.0**	**21.6**	**21.3**	**20.4**
inner diameter	**25.3**	**24.8**	**23.3**	**23.0**	**20.6**	**20.8**	**20.3**	**19.4**
Töpfersche Normalmensur	*32.6*	*31.3*	*29.9*	*28.7*	*27.4*	*26.3*	*25.2*	*24.1*
deviation from Töpfer	***-7.3***	***-6.5***	***-6.6***	***-5.7***	***-6.8***	***-5.5***	***-4.9***	***-4.7***
deviation from Töpfer (in semitones)	***-6HT***	***-5.5HT***	***-6HT***	***-5HT***	***-6.5HT***	***-5HT***	***-5HT***	***-5HT***
surface area	**561.5**	**522.1**	**471.8**	**435.8**	**378.9**	**368.0**	**357.2**	**325.9**
resonator length:diameter	**10.8**	**10.1**	**10.3**	**10.2**	**10.3**	**9.9**	**9.5**	**9.3**
resonator length:surface area	**0.52**	**0.50**	**0.53**	**0.55**	**0.60**	**0.58**	**0.57**	**0.58**
width of mouth	**19.5**	**18.5**	**17.8**	**16.6**	**15.3**	**16.1**	**15.3**	**14.7**
width of mouth:innder diameter	77.0%	74.6%	76.4%	72.3%	74.4%	77.2%	75.3%	75.9%
cut-up	**6.5**	**6**	**6.2**	**6.7**	**5.1**	**5.5**	**5.1**	**5**
cut-up:inner diameter	25.7%	24.2%	26.6%	29.2%	24.8%	26.4%	25.1%	25.8%
height of upper lip	-	**14.8**	**13.4**	-	**8.1**	**25.9**	-	-
form of upper lip	pressed in	Roman scored	Roman pressed-scored.	pressed in	Roman pressed in	bayleaf pressed in	pressed in	pressed in
diameter toe	**10**	**9.8**	**9.8**	**10.6**	**10.1**	**10.1**	**9.7**	**10.7**
diameter toe hole	5.7	5.6	4.2	5.4	6.8	5.9	5.7	5.6
length of foot	**204**	**214**	**215**	**215**	**205**	**215**	**210**	**201**
resonator length total	**290**	**260**	**252**	**240**	**226**	**215**	**202**	**190**
resonator length without tuning slide etc.	-	**250**	**245**	-	**212**	**200**	**197**	**185**
height of languid	**1.5**	**1.7**	**0.9**	**1.6**	**1.5**	**1.2**	**0.9**	**0.5**
bevel of languid	**90°**	**85°**	**90°**	**90°**	**85°**	**90°**	**90°**	**90°**
nicks	-	-	-	-	-	-	-	-
flue	**0.5**	**0.5**	**1**	**0.5**	**0.5**	**1**	**1**	**1**
flue:toe hole								
ear length	-	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-
thickness upper wall	**0.6**	**0.6**	**0.6**	**0.3**	**0.7**	**0.3**	**0.5**	**0.4**
thickness wall near mouth	**0.7**	**0.5**	**0.6**	**0.3**	**0.7**	**0.4**	**0.5**	**0.5**
thickness wall near foot hole	-	-	-	-	-	-	-	-
obersvations	0.8 cm new on top light rack imprint foot		slight rack imprint foot	slight rack imprint foot	slight rack imprint foot	slight rack imprint foot		lip stands out; speaks badly (overblow)

Callalli, scaling measurements rank III (continued)

Callalli, 3rd rank (III)

pipe number	39/D5	40/D#5	41/E5	42/F5	43/F#5	44/G5	45/G#5	46/A5
circumference	61.5	57	55.5	53.5	50	47.5	47	47.5
diameter	19.6	18.1	17.7	17.0	15.9	15.1	15.0	15.1
inner diameter	19.0	17.1	16.5	16.0	14.5	13.9	14.0	14.1
Töpfersche Normalmensur	*23.1*	*22.1*	*21.1*	*20.2*	*19.3*	*18.6*	*17.8*	*16.9*
deviation from Töpfer	*-4.1*	*-5.0*	*-4.6*	*-4.2*	*-4.8*	*-4.7*	*-3.8*	*-2.8*
deviation from Töpfer (in semitones)	*-4HT*	*-6HT*	*-6HT*	*-5HT*	*-7HT*	*-7HT*	*-5HT*	*-4HT*
surface area	301.0	258.5	245.1	227.8	198.9	179.5	175.8	179.5
resonator length:diameter	9.0	9.2	8.9	8.6	8.8	8.6	8.4	7.6
resonator length:surface area	0.58	0.65	0.64	0.65	0.70	0.72	0.71	0.64
width of mouth	14.4	12.5	12.9	12.9	11.2	10.9	10.4	10.5
width of mouth:innder diameter	75.9%	72.9%	78.3%	80.5%	77.2%	78.3%	74.5%	74.4%
cut-up	4.8	4	4.4	4.5	9.6	4.2	3.6	3.4
cut-up:inner diameter	25.3%	23.3%	26.7%	28.1%	66.1%	30.2%	25.8%	24.1%
height of upper lip	-	-	13.7	-	11	-	12.4	-
form of upper lip	pressed in	pressed in	Roman pressed-in	pressed in	Roman pressed in	pressed in	bayleaf pressed in	pressed in
diameter toe	10.4	11	8.9	11	10.2	10.3	10.6	8.1
diameter toe hole	6.4	5.7	5.8	5.9	5.9	5.3	5.7	4.1
length of foot	206	205	207	205	207	201	205	195
resonator length total	176	167	157	147	140	130	125	115
resonator length without tuning slide etc.	-	160	-	-		125	-	-
height of languid	1.4	1.5	1.2	1.4	0.9	1.3	1.1	1.2
bevel of languid	85°	90°	90°	90°	90°	90°	85°	90°
nicks	-	-	-	-	-	-	-	-
flue	0.5	0.5	1	0.5	0.5	0.5	1	1
flue:toe hole								
ear length	-	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-
thickness upper wall	0.4	0.5	0.3	0.6	0.4	0.6	0.5	0.4
thickness wall near mouth	0.3	0.5	0.6	0.5	0.7	0.6	0.5	0.5
thickness wall near foot hole	-	-	-	-	-	-	-	-
obersvations	slight rack imprint foot; slightly collapsed near cut-up;		upper edge of languid in front slightly "aangefaasd"	0.5 cm deep cut		doesn't speak easily	interesting pattern on material of foot, see picture	

Callalli, scaling measurements rank III (continued)

Callalli, 3rd rank (III)									
pipe number	47/A#5	48/H5	49/C6	50/C#6	51/D6	52/D#6	53/E6	54/F6	55/F#6
circumference	44	45.5	38.5	34	38	36	32	33	41.5
diameter	14.0	14.5	12.3	10.8	12.1	11.5	10.2	10.5	13.2
inner diameter	13.0	13.7	-	9.8	11.1	10.7	9.2	9.7	-
Töpfersche Normalmensur	*16.3*	*15.6*	*14.9*	*14.3*	*13.7*	*13.1*	*12.6*	*12*	*11.5*
deviation from Töpfer	*-3.3*	*-1.9*	*-2.6*	*-4.5*	*-2.6*	*-2.4*	*-3.4*	*-2.3*	*1.7*
deviation from Töpfer (in semitones)	*-5HT*	*-3HT*	*-4.5HT*	*-9HT*	*-3HT*	*-4.5HT*	*-7HT*	*-5HT*	*3HT*
surface area	154.1	164.7	118.0	92.0	114.9	103.1	81.5	86.7	137.1
resonator length:diameter	7.9	8.1	7.9	8.6	7.1	7.2	7.7	7.0	5.4
resonator length:surface area	0.71	0.72	0.82	1.01	0.75	0.80	0.96	0.85	0.52
width of mouth	9.9	10.6	8.1	7.4	7.8	7.7	7.1	7.5	9.1
width of mouth:innder diameter	76.1%	77.5%	-	75.3%	70.3%	72.2%	77.3%	77.3%	-
cut-up	3.1	2.8	2.9	2.7	2.5	2.7	2.5	2.5	4.6
cut-up:inner diameter	23.8%	20.5%	-	27.5%	22.5%	25.3%	27.2%	25.8%	-
height of upper lip	-	-	-	-	-	-	8.6	10	9.6
form of upper lip	pressed in	pressed in	pressed in	pressed in	pressed in	pressed in	Roman pressed in	Roman pressed in	Roman pressed in
diameter toe	10.1	9.3	10	10	8.6	9.9	9.9	9.3	10.5
diameter toe hole	6.1	5.4	5.1	3.9	4.7	5.5	5.5	5.2	4.9
length of foot	206	196	205	212	208	190	210	208	208
resonator length total	110	118	97	93	86	83	78	74	71
resonator length without tuning slide etc.	-	109	91	-	-	75	72	-	-
height of languid	1.2	1.2	1.1	0.7	1.2	1.1	0.8	0.6	1
bevel of languid	90°	90°	85°	90°	80°	90°	90°	90°	90°
nicks	-	-	-	-	-	-	-	-	-
flue	0.5	0.5	0.5	0.5	0.5	1	1	1	1
flue:toe hole									20.4%
ear length	-	-	-	-	-	-	-	-	-
ear width	-	-	-	-	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-	-
thickness upper wall	0.4	0.4	-	0.5	0.5	0.4	0.5	0.4	-
thickness wall near mouth	0.5	0.4	-	-	-	-	-	-	-
thickness wall near foot hole	-	-	-	-	-	-	-	-	-
obersvations									different type of pipe (stopped, ears); rack imprint;

Callalli, scaling measurements rank III (continued)

Callalli, 4th rank (IV)	50/55 pipes				full diatonic measurement, rest only lengths				
pipe number	1/C2	2/C#2	3/D2	4/D#2	5/E2	6/F2	7/F#2	8/G2	9/G#2
circumference					90	91		83	
diameter					28.6	29.0		26.4	
inner diameter					28.0	27.6		25.8	
Töpfersche Normalmensur					*35.6*	*34.1*		*31.3*	
deviation from Töpfer					*-7.6*	*-6.5*		*-5.5*	
deviation from Töpfer (in semitones)					*-5.5HT*	*-5HT*		*-4.5HT*	
surface area					644.6			548.2	
resonator length:diameter					18.3	10.4		10.1	
resonator length:surface area					0.81			0.49	
width of mouth					20.9	20.7		20.6	
width of mouth:innder diameter					74.5%	75.1%		79.8%	
cut-up					5.3	5.9		5.3	
cut-up:inner diameter					18.9%			20.5%	
height of upper lip					36.9	-		15.3	
form of upper lip					pressed in	pressed in		Roman scored	
diameter toe					10.5	10.4		9.3	
diameter toe hole					4.1	6		5	
length of foot					196	200		203	
resonator length total					523	300	287	267	251
resonator length without tuning slide etc.					-	-		-	
height of languid					1.8	1		1.3	
angle of languid					90°	90°		90°	
nicks					-	-		-	
flue					1	1		<1	
flue:toe hole					24.4%			#VALUE!	
ear length					-	-		-	
ear width					-	-		-	
tuning slide height (stopped pipes)					-	-		-	
thickness upper wall					0.3	0.7		0.3	
thickness wall near mouth					0.5	0.6		0.6	
thickness wall near foot hole					-	-		-	
obersvations	pipe missing	pipe missing	pipe missing	pipe missing	resonator is new (and very dented); light rack imprint; foot on top slightly collapsed;	resonator: 40 mm ne	resonator: 40 mm new	resonator on top 0.5 cm cut into; slight rack imprint	

Callalli, scaling measurements rank IV

Callalli, 4th rank (IV)

pipe number	10/A2	11/A#2	12/H2	13/C3	14/C#3	15/D3	16/D#3	17/E3	18/F3
circumference	74		75	71		65		59	59
diameter	23.6		23.9	22.6		20.7		18.8	18.8
inner diameter	22.6		23.1	22.0		19.9		17.8	18.2
Töpfersche Normalmensur	*28.7*		*26.3*	*25.2*		*23.1*		*21.1*	*20.2*
deviation from Töpfer	*-6.1*		*-3.2*	*-3.2*		*-3.2*		*-3.3*	*-2.0*
deviation from Töpfer (in semitones)	*-5.5HT*		*-3HT*	*-3HT*		*-3.5HT*		*-5HT*	*-2.5HT*
surface area	435.8		447.6	401.2		336.2		277.0	277.0
resonator length:diameter	10.3		8.8	8.9		8.5		8.3	7.6
resonator length:surface area	0.56		0.47	0.50		0.52		0.56	0.51
width of mouth	16.6		17.7	16.5		14.2		13.8	13.7
width of mouth:innder diameter	73.6%		76.7%	75.0%		71.4%		77.6%	75.4%
cut-up	6		5.3	5.1		5.2		3.8	4.9
cut-up:inner diameter	26.6%		23.0%	23.2%		26.1%		21.4%	27.0%
height of upper lip	-		-	11.7		-		-	14.2
form of upper lip	pressed in		pressed in	pressed in		pressed in		none	Roman pressed in
diameter toe	10.7		9.3	10.5		9.7		11.1	10.4
diameter toe hole	3.4		5.3	6.4		4.9		5.2	4.8
length of foot	202		201	141		208		207	197
resonator length total	242	225	210	202	185	175	164	156	142
resonator length without tuning slide etc.	-		-	121		-		-	187
height of languid	1.1		1.6	1.1		1.5		0.9	1.1
angle of languid	85°		85°	90°		90°		90°	90°
nicks	-		-	-		-		-	-
flue	<1		1	1		0.5		1	<1
flue:toe hole	#VALUE!		18.9%	15.6%		10.2%		19.2%	#VALUE!
ear length	-		-	-		-		-	-
ear width	-		-	-		-		-	-
tuning slide height (stopped pipes)	-		-	-		-		-	-
thickness upper wall	0.5		0.4	0.3		0.4		0.5	0.3
thickness wall near mouth	0.7		0.6	0.6		0.5		0.7	0.4
thickness wall near foot hole	-		-	-		-		-	-
obersvations	dents and breakage on top		slight rack imprint	slight rack imprint; resonator: 33mm new	18mm nw				foot dented

Callalli, scaling measurements rank IV (continued)

Callalli, 4th rank (IV)

pipe number	19/F#3	20/G3	21/G#3	22/A3	23/A#3	24/H3	25/C4	26/C#4	27/D4
circumference		57		56		46	41		41.5
diameter		18.1		17.8		14.6	13.1		13.2
inner diameter		16.9		16.6		13.6	11.9		12.4
Töpfersche Normalmensur		*18.6*		*16.9*		*15.6*	*14.9*		*13.7*
deviation from Töpfer		*-1.7*		*-0.3*		*-2.0*	*-3.0*		*-1.3*
deviation from Töpfer (in semitones)		*-2HT*		*-0.5HT*		*-3HT*	*-5HT*		*-2HT*
surface area		258.5		249.6		168.4	133.8		137.1
resonator length:diameter		7.1		6.3		6.7	7.5		6.2
resonator length:surface area		0.50		0.45		0.58	0.73		0.60
width of mouth		13.7		12		10.5	9.3		8.7
width of mouth:innder diameter		80.9%		72.2%		77.0%	78.5%		70.1%
cut-up		4.5		3.6		3.5	3.4		4.1
cut-up:inner diameter		26.6%		21.7%		25.7%	28.7%		33.0%
height of upper lip		10.7		-		9.2	10		-
form of upper lip		Roman pressed in		none		Roman pressed in	pressed in		pressed in
diameter toe		9.7		10.3		9.4	9.6		10.8
diameter toe hole		5.5		4.2		5.1	4.9		6.5
length of foot		207		208		214	202		207
resonator length total	137	129	116	113	106	98	98	92	82
resonator length without tuning slide etc.		-		-		-	194		-
height of languid		1.2		1		1.3	0.8		1.5
angle of languid		80°		90°		85°	90°		90°
nicks		-		-		-	-		-
flue		0.5		-		<1	1		1.2
flue:toe hole		9.1%		#VALUE!		#VALUE!	20.4%		18.5%
ear length		-		-		-	-		-
ear width		-		-		-	-		-
tuning slide height (stopped pipes)		-		-		-	-		-
thickness upper wall		0.6		0.6		0.5	0.6		0.4
thickness wall near mouth		0.6		0.6		0.5	0.4		-
thickness wall near foot hole		-		-		-	-		-
obersvations		foot severely damaged by rack		foot dented (rack?); lower lip breaks					

Callalli, scaling measurements rank IV (continued)

Callalli, 4th rank (IV)

pipe number	28/D4	29/E4	30/F4	31/F#4	32/G4	33/G#4	34/A4	35/A#4	36/H4
circumference		64	60		57		62		54
diameter		20.4	19.1		18.1		19.7		17.2
inner diameter		19.6	18.5		17.1		18.7		16.8
Töpfersche Normalmensur		*21.1*	*20.2*		*18.6*		*16.9*		*15.6*
deviation from Töpfer		*-0.7*	*-1.1*		*-0.5*		*2.8*		*1.6*
deviation from Töpfer (in semitones)		*-1HT*	*-1HT*		*-1HT*		*3.5HT*		*2HT*
surface area									
resonator length:diameter		7.5	7.8		7.0		5.4		5.5
resonator length:surface area									
width of mouth		14.4	13.7		13.1		13.5		12.3
width of mouth:innder diameter		70.7%	71.7%	-	72.2%	-	68.4%		71.6%
cut-up		4.5	4.6		3.8		4.2		3.1
cut-up:inner diameter		23.0%	24.9%		22.2%		22.4%		18.5%
height of upper lip		15.3	14.2		-		-		-
form of upper lip		Roman pressed in	Roman pressed in		pressed in		pressed in		pressed in
diameter toe		9.6	9.2		9.3		8.9		9.1
diameter toe hole		5.3	5.9		4.7		6		4
length of foot		203	195		195		191		195
resonator length total	162	152	149	132	127	117	107	103	95
resonator length without tuning slide etc.		192	186		-		-		184
height of languid		0.9	1		1.2		1		1.4
angle of languid		90°	90°		90°		90°		80°
nicks		-	-		-		-		-
flue		1	1		0.5		0.5		<1
flue:toe hole									
ear length		-	-		-		-		-
ear width		-	-		-		-		-
tuning slide height (stopped pipes)		-	-		-		-		-
thickness upper wall		0.4	0.3		0.5		0.5		0.2
thickness wall near mouth		0.4	0.4		0.3		0.4		0.5
thickness wall near foot hole		-	-		-		-		-
obersvations			corrosion through rack		hole filled with solder near top of resonator		bird discharge on languid; lower lip pushed in		

Callalli, scaling measurements rank IV (continued)

Callalli, 4th rank (IV)

pipe number	37/C5	38/C#5	39/D5	40/D#5	41/E5	42/F5	43/F#5	44/G5	45/G#5
circumference	60		55		50.5	55		41	
diameter	19.1		17.5		16.1	17.5		13.1	
inner diameter	18.5		16.5		15.3	16.9		12.1	
Töpfersche Normalmensur	*14.9*		*13.7*		*12.6*	*12*		*11*	
deviation from Töpfer	*4.2*		*3.8*		*3.5*	*5.5*		*2.1*	
deviation from Töpfer (in semitones)	*6HT*		*6HT*		*6HT*	*8.5HT*		*4HT*	
surface area									
resonator length:diameter	4.5		4.4		4.2	3.3		4.8	
resonator length:surface area									
width of mouth	13.2		12.7		11.3	12.7		9.6	
width of mouth:innder diameter	69.1%		72.5%		70.3%	72.5%		73.6%	
cut-up	3.7		4.8		3.7	3.7		3.1	
cut-up:inner diameter	20.0%		29.1%		24.2%	21.9%		25.7%	
height of upper lip	13		-		-	-		12.5	
form of upper lip	Roman pressed in		pressed in		pressed in	pressed in		pressed in	
diameter toe	10.2		9		9.3	9.6		9.7	
diameter toe hole	5.6		4.7		5.3	5.4		4.4	
length of foot	195		196		199	197		213	
resonator length total	85	82	77	72	68	58	60	62	56
resonator length without tuning slide etc.	190		-		-	-		-	
height of languid	1.3		0.9		1.1	0.9		0.8	
angle of languid	90°		90°		90°	90°		90°	
nicks	-		-		-	-		-	
flue	0.5		<1		0.5	0.5		1	
flue:toe hole									
ear length	-		-		-	-		-	
ear width	-		-		-	-		-	
tuning slide height (stopped pipes)	-		-		-	-		-	
thickness upper wall	0.3		0.5		0.4	0.3		0.5	
thickness wall near mouth	0.4		0.6		0.4	0.5		-	
thickness wall near foot hole	-		-		-	-		-	
obersvations	slight rack imprint		slight rack imprint		left ear detaches; slight rack imprint;			slight rack imprint	

Callalli, scaling measurements rank IV (continued)

Callalli, 4th rank (IV)

pipe number	46/A5	47/A#5	48/H5	49/C6	50/C#6	51/D6	52/D#6	53/E6	54/F6	55/F#6
circumference	39		38	36		32		36.5		32
diameter	12.4		12.1	11.5		10.2		11.6		10.2
inner diameter	11.6		11.1	10.7		9.4		10.0		9.4
Töpfersche Normalmensur	*10.1*		*9.3*	*8.8*		*8.1*		*7.4*		*6.8*
deviation from Töpfer	*2.3*		*2.8*	*2.7*		*2.1*		*4.2*		*3.4*
deviation from Töpfer (in semitones)	*5HT*		*6HT*	*6HT*		*5HT*		*10HT*		*9HT*
surface area										
resonator length:diameter	4.0		4.1	3.5		3.6		2.8		2.2
resonator length:surface area										
width of mouth	7.6		7.6	6.8		7		8.3		7.2
width of mouth:innder diameter	61.2%		62.8%	59.3%		68.7%		71.4%		70.7%
cut-up	3.7		3.8	2.1		2.4		3.5		2.3
cut-up:inner diameter	31.9%		34.2%	19.7%		25.6%		34.9%		24.5%
height of upper lip	-		12.8	-		8.4		-		9.5
form of upper lip	pressed in		Roman pressed in	none		Roman pressed in		pressed in		Roman pressed in
diameter toe	8.5		9	8.6		9.1		9.1		9.1
diameter toe hole	4.9		4.8	5.2		4.8		4.3		4.3
length of foot	196		198	197		200		216		186
resonator length total	50	49	49	40	42	37	33	33		22
resonator length without tuning slide etc.	191		-	-		-		109		-
height of languid	0.8		0.8	1		0.6		0.7		0.8
angle of languid	90°		90°	60°		90°		90°		85°
nicks	-		-	-		-		-		-
flue	1		0.5	<1		1		-		<0.5
flue:toe hole										
ear length	-		-	-		-		-		-
ear width	-		-	-		-		-		-
tuning slide height (stopped pipes)	-		-	-		-		-		-
thickness upper wall	0.4		0.5	0.4		0.4		0.8		0.4
thickness wall near mouth	-		-	-		-		-		-
thickness wall near foot hole	-		-	-		-		-		-
obersvations	slight rack imprint			-				lower lip pressed tight	pipe missing	foot bent, slight rack imprint

Callalli, scaling measurements rank IV (continued)

Callalli, 5th rank (V)

101/110 pipes

full C-F-measurement, rest only lengths

pipe number	1/C2-front	1/C2-back	2/C#2-front	2/C#2-back	3/D2-front	3/D2-back	4/D#2-front	4/D#2-back	5/E2-front	5/E2-back	6/F2-back
circumference							59.9	41			
diameter							19.1	13.1			
inner diameter							18.5	12.1			
Töpfersche Normalmensur											
deviation from Töpfer							*#¡REF!*	*13.1*			
deviation from Töpfer (in semitones)											
surface area							285.5	133.8			
resonator length:diameter							8.8	6.1			
resonator length:surface area							0.58	0.59			
width of mouth							14	9.1			
width of mouth:innder diameter							75.8%	75.5%			
cut-up							3.8	3.5			
cut-up:inner diameter							20.6%	29.0%			
height of upper lip							10.9	-			
form of upper lip							Roman pressed in	pressed in			
diameter toe							10.1	10.3			
diameter toe hole							4.7	5.6			
length of foot							195	200			
resonator length total						79	167	79	155	71	
resonator length without tuning slide etc.						-	-	-	-	-	
height of languid							1.3	0.9			
angle of languid							90°	90°			
nicks							-	-			
flue							1	0.5			
flue:toe hole							21.3%	8.9%			
ear length							-	-			
ear width							-	-			
tuning slide height (stopped pipes)							-	-			
thickness upper wall							0.3	0.5			
thickness wall near mouth							0.6	-			
thickness wall near foot hole							-	-			
obersvations							0.5 cm cut into upper lip, cut-up collapsed	0.5 cm cut into upper lip; foot dented			pipe missing

Callalli, scaling measurements rank V

Callalli, 5th rank (V)

pipe number	6/F2-front	7/F#2-front	7/F#2-back	8/G2-front	8/G2-back	9/G#2-front	9/G#2-back	10/A2-front	10/A2-back	11/A#2-front	11/A#2-back
circumference	66.5	65	36.5								
diameter	21.2	20.7	11.6								
inner diameter	20.6	20.1	11.2								
Töpfersche Normalmensur											
deviation from Töpfer	*21.2*	*20.7*	*11.6*								
deviation from Töpfer (in semitones)											
surface area	351.9	336.2	106.0								
resonator length:diameter	6.6	6.4	5.5								
resonator length:surface area	0.40	0.40	0.60								
width of mouth	15.5	16.2	8.1								
width of mouth:innder diameter	75.4%	80.6%	72.2%								
cut-up	4.8	3.7	3.6								
cut-up:inner diameter	23.3%	18.4%	32.1%								
height of upper lip	13.8	16	-								
form of upper lip	Roman pressed in	Roman pressed in	pressed in								
diameter toe	9.3	9	9.2								
diameter toe hole	4.5	5.1	4.5								
length of foot	195	198	190								
resonator length total	140	133	64	120	58	120	59	113	55	97	48
resonator length without tuning slide etc.	135	-	-	-	-	-	-	-	-	-	-
height of languid	1.1	0.9	0.9								
angle of languid	90°	80°	80°								
nicks	-	-	-								
flue	0.5	1	<1								
flue:toe hole	11.1%	19.6%	#¡VALOR!								
ear length	-	-	-								
ear width	-	-	-								
tuning slide height (stopped pipes)	-	-	-								
thickness upper wall	0.3	0.3	0.2								
thickness wall near mouth	0.3	0.2	-								
thickness wall near foot hole	-	-	-								
obersvations		cut-up collapsed	soldering seam of foot breaking open								

Callalli, scaling measurements rank V (continued)

Callalli, 5th rank (V)

pipe number	12/H2-front	12/H2-back	13/C3-front	13/C3-back	14/C#3-front	14/C#3-back	15/D3-front	15/D3-back	16/D#3-front	16/D#3-back	17/E3-front
circumference			42.5	47							
diameter			13.5	15.0							
inner diameter			12.5	14.2							
Töpfersche Normalmensur											
deviation from Töpfer			*13.5*	*15.0*							
deviation from Töpfer (in semitones)											
surface area			143.7	175.8							
resonator length:diameter			7.1	6.5							
resonator length:surface area			0.67	0.55							
width of mouth			10.1	10.6							
width of mouth:innder diameter			80.6%	74.9%							
cut-up			3.1	4.2							
cut-up:inner diameter			24.7%	29.7%							
height of upper lip			7	9.4							
form of upper lip			pressed in	Roman pressed in							
diameter toe			9.8	10.1							
diameter toe hole			4.1	4.4							
length of foot			213	211							
resonator length total	100	43	96	97	187	92	177	83	168	76	159
resonator length without tuning slide etc.	-	-	208	206	-	-	-	-	-	-	-
height of languid			1.2	1							
angle of languid			90°	90°							
nicks			-	-							
flue			<1	1.2							
flue:toe hole			#¡VALOR!	27.3%							
ear length			-	-							
ear width			-	-							
tuning slide height (stopped pipes)			-	-							
thickness upper wall			0.5	0.4							
thickness wall near mouth			-	-							
thickness wall near foot hole			-	-							
obersvations			0.5 cm cut into upper lip								

Callalli, scaling measurements rank V (continued)

Callalli, 5th rank (V)

pipe number	17/E3-back	18/F3-front	18/F3-back	19/F#3-front	19/F#3-back	20/G3-front	20/G3-back	21/G3#-front	21/G#3-back	22/A3-front	22/A3-back
circumference		56.5	59.5								
diameter		18.0	18.9								
inner diameter		17.4	18.1								
Töpfersche Normalmensur											
deviation from Töpfer		*18.0*	*18.9*								
deviation from Töpfer (in semitones)											
surface area		254.0	281.7								
resonator length:diameter		8.3	3.7								
resonator length:surface area		0.59	0.25								
width of mouth		13.3	8.1								
width of mouth:innder diameter		76.5%	44.7%								
cut-up		4.2	2.4								
cut-up:inner diameter		24.2%	13.2%								
height of upper lip		-	-								
form of upper lip		pressed in	pressed in								
diameter toe		9.6	9.8								
diameter toe hole		5.1	5.1								
length of foot		208	203								
resonator length total	73	149	70	141	63	128	60	118	53	110	50
resonator length without tuning slide etc.	-	-	196	-	-	-	-	-	-	-	-
height of languid		1.1	0.7								
angle of languid		90°	90°								
nicks		-	-								
flue		1	1								
flue:toe hole		19.6%	19.6%								
ear length		-	-								
ear width		-	-								
tuning slide height (stopped pipes)		-	-								
thickness upper wall		0.3	0.4								
thickness wall near mouth		0.6	-								
thickness wall near foot hole		-	-								
obersvations		0.5 cm cut into upper lip; foot dented; corrosion on foot									

Callalli, scaling measurements rank V (continued)

Callalli, 5th rank (V)

pipe number	23/A#3-front	23/A#3-back	24/H3-front	24/H3-back	25/C4-front	25/C4-back	26/C#4-front	26/C#4-back	27/D4-front	27/D4-back	28/D#4-front
circumference					59.5	38.5					
diameter					18.9	12.3					
inner diameter					17.7	11.7					
Töpfersche Normalmensur											
deviation from Töpfer					*18.9*	*12.3*					
deviation from Töpfer (in semitones)											
surface area					281.7	118.0					
resonator length:diameter					4.8	3.2					
resonator length:surface area					0.32	0.33					
width of mouth					13.6	6.9					
width of mouth:innder diameter					76.7%	59.2%					
cut-up					3.5	3.5					
cut-up:inner diameter					19.7%	30.0%					
height of upper lip					23.6	-					
form of upper lip					bayleaf pressed in	pressed in					
diameter toe					9.2	9.3					
diameter toe hole					4.6	5.1					
length of foot					191	195					
resonator length total	109	49	108	49	91	39	88	85	177	85	167
resonator length without tuning slide etc.	-	-	-	-	181	-	-	-	-	-	-
height of languid					1.1	1.1					
angle of languid					90°	90°					
nicks					-	-					
flue					0.5	<1					
flue:toe hole					10.9%						
ear length					-	-					
ear width					-	-					
tuning slide height (stopped pipes)					-	-					
thickness upper wall					0.6	0.3					
thickness wall near mouth					0.3	-					
thickness wall near foot hole					-	-					
obersvations					rack imprint	rack imprint; breakage; bird discharge on ower edge of upper lip and languid;					

Callalli, scaling measurements rank V (continued)

Callalli, 5th rank (V)

pipe number	28/D#4-back	29/E4-front	29/E4-back	30/F4-front	30/F4--back	31/F#4--front	31/F#4--back	32/G4-front	32/G4-back	33/G#4-front	33/G#4-back
circumference				61.5	36.5						
diameter				19.6	11.6						
inner diameter				19.0	11.0						
Töpfersche Normalmensur											
deviation from Töpfer				*19.6*	*11.6*						
deviation from Töpfer (in semitones)											
surface area				301.0	106.0						
resonator length:diameter				7.4	5.9						
resonator length:surface area				0.48	0.64						
width of mouth				13.7	7.8						
width of mouth:innder diameter				72.2%	70.8%						
cut-up				4.3	3.7						
cut-up:inner diameter				22.7%	33.6%						
height of upper lip				-	-						
form of upper lip				hardly pressed in	hardly pressed in						
diameter toe				9.6	8.9						
diameter toe hole				6.8	6.8						
length of foot				191	204						
resonator length total	78	159		145	68	138	65	128	61	117	52
resonator length without tuning slide etc.	-	-		-	192	-	-	-	-	-	-
height of languid				1.2	1						
angle of languid				90°	85°						
nicks				-	-						
flue				1	0.5						
flue:toe hole				14.7%	7.4%						
ear length				-	-						
ear width				-	-						
tuning slide height (stopped pipes)				-	-						
thickness upper wall				0.3	0.3						
thickness wall near mouth				0.5	0.4						
thickness wall near foot hole				-	-						
obersvations			pipe missing	rack imprint							

Callalli, scaling measurements rank V (continued)

Callalli, 5th rank (V)

pipe number	34/A4--front	34/A4-back	35/A#4--front	35/A#4--back	36/H4-front	36/H4-back	37/C5-front	37/C5-back	38/C#5-front	38/C#5-back	39/D5-front
circumference							46.5	47			
diameter							14.8	15.0			
inner diameter							14.0	14.2			
Töpfersche Normalmensur											
deviation from Töpfer							*14.8*	*15.0*			
deviation from Töpfer (in semitones)											
surface area							172.1	175.8			
resonator length:diameter							6.3	6.4			
resonator length:surface area							0.54	0.54			
width of mouth							10	10.3			
width of mouth:innder diameter							71.4%	72.7%			
cut-up							3.3	3.5			
cut-up:inner diameter							23.6%	24.7%			
height of upper lip							7.2	-			
form of upper lip							Roman pressed in	hardly pressed in			
diameter toe							10	10.4			
diameter toe hole							5.4	5.3			
length of foot							200	214			
resonator length total	114	55	105	118	97	100	93	95	87	84	80
resonator length without tuning slide etc.	-	-	-	-	-	-	-	-	-	-	-
height of languid							1.1	1.3			
angle of languid							90°	90°			
nicks							-	-			
flue							1	1			
flue:toe hole							18.5%	18.9%			
ear length							-	-			
ear width								-			
tuning slide height (stopped pipes)							-	-			
thickness upper wall							0.4	0.4			
thickness wall near mouth							0.6	0.6			
thickness wall near foot hole							-	-			
obersvations											

Callalli, scaling measurements rank V (continued)

Callalli, 5th rank (V)

pipe number	39/D5-back	40/D#5-front	40/D#5-back	41/E5-front	41/E5-back	42/F5-front	42/F5-back	43/F#5-front	43/F#5-back	44/G5-front	44/G5-back
circumference						38		37	39		
diameter						12.1		11.8	12.4		
inner diameter						11.1		10.8	11.2		
Töpfersche Normalmensur											
deviation from Töpfer						*12.1*		*11.8*	*12.4*		
deviation from Töpfer (in semitones)											
surface area						114.9		108.9	121.0		
resonator length:diameter						5.7		5.4	5.2		
resonator length:surface area						0.60		0.59	0.53		
width of mouth						7.8		8.1	9.2		
width of mouth:innder diameter						70.3%		75.2%	82.0%		
cut-up						3.7		3.2	3.3		
cut-up:inner diameter						33.3%		29.7%	29.4%		
height of upper lip						-		-	7.8		
form of upper lip						pressed in		pressed in	Roman pressed in		
diameter toe						9.5		9.5	9.2		
diameter toe hole						4.9		5.1	4.9		
length of foot						201		204	213		
resonator length total	81	76	76	77	70	69		64	64	121	61
resonator length without tuning slide etc.	-	-	-	-	-	196		197	206	-	-
height of languid						0.9		0.7	1.1		
angle of languid						90°		90°	90°		
nicks						-		-	-		
flue						<1		0.5	1.2		
flue:toe hole								9.8%	24.5%		
ear length						-		-	-		
ear width						-		-	-		
tuning slide height (stopped pipes)						-		-	-		
thickness upper wall						0.5		0.5	0.6		
thickness wall near mouth						-		-	-		
thickness wall near foot hole						-		-	-		
obersvations						slight rack imprint	pipe missing	slight rack imprint			

Callalli, scaling measurements rank V (continued)

Callalli, 5th rank (V)

pipe number	45/G#5-front	45/G#5-back	46/A5-front	46/A5-back	47/A#5-front	47/A#5-back	48/H5-front	48/H5-back	49/C6-front	49/C6-back	50/C#6-front	50/C#6-back	51/D6-front
circumference							42	49					
diameter							13.4	15.6					
inner diameter							12.6	14.8					
Töpfersche Normalmensur													
deviation from Töpfer							*13.4*	*15.6*					
deviation from Töpfer (in semitones)													
surface area							140.4	191.1					
resonator length:diameter							7.9	6.5					
resonator length:surface area							0.76	0.53					
width of mouth							9	10.7					
width of mouth:innder diameter							71.6%	72.3%					
cut-up							3.4	3.4					
cut-up:inner diameter							27.1%	23.0%					
height of upper lip							7	-					
form of upper lip							pressed in	hardly pressed in					
diameter toe							10	9.4					
diameter toe hole							5.6	4.2					
length of foot							206	194					
resonator length total	51	52	116	116	117	117	106	102					
resonator length without tuning slide etc.	-	-	-	-	-	-	201	-					
height of languid							0.9	0.8					
angle of languid							90°	90°					
nicks							-	-					
flue							1	1					
flue:toe hole							17.9%	23.8%					
ear length							-	-					
ear width							-	-					
tuning slide height (stopped pipes)							-	-					
thickness upper wall							0.4	0.4					
thickness wall near mouth							-	-					
thickness wall near foot hole							-	-					
obersvations								light rack imprint	pipe missing	pipe missing	pipe missing	pipe missing	pipe missing

Callalli, scaling measurements rank V (continued)

Callalli, 5th rank (V)

pipe number	51/D6-back	52/D#6--front	52/D#6-back	53/E6-front	53/E6-back	54/F6-front	54/F6-back	55/F#6-front	55/F#6-back
circumference						39	38.5		
diameter						12.4	12.3		
inner diameter						11.6	11.5		
Töpfersche Normalmensur									
deviation from Töpfer						*12.4*	*12.3*		
deviation from Töpfer (in semitones)									
surface area						121.0	118.0		
resonator length:diameter						5.2	5.6		
resonator length:surface area						0.54	0.58		
width of mouth						7	8.1		
width of mouth:innder diameter						60.3%	70.7%		
cut-up						3.3	3.8		
cut-up:inner diameter						28.4%	33.2%		
height of upper lip						8.9	-		
form of upper lip						bayleaf pressed in	nauw.pressed in		
diameter toe						9.2	10		
diameter toe hole						5.5	4.5		
length of foot						222	192		
resonator length total	84	74	76	72	70	65	69	52	
resonator length without tuning slide etc.	-	-	-	-	-	212	184	-	
height of languid						0.9	0.8		
angle of languid						90°	90°		
nicks						-	-		
flue						1	1		
flue:toe hole						18.2%	22.2%		
ear length						-	-		
ear width						-	-		
tuning slide height (stopped pipes)						-	-		
thickness upper wall						0.4	0.4		
thickness wall near mouth						-	-		
thickness wall near foot hole						-	-		
obersvations							dent on foot (rack?)		pipe missing

Callalli, scaling measurements rank V (continued)

Callalli, 6th (last) rank (VI)

44/55pipes

pipe number	1/C2	2/C#2	3/D2	4/D#2
circumference				68
diameter				21.6
inner diameter				20.6
Töpfersche Normalmensur				
deviation from Töpfer				*21.6*
deviation from Töpfer (in semitones)				
surface area				368.0
resonator length:diameter				7.9
resonator length:surface area				0.47
width of mouth				15.8
width of mouth:innder diameter				76.5%
cut-up				4.6
cut-up:inner diameter				22.3%
height of upper lip				-
form of upper lip				pressed in
diameter toe				9.4
diameter toe hole				4.9
length of foot				202
resonator length total				172
resonator length without tuning slide etc.				160
height of languid				-
angle of languid				80°
nicks				-
flue				<0.5
flue:toe hole				
ear length				-
ear width				-
tuning slide height (stopped pipes)				-
thickness upper wall				0.5
thickness wall near mouth				0.5
thickness wall near foot hole				-
obersvations	pipe missing	pipe missing	pipe missing	languid onregelmatig hoog; foot very ingedrukt/

pipe number	5/E2	6/F2	7/F#2	8/G2	9/G#2
length of boot	220		222		222
length tip of boot	30		35		37
circumference boot	73.0		74.0		72.0
length resonator	976.0		740.0		740.0
circumference resonator top	295		213		196
circumference resonator bottom	64.0		77.0		65.0
circumference block	67		69		66
diameter block	21.3		22.0		21.0
visible length reed/shallot	61.0		48.0		43.0
outer width shallot	12.10		10.10		11.30
inner width shallot	9.9		9		8.9
shape shallot	flattened		flattened		flattened
length reed	72		61		53
vibrating length of reed	45.0		39.0		26.0
thickness reed	0.3		0.3		0.2
distance between reed and shallot (at front)	1.4		0.7		0.2
observations		pipe missing	resonator top 2.8 cm cut; boot top 3.8 cm cut		boot on top 1.5cm cut into; wedge missing

General observations:

from 45 onwards, block directly attached to resonator

Callalli, scaling measurements rank VI

Callalli, 6th (last) rank (VI)

pipe number	10/A2	11/A#2	12/H2	13/C3	14/C#3	15/D3	16/D#3	17/E3	18/F3	19/F#3	20/G3	21/G#3
length of boot						223	222	222	222	222	222	221
length tip of boot						36	37	36	35	36	36	37
circumference boot						74.0	72.0	71.0	72.0	72.0	72.0	73.0
length resonator						777.0	713.0	659.0	640.0	671.0	603.0	530.0
circumference resonator top						225	201	178	182	180	181	192
circumference resonator bottom						65.0	62.0	55.5	63.0	58.5	60.0	61.0
circumference block						68	66	62.5	64.7	65.0	62.8	65.3
diameter block						21.6	21.0	19.9	20.6	20.7	20.0	20.8
visible length reed/shallot						53.0	37.0	47.0	45.0	44.0	39.0	33.0
outer width shallot						11.60	8.40	10.40	8.70	10.30	9.00	8.40
inner width shallot						10	6.2	8	6.4	8	6.4	6.4
shape shallot						flattened	flattened	flattened	flattened	flattened	flattened	flattened
length reed						62	49	55	54.4	57.8	52.6	44.4
vibrating length of reed						35.0	28.0	30.0	27.0	29.0	31.0	17.0
thickness reed						0.2	0.3	0.2	0.4	0.3	0.4	0.3
distance between reed and shallot (at front)						1.5	1	1	1.5	0.5	1.2	0.8
observations	pipe missing	pipe missing	pipe missing	pipe missing	pipe missing	light rack imprint boot	light rack imprint boot; speaks!	corrosion boot; speaks	boot 2.4 cm cut into; resonator 1cm cut	speaks a bit; resonator very dented and kinked; pattern on resonator	boot 0.5 cm cut; corrosion resonator; resonator 0.9 cm cut into; resonator very dented and kinked	resonator kinked in two places and broken in two placed; resonator 1.6 cm cut into; boot 0.5 cm cut into;

Callalli, scaling measurements rank VI (continued)

Callalli, 6th (last) rank (VI)												
pipe number	22/A3	23/A#3	24/H3	25/C4	26/C#4	27/D4	28/D4	29/E4	30/F4	31/F#4	32/G4	33/G#4
length of boot	222	222	220	222	222	222	223	222	222	224	223	224
length tip of boot	35	36	35	33	36	37	34	37	37	38	36	37
circumference boot	70.0	73.0	69.0	74.0	70.0	71.0	73.0	72.0	69.0	73.0	78.0	74.0
length resonator	507.0	450.0	423.0	411.0	412.0	397.0	370.0	370.0	340.0	312.0	290.0	274.0
circumference resonator top	163	171	138	135	130	179	160	134	172	167	157	149
circumference resonator bottom	58.0	59.0	55.0	55.0	52.0	61.0	63.0	62.0	67.5	69.0	69.0	69.0
circumference block	61.9	66.0	61.6	66.3	64.7	62.8	64.1	64.4	64.4	63.5	64.7	63.5
diameter block	19.7	21.0	19.6	21.1	20.6	20.0	20.4	20.5	20.5	20.2	20.6	20.2
visible length reed/shallot	35.0	35.0	28.7		34.0	32.0	31.2	33.5	34.5	33.6	26.5	32.1
outer width shallot	7.90	8.10	7.30		7.50	7.30	7.60	8.10	7.80	8.10	7.40	8.10
inner width shallot	6.1	5.9	5		5.4	5.1	5.7	6.7	5.2	-	5.1	6.5
shape shallot	flattened	round	flattened		round	round	round-flattened	round-flattened	round-flattened	round	round-flattened	round-flattened
length reed	48.2	49.1	44.7		41.5	43.5	46.7	45.6	41.3	-	39.3	40.3
vibrating length of reed	28.0	11.6	19.1	-	22.1	-	23.2	15.7	23.5	20.0	19.4	22.5
thickness reed	0.3	0.2	0.2		0.2	0.3	0.29	0.3	0.2	0.1	0.1	0.39
distance between reed and shallot (at front)	1.1	-	0.5		0.7	-	1.1	1.3	0.7	0.4	0.7	0.7
observations	corrosion; kinked and broken; speaks	corrosion, even on reed, shallot and tuning wire; resonator dented; soldering seam resonator breaks opeb; pattern on material resonator	new tuning wire; resonator omgebogen en ingedrukt; new reed?	no reed, keel or tuning wire; corrosion	new tuning wire; new reed?; resonator very bent and dented	corrosion; block breaks off; tuning wire missing	wedge missing; resonator dented; green corrosion on reed	near top boot 2.2 cm cut	near top boot 0.5 cm cut; speaks; top of resonator dented	new tuning wire; keel and reed are stuck; resonator dented on top	on top boot 0.3 cm cut; new tuning wire; new reed?	nw. tuning wire; nw. reed?; no wedge; speaks

Callalli, scaling measurements rank VI (continued)

Callalli, 6th (last) rank (VI)

pipe number	34/A4	35/A#4	36/H4	37/C5	38/C#5	39/D5	40/D#5	41/E5	42/F5	43/F#5	44/G5	45/G#5
length of boot	222	222	222	222	222	222	222	224	228	221	220	220
length tip of boot	33	33	36	36	36	36	35	34	32	34	36	37
circumference boot	74.0	72.0	71.0	71.0	71.0	70.0	70.0	73.0	71.0	70.0	70.0	71.0
length resonator	270.0	323.0	311.0	290.0	267.0	255.0	244.0	228.0	206.0	203.0	198.0	164.0
circumference resonator top	144	142	136	130	124	121	124	121	119	113	108	102
circumference resonator bottom	63.0	33.5	38.0	37.0	40.0	37.0		33.5	36.5	33.5	36.5	33.5
circumference block	*61.6*	*60.6*	*64.7*	*66.0*	*65.3*	*64.7*	*63.5*	*65.7*	*65.0*	*64.4*	*60.9*	*63.5*
diameter block	19.6	19.3	20.6	21.0	20.8	20.6	20.2	20.9	20.7	20.5	19.4	20.2
visible length reed/shallot	30.6	33.2	30.6	26.6	24.3	30.7	25.4	26.8	22.3	22.6	24.1	22.4
outer width shallot	8.70	7.10	7.30	7.10	7.00	6.90	6.60	6.60	6.60	6.60	6.80	7.00
inner width shallot	5.9	4.7	5.2	4.6	4.5	-	-	5.3	4.6	4.7	4.8	4.7
shape shallot	round-flattened	round-flattened	round-flattened	round	round-flattened	round	round	round-flattened	round	round	round-flattened	flattened
length reed	48.9	40.2	38.3	37.5	33.1	-	-	37.4	28.4	33	32.4	31.7
vibrating length of reed	21.5	24.4	21.1	19.8	18.6	17.2	15.6	13.5	13.4	11.3	12.4	15.2
thickness reed	0.3	0.1	0.2	0.1	0.1	1.9	0.2	0.1	0.1	0.1	0.1	0.1
distance between reed and shallot (at front)	0.3	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3
observations	nw. reed?; speaks	nw. tuning wire; speaks	nw. tuning wire; nw. reed?; speaks	nw. tuning wire; nw. reed?; speaks; soldering seam new near top of] resonator	nw. tuning wire; nw. reed?	shallot/reed are stuck; speaks	shallot/reed are stuck; speaks	boot on top 1cm cut into; corrosion; speaks	speaks	corrosion	nw. tuning wire; nw. reed?; speaks	nw. tuning wire; nw. reed?; speaks

Callalli, scaling measurements rank VI (continued)

Callalli, 6th (last) rank (VI)										
pipe number	46/A5	47/A#5	48/H5	49/C6	50/C#6	51/D6	52/D#6	53/E6	54/F6	55/F#6
length of boot	220	220	221	220	220	220	222	220	219	
length tip of boot	36	35	36	36	36	36	37	36	36	
circumference boot	72.0	69.0	71.0	71.0	70.0	71.0	70.0	70.0	69.0	
length resonator	161.0	151.0	143.0	133.0	122.0	118.0	112.0	102.0	95.0	
circumference resonator top	103	99	94	90	84	86	81	80	70	
circumference resonator bottom	33.0	32.5	32.5	33.0	32.5		33.5	36.0		
circumference block	*65.0*	*63.5*	*63.8*	*63.1*	*64.1*	*62.5*	*65.0*	*63.8*	*60.0*	
diameter block	20.7	20.2	20.3	20.1	20.4	19.9	20.7	20.3	19.1	
visible length reed/shallot	22.7	20.3	18.8	22.4	21.4	23.0	18.4	19.6	16.4	
outer width shallot	7.00	6.90	6.80	6.60	6.70	6.60	5.60	6.50	6.30	
inner width shallot	-	4.6	4.6	3.8	4.3	4.7	3.5	4.5	4.2	
shape shallot	round	round-flattened	round-flattened	round-flattened	round-flattened	round	round-flattened	round-flattened	round-flattened	
length reed	-	28	30.6	28.8	28.5	29.6	30.5	30.1	28.8	
vibrating length of reed	15.3	10.9	14.4	18.8	19.3	13.6	9.1	5.7	8.7	
thickness reed	0.1	0.1	0.0.9	0.09	0.1	0.09	0.09	0.09	<0.09	
distance between reed and shallot (at front)	0.4	0.6	0.4	0.3	0.4	0.9	0.4	-	0.2	
observations	nw. tuning wire; nw. reed?; speaks; shallot/reed are stuck	nw. tuning wire; nw. reed?; speaks; black stripes	nw. tuning wire; nw. reed?; speaks; black stripes	nw. tuning wire; nw. reed?; speaks; black stripes	boot top 0.5cm cut; corrosion; speaks; black stripes	shallot made of more reddish material (fosforbrons?);wedge missing; nw. reed?; black stripes	resonator prob. nw; resonator of brass; nw. reed?; nw keel?;	resonator brass; resonator probl. nw; nw. reed?; reddish shallot; speaks	nw. wedge; reddish shallot; two blocks; nw. shallot?; speaks;	

Callalli, scaling measurements rank VI (continued)

Callalli, loose pipes (LF) (front pipe type)

pipe number	1	2	3	4
circumference	164	146	130	120
diameter	52.2	46.5	41.4	38.2
inner diameter	51.2	45.7	40.6	37.2
Töpfersche Normalmensur				
deviation from Töpfer	*52.2*	*46.5*	*41.4*	*38.2*
deviation from Töpfer (in semitones)				
surface area	2140.3	1696.3	1344.9	1145.9
resonator length:diameter	9.9	10.4	8.9	10.1
resonator length:surface area	0.24	0.28	0.27	0.34
width of mouth	39	35	30	29
width of mouth:innder diameter	76.2%	76.6%	73.9%	78.0%
cut-up	10	8.5	8.1	8.7
cut-up:inner diameter	19.5%	18.6%	20.0%	23.4%
height of upper lip	32	23	23	26
form of upper lip	Roman pressed-scored	Roman pressed-scored	scored	pressed in
diameter toe	12.3	10.5	10.7	10.1
diameter toe hole	10	8.2	9.1	8
length of foot	544	565	548	598
resonator length total	515	482	368	384
resonator length without tuning slide etc.	505	460	-	250
height of languid	1.6	1.8	0.7	1.4
angle of languid	90°	90°	90°	90°
nicks	-	-	-	-
flue	<1	1	<0.5	1
flue:toe hole	#¡VALOR!	12.2%	#¡VALOR!	12.5%
ear length	-	-	-	-
ear width	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-
thickness upper wall	0.5	0.4	0.4	0.5
thickness wall near mouth	0.4	0.4	0.4	0.4
thickness wall near foot hole	0.4	0.4	0.6	0.5
obersvations	on top 2cm new; dents; bad soldering seam languid	dents; bad soldering seam languid: foot breaking open	black soldering seam resonator; bad soldering seam languid	dents

Callalli, scaling measurements, loose pipes

Callalli, loose pipes (LI) (type interior pipes)

pipe number	1	2	3	4	5	6	7	8	9	10	11	12	13
circumference	194	208	181	157	174	163	151	185	150	145	126	105	102
diameter	61.8	66.2	57.6	50.0	55.4	51.9	48.1	58.9	47.7	46.2	40.1	33.4	32.5
inner diameter		64.2	55.2	48.8	54.2	49.5	46.1	#VALUE!	46.5	45.4	39.3	32.4	31.3
Töpfersche Normalmensur													
deviation from Töpfer	*61.8*	*66.2*	*57.6*	*50.0*	*55.4*	*51.9*	*48.1*	*58.9*	*47.7*	*46.2*	*40.1*	*33.4*	*32.5*
deviation from Töpfer (in semitones)													
surface area	2995.0	3442.8	2607.0	1961.5	2409.3	2114.3	1814.4	2723.5	1790.5	1673.1	1263.4	877.3	827.9
resonator length:diameter	12.6	12.6	13.0	15.8	11.5	15.8	15.4	11.6	14.5	14.3	10.1	10.8	10.4
resonator length:surface area	0.26	0.24	0.29	0.40	0.26	0.39	0.41	0.25	0.39	0.39	0.32	0.41	0.41
width of mouth	47	53	45	37	40.9	39	36	46	35	35	27	24	25
width of mouth:innder diameter	#DIV/0!	82.5%	81.5%	75.9%	75.5%	78.8%	78.2%	#VALUE!	75.2%	77.2%	68.7%	74.0%	80.0%
cut-up	16.3	13	17.8	12	14.1	-	11.7	16.4	9.7	10.4	8.4	5.9	6.7
cut-up:inner diameter	#DIV/0!	20.2%	32.2%	24.6%	26.0%	#VALUE!	25.4%	#VALUE!	20.8%	22.9%	21.4%	18.2%	21.4%
height of upper lip	63	-	-	29	-	33	27	-	27	26	-	34	-
form of upper lip	Roman pressed in	none	none	Roman scored and soldered in	none	Roman scored	Roman pressed-scored.	pressed in	Roman pressed-scored and soldered in	Roman pressed-scored.	pressed in	Roman pressed in	pressed in
diameter toe	12.6	16.8	12.8	-	12.9	12.9	12.5	12.9	9.4	13.6	10.8	11.4	9.6
diameter toe hole	5.9	8.5	8	-	5.8	-	-	5.6	4.6	4.7	5.5	5.1	3.8
length of foot	225	210	200	205	220	198	199	215	-	205	219	199	194
resonator length total	780	835	750	790	638	818	740	685	690	658	405	360	337
resonator length without tuning slide etc.	-	-	-	-	-	-	720	-	-	-	-	-	318
height of languid	1.9	2.7	2.5	2.1	2.2	-	1.4	2.3	1.6	1	2	1.1	1.1
angle of languid	90°	80°	80°	90°	90°	90°	90°	80°	90°	85°	90°	90°	90°
nicks	-	-	-	-	-	-	-	-	-	-	-	-	-
flue	<0.5	-	1.5	-	<0.5	2	-	0.5	-	>0.5	>1	>0.5	-
flue:toe hole													
ear length	40	42	36	-	31	-	-	38	-	-	-	-	-
ear width	21	24	15	-	15	-	-	26	-	-	-	-	-
tuning slide height (stopped pipes)	-	-	-	-	-	-	-	-	-	-	-	-	-
thickness upper wall	-	-	-	0.6	-	1.2	1	-	0.6	0.4	0.4	0.5	0.6
thickness wall near mouth	-	1	1.2	0.6	0.6	-	1	0.5	0.6	0.4	1	0.4	0.4
thickness wall near foot hole	-	-	-	-	-	-	-	-	-	-	-	-	-
obersvations	stopped; foot collapsed and showing scratches	structure of material+discoloration; foot totally collapsed, almost breaking off; tape	top 16cm new; top cover plate collapsed; discolorations; bad soldering seams; foot collapsed+"pig's snout"	top 14.5cm new; light; foot collapsed+"pig's snout"; soldering seams breaking	top 8.6cm new; holw filled with solder, foot collapsed	14.7cm new; in 2 parts; upper lip see picture; many dents in newer part	top 13cm new; foot collapsed+imprint of rack	top 5.8cm new; in 2 parts; stopped	top 10.5cm new; foot kinked	top 11cm new; foot collapsed+imprint of rack	top 3.3cm new; many inscriptions	top 1.1cm new; entire pipe totally collapsed including mouth/lips	top 2.3cm new

Callalli, scaling measurements, loose pipes (continued)

Callalli loose pipes (TL)	(type VI)								
pipenummer/toon	R1	R2	R3	R4	R5	R6	R7	R8	R9
length of boot	222	282	286	260	257	-	-	295	
length tip of boot	36	31	53	34	35	-	-	43	
circumference boot	71.0	83.0	88.0	84.0	85.0	-	-	98.0	
length resonator	80.0	1462+380	1350.0	1511.0	1348+374	1280.0	1305+970	-	
circumference resonator top	90	323	324	341	288	395	300	-	
circumference resonator bottom		64.0	68.0	64.0	66.0	80.0	69.0	-	
circumference block	*60.3*	*70.1*	*69.4*	*71.0*	*66.3*	*#VALUE!*	*0.0*	*91.1*	*0.0*
diameter block	19.2	22.3	22.1	22.6	21.1	-		29.0	
visible length reed/shallot	15.6	57.0	67.0	64.0	-	-		78.5	51.8
outer width shallot	6.40	12.70	14.10	12.30	10.80	-		18.00	7.70
inner width shallot	4.6	-	-	-	8.3	—		15.5	4.7
shape shallot	round-flattened	round-flattened	round-flattened	round-flattened	round-flattened	--		round-flattened	round-flattened
length reed	29.5	-	-	-	74	-			
vibrating length of reed	8.4	54.0	40.0	48.0	-	-		49.6	
shape reed	round-flattened	round	round-flattened	round-flattened	round	-		round-flattened	
thickness reed	<0.09	0.2	0.2	0.2	0.2	-		0.4	0.2
distance between reed and shallot (at front)	0.1	2.4	0.5	1.4	-	-		1.3	
observations	lying underneath the other reed pipes; speaks; 0.5 cm cut into boot; only one block	lying on the floor in the organ; textile around boot and upper block; top 0.1-1 cm new resonator; tuning wire stuck (won't detach)	very bad soldering seam boot; top of boot 1.8 cm new and 3 cm cut into; top resonator 6.8 cm new; textile around upper block	boot dented and textile around top of boot; top resonator 22.0 cm new; resonator dented 6.0 cm; felt underneath shallot; textile around upper block	boot 3.5 cm dented; boot breaking open; tuning wire and wedge missing; resonator 26 cm (partly very) dented;	only resonator present; does not belong to R7 or R8	resonator broken off; tip of boot wrapped with textile	only lowest part with broken-off boot (directly above upper block broken off); maybe originally lowest note?; NOT compatible with loose resonator. Lying under wind duct.	only reed, shallot and wedge.

Callalli, scaling measurements, loose pipes (continued)

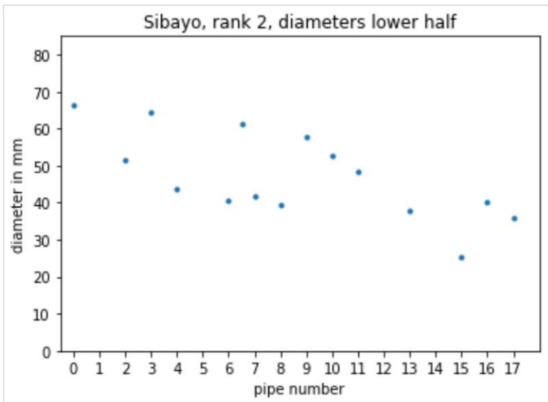
Tisco, front pipes

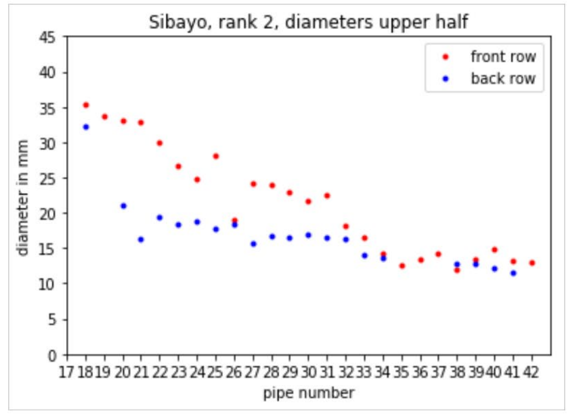
pipe number	middel	2nd left of middel	2nd right of middel
circumference	320.0	245.0	237.0
diamter	101.9	78.0	75.4
inner diameter	99.5	75.4	73.0
Töpfersche Normalmensur	-	-	-
deviation from Töpfer	-	-	-
deviation from Töpfer (in semitones)	-	-	-
surface area	7769.3	4463.4	4189.9
resonator length:diameter	12.7	12.4	12.1
resonator length:surface area	0.2	0.2	0.2
width of mouth	88.0	65.0	60.0
width of mouth:inner diameter	0.9	0.9	0.8
cut-up	17.5	14.4	14.3
cut-up:inner diameter	0.2	0.2	0.2
height of upper lip	105.0	95.0	87.0
form of upper lip	scored bayleaf	scored bayleaf	scored bayleaf
diameter toe	28.7	15.6	15.4
diameter toe hole	9.0	8.2	8.2
length of foot	228.0	263.0	262.0
resonator length total	1297.0	970.0	915.0
resonator length without tuning slide etc.	-	-	-
height of languid	3.7	3.9	3.4
angle of languid	50°	60°	70°
nicks	0.0	0.0	0.0
flue	0.4	0.4	0.3
flue:toe hole	0.0	0.0	0.0
ear length	-	-	-
ear width	-	-	-
tuning slide height (stopped pipes)	-	-	-
thickness upper wall	-	1.3	1.2
thickness wall near mouth	1.2	1.0	0.8
thickness wall near foot hole	0.8	-	1.1
observations	upper lip has a nick; inscription (cross) abve upper lip; milky stains (as if some liquid ran down); collapsed foot		inscription: cross with circle on top; ribbed material; material mended (inside)

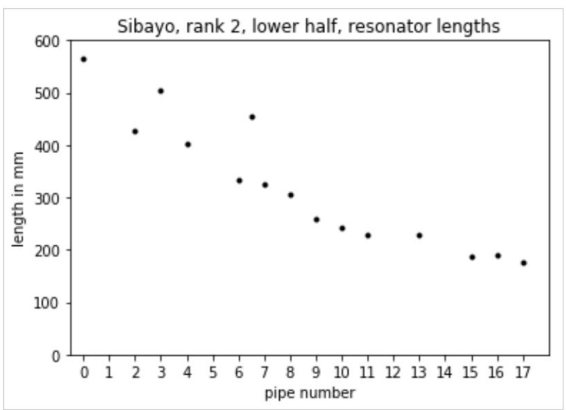
Tisco, scaling measurements, front pipes

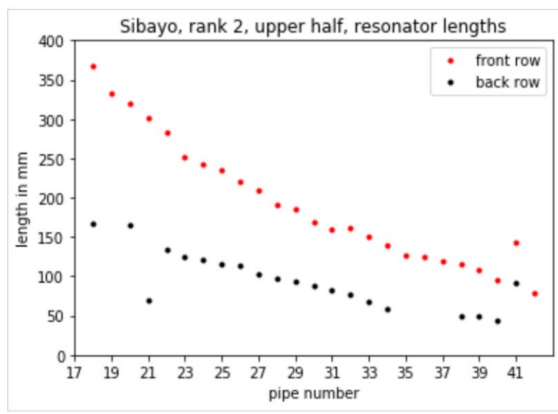
APPENDIX D: PLOTS OF SCALING PROGRESSIONS

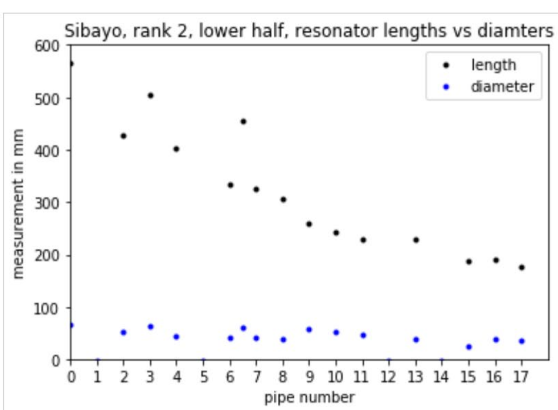
Sibayo, rank 2, scaling proportions and progressions

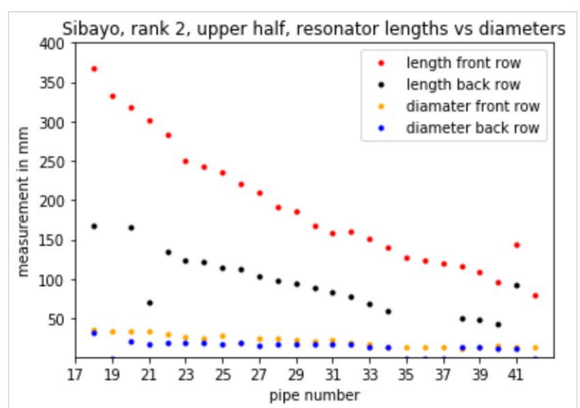




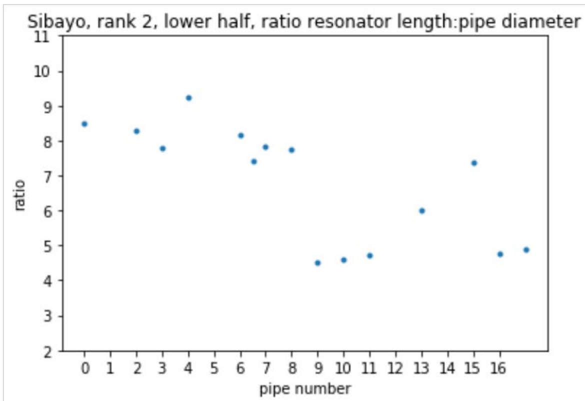


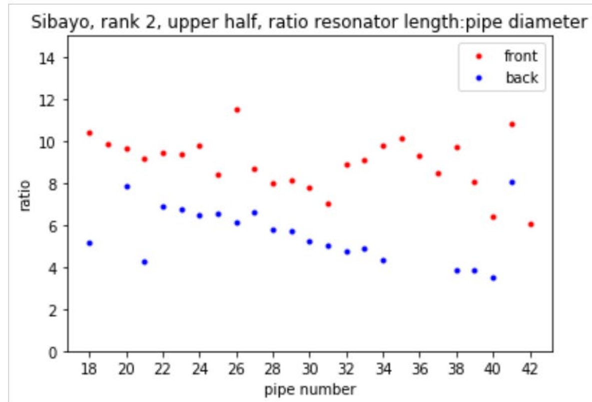


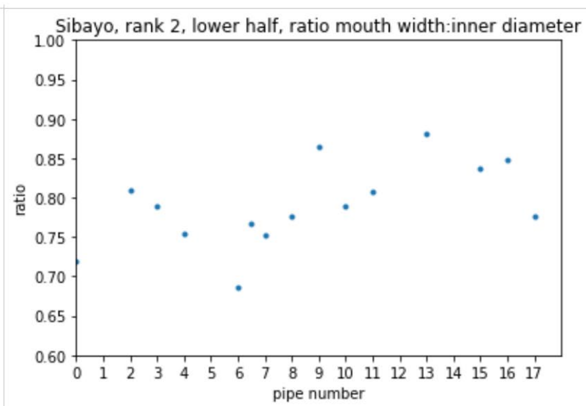


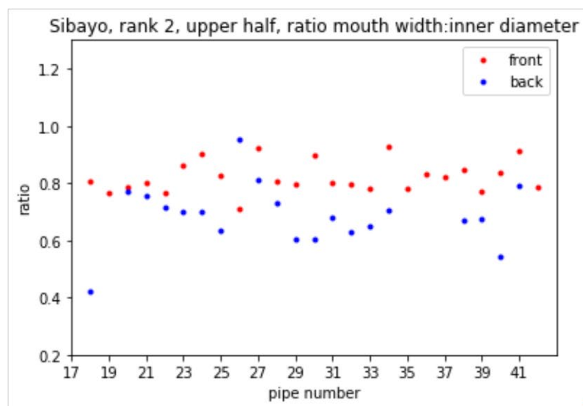


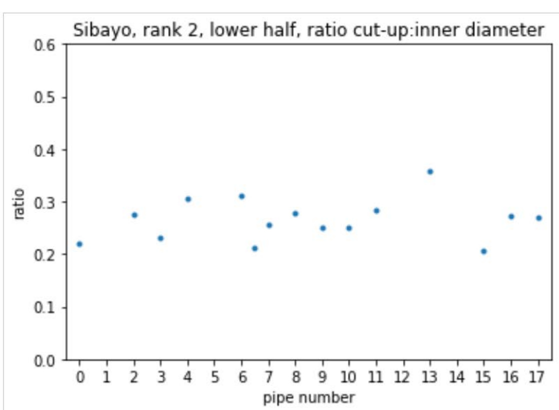
Sibayo, rank 2, scaling proportions and progressions (continued)

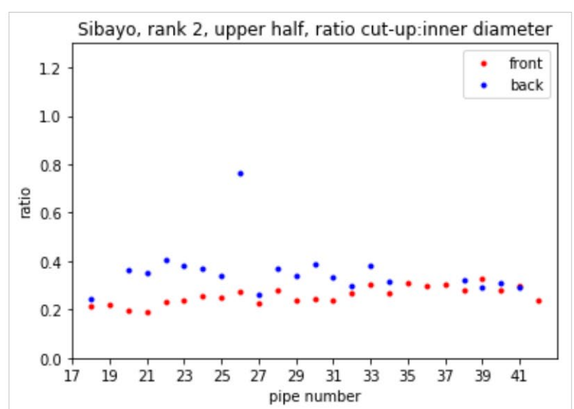




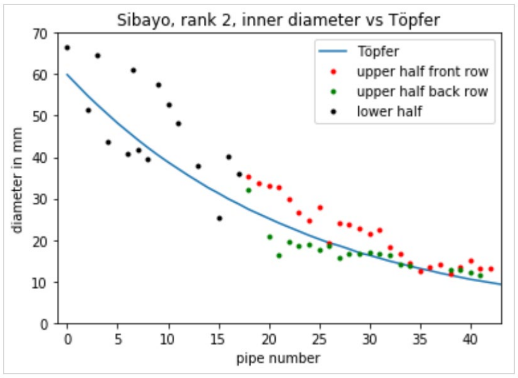




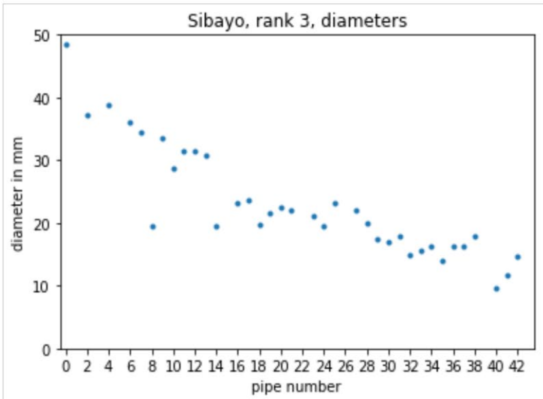


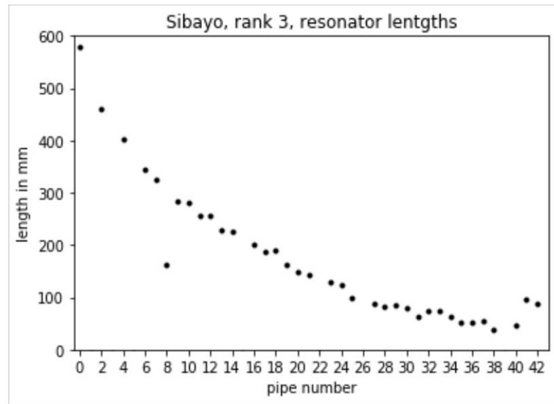


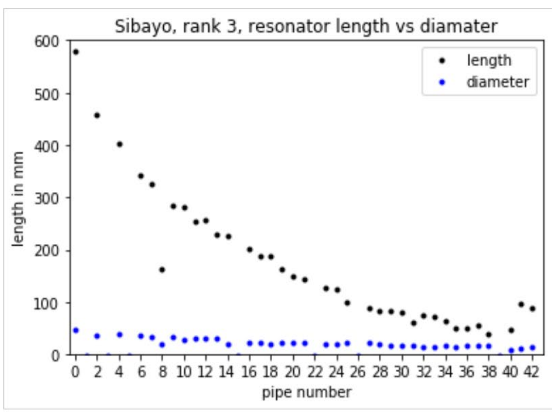
Sibayo, rank 2, scaling proportions and progressions (continued)

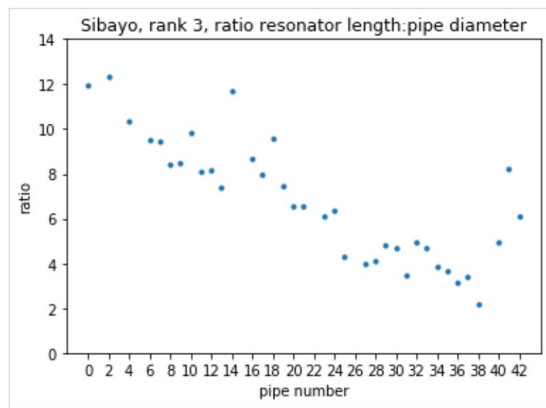


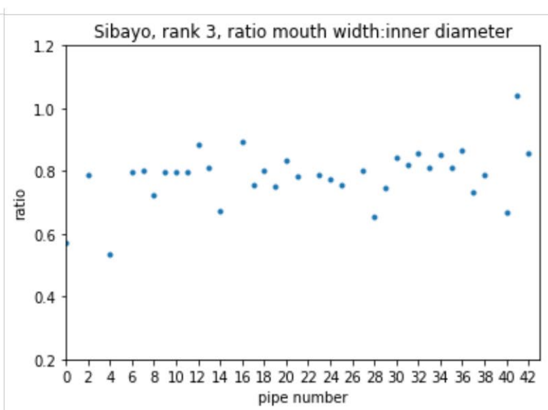
Sibayo, rank 3, scaling proportions and progressions

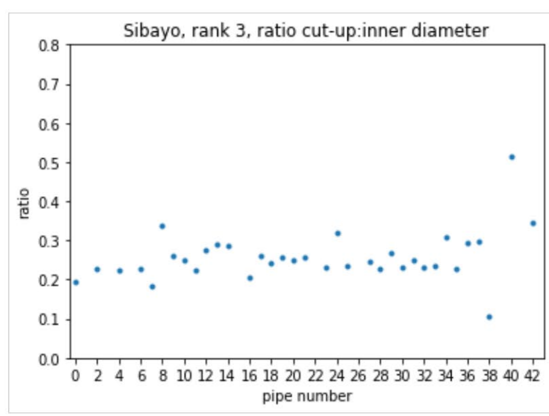




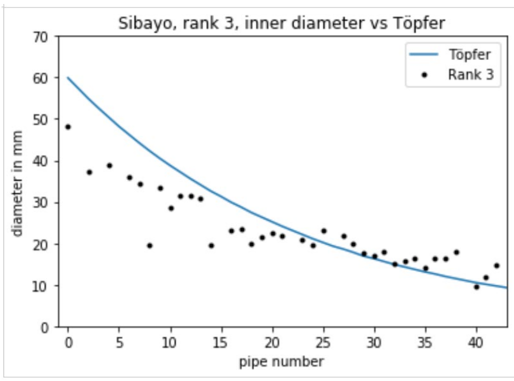




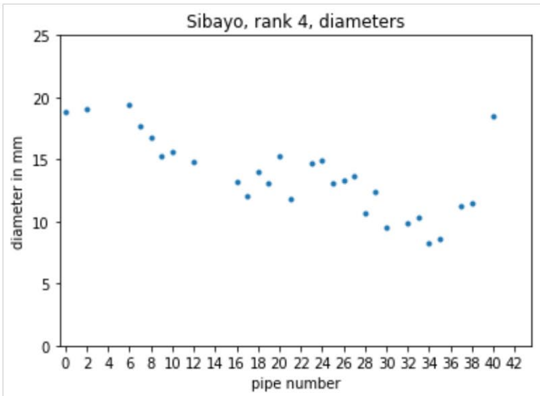


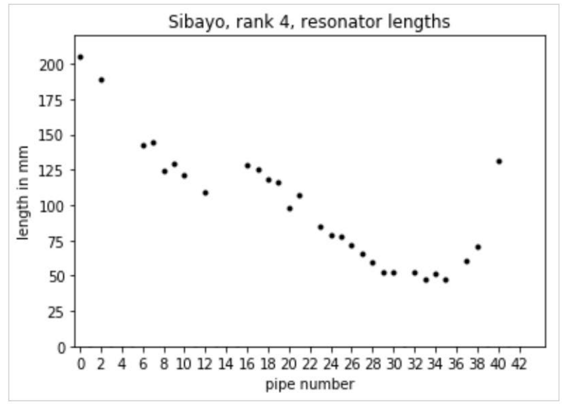


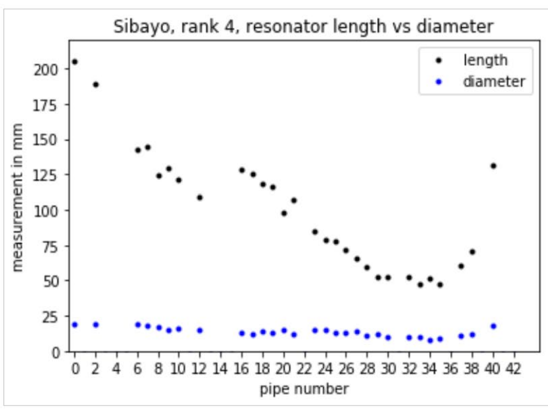
Sibayo, rank 3, scaling proportions and progressions (continued)

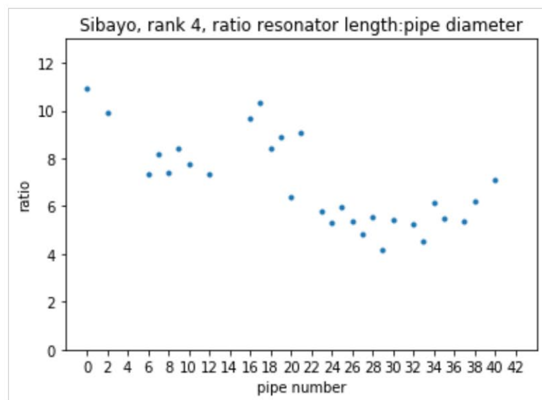


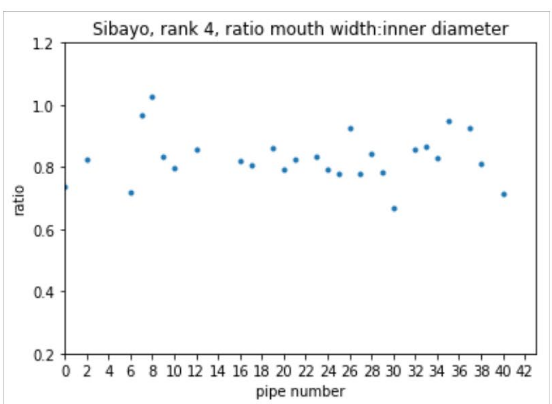
Sibayo, rank 4, scaling proportions and progressions

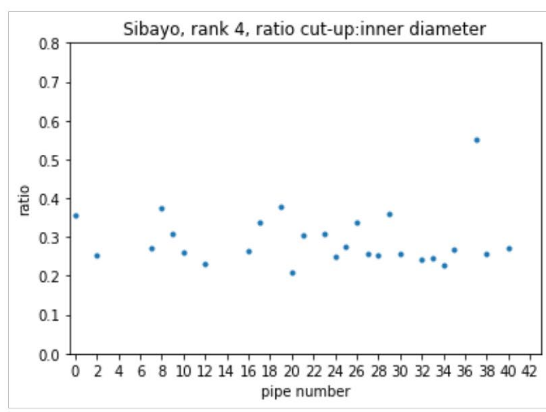




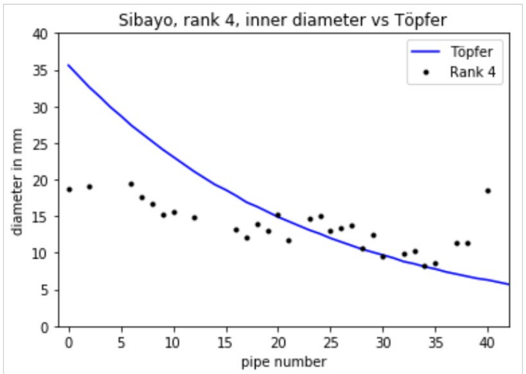




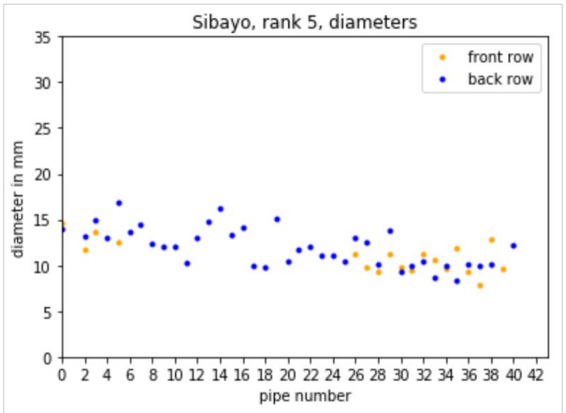


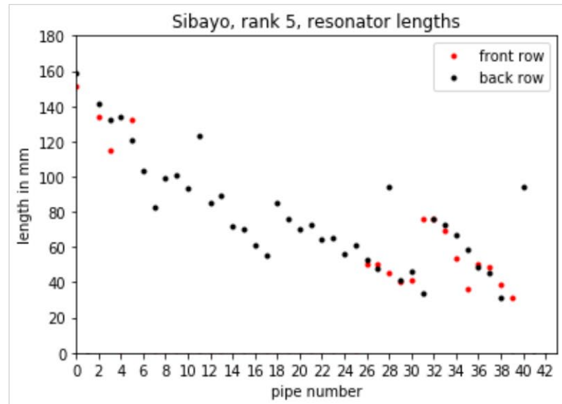


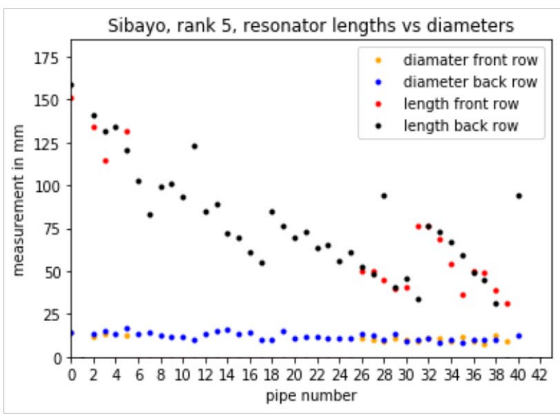
Sibayo, rank 4, scaling proportions and progressions (continued)

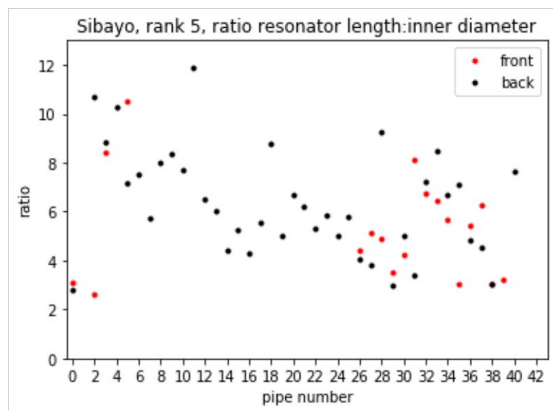


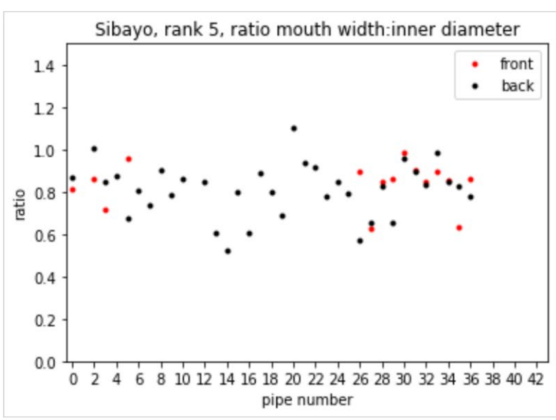
Sibayo, rank 5, scaling proportions and progressions

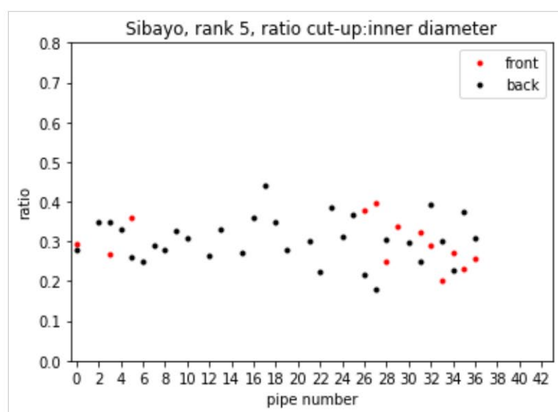




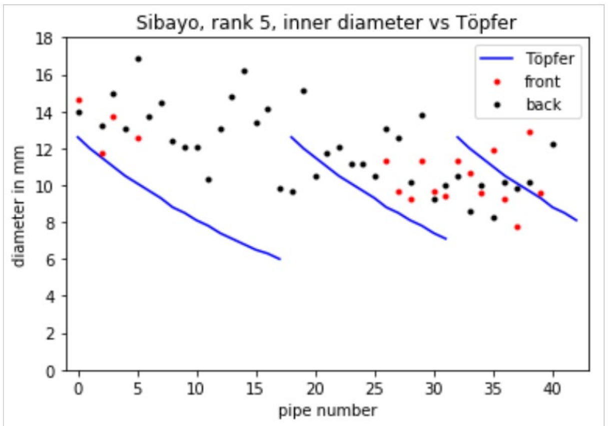




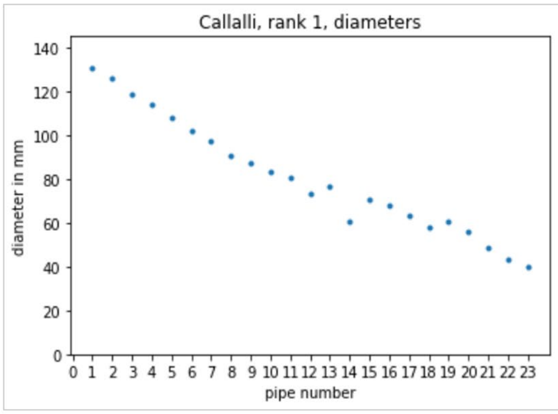


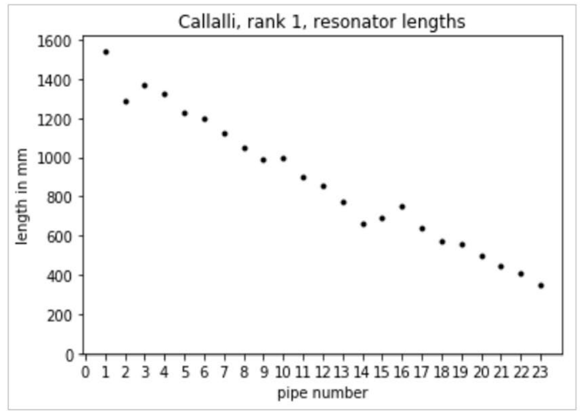


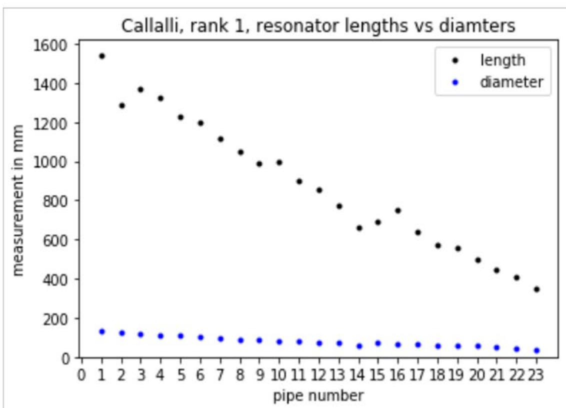
Sibayo, rank 5, scaling proportions and progressions (continued)

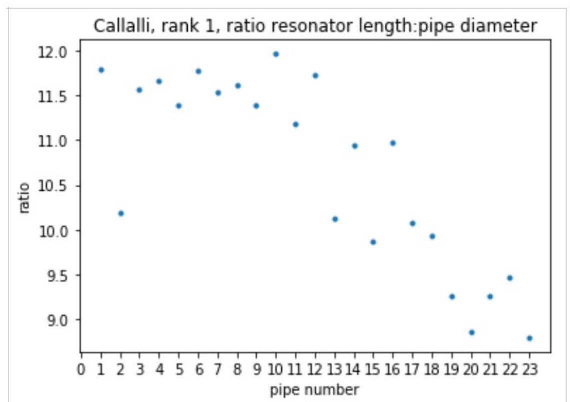


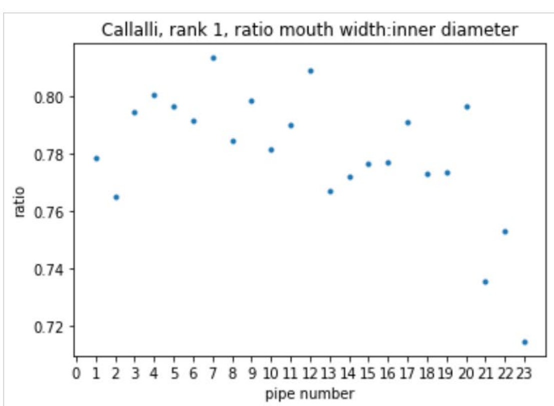
Callalli, rank 1, scaling proportions and progressions

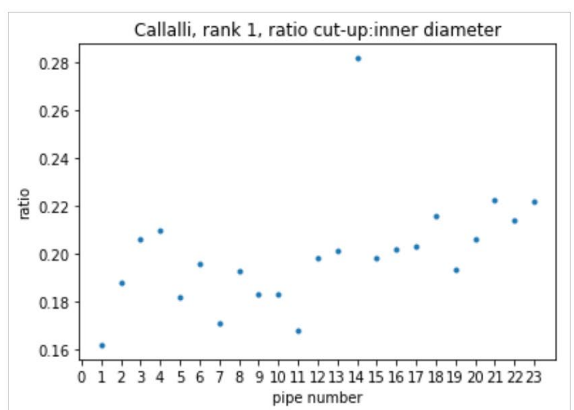




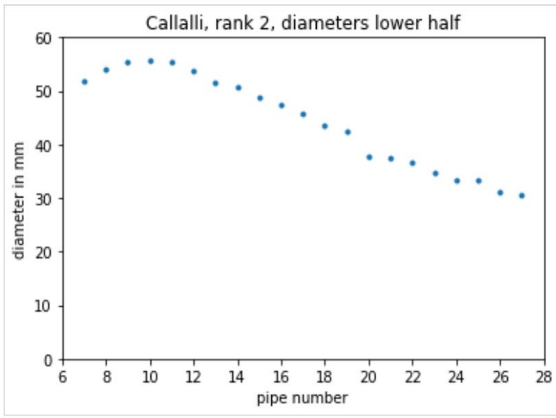


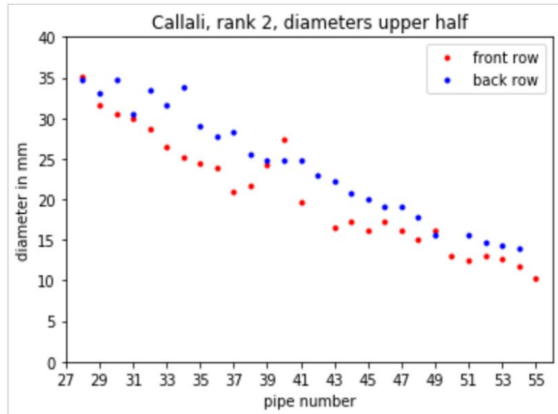


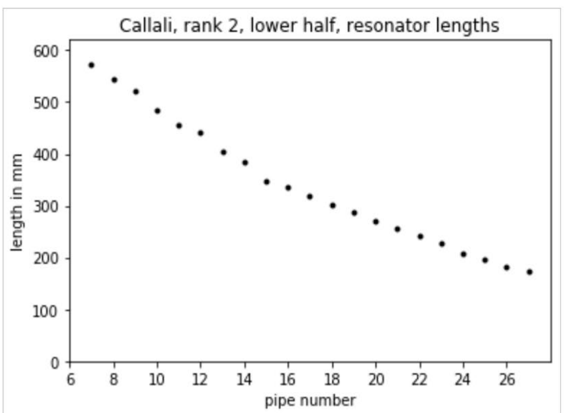


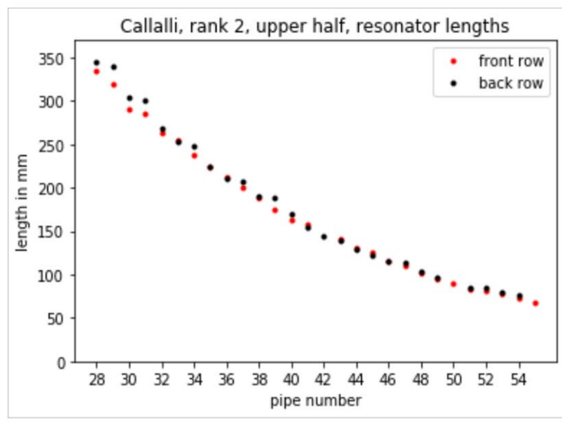


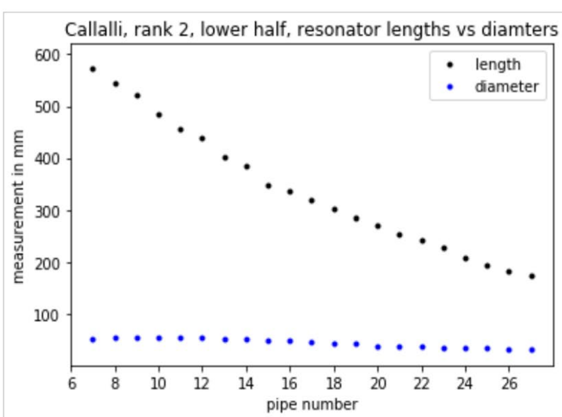
Callalli, rank 2, scaling proportions and progressions

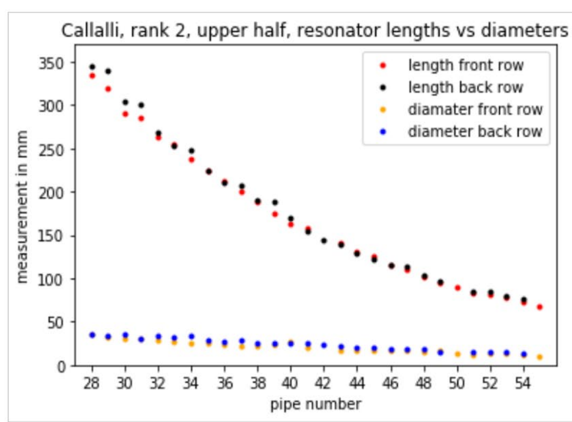




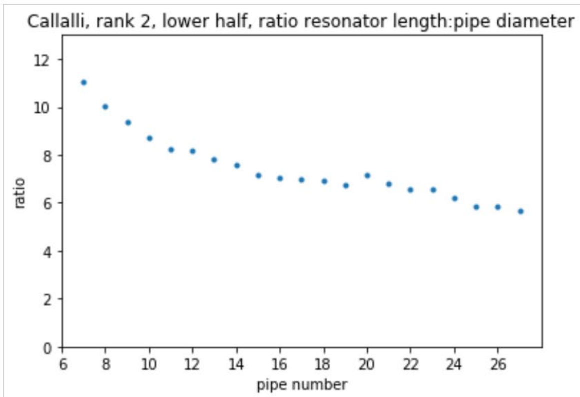


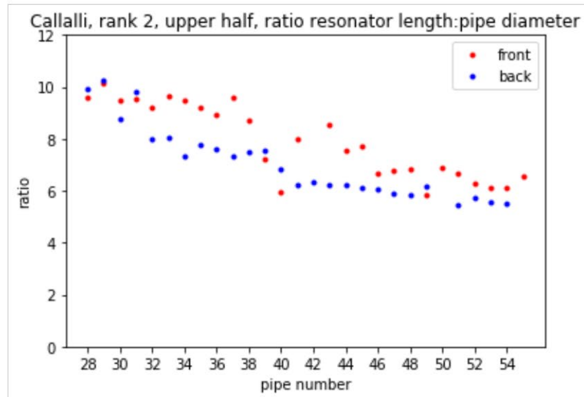


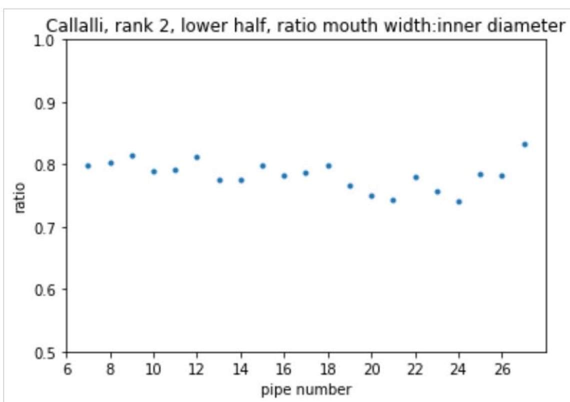


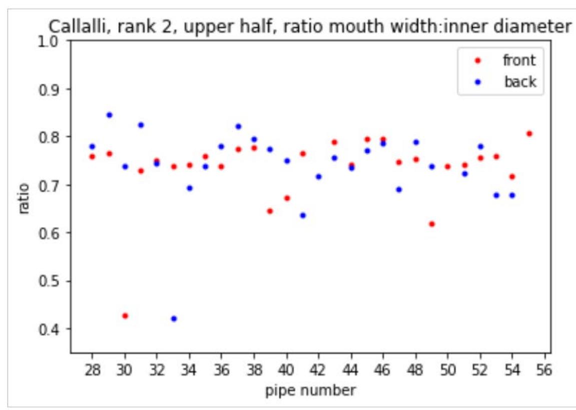


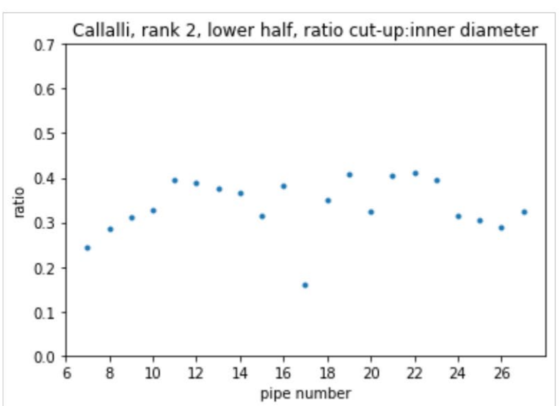
Callalli, rank 2, scaling proportions and progressions (continued)

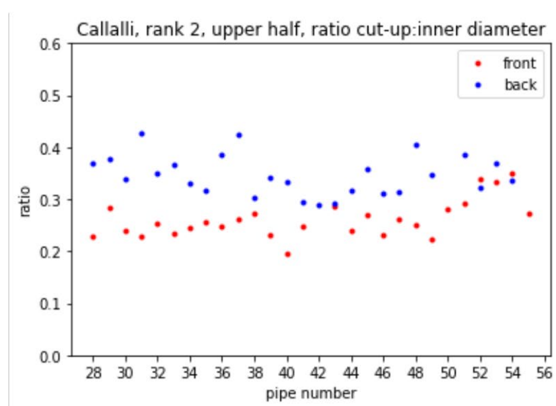




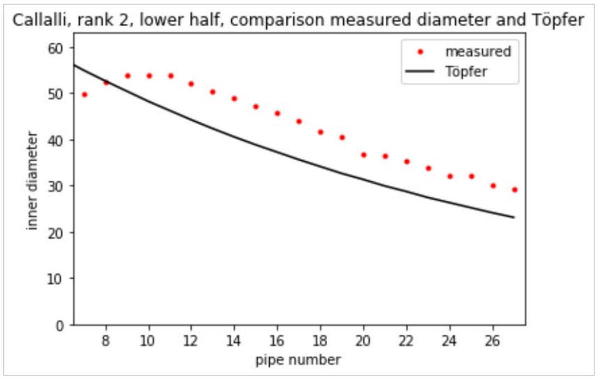


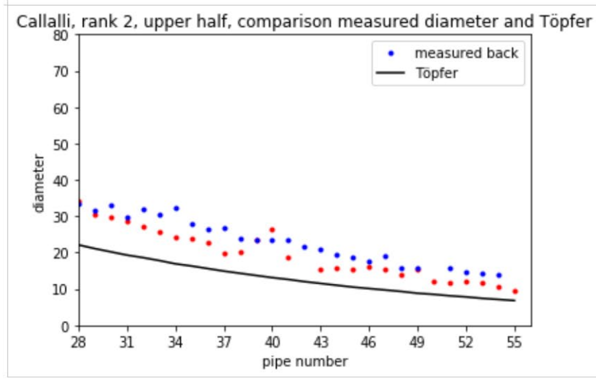


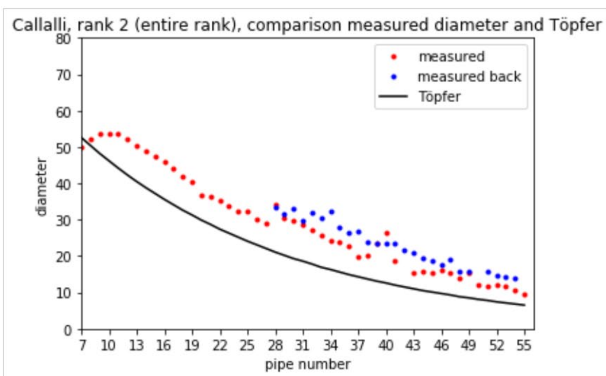


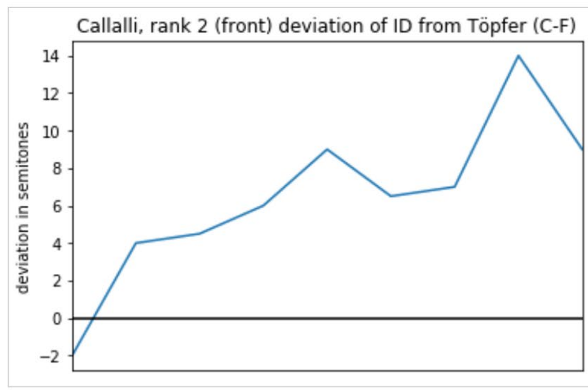


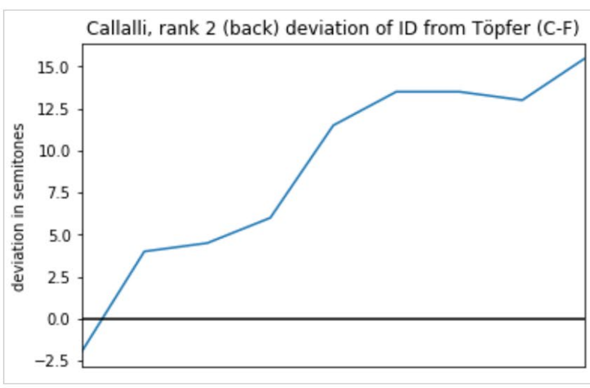
Callalli, rank 2, scaling proportions and progressions (continued)

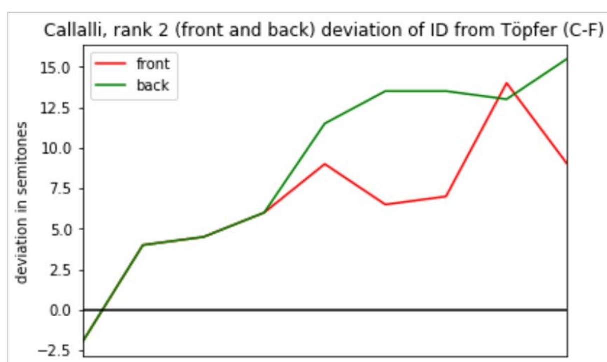




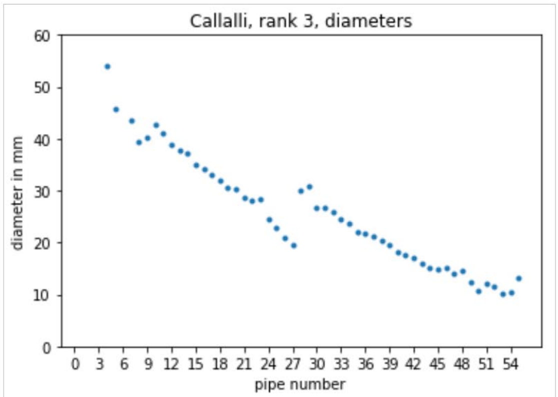


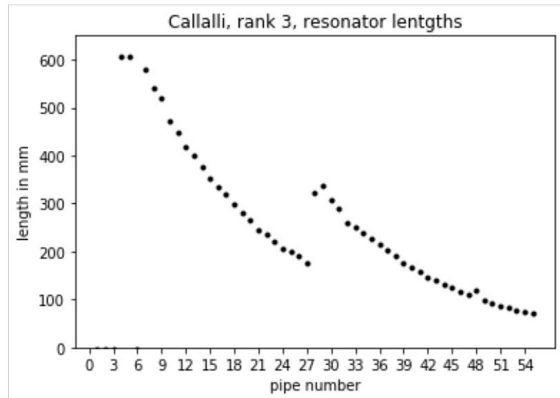


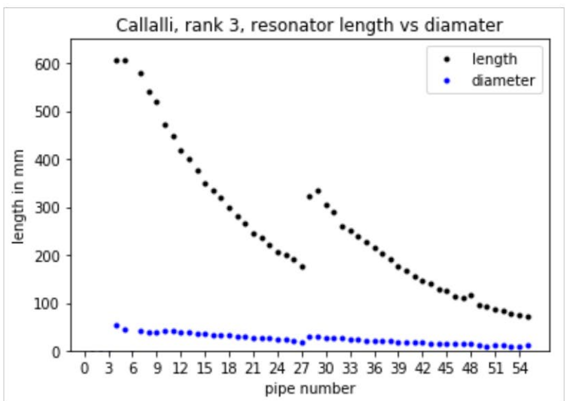


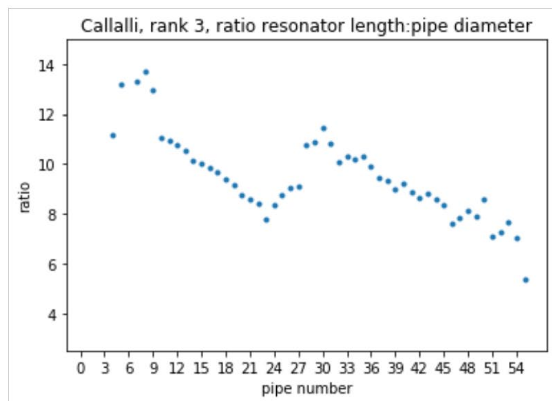


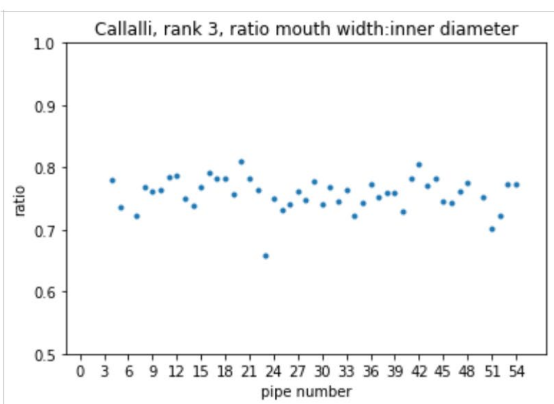
Callalli, rank 3, scaling proportions and progressions

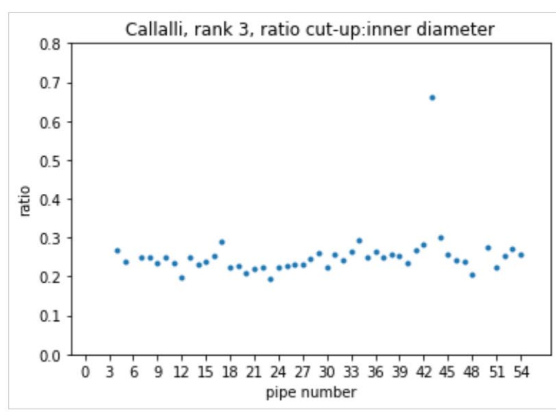




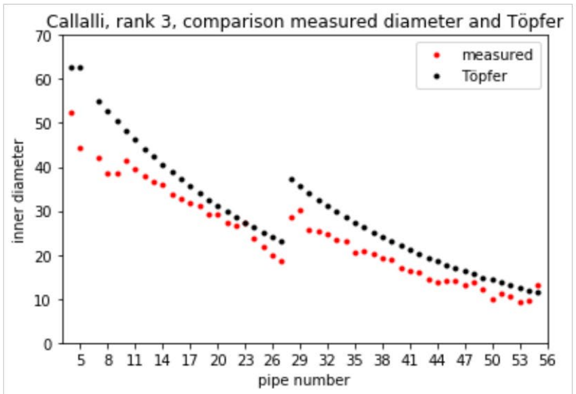


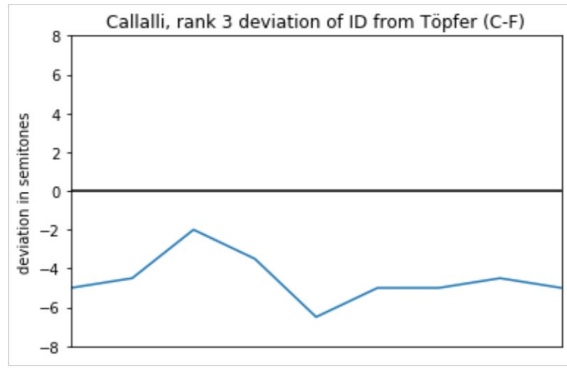




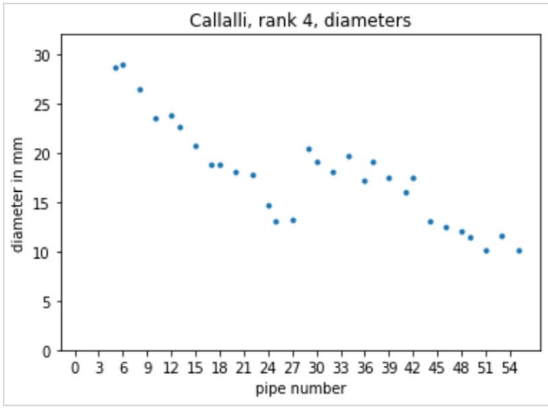


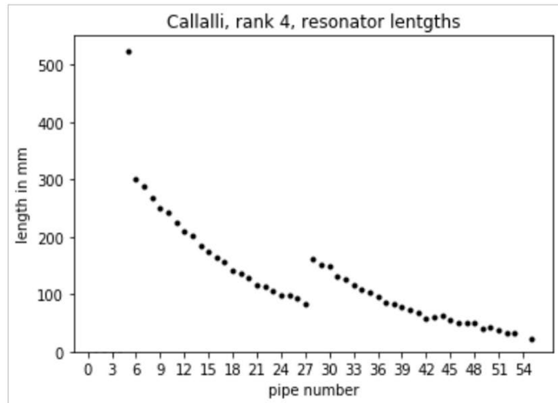
Callalli, rank 3, scaling proportions and progressions (continued)

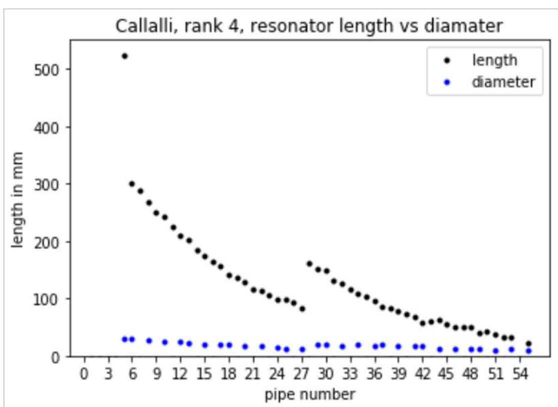


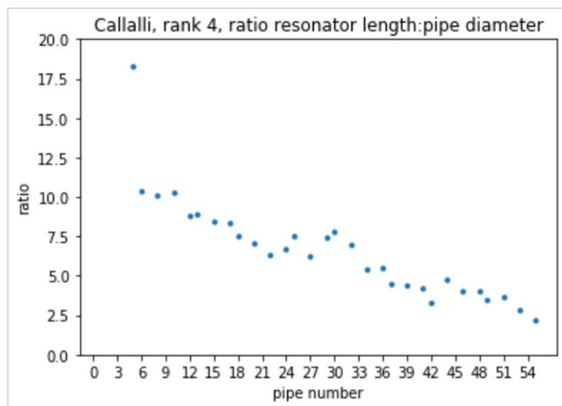


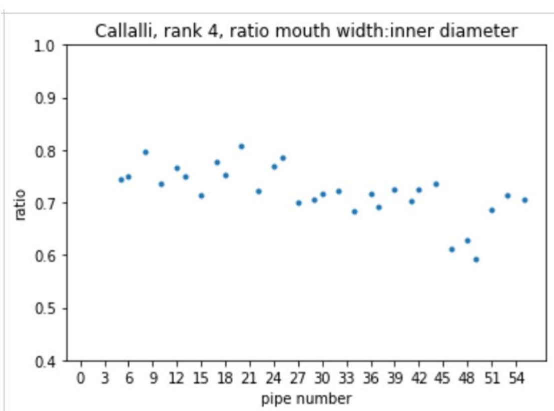
Callalli, rank 4, scaling proportions and progressions

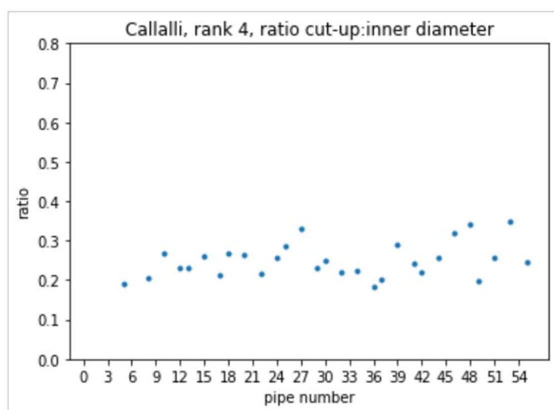




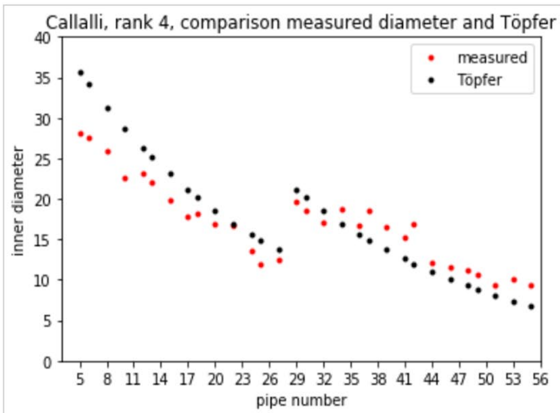


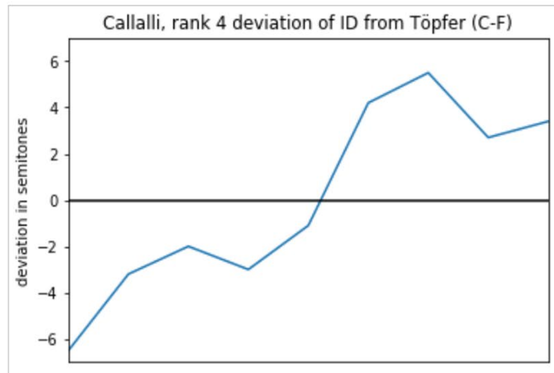




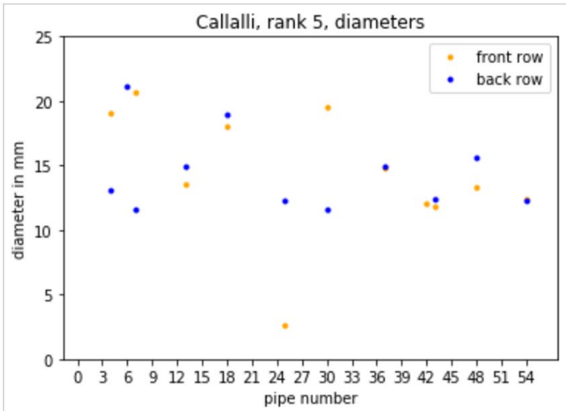


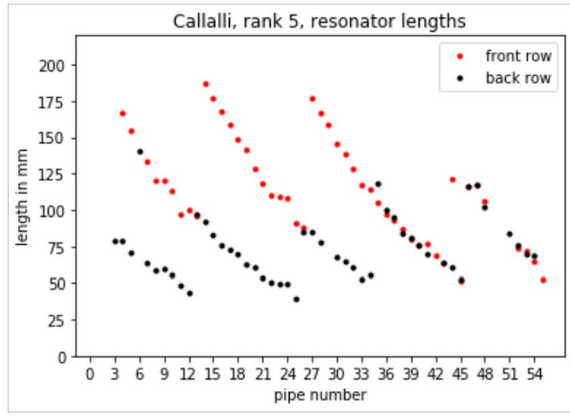
Callalli, rank 4, scaling proportions and progressions (continued)

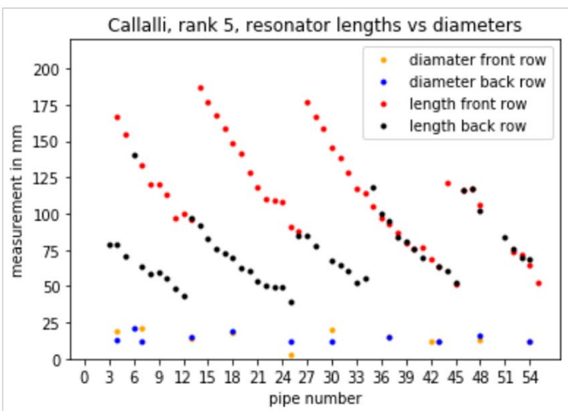


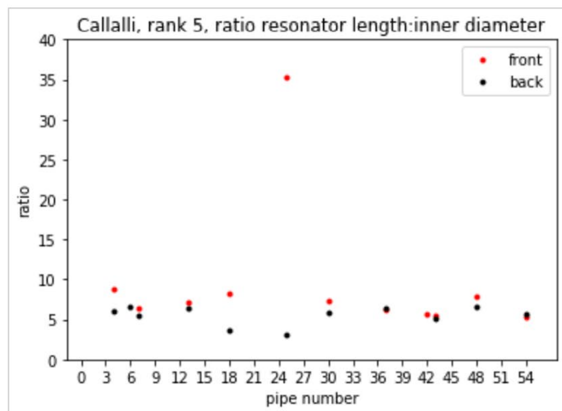


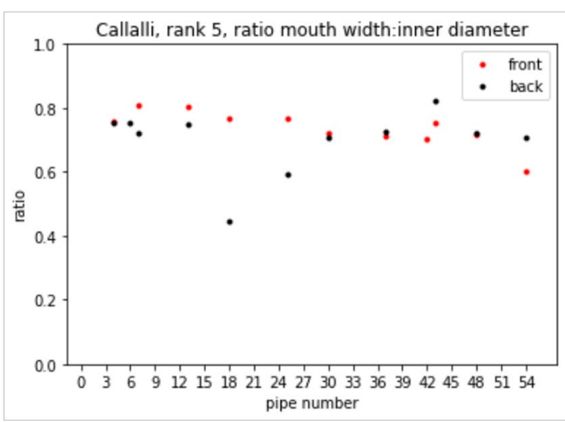
Callalli, rank 5, scaling proportions and progressions

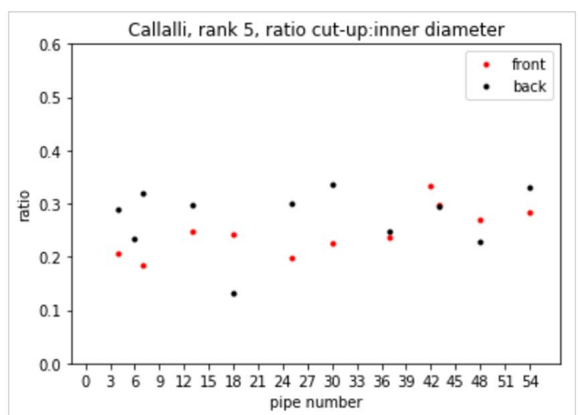




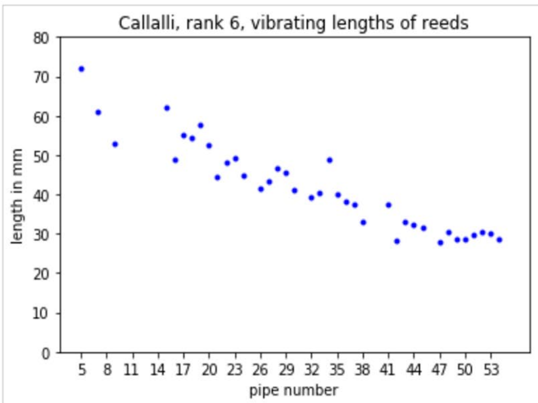


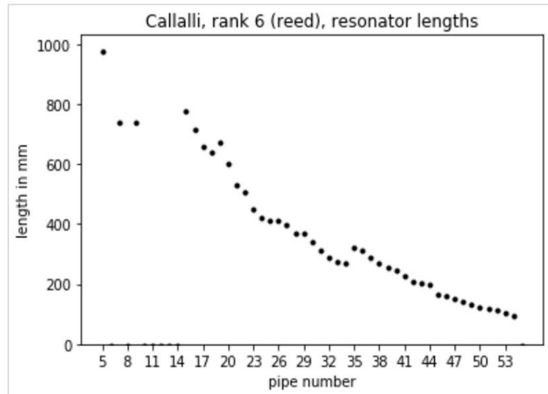


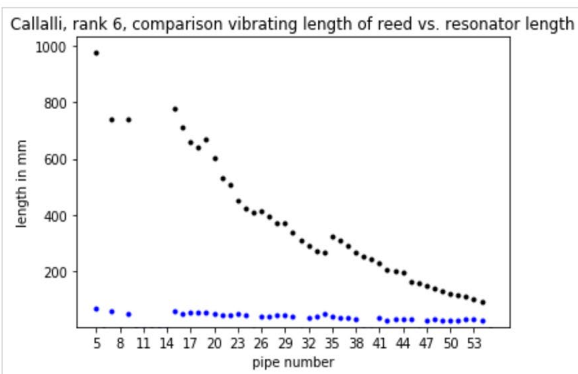


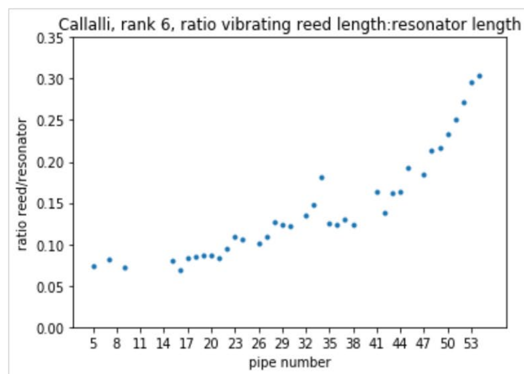


Callalli, rank 6, scaling proportions and progressions

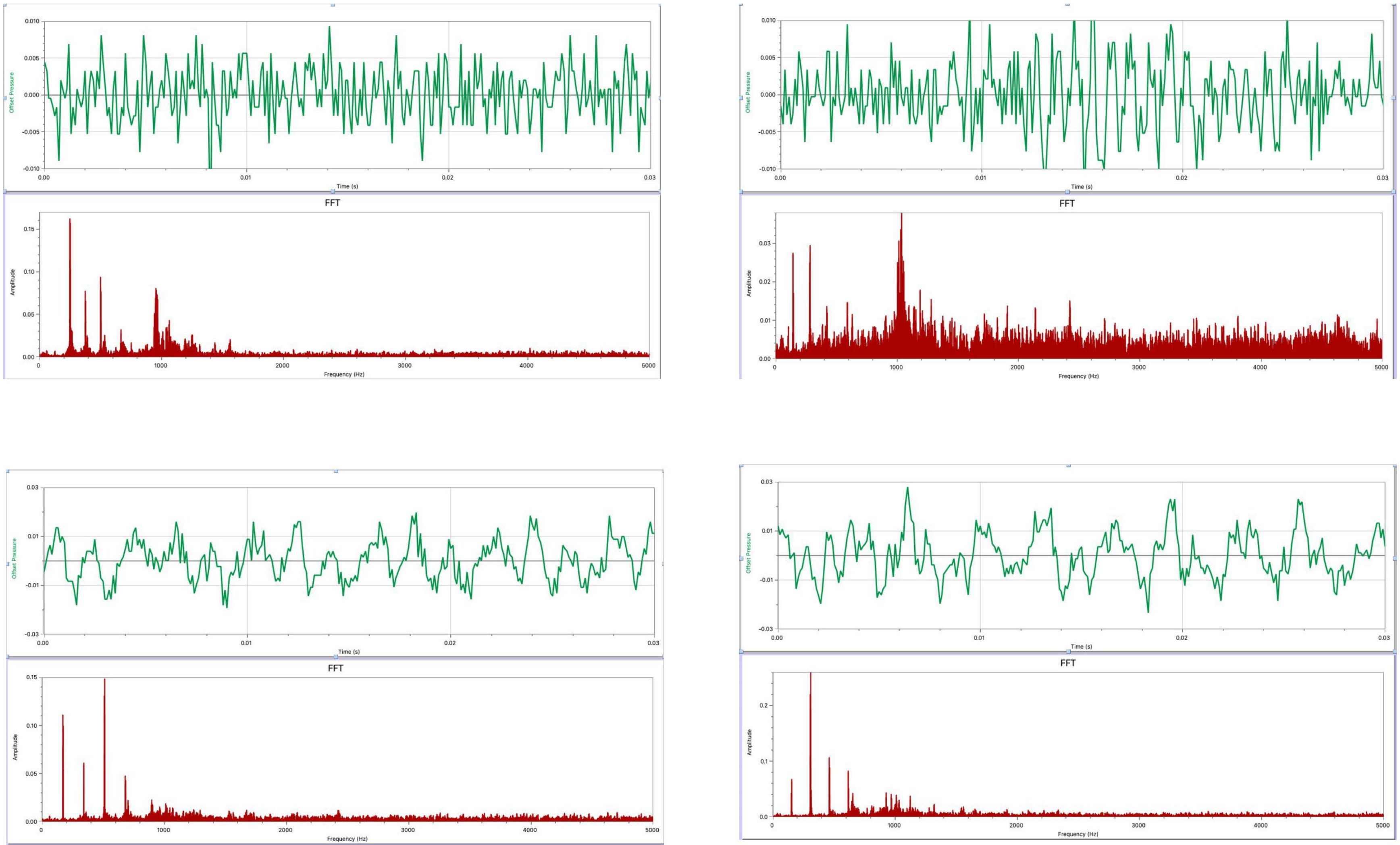




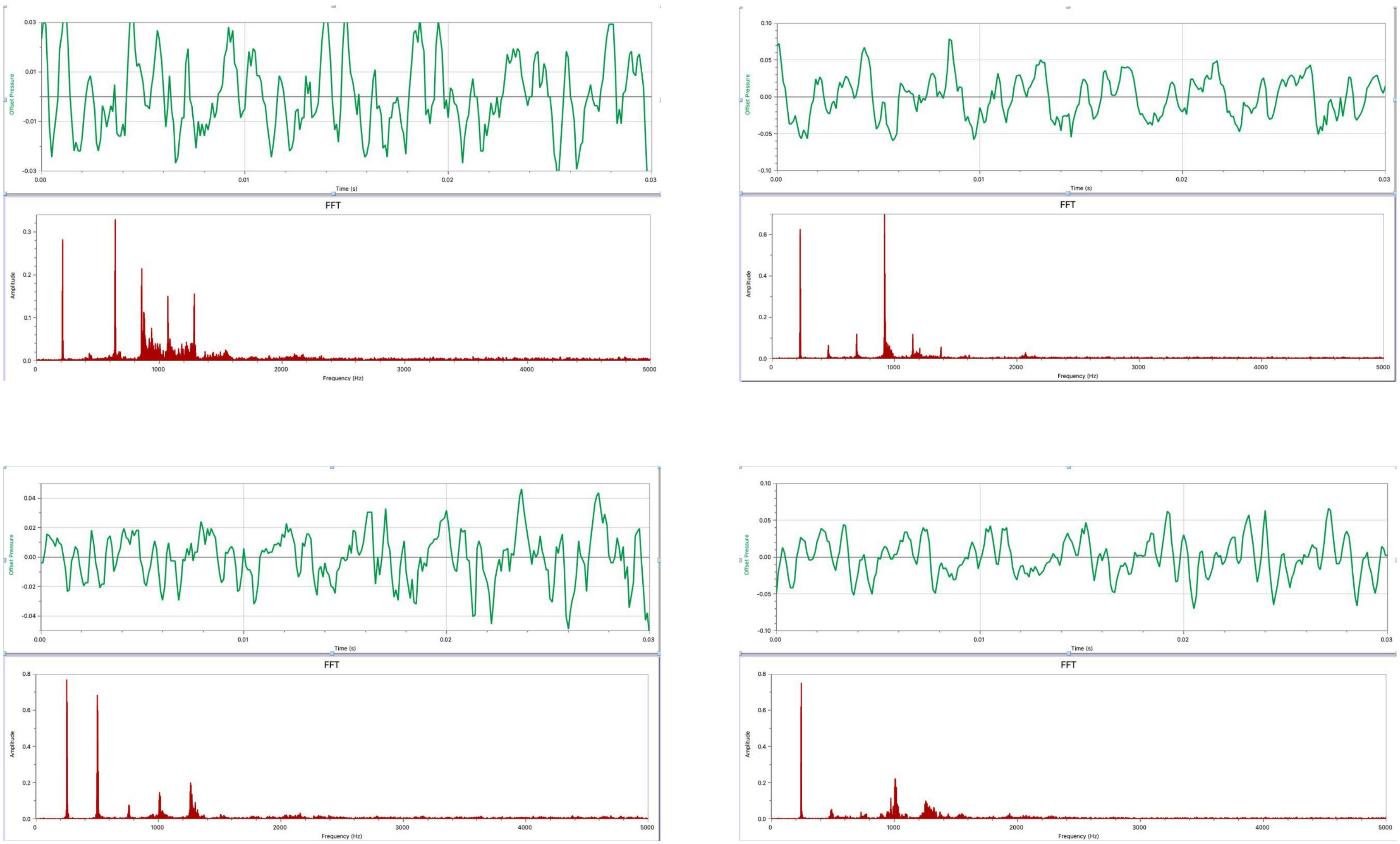




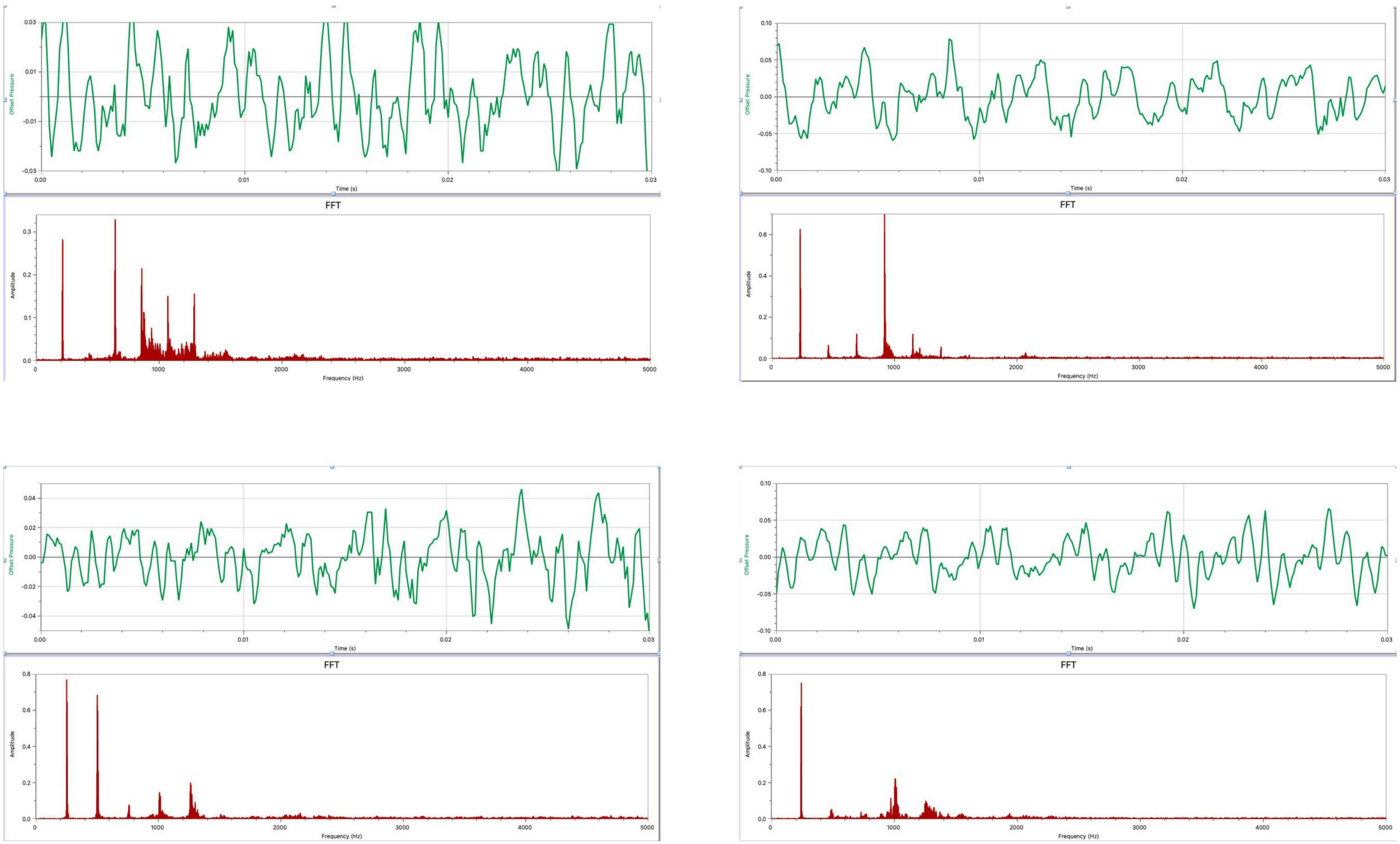
APPENDIX E: FFT SPECTRA AND WAVE FORMS



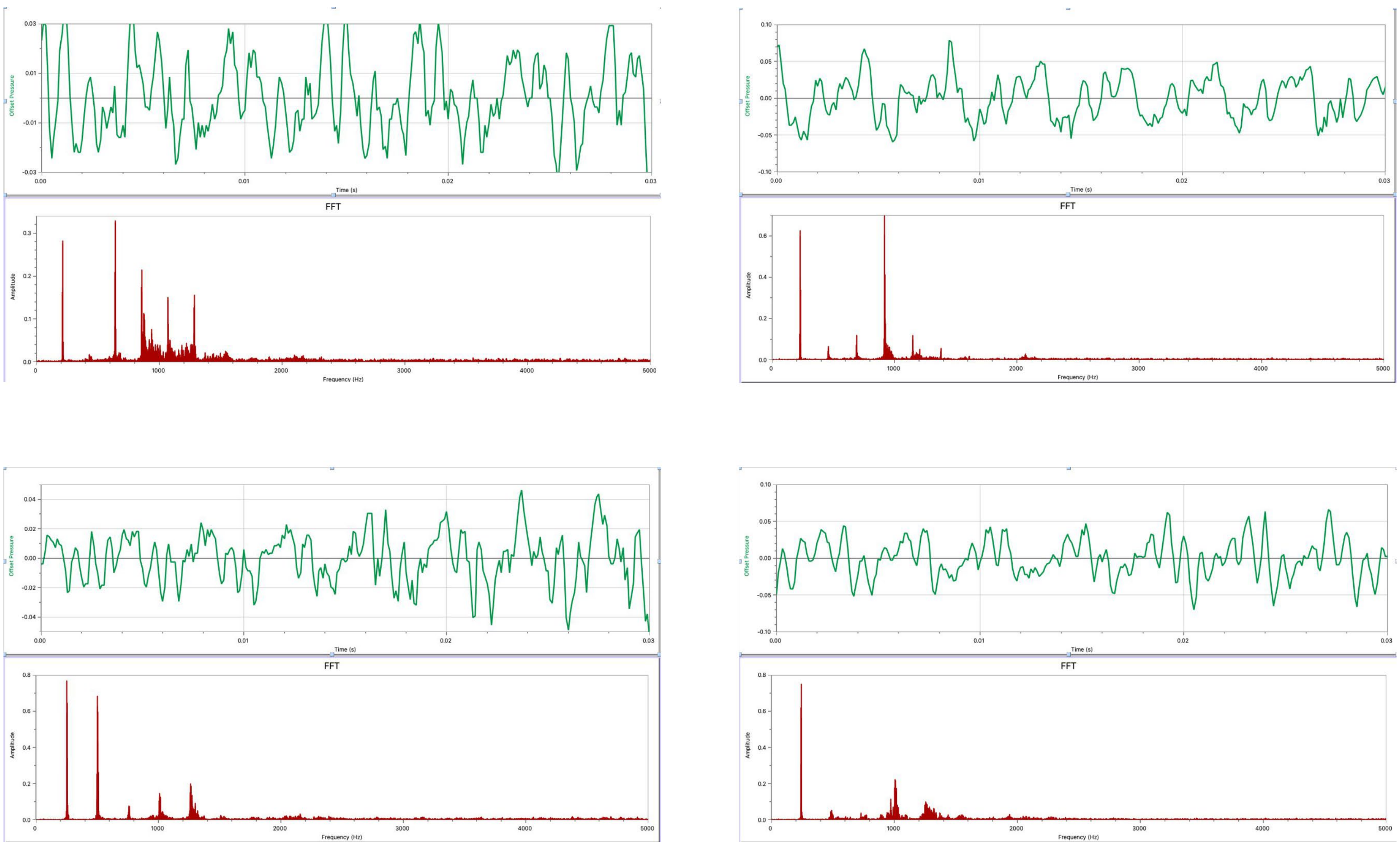
Sibayo, sound spectra rank I, pipe numbers 1, 4, 7, and 9 (clockwise from the top left)



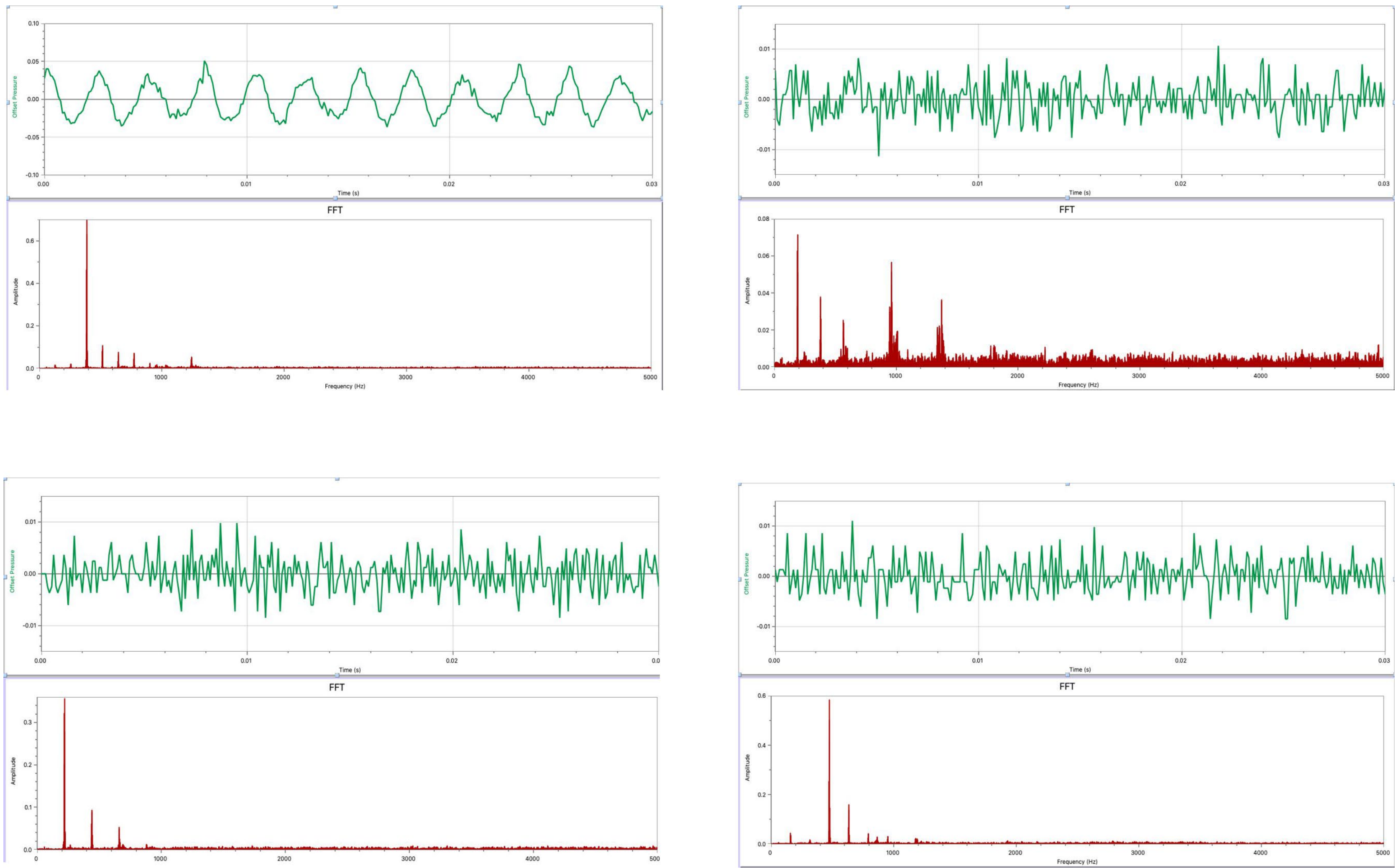
Sibayo, sound spectra rank I, pipe numbers 15, 17, 20, and 22 (clockwise from the top left)



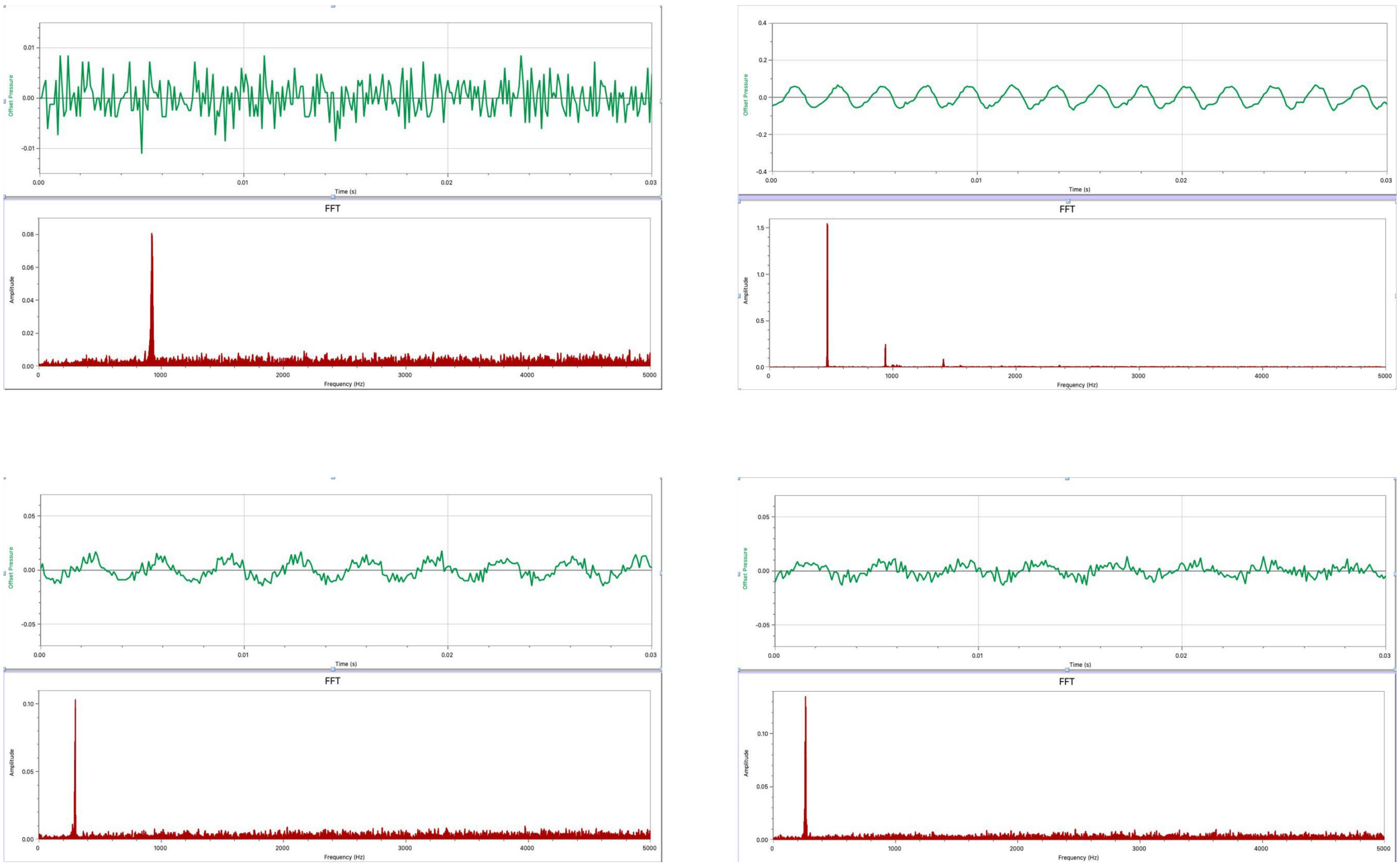
Sibayo, sound spectra rank I, pipe numbers 24, 27, 29, and 32 (clockwise from the top left)



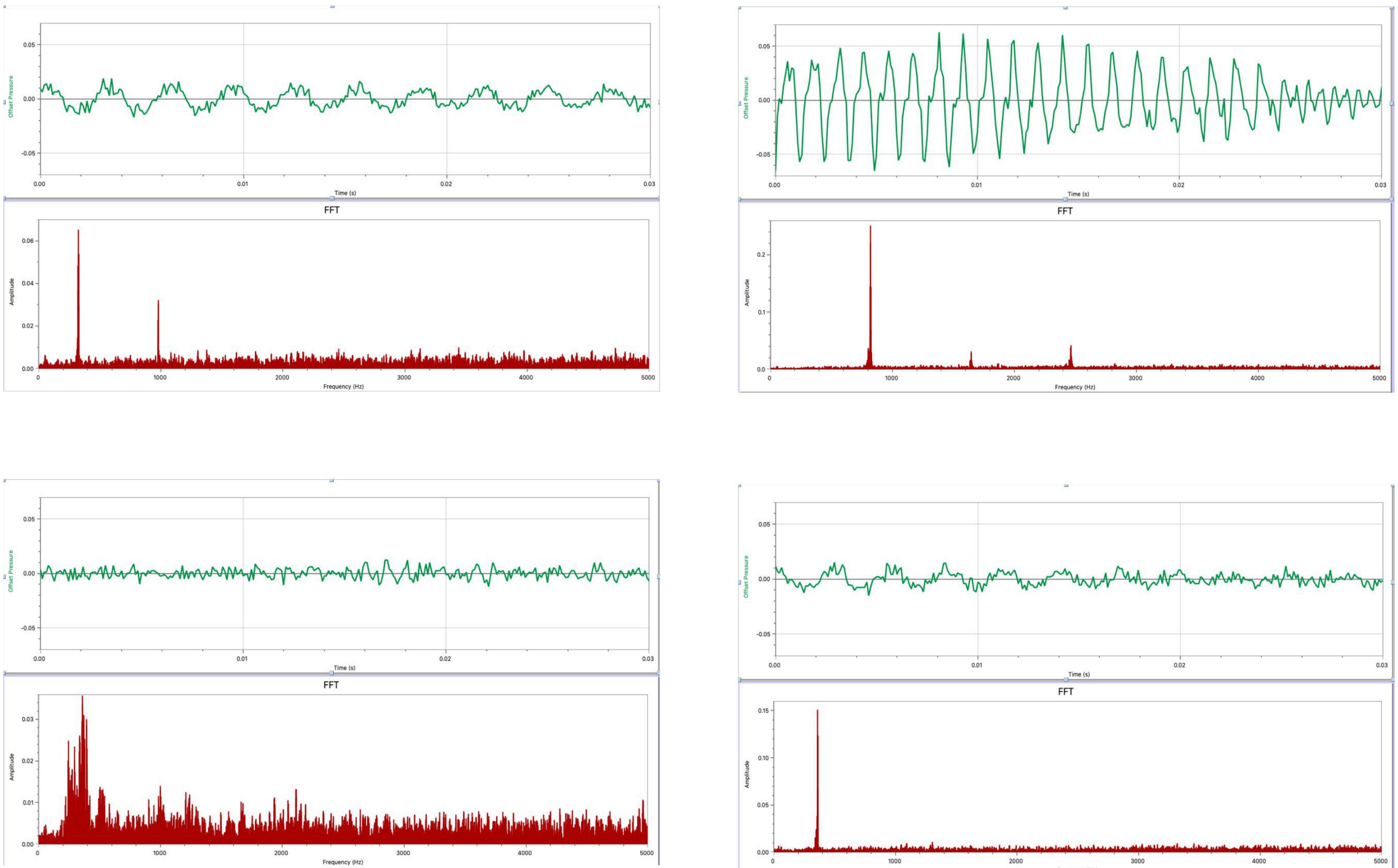
Sibayo, sound spectra rank I, pipe numbers 34, 37, 39, and 41 (clockwise from the top left)



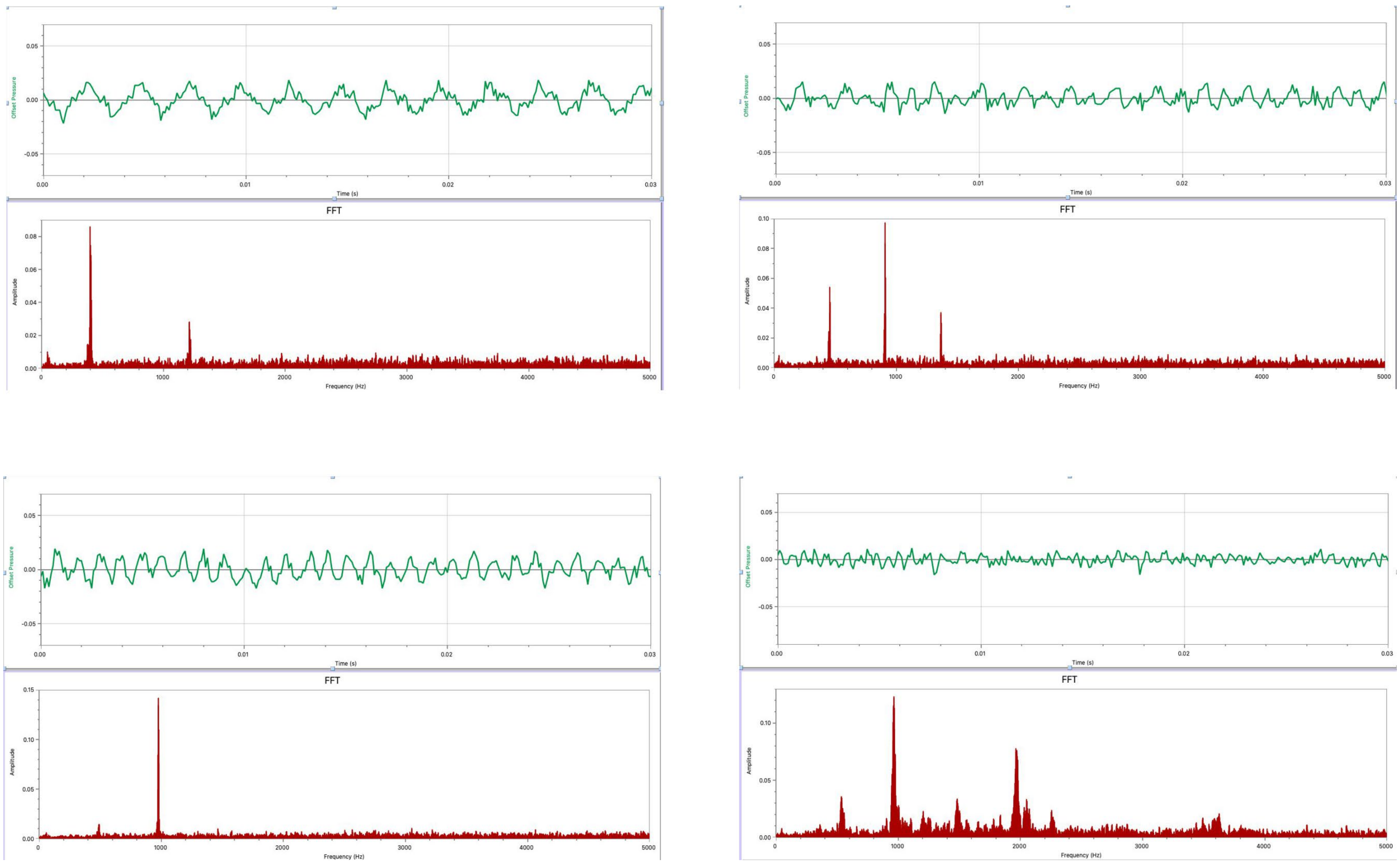
Sibayo, sound spectra rank II, pipe numbers 0, 4, 6.5, and 6 (clockwise from the top left)



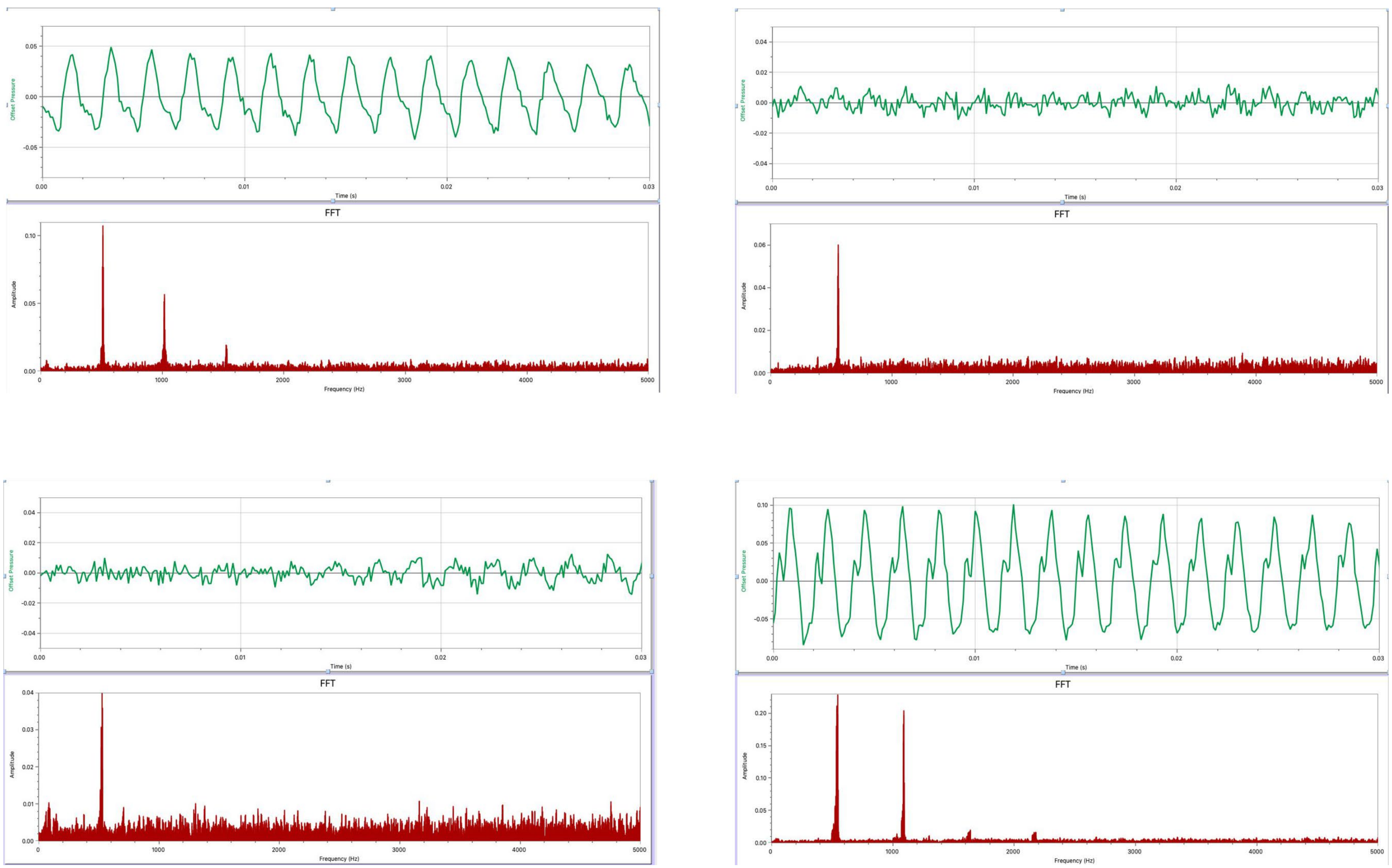
Sibayo, sound spectra rank II, pipe numbers 7, 8, 10, and 11 (clockwise from the top left)



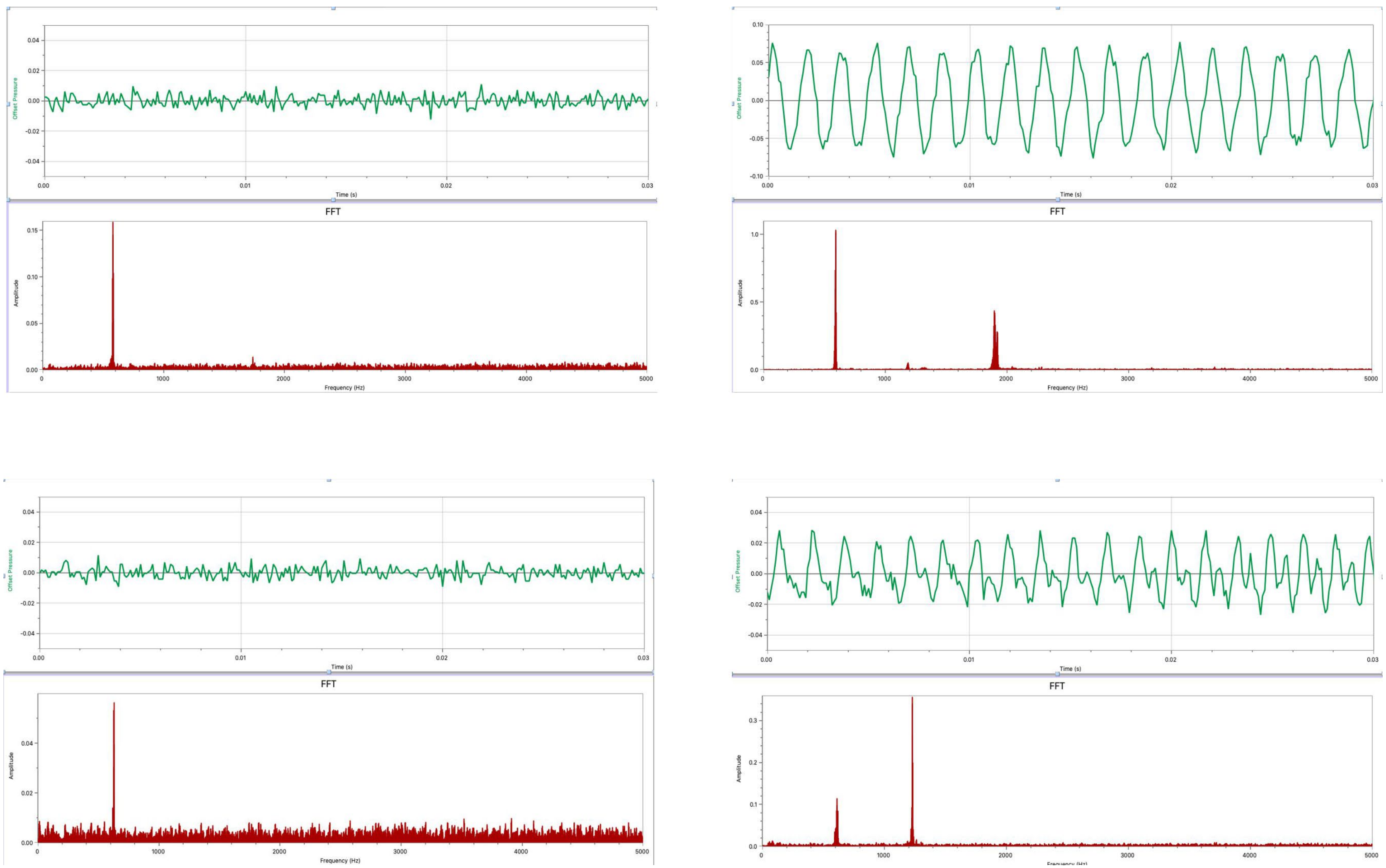
Sibayo, sound spectra rank II, pipe numbers 13, 15, 16, and 17 (clockwise from the top left)



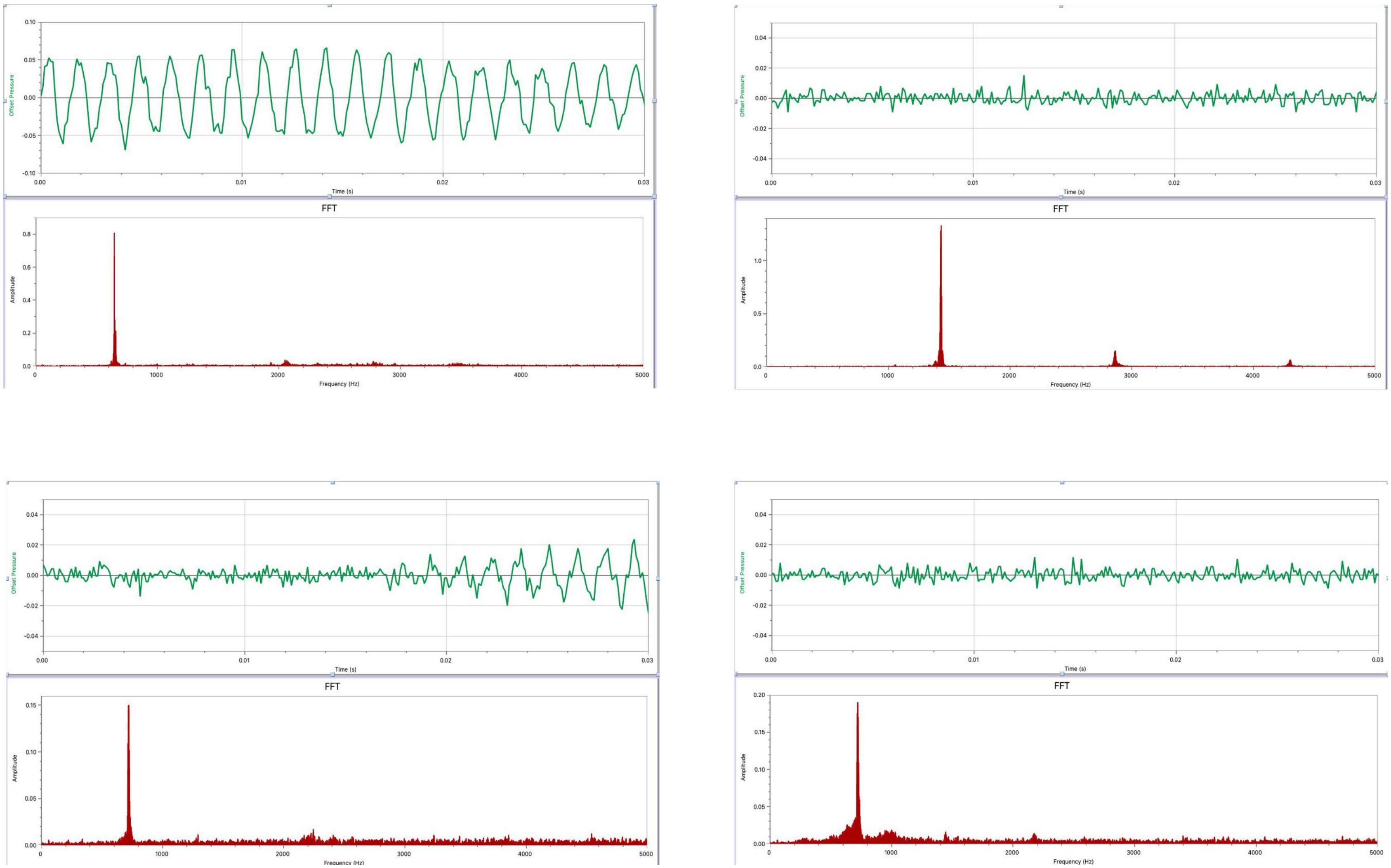
Sibayo, sound spectra rank II, pipe numbers 18B, 19F, 20B, and 20F (clockwise from the top left)



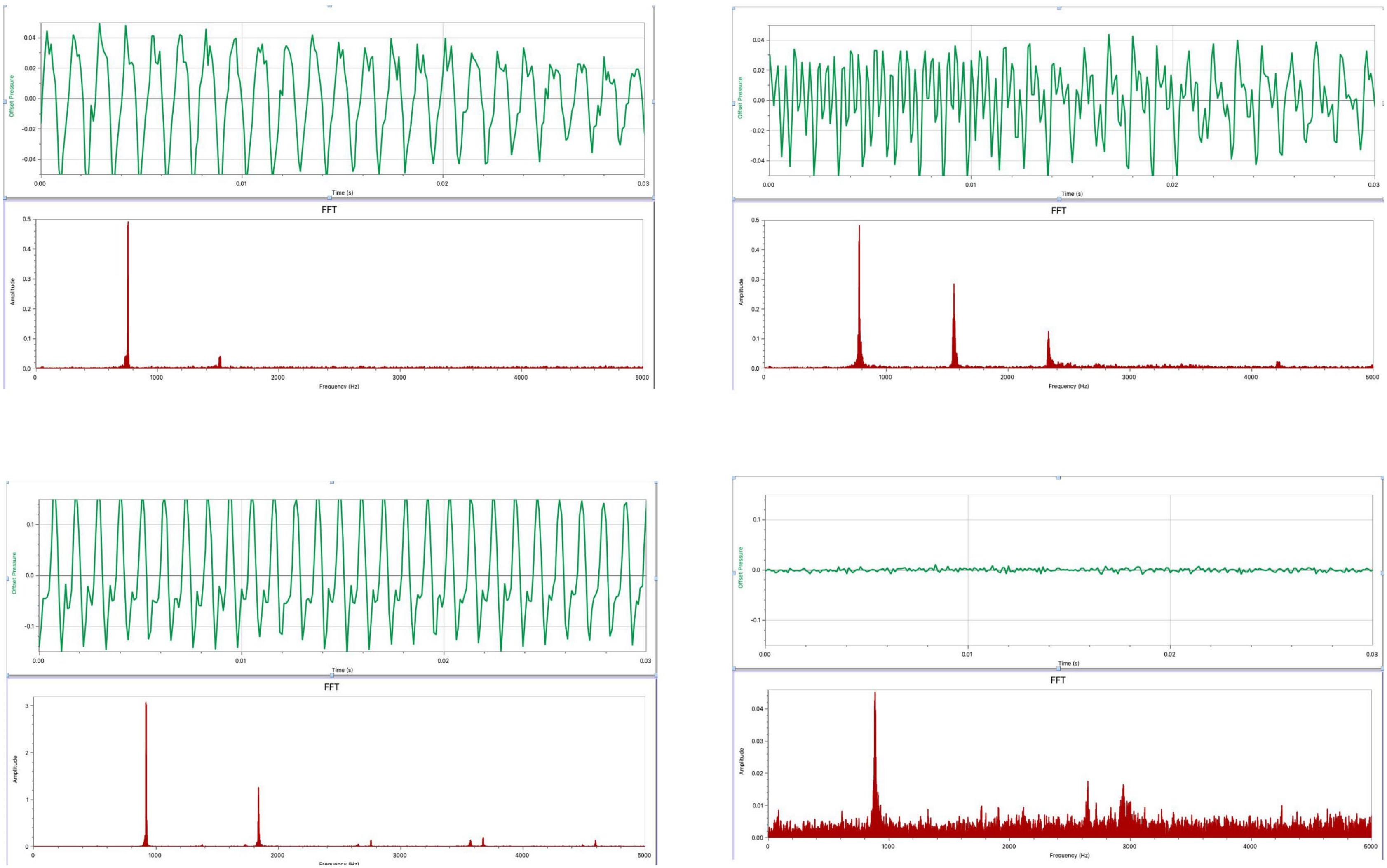
Sibayo, sound spectra rank II, pipe numbers 21F, 22B, 22F, and 23B (clockwise from the top left)



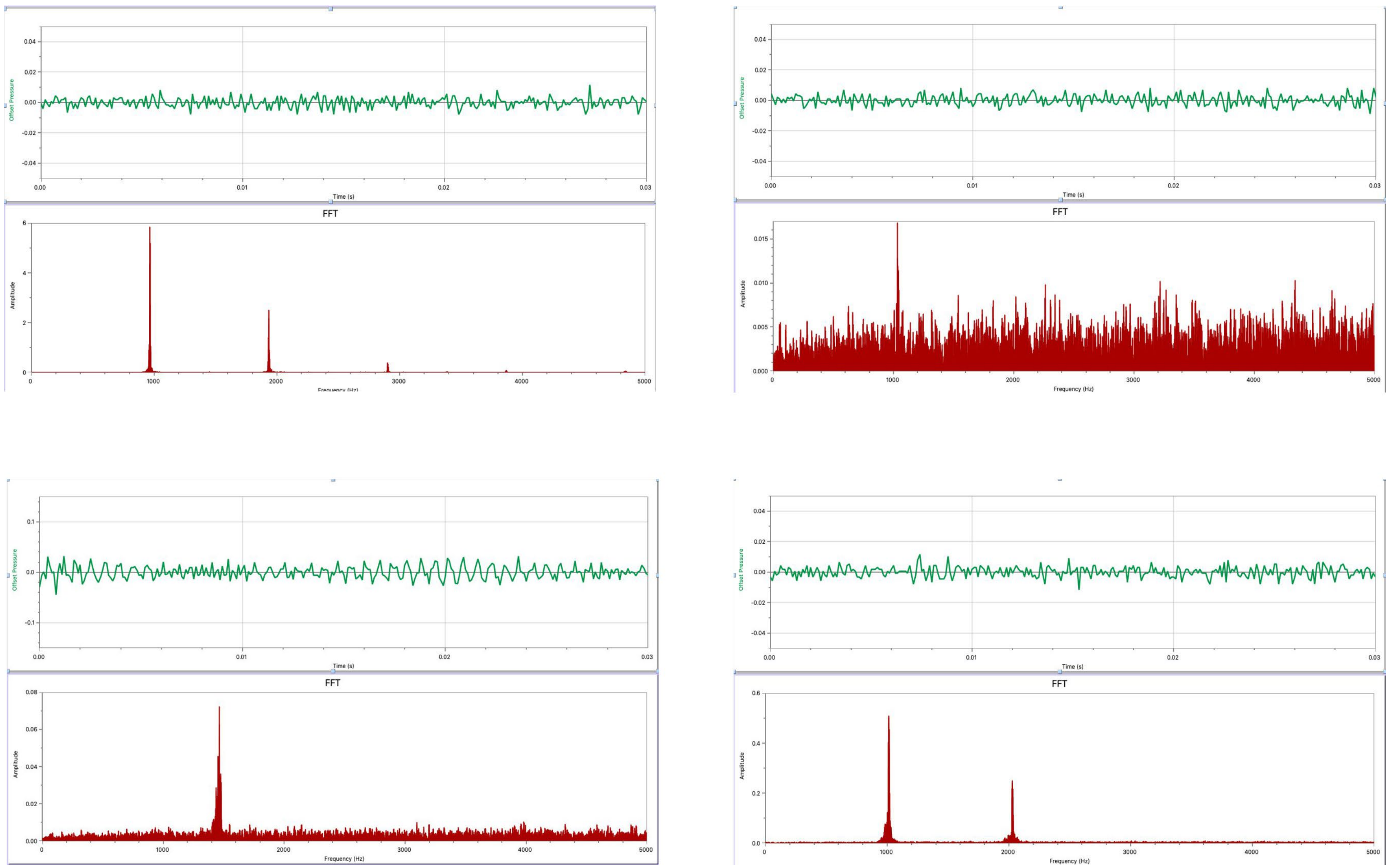
Sibayo, sound spectra rank II, pipe numbers 23F, 24B, 24F, and 25 (clockwise from the top left)



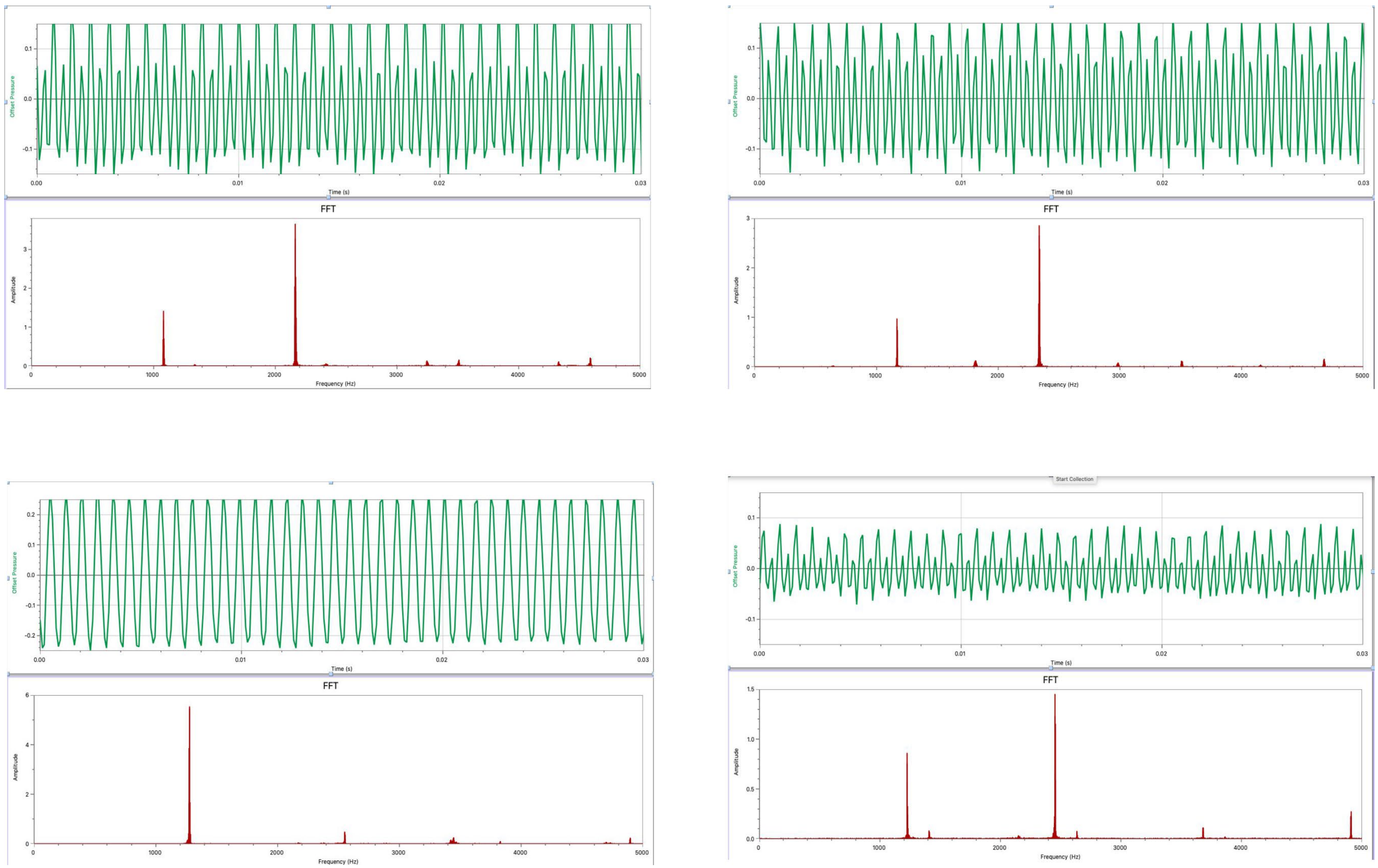
Sibayo, sound spectra rank II, pipe numbers 26B, 27B, 27F, and 22B (clockwise from the top left)



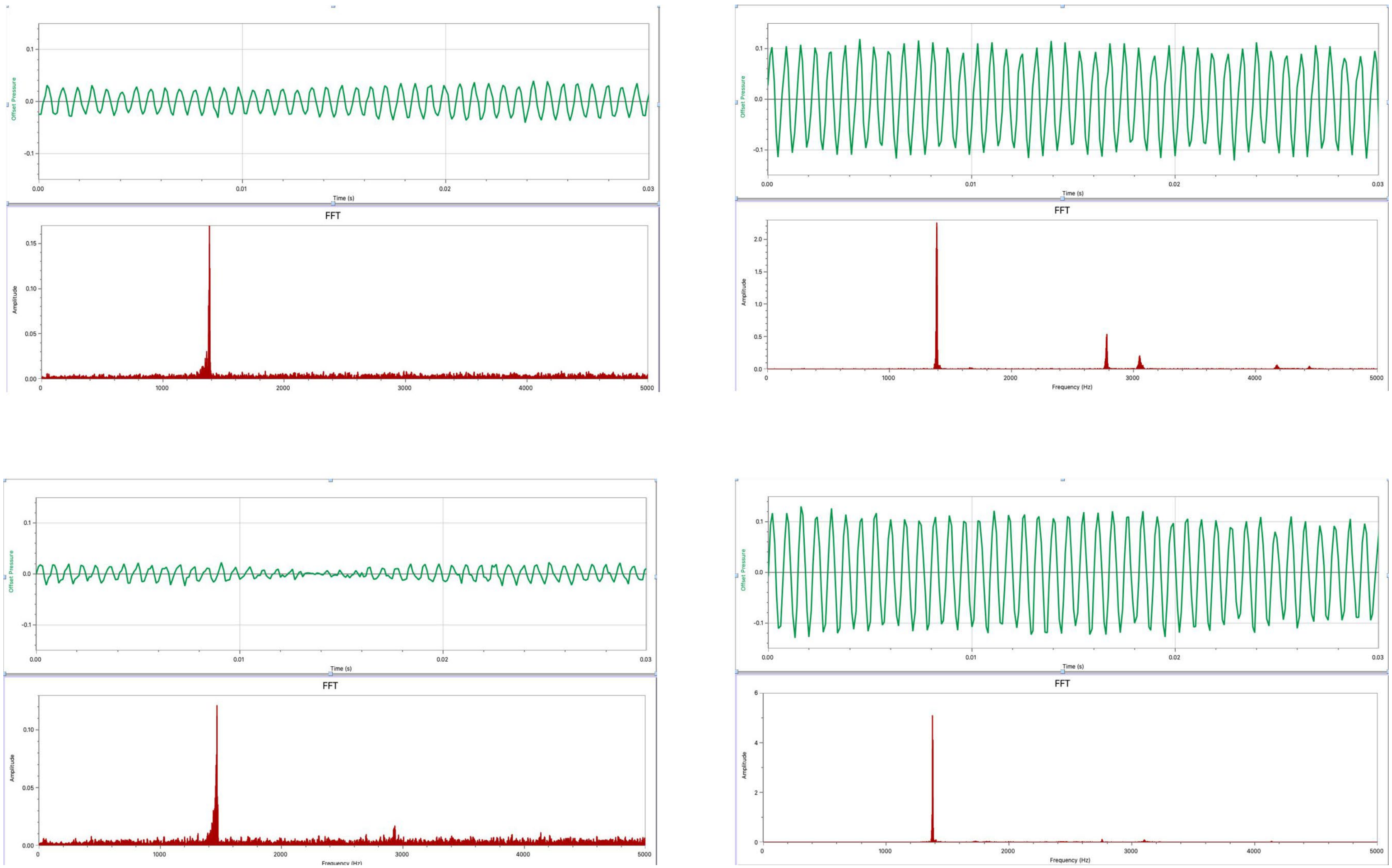
Sibayo, sound spectra rank II, pipe numbers 28F, 29F, 31B, and 31F (clockwise from the top left)



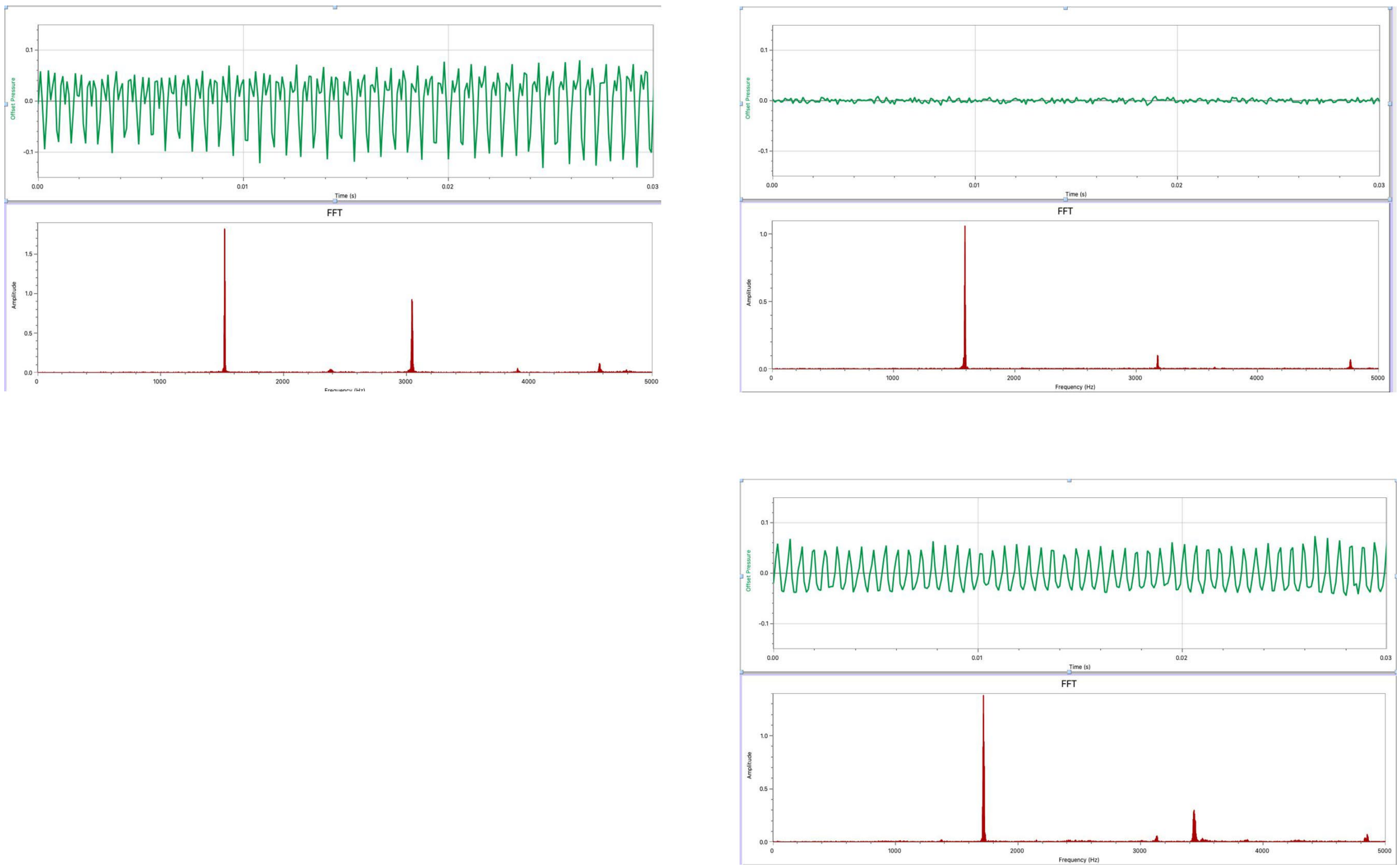
Sibayo, sound spectra rank II, pipe numbers 32F, 33B, 33F, and 34B (clockwise from the top left)



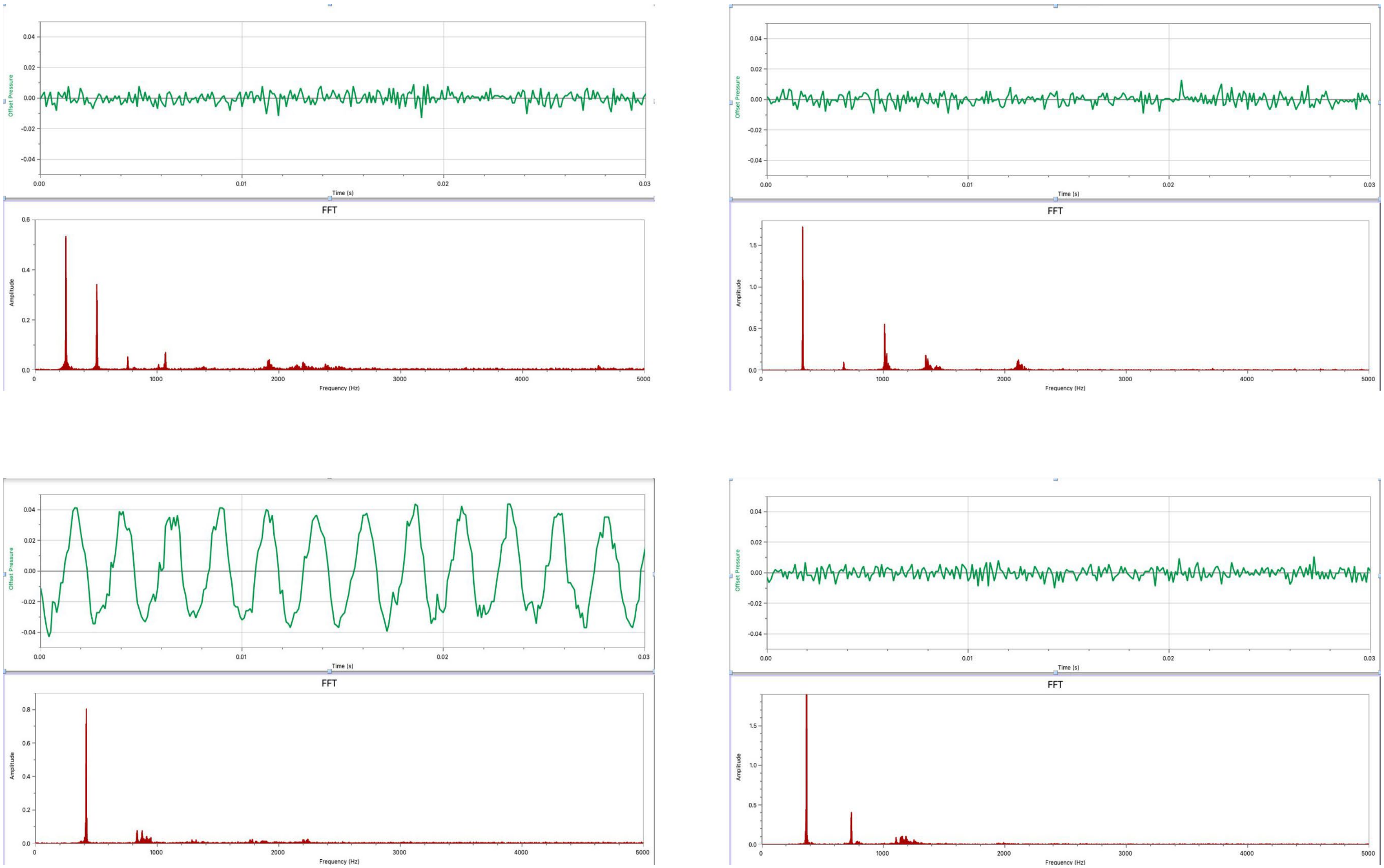
Sibayo, sound spectra rank II, pipe numbers 34F, 35F, 36F, and 37F (clockwise from the top left)



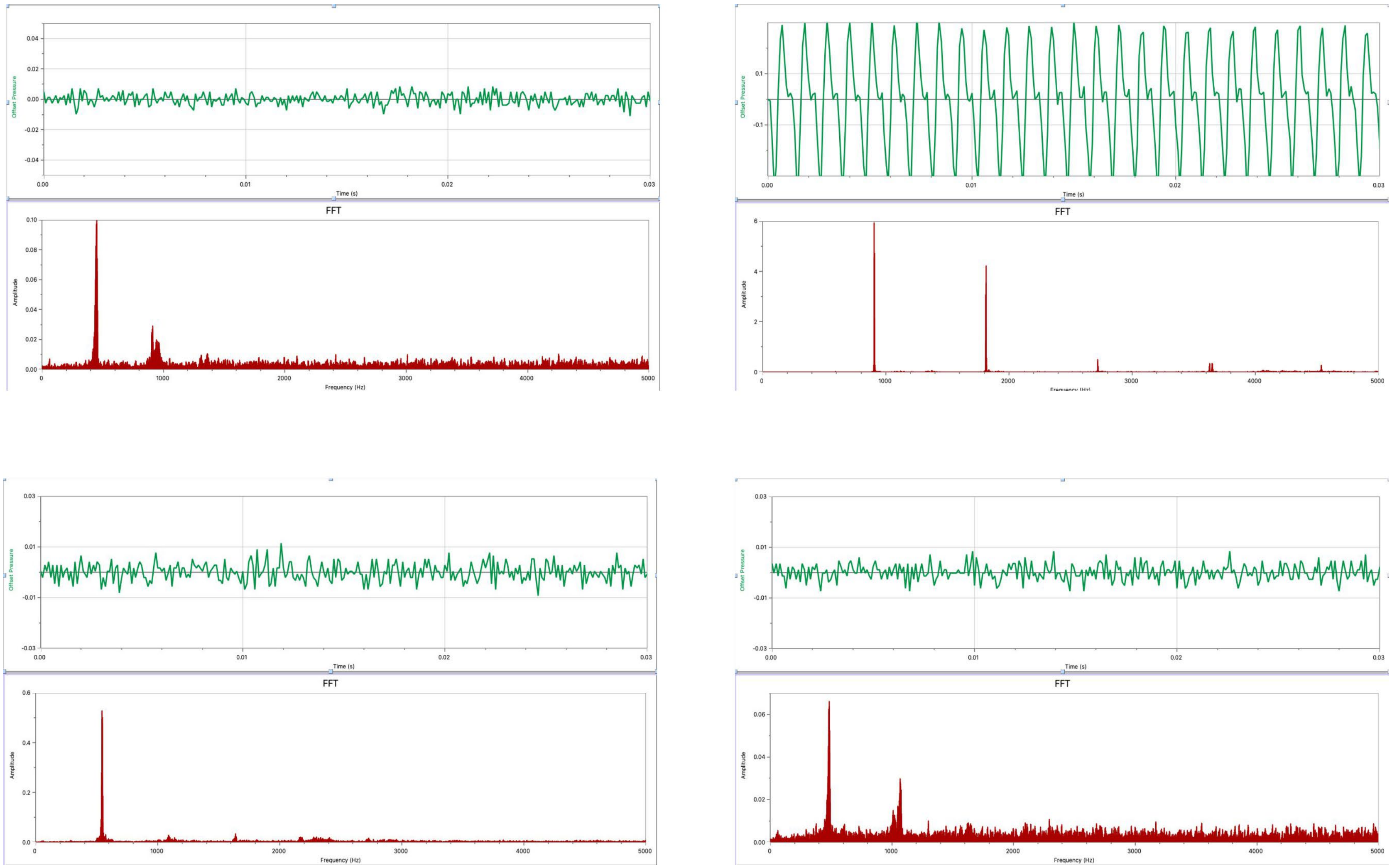
Sibayo, sound spectra rank II, pipe numbers 38B, 38F, 39B, and 39F (clockwise from the top left)



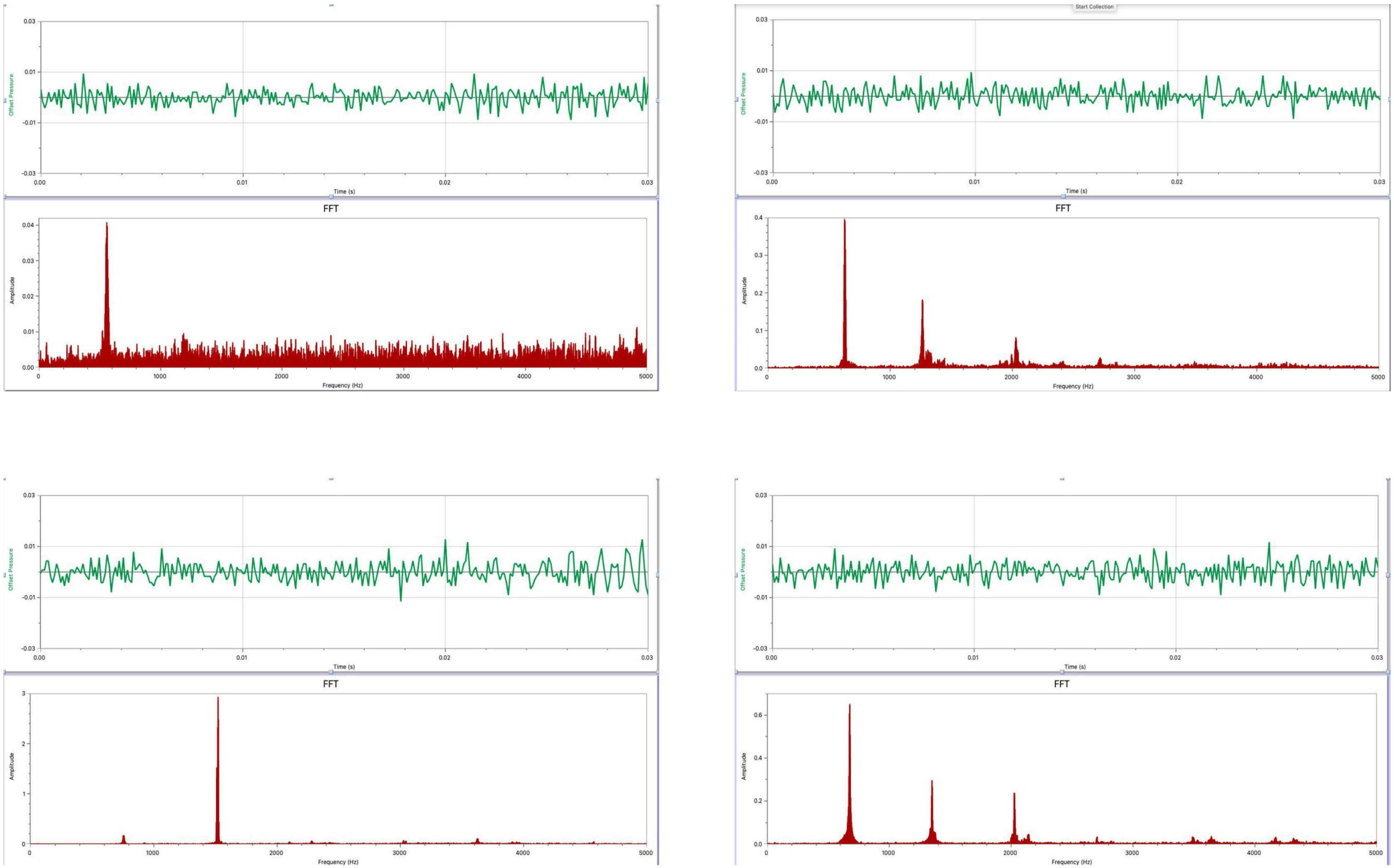
Sibayo, sound spectra rank II, pipe numbers 40F, 41B and 42F (clockwise from the top left)



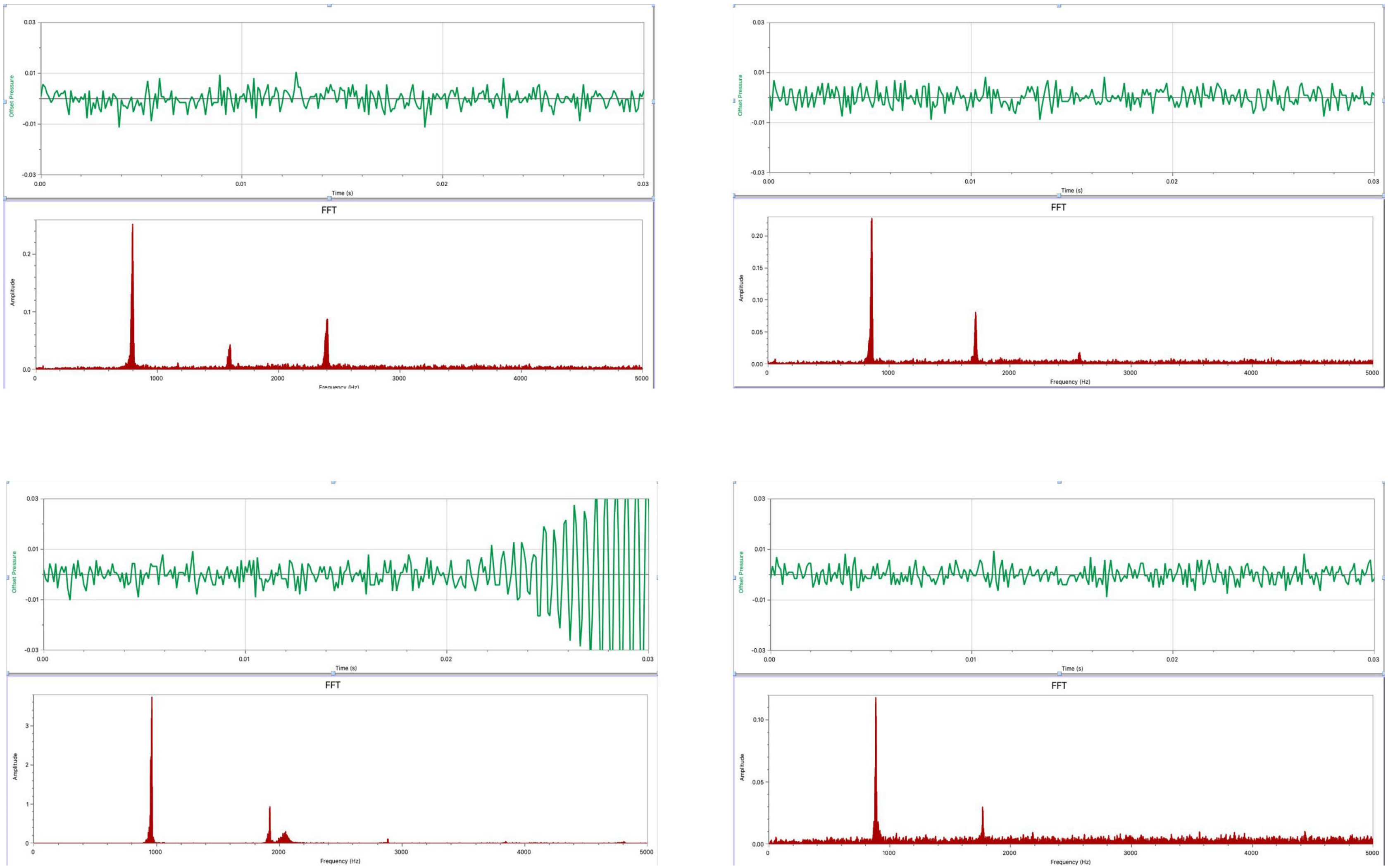
Sibayo, sound spectra rank III, pipe numbers 0, 2, 4 and 6 (clockwise from the top left)



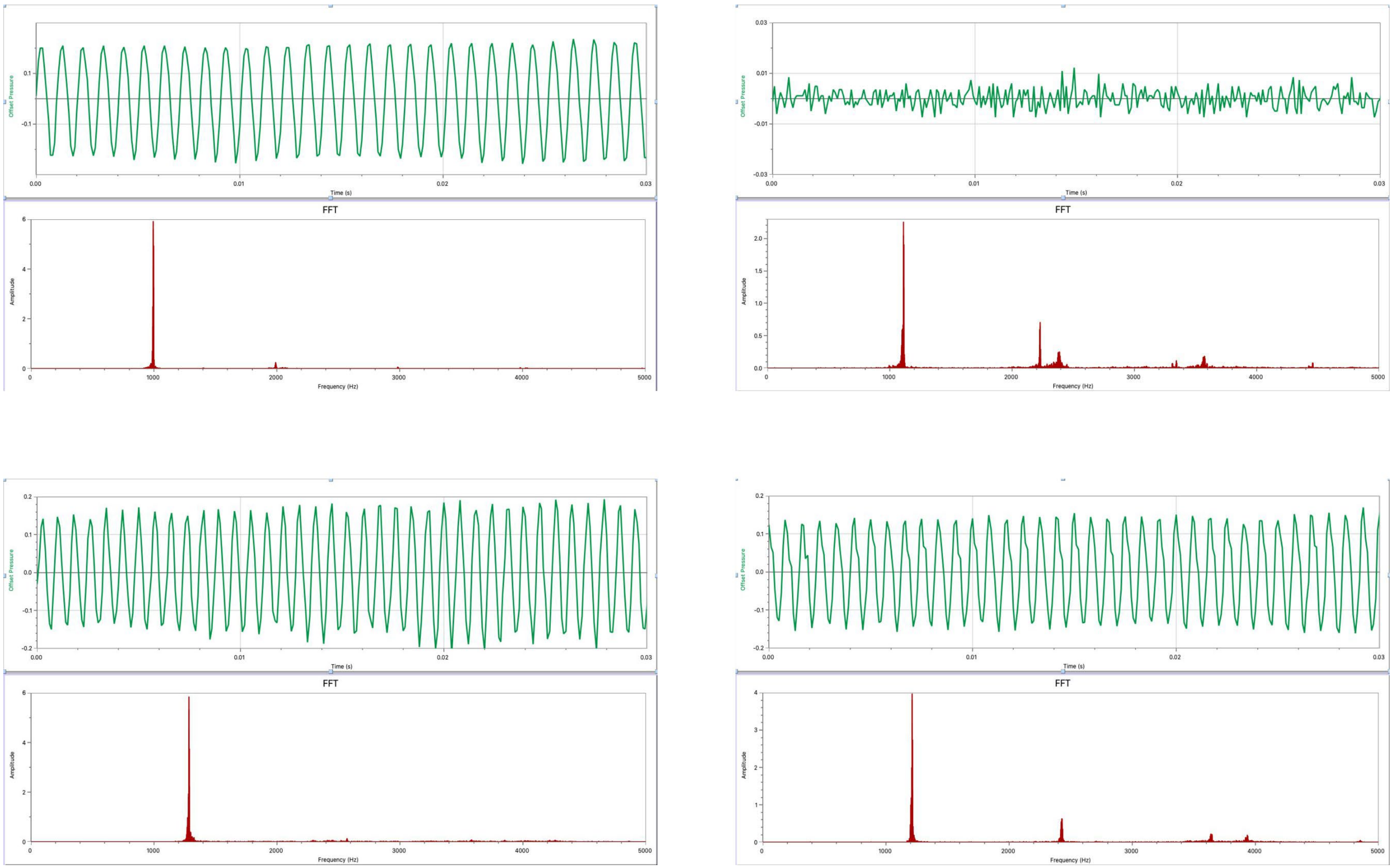
Sibayo, sound spectra rank III, pipe numbers 7, 8, 9 and 10 (clockwise from the top left)



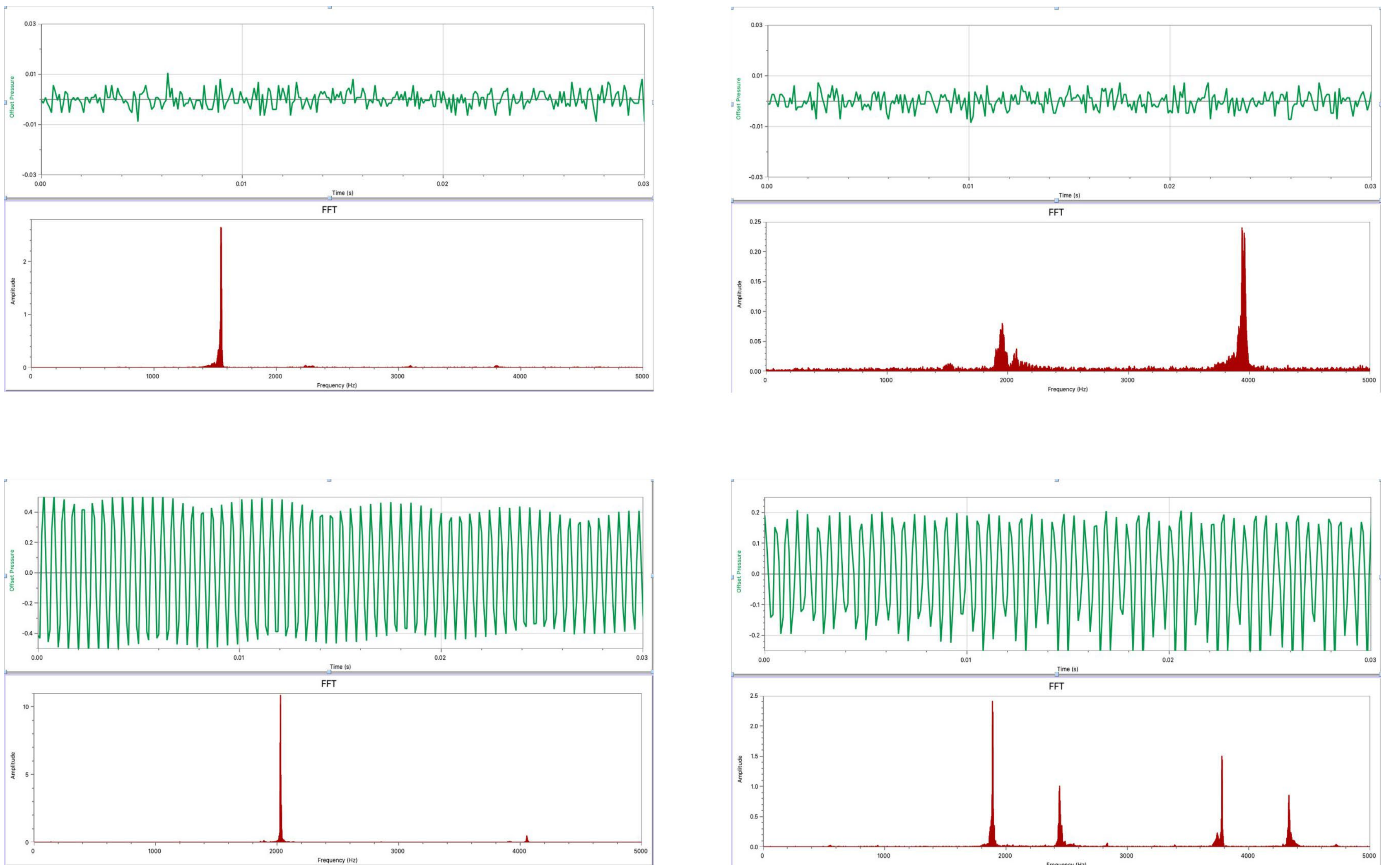
Sibayo, sound spectra rank III, pipe numbers 11, 13, 14 and 16 (clockwise from the top left)



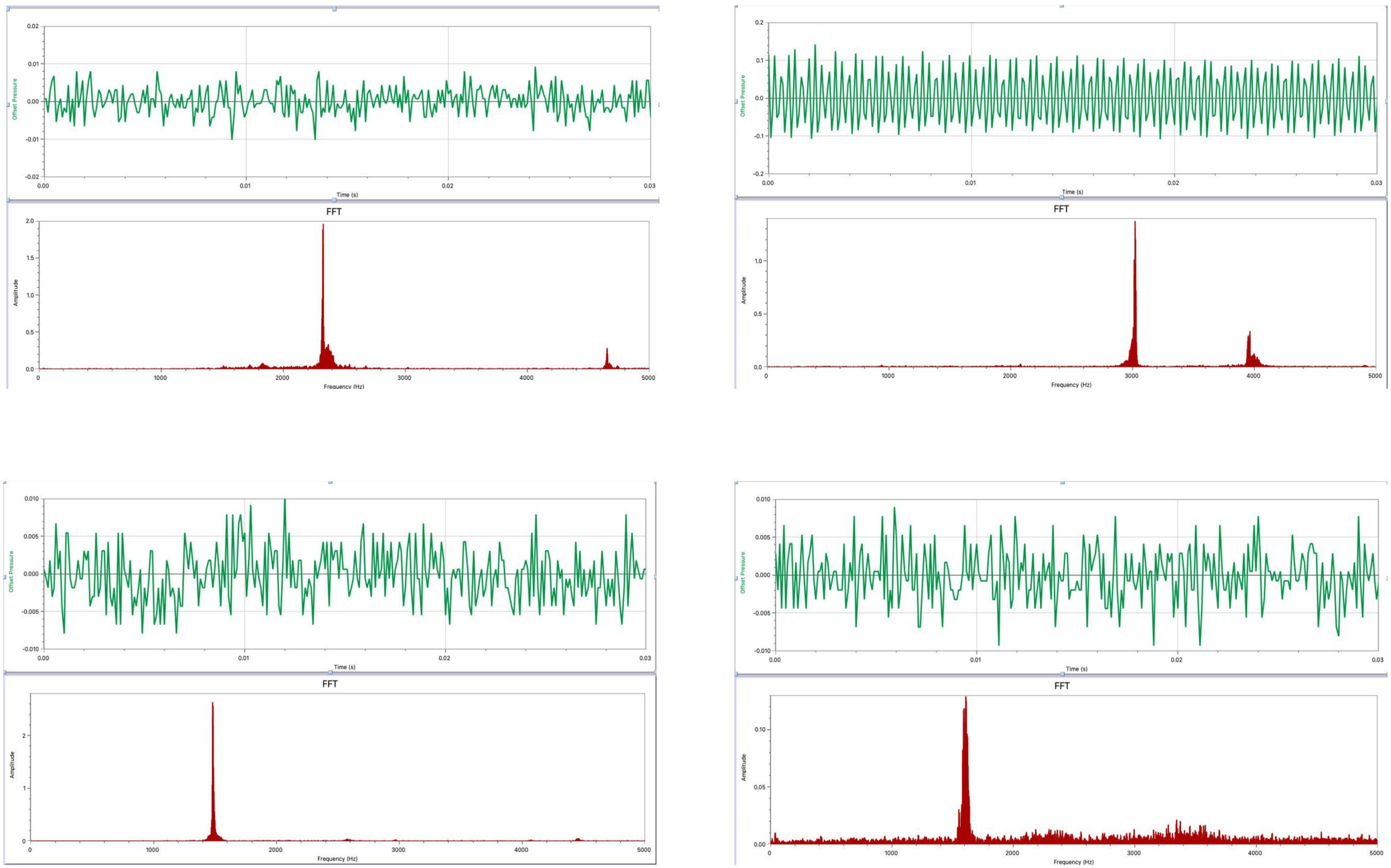
Sibayo, sound spectra rank III, pipe numbers 12, 18, 19 and 20 (clockwise from the top left)



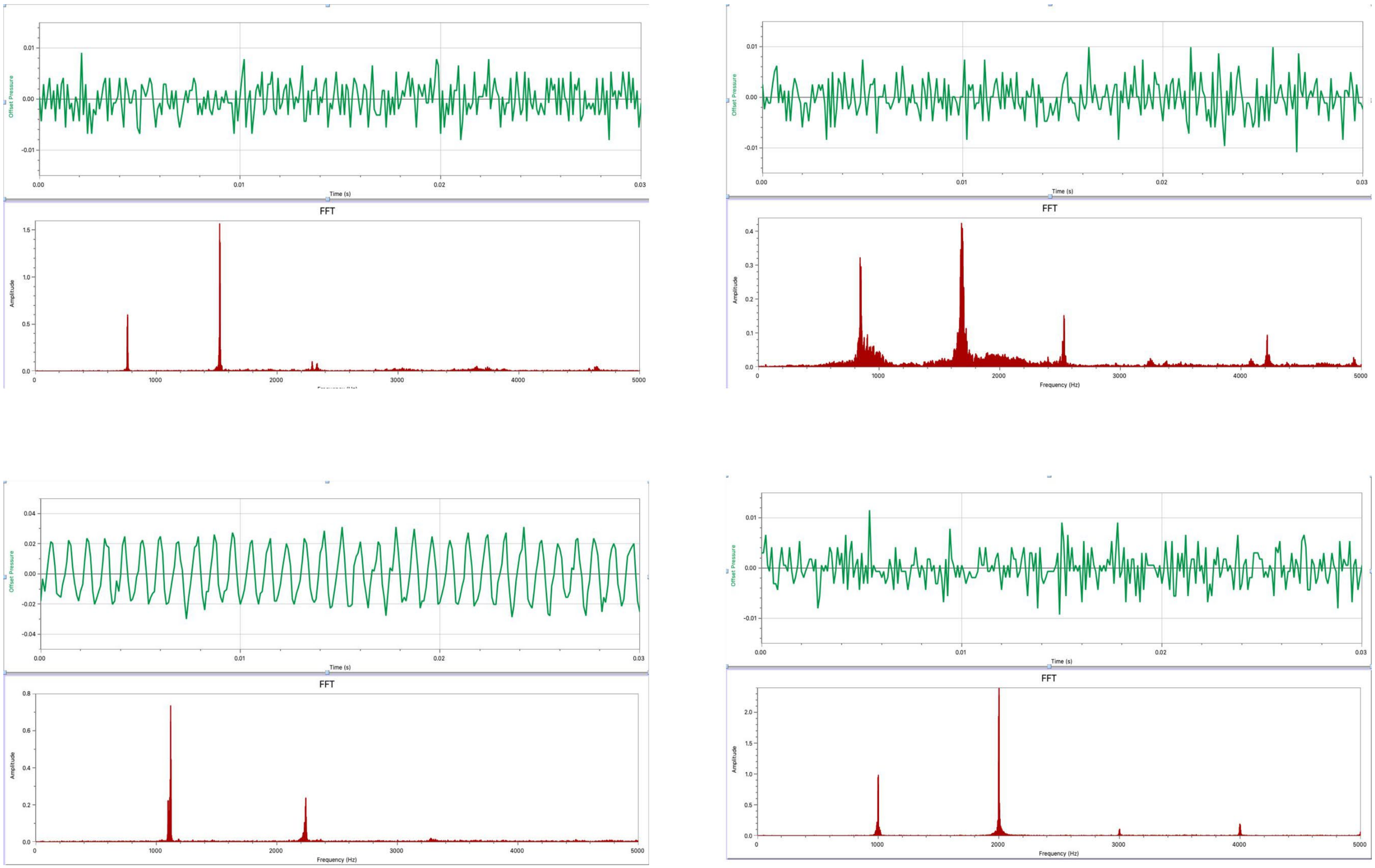
Sibayo, sound spectra rank III, pipe numbers 21, 23, 24 and 25 (clockwise from the top left)



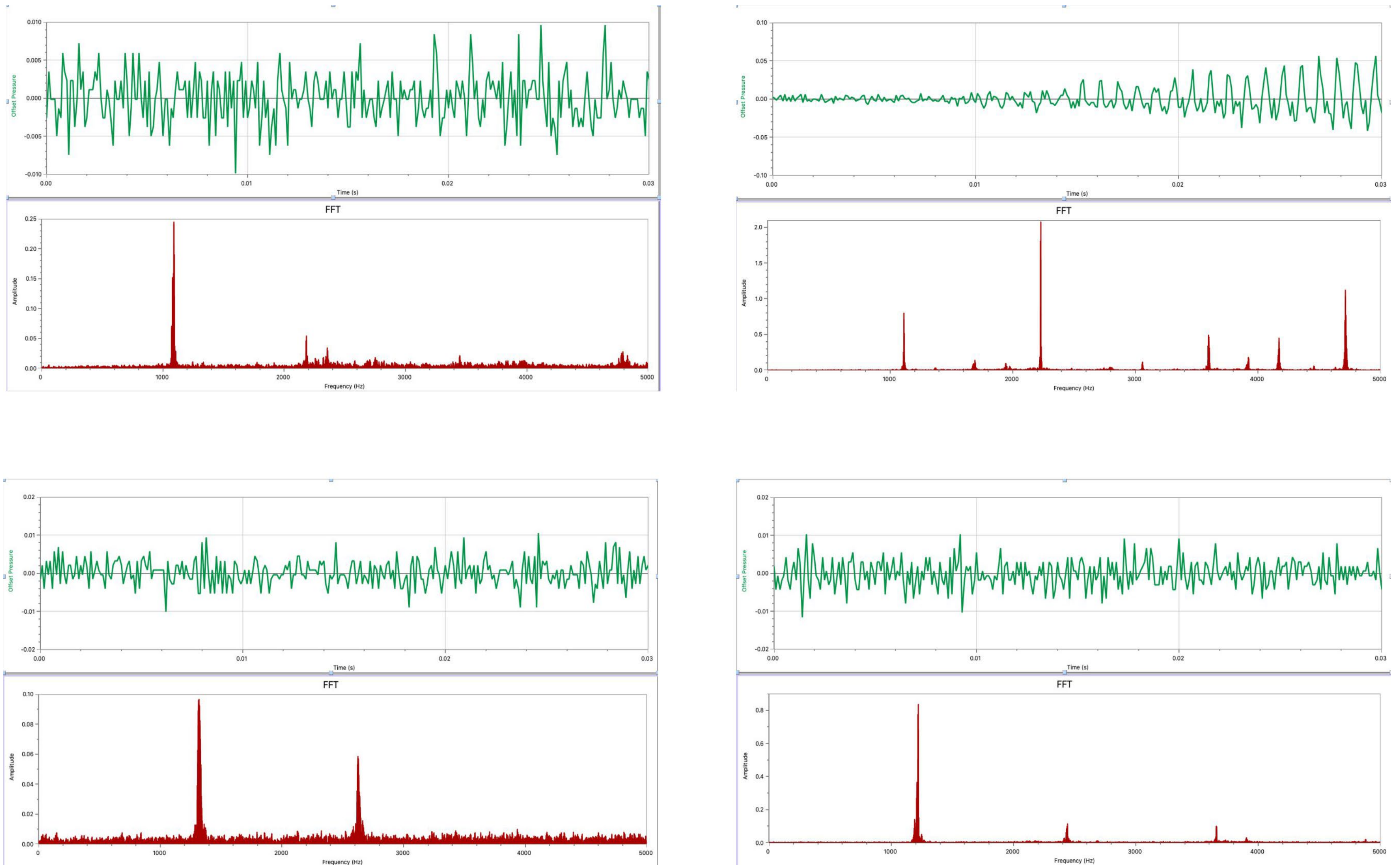
Sibayo, sound spectra rank III, pipe numbers 28, 31, 32 and 33 (clockwise from the top left)



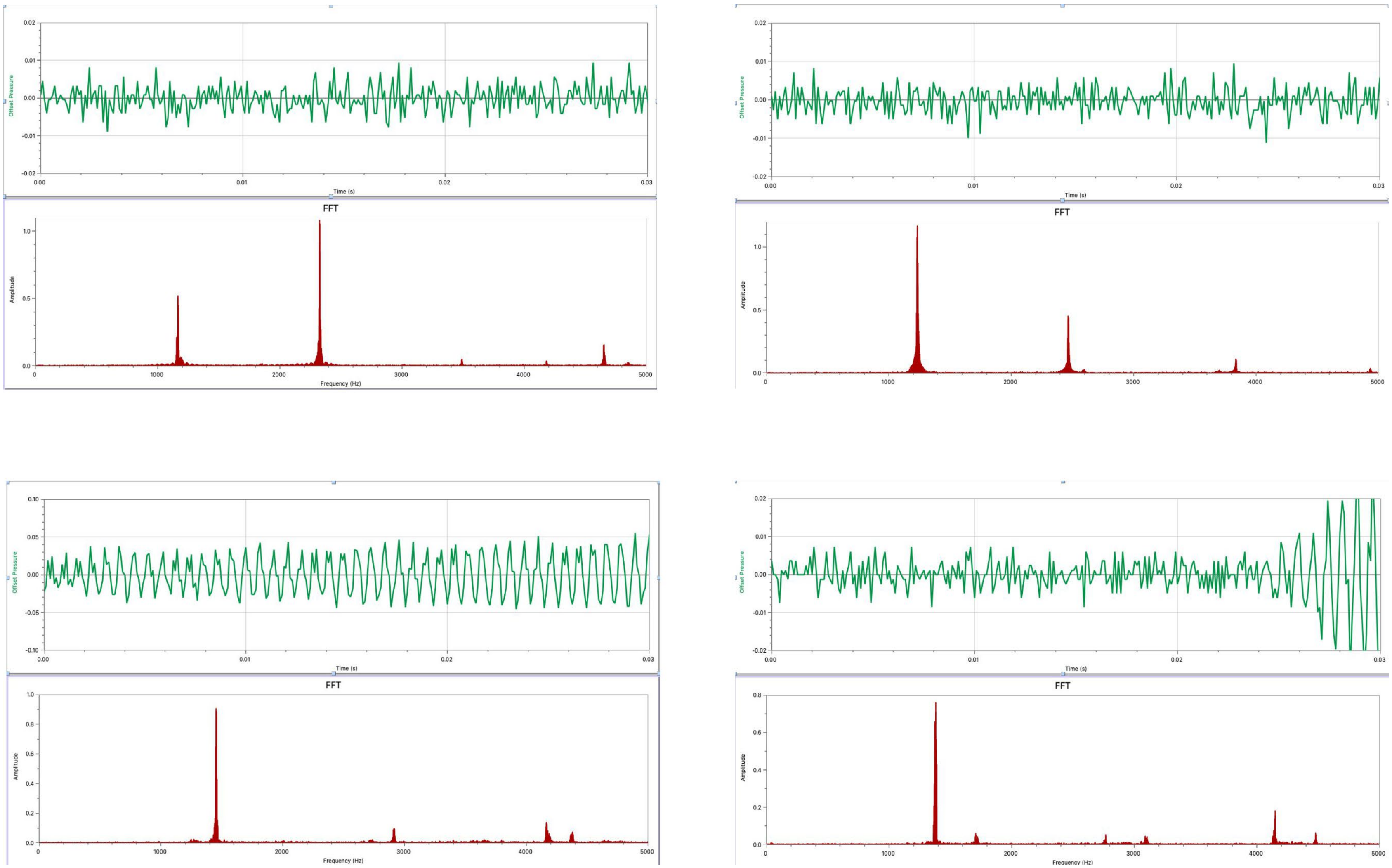
Sibayo, sound spectra rank III, pipe numbers 35, 40, 41 and 42 (clockwise from the top left)



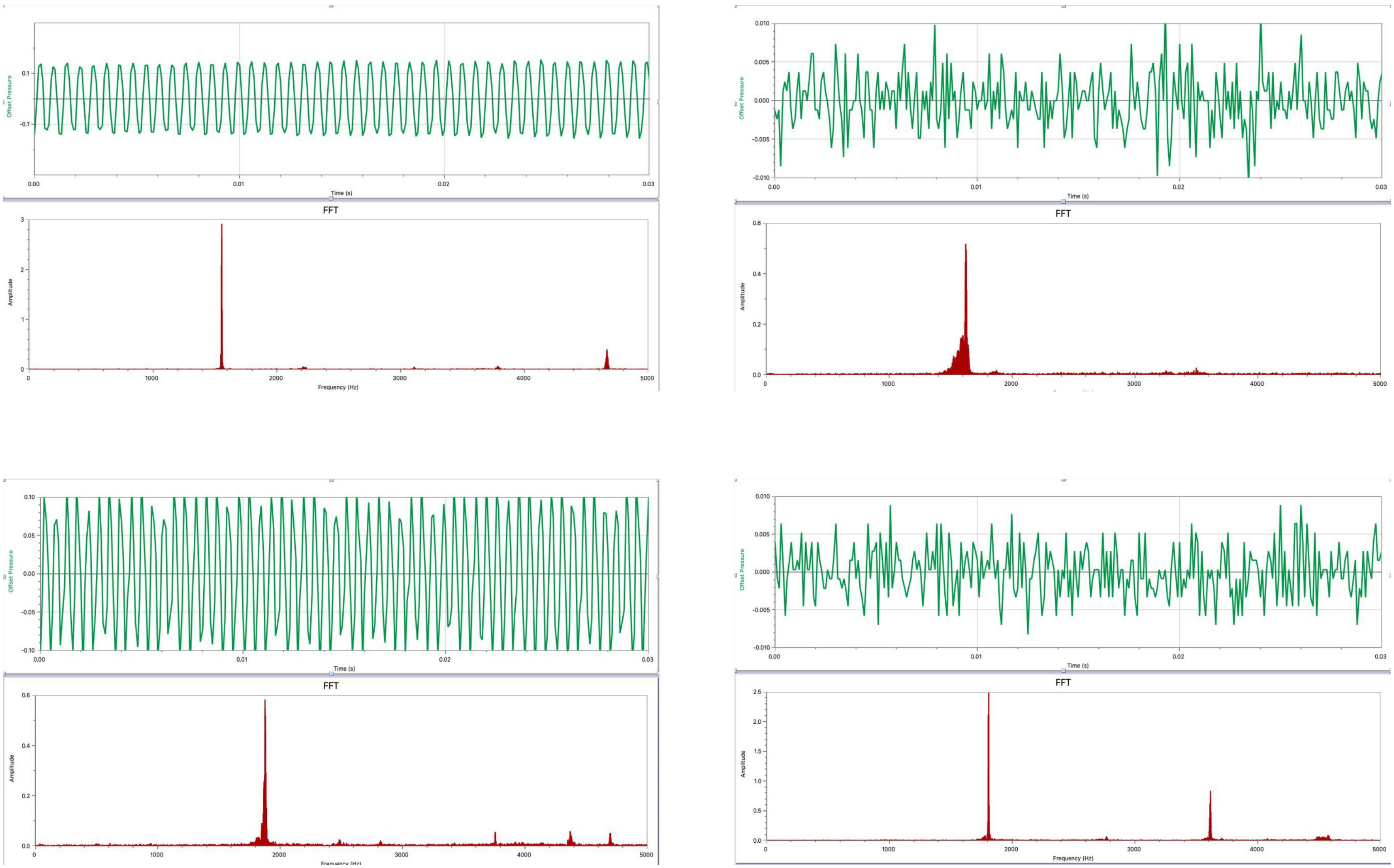
Sibayo, sound spectra rank IV, pipe numbers 0, 2, 6 and 7 (clockwise from the top left)



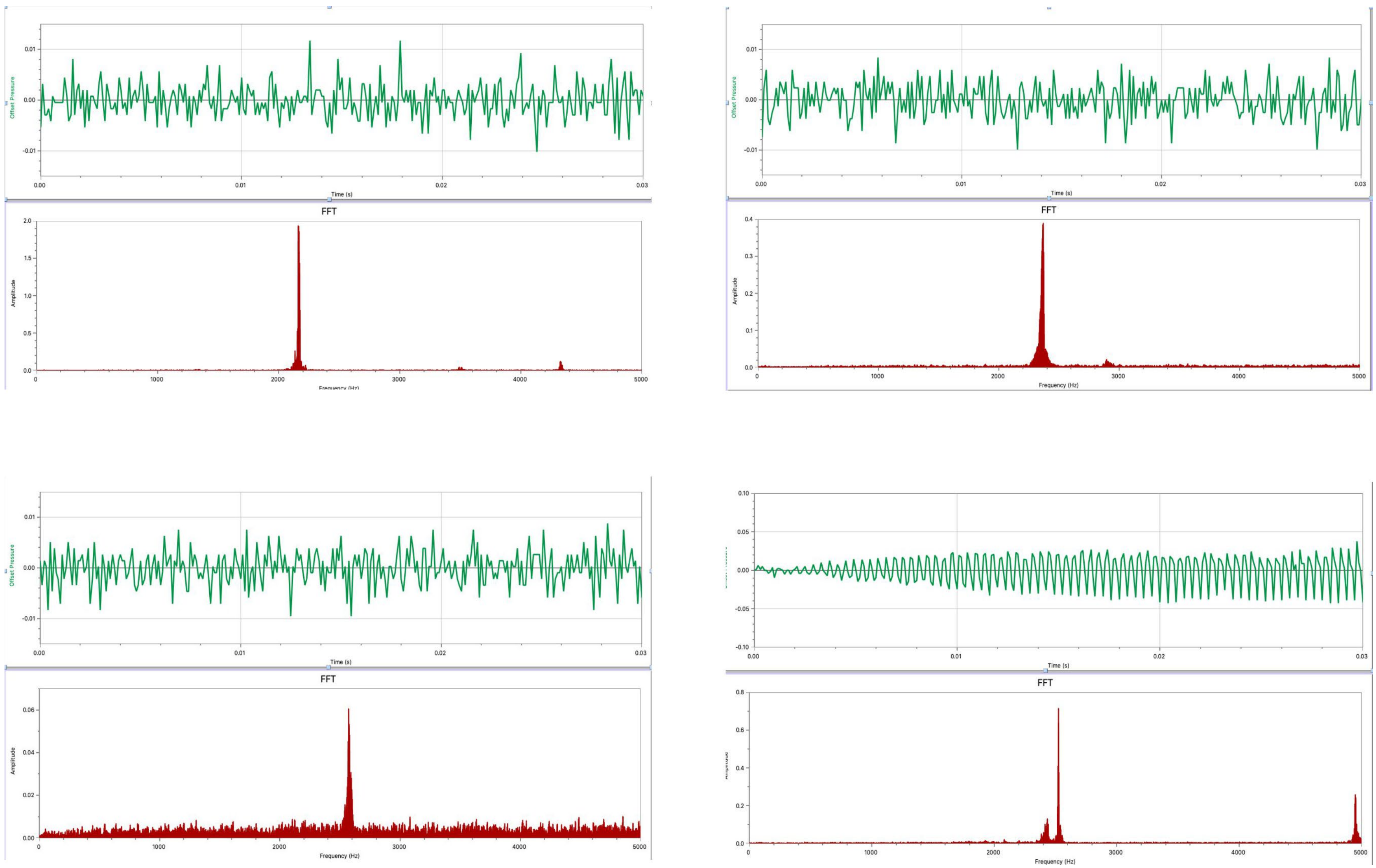
Sibayo, sound spectra rank IV, pipe numbers 8, 9, 10 and 12 (clockwise from the top left)



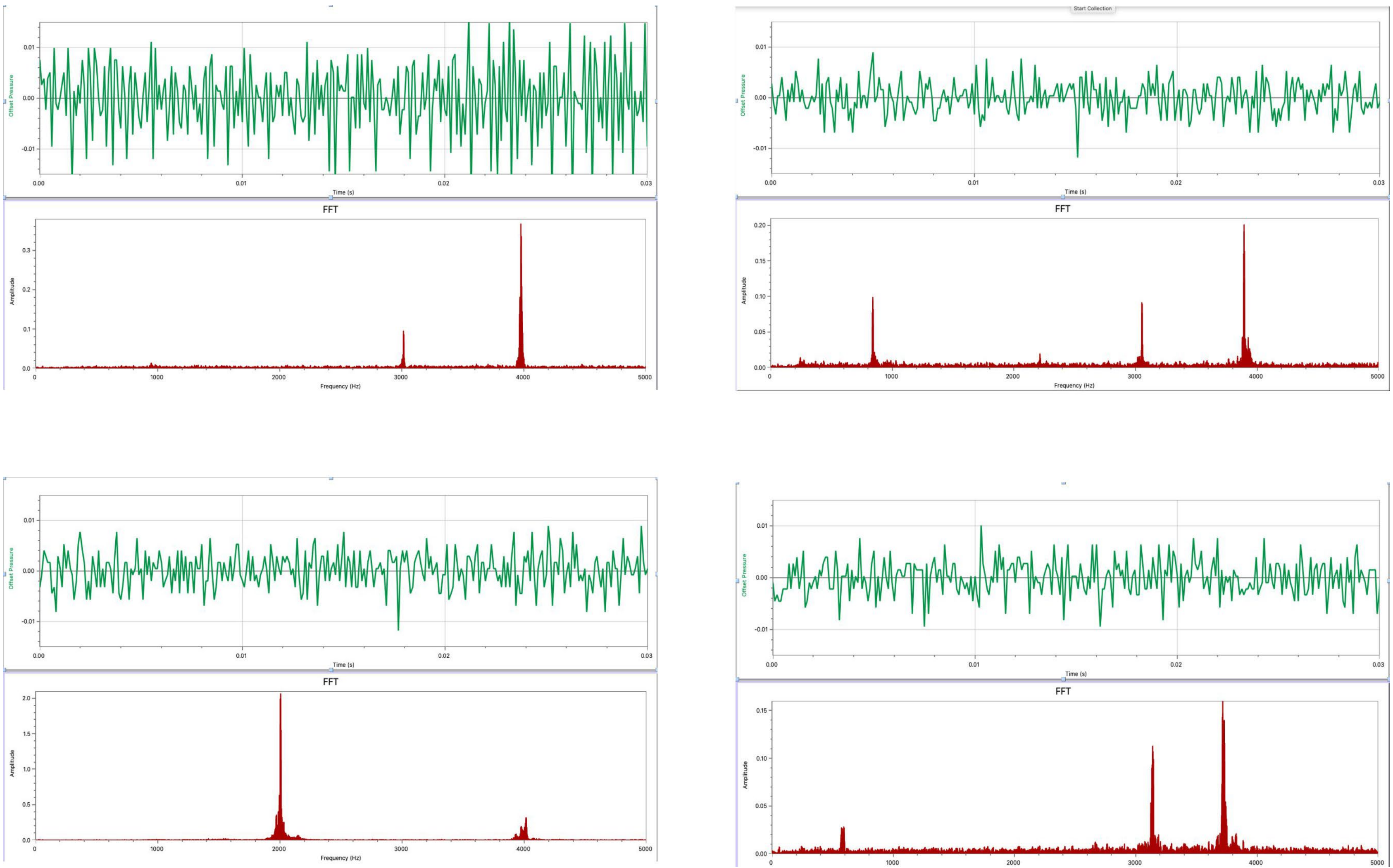
Sibayo, sound spectra rank IV, pipe numbers 16, 17, 19 and 20 (clockwise from the top left)



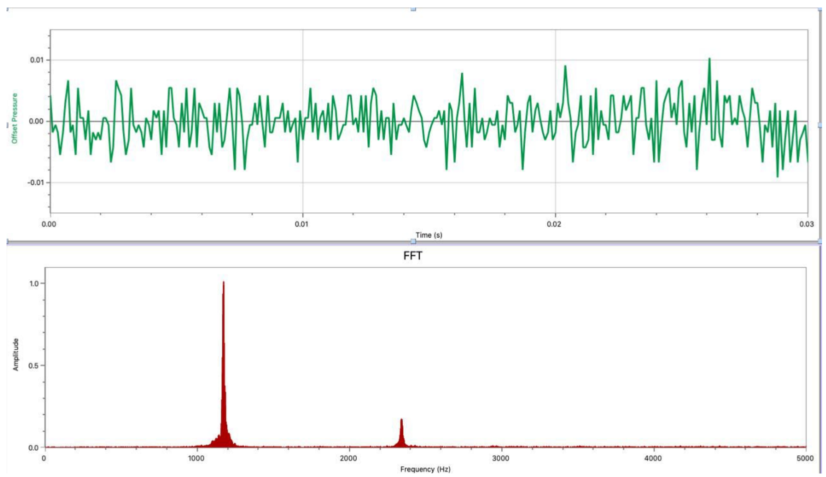
Sibayo, sound spectra rank IV, pipe numbers 21, 23, 24 and 25 (clockwise from the top left)



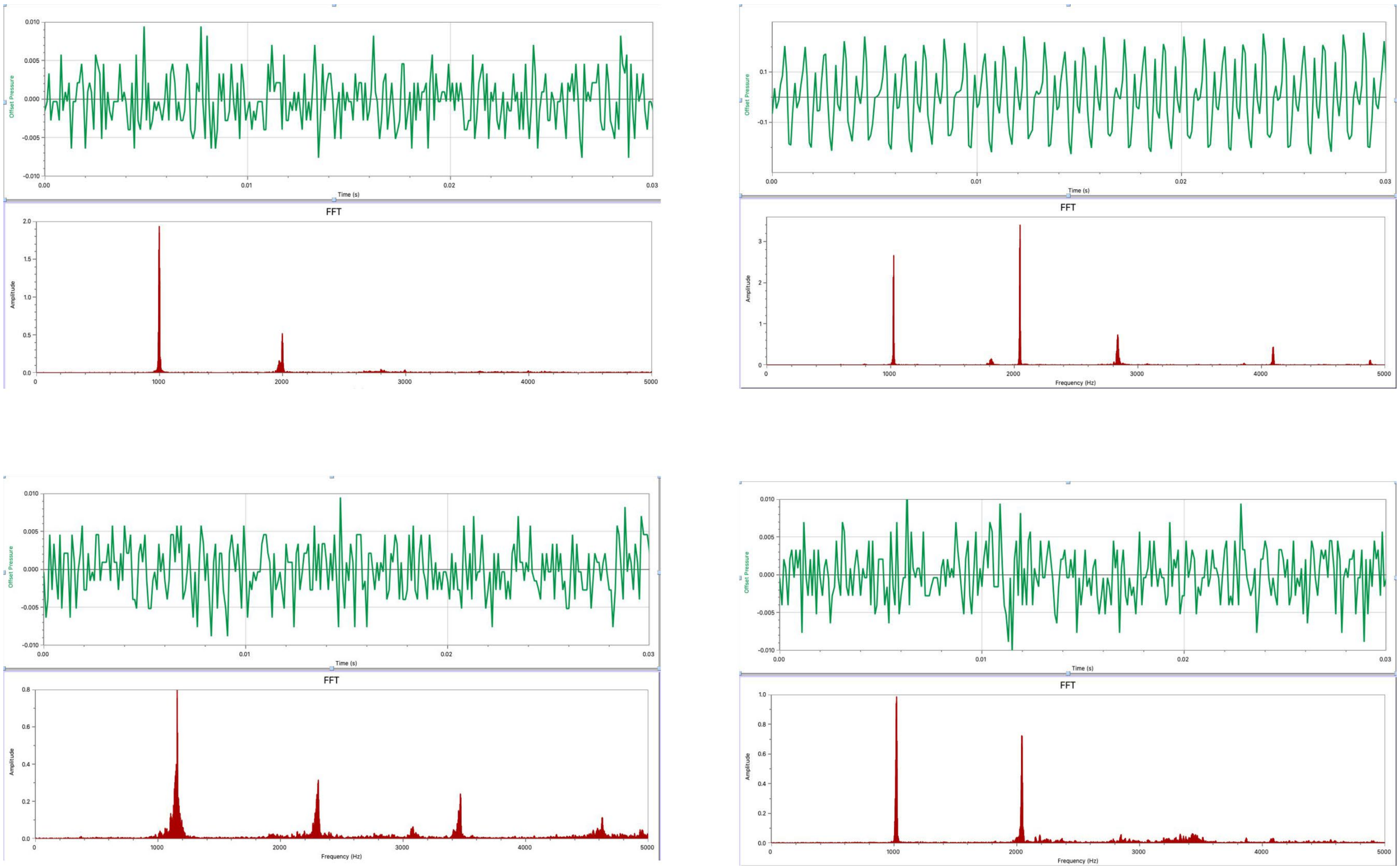
Sibayo, sound spectra rank IV, pipe numbers 27, 28, 30 and 32 (clockwise from the top left)



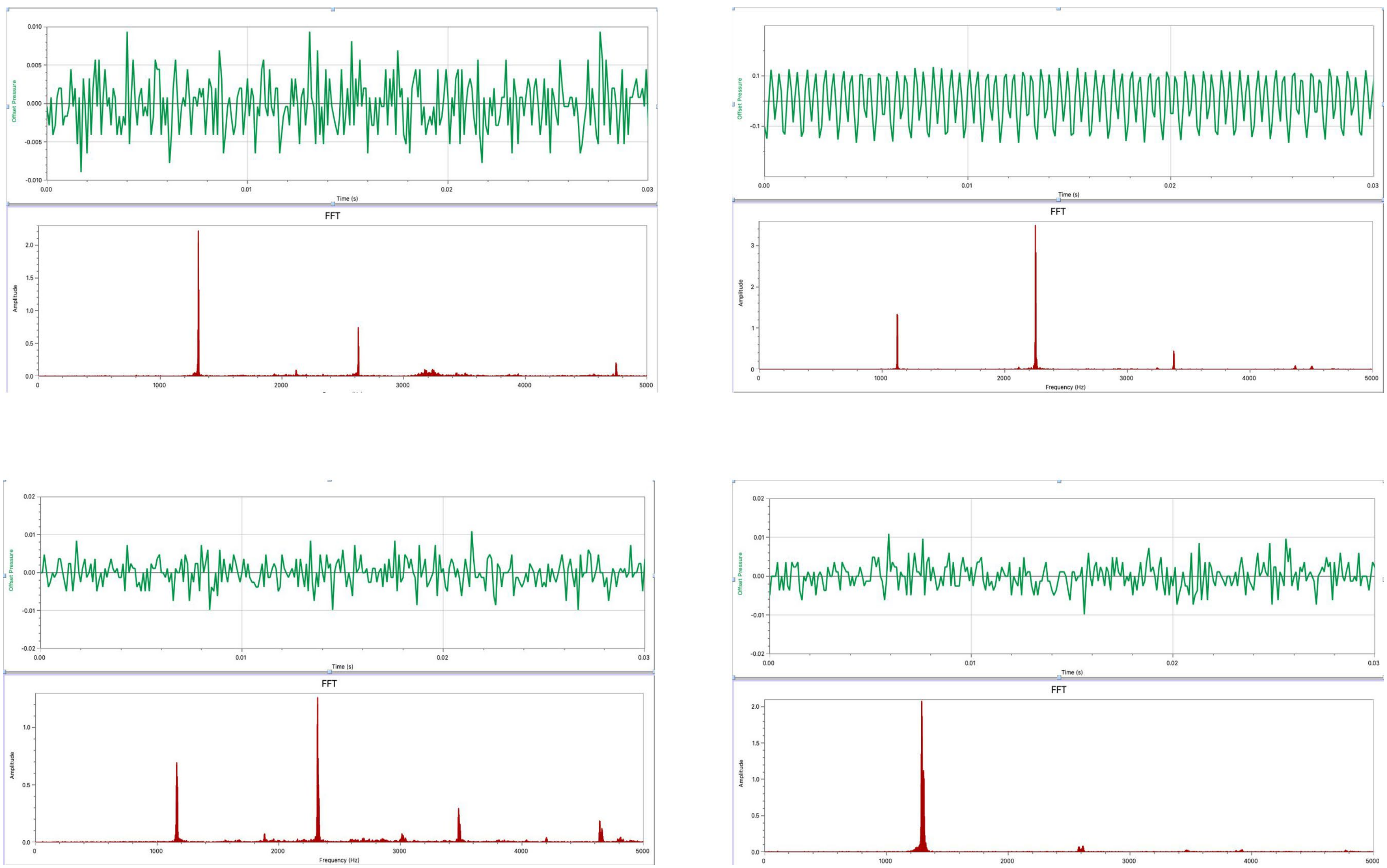
Sibayo, sound spectra rank IV, pipe numbers 33, 34, 35 and 38 (clockwise from the top left)



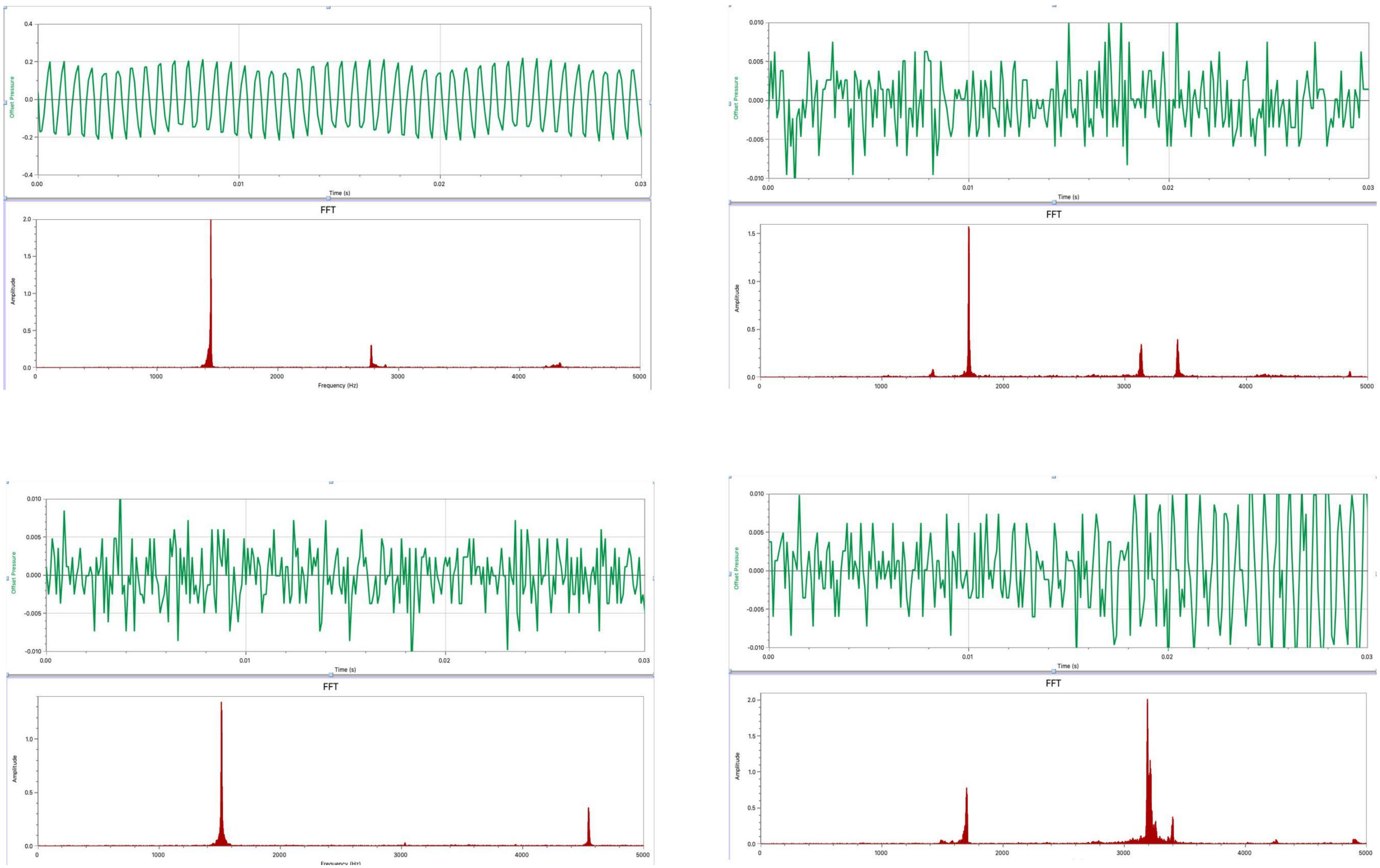
Sibayo, sound spectrum rank IV, pipe number 40



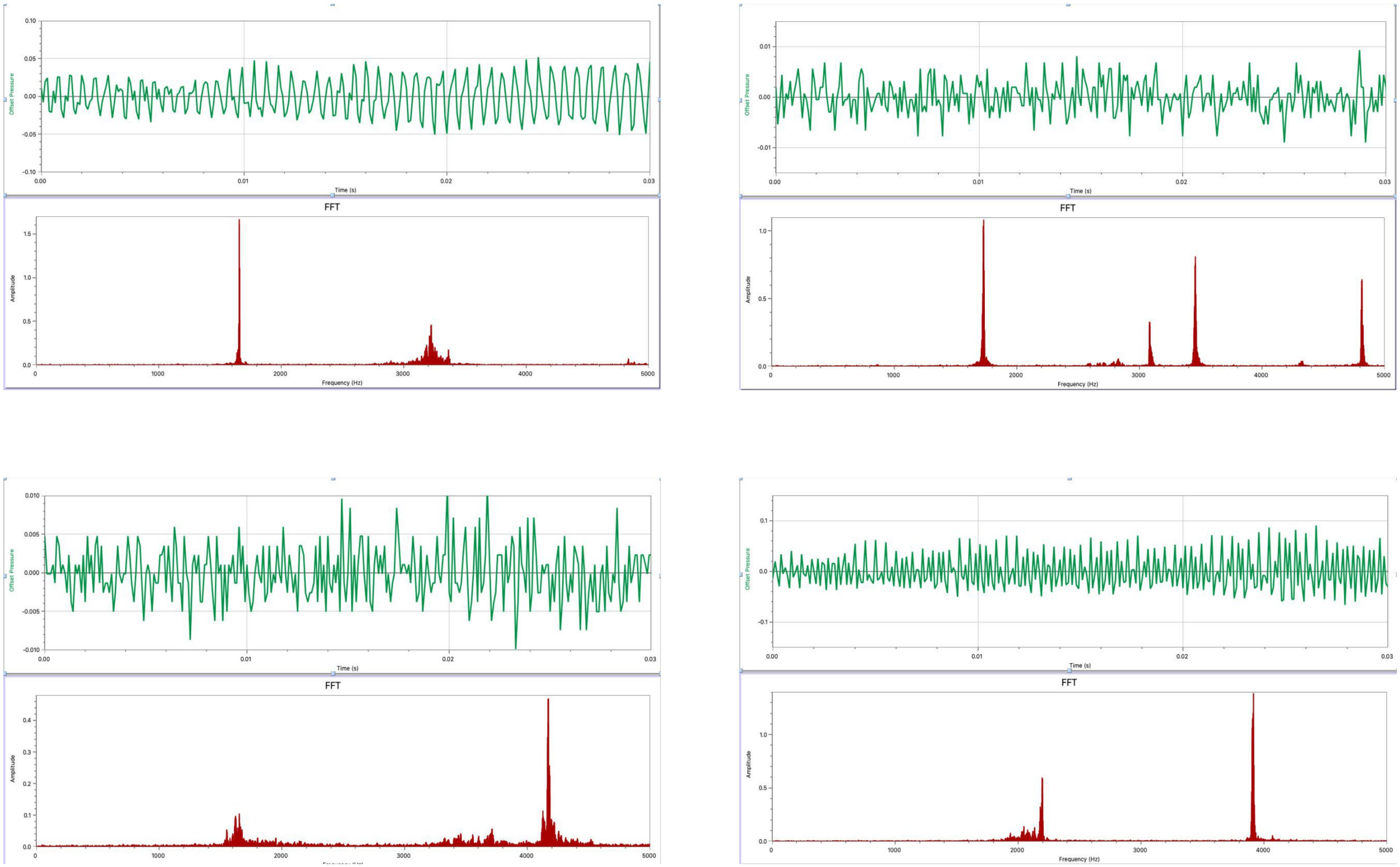
Sibayo, sound spectra rank V, pipe numbers 0B, 0F, 2B and 3B (clockwise from the top left)



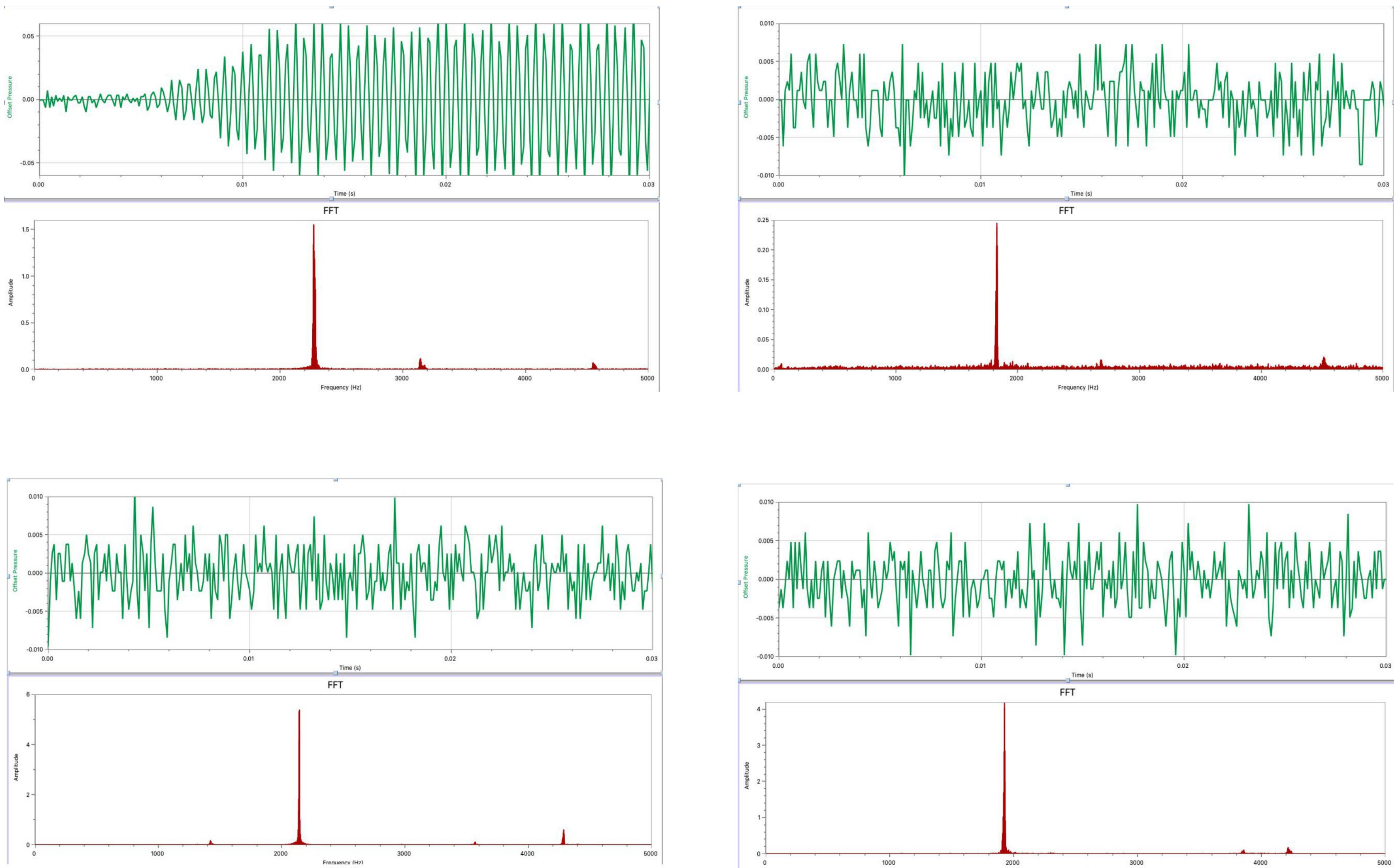
Sibayo, sound spectra rank V, pipe numbers 3F, 4B, 5B and 5F (clockwise from the top left)



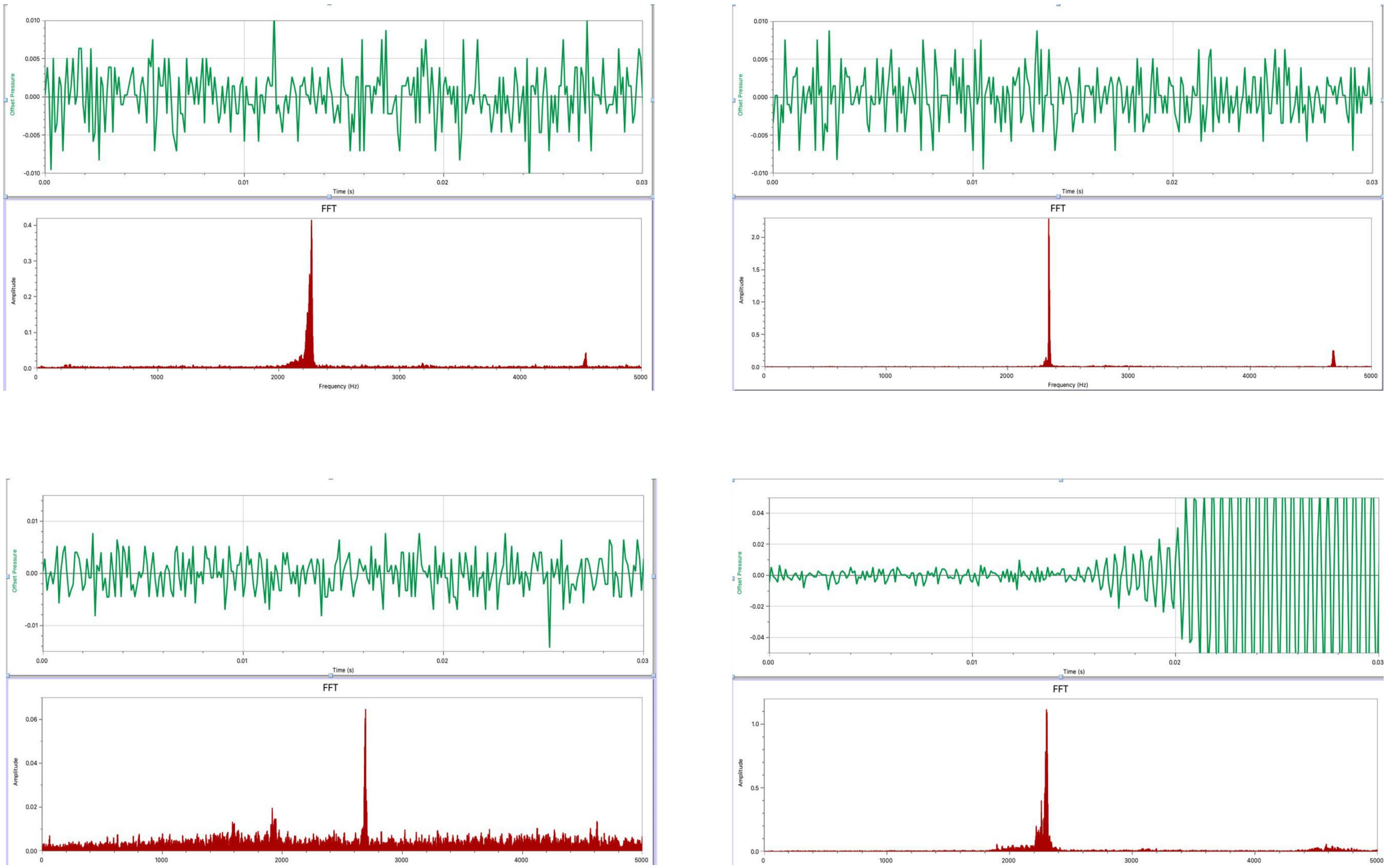
Sibayo, sound spectra rank V, pipe numbers 6B, 7B, 8B and 9B (clockwise from the top left)



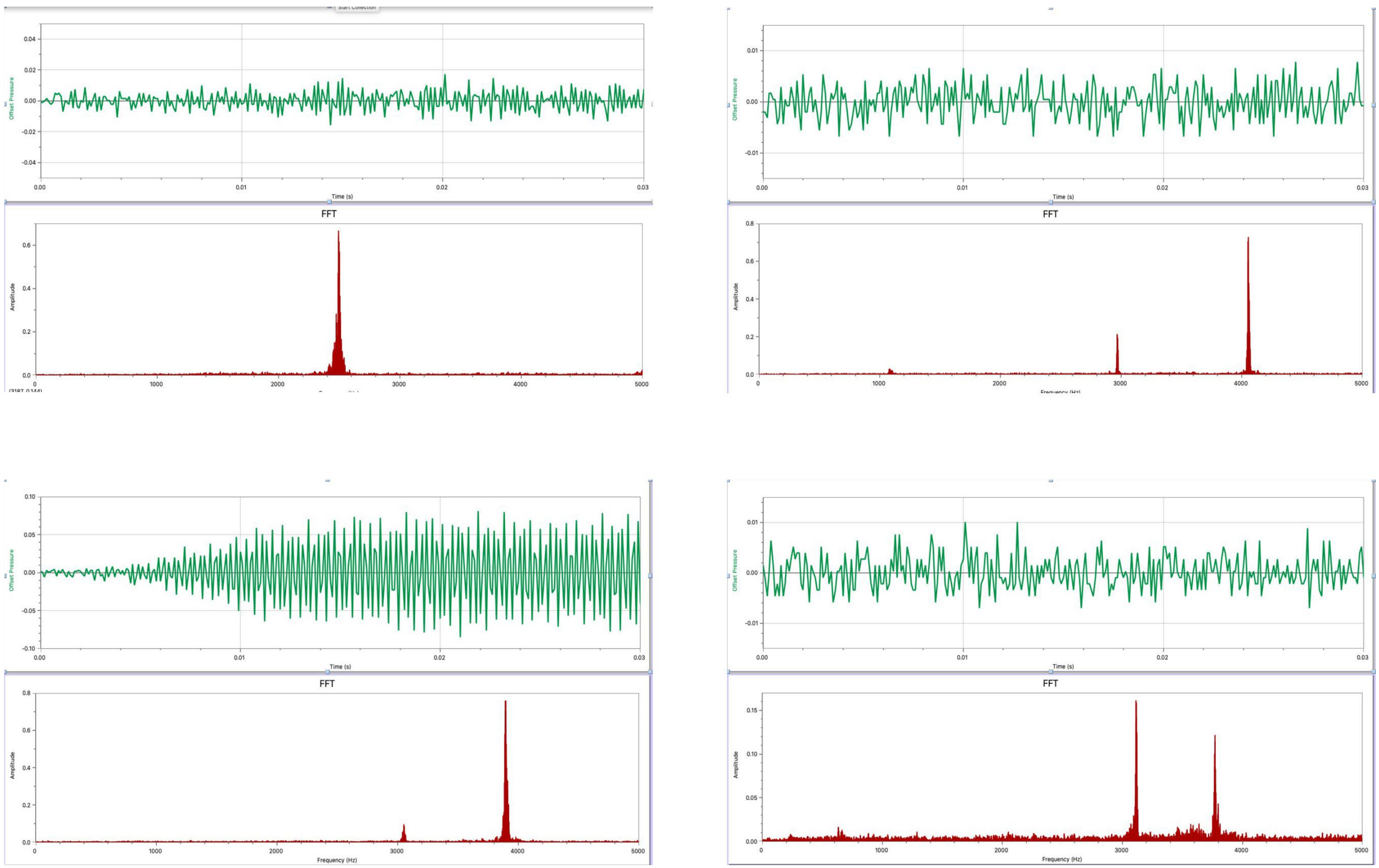
Sibayo, sound spectra rank V, pipe numbers 10B, 12B, 13B and 14B (clockwise from the top left)



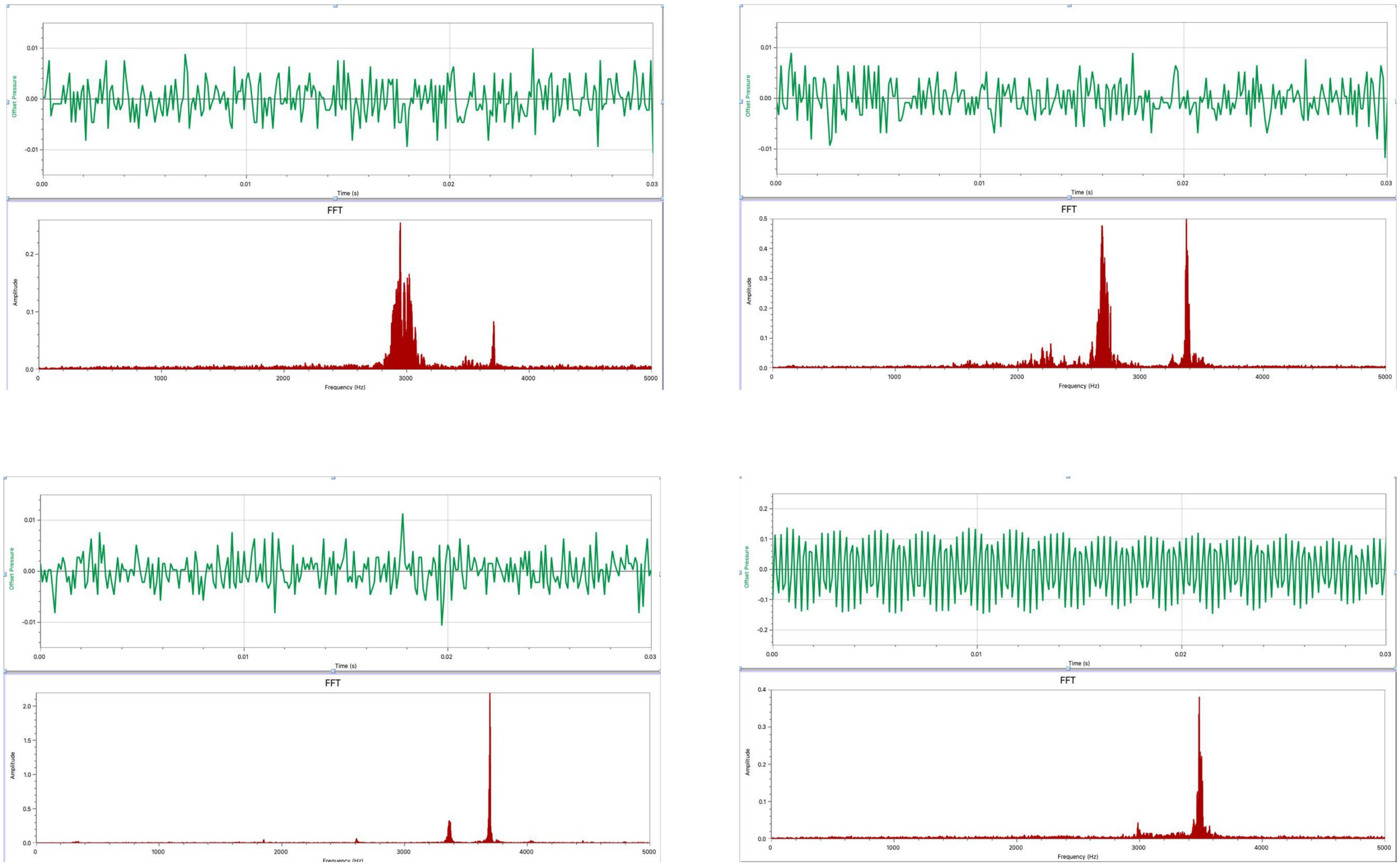
Sibayo, sound spectra rank V, pipe numbers 16B, 19B, 21B and 22B (clockwise from the top left)



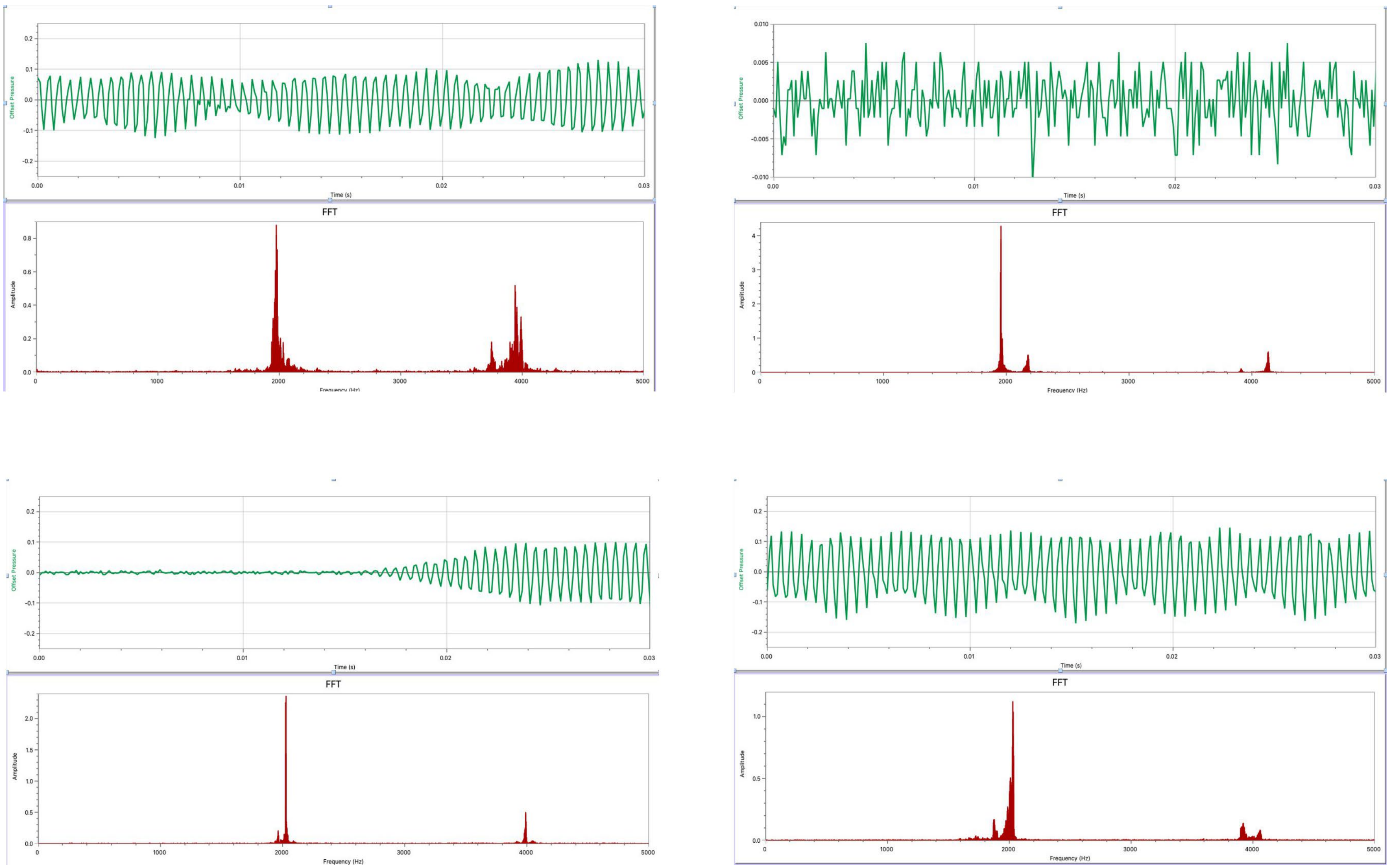
Sibayo, sound spectra rank V, pipe numbers 23B, 24B, 25B and 26B (clockwise from the top left)



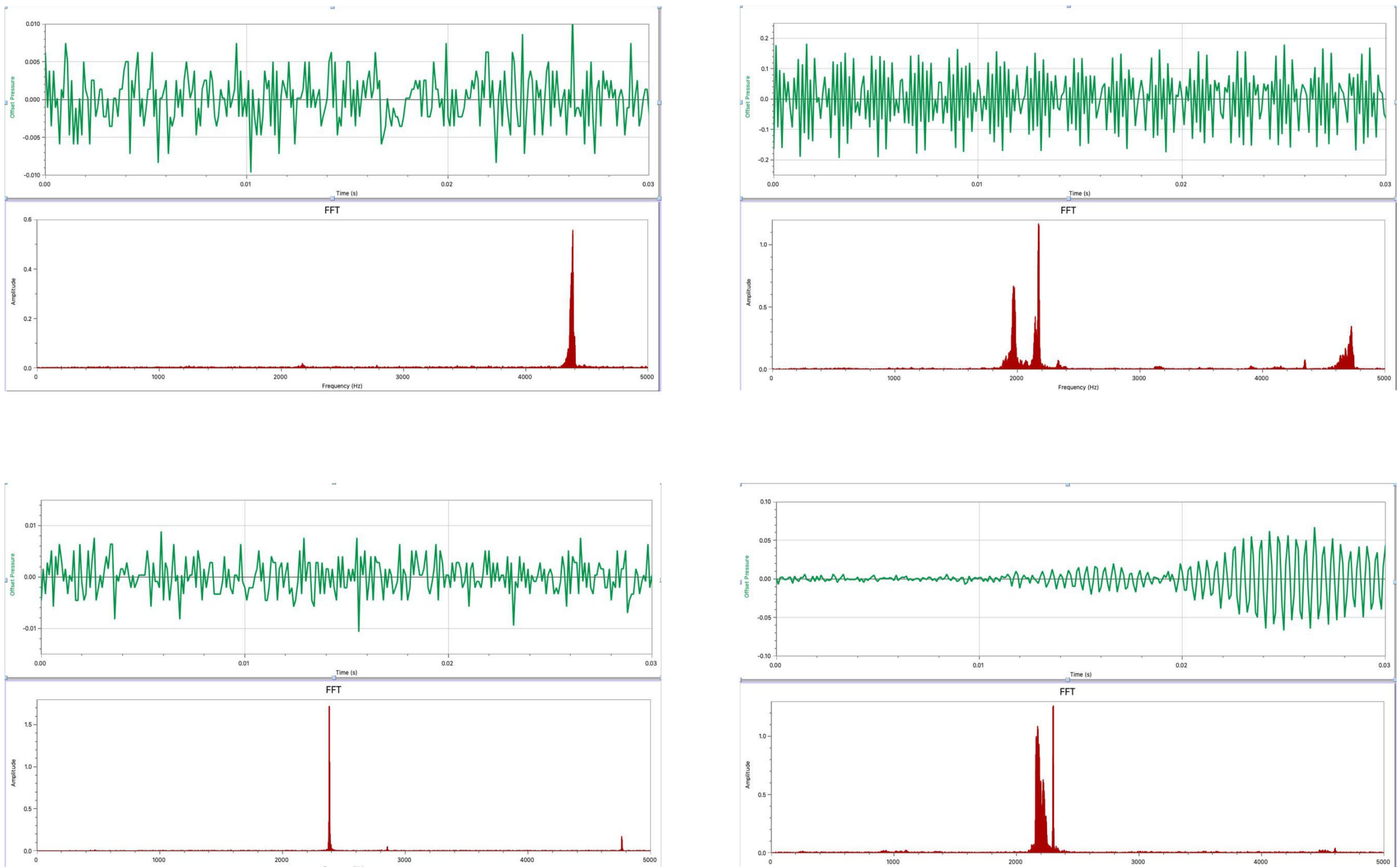
Sibayo, sound spectra rank V, pipe numbers 26F, 27B, 28B and 28F (clockwise from the top left)



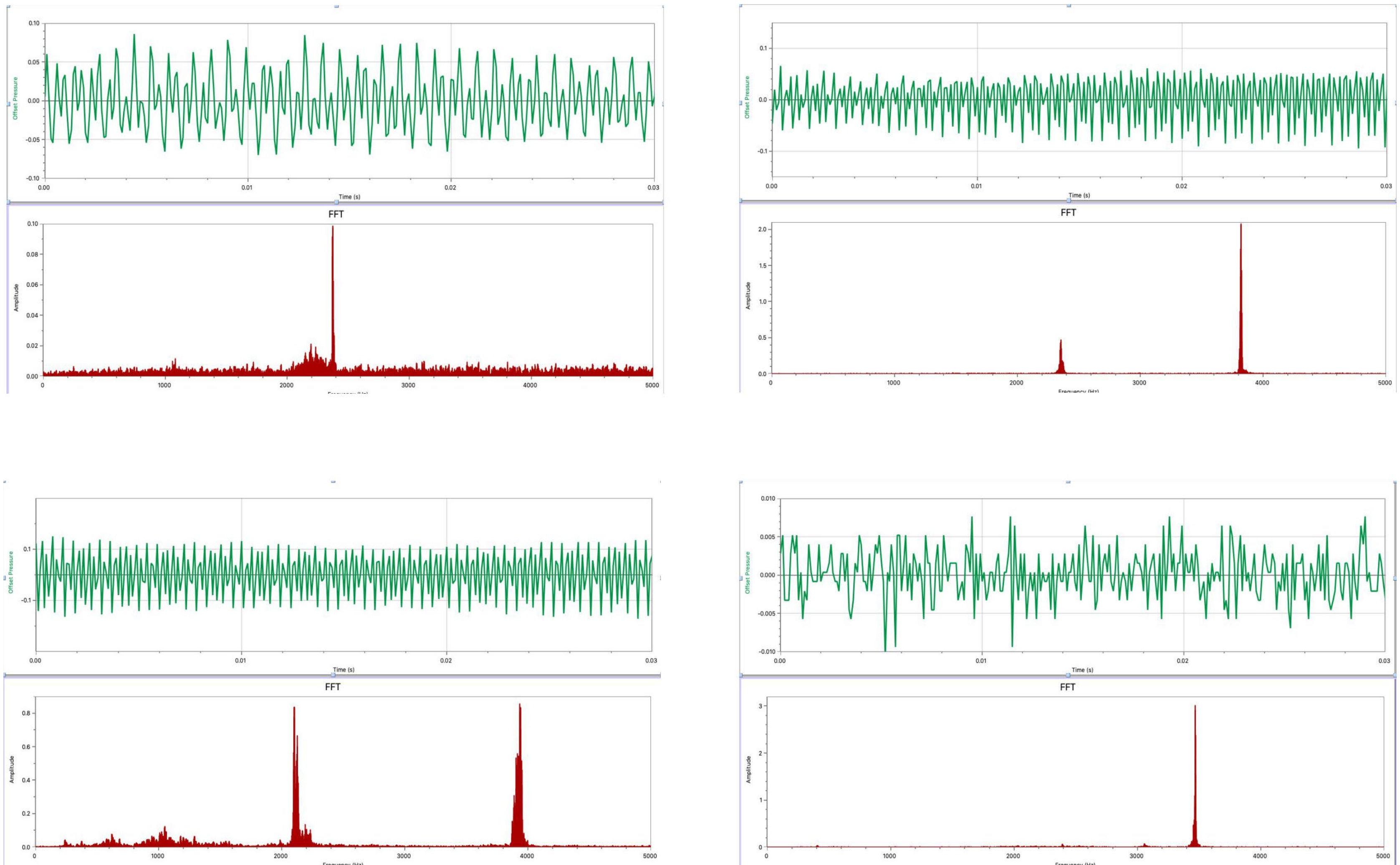
Sibayo, sound spectra rank V, pipe numbers 29B, 30F, 31B and 31F (clockwise from the top left)



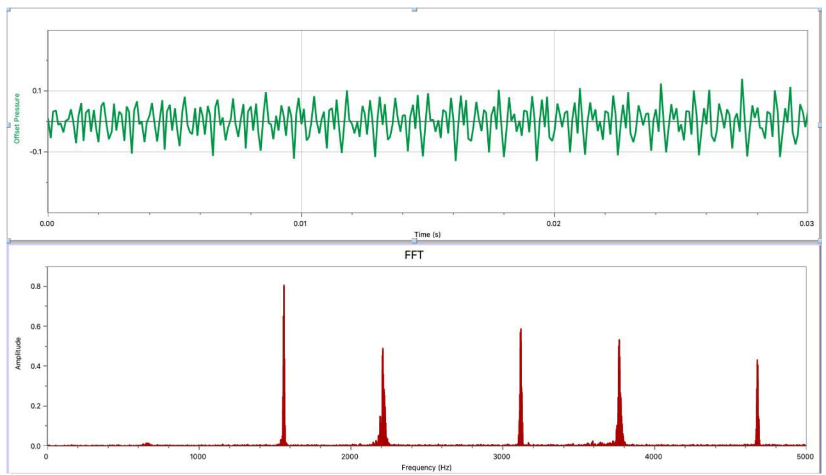
Sibayo, sound spectra rank V, pipe numbers 32B, 34F, 35F and 36B (clockwise from the top left)



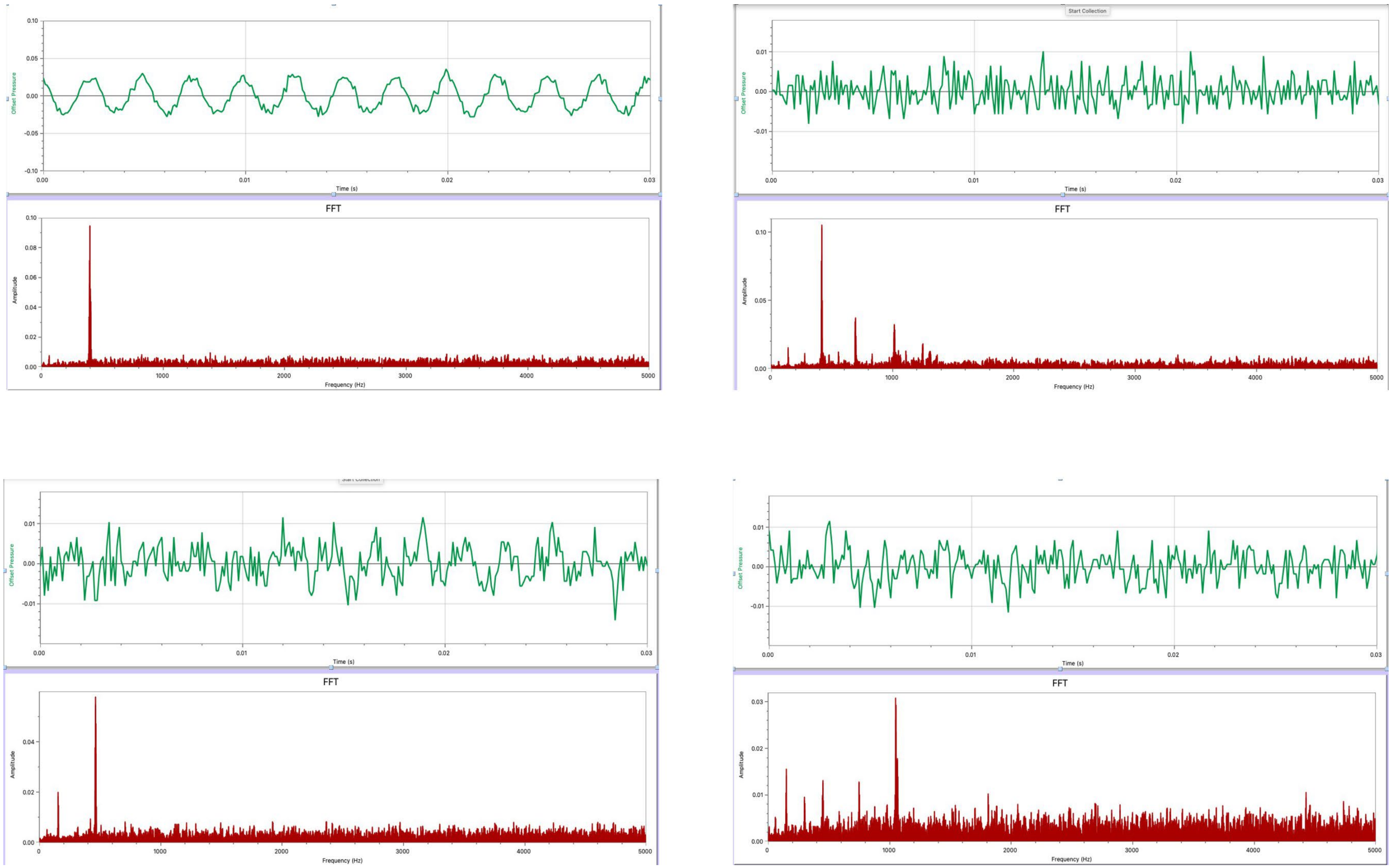
Sibayo, sound spectra rank V, pipe numbers 34B, 34F, 35F and 36B (clockwise from the top left)



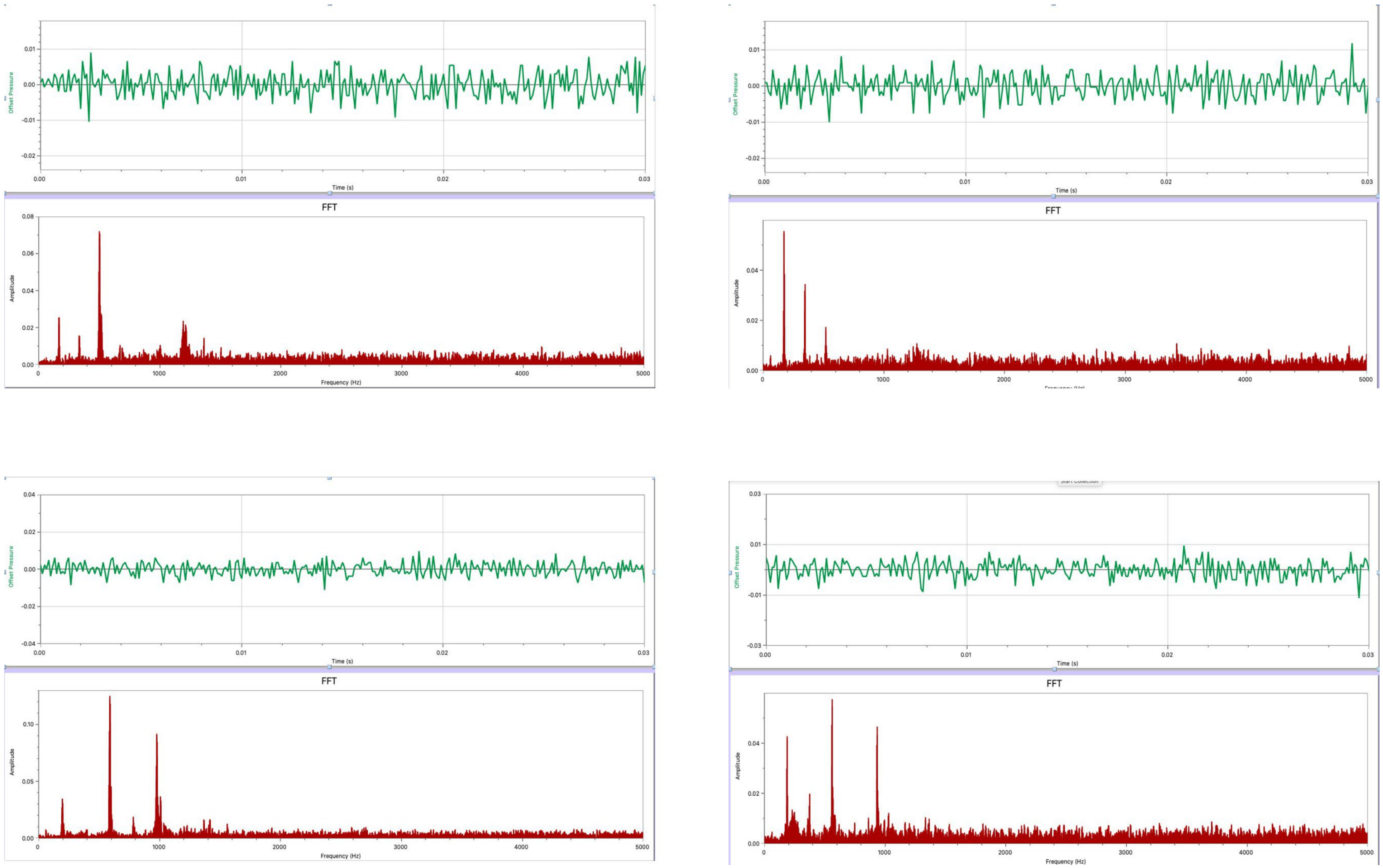
Sibayo, sound spectra rank V, pipe numbers 36F, 37B, 38B and 39F (clockwise from the top left)



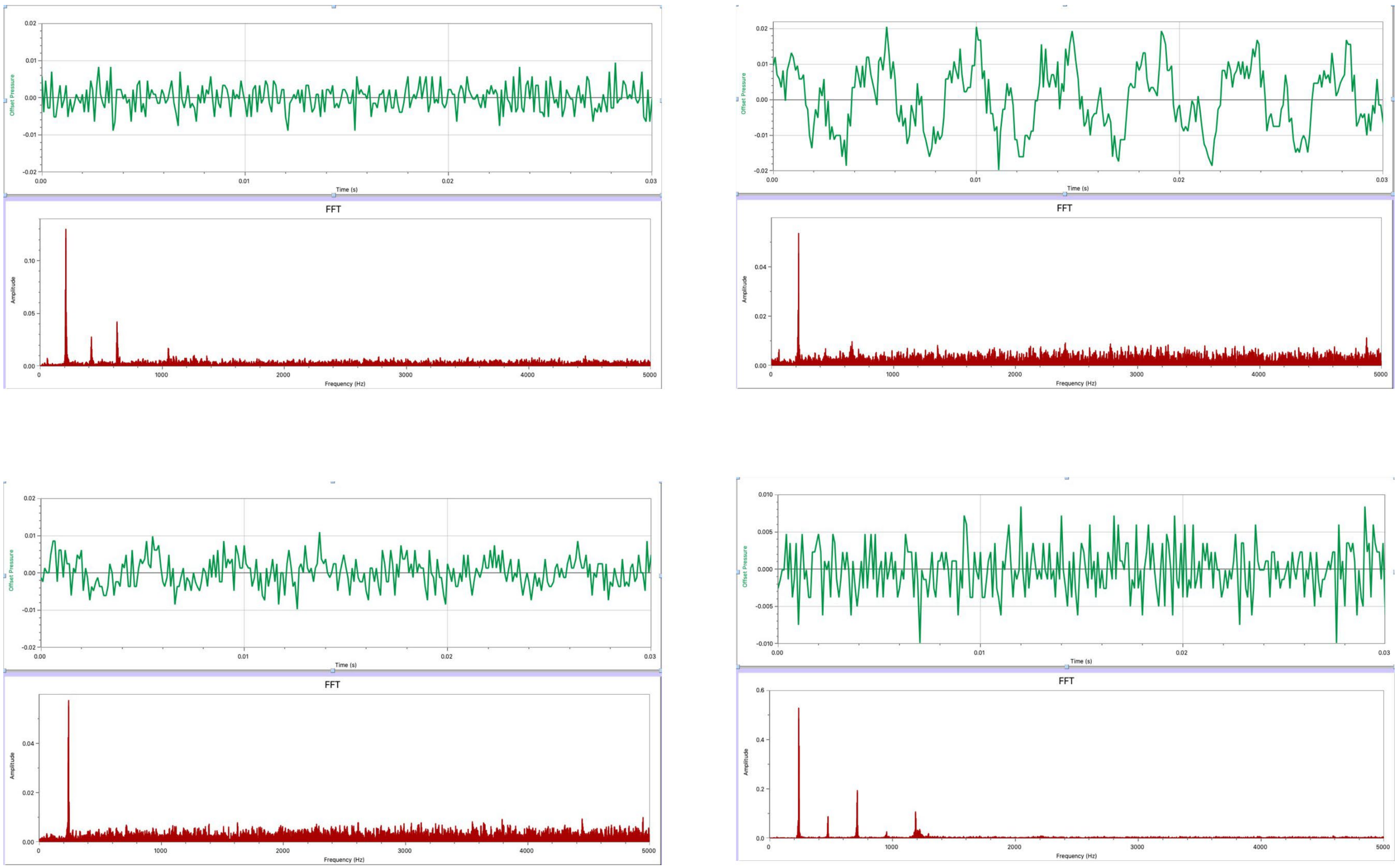
Sibayo, sound spectrum rank V, pipe number 40B



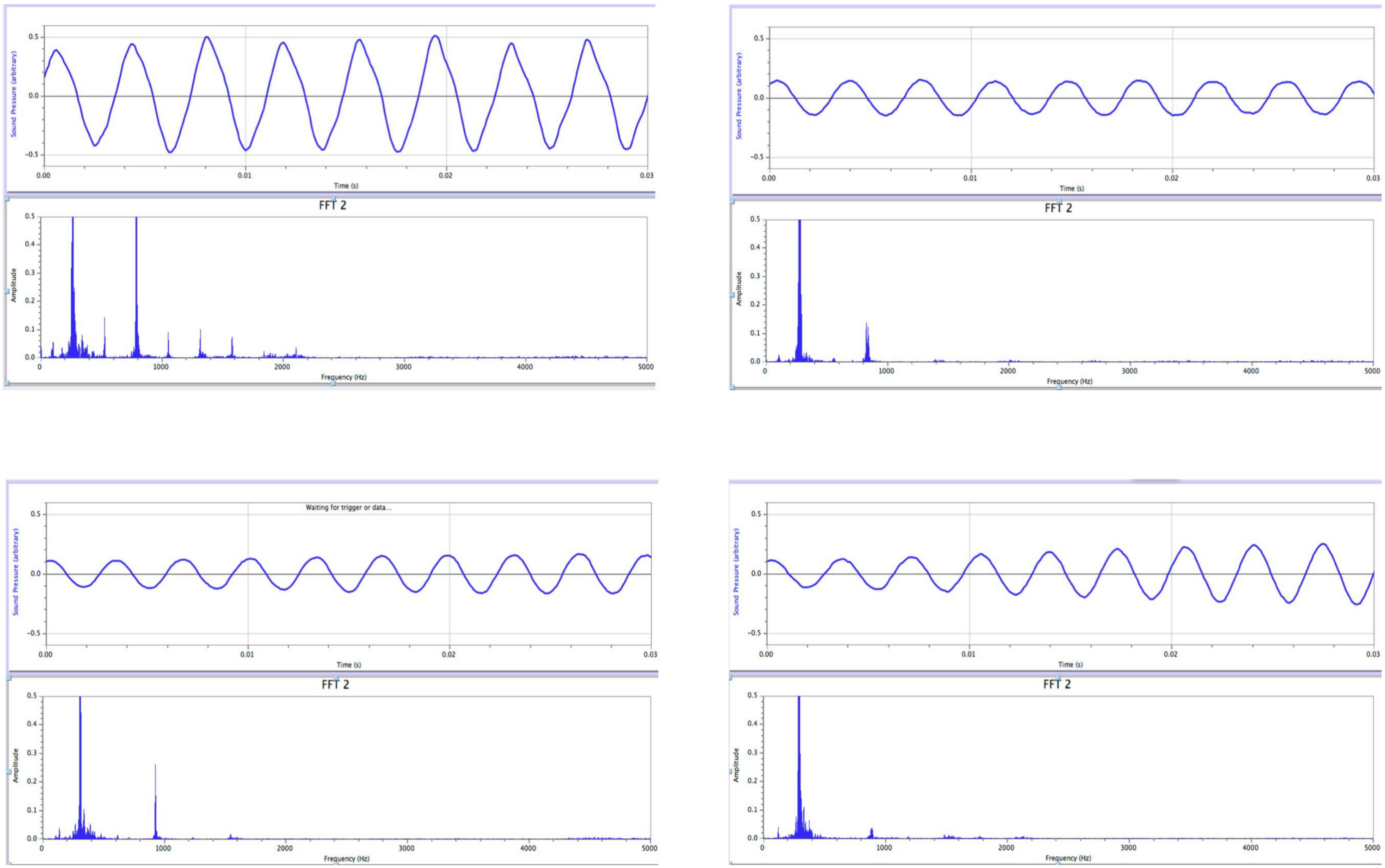
Callalli, sound spectra rank II, pipe numbers 7, 8, 9, and 10 (clockwise from the top left)



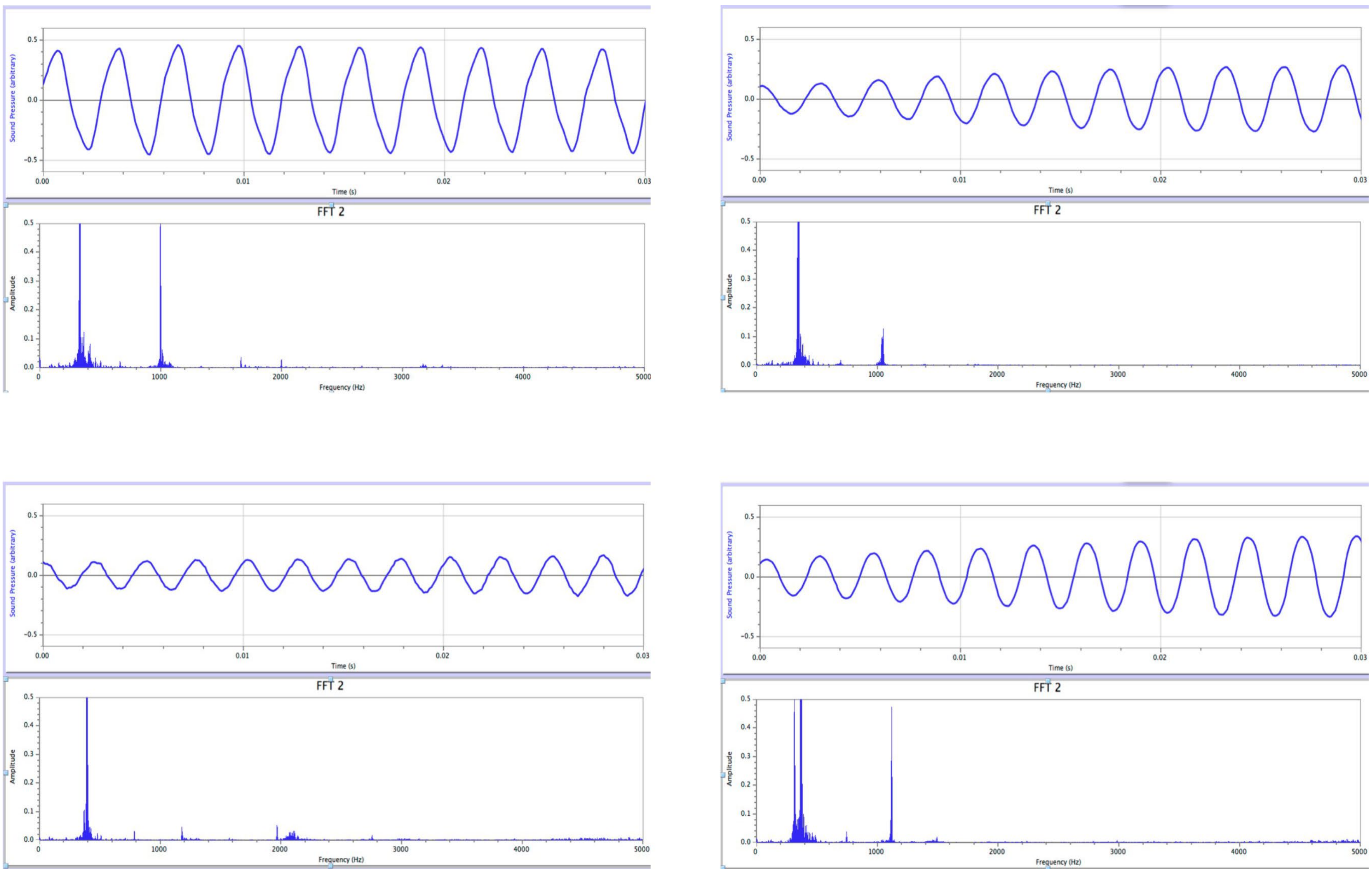
Callalli, sound spectra rank II, pipe numbers 11, 12, 13, and 14 (clockwise from the top left)



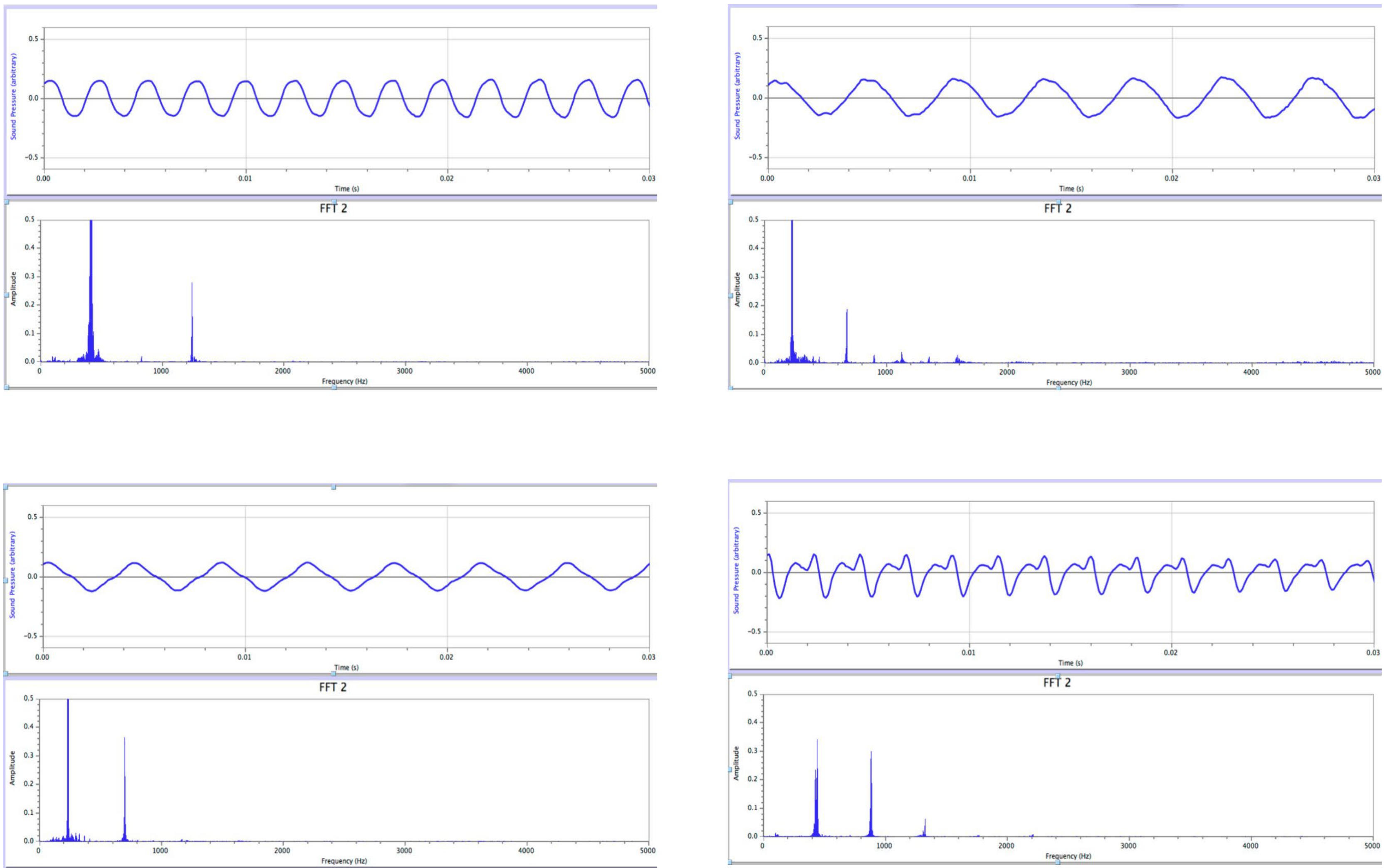
Callalli, sound spectra rank II, pipe numbers 15, 16, 17, and 18 (clockwise from the top left)



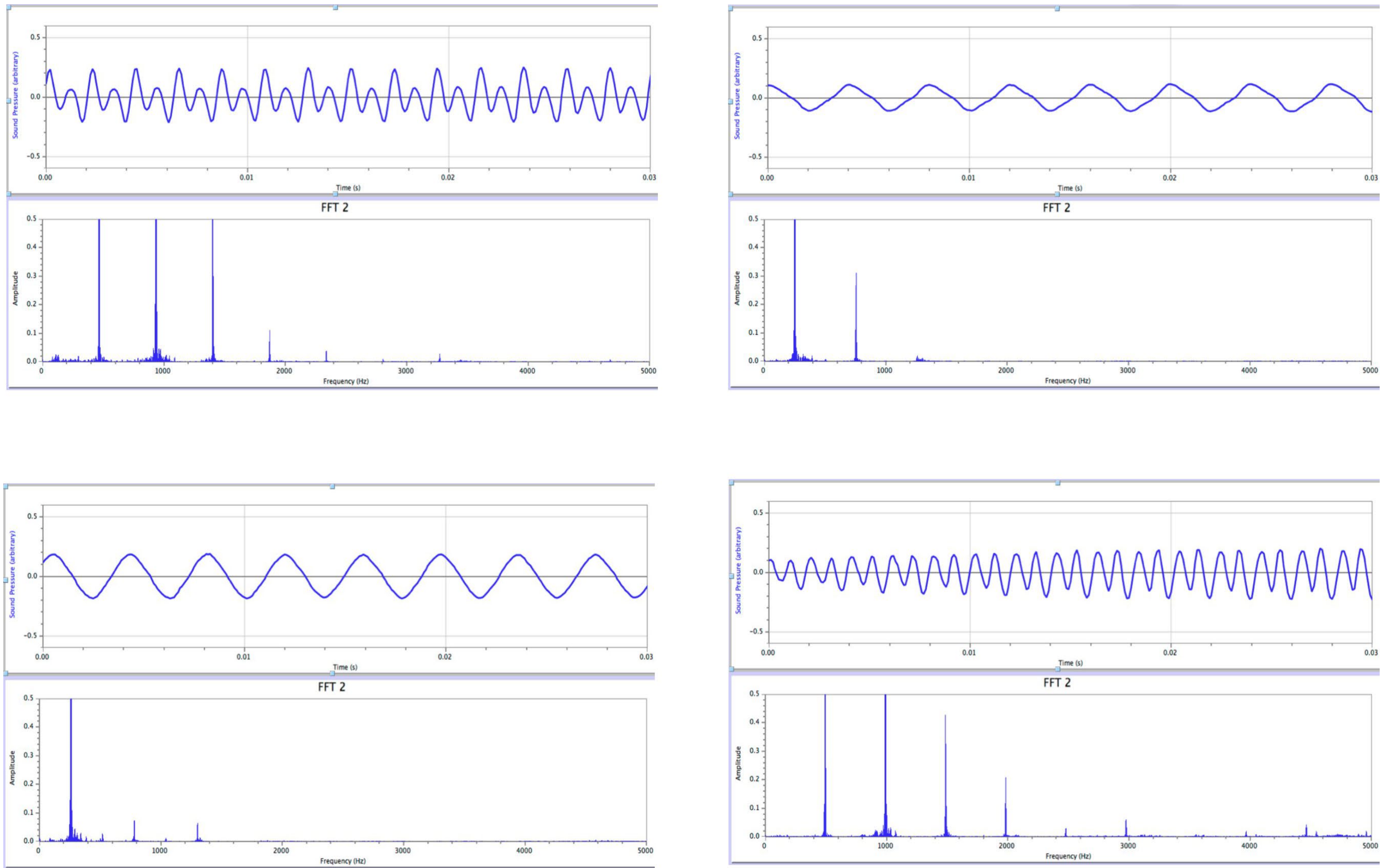
Callalli, sound spectra rank II, pipe numbers 19, 20, 21, and 22 (clockwise from the top left)



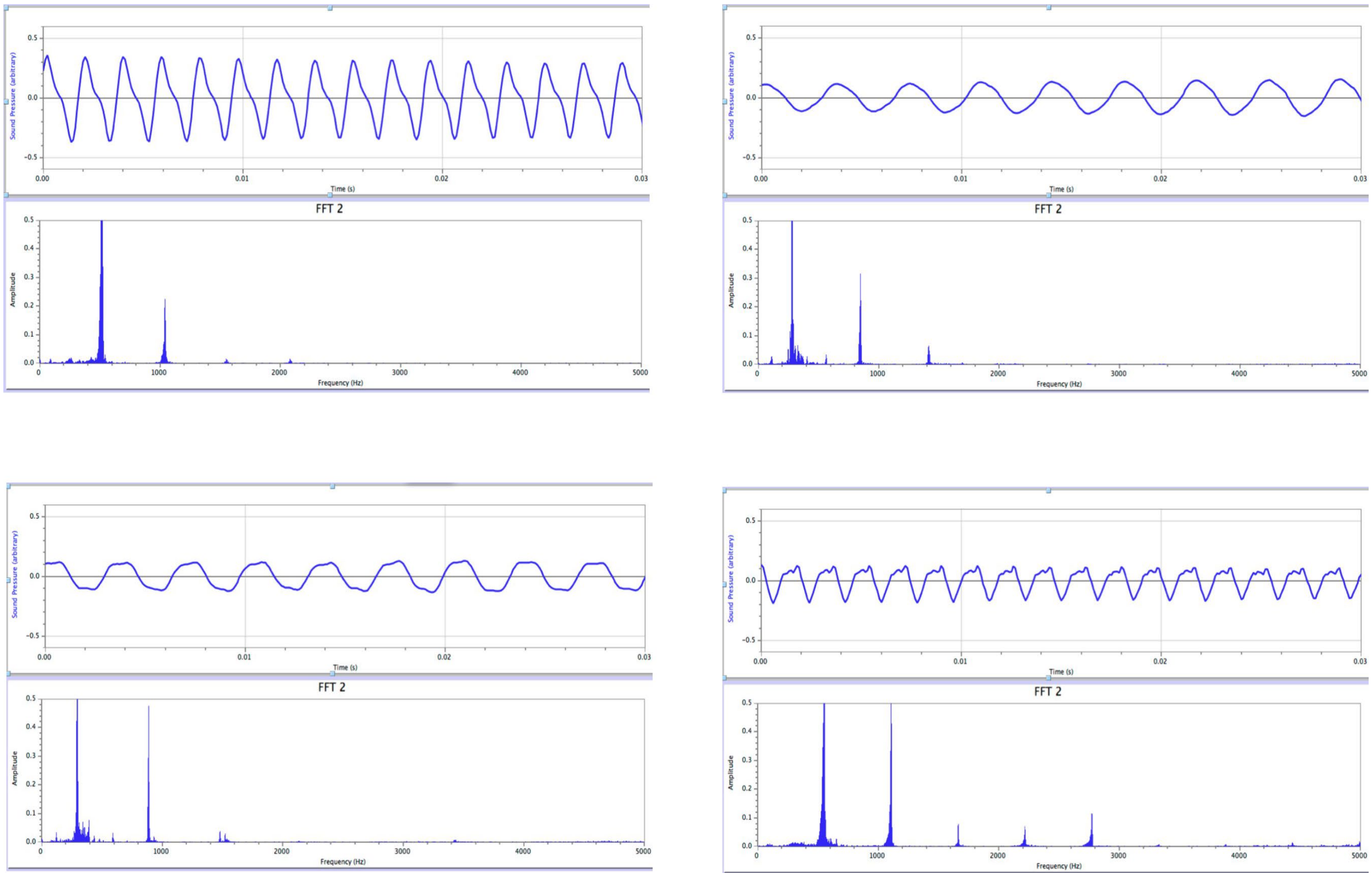
Callalli, sound spectra rank II, pipe numbers 23, 24, 25, and 26 (clockwise from the top left)



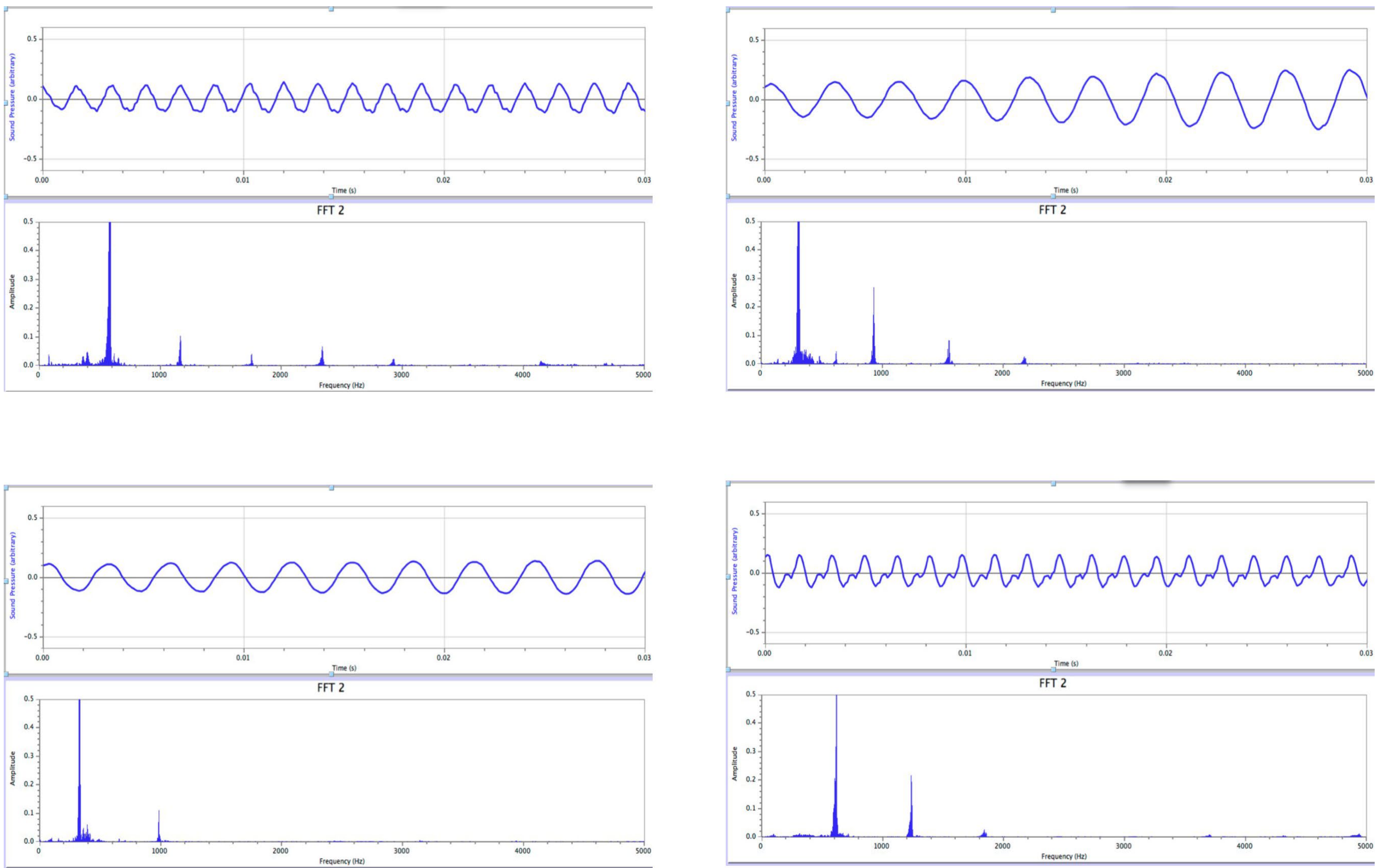
Callalli, sound spectra rank II, pipe numbers 27, 28 back, 28 front, and 29 back (clockwise from the top left)



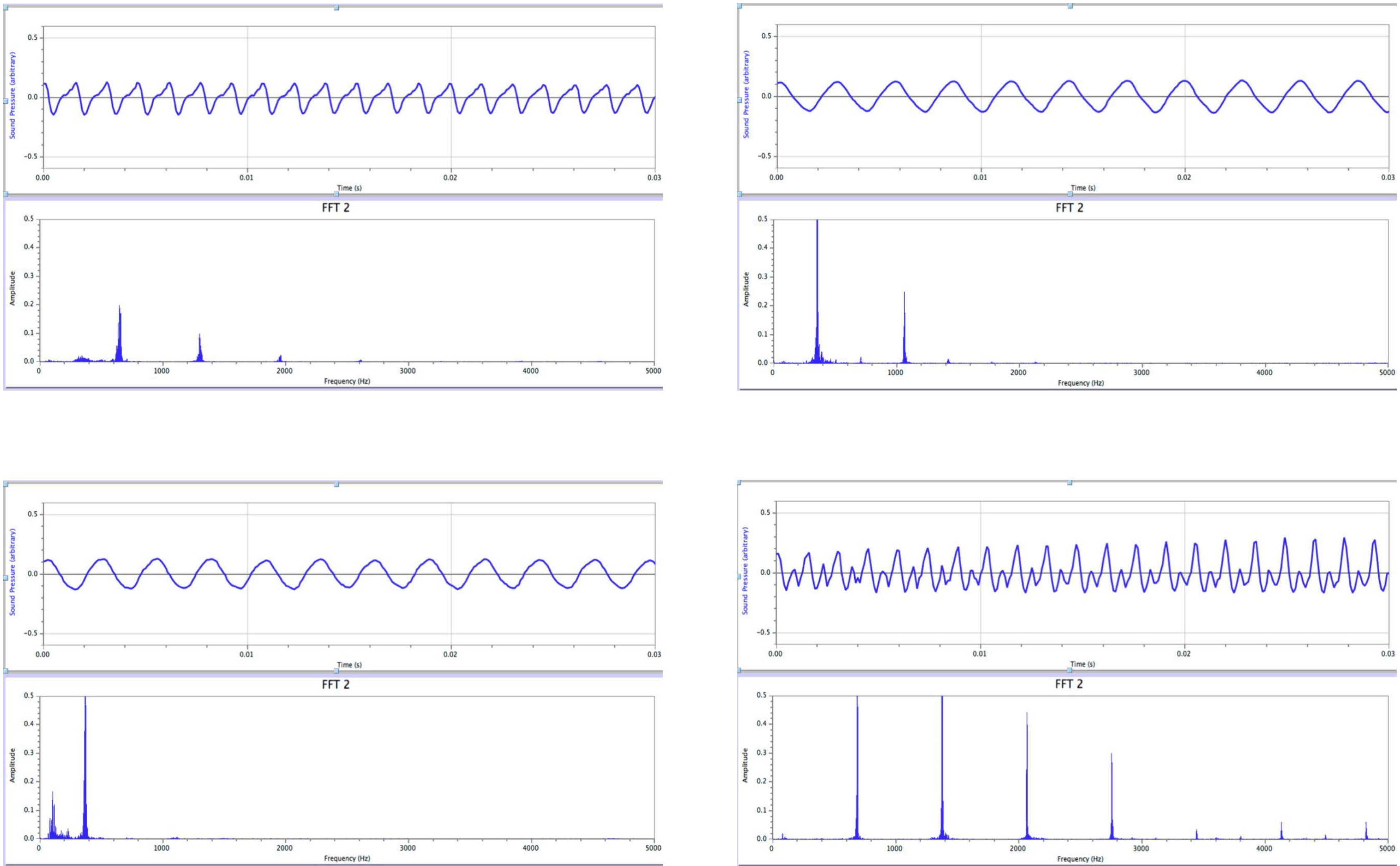
Callalli, sound spectra rank II, pipe numbers 29 front, 30 back, 30 front, and 31 back (clockwise from the top left)



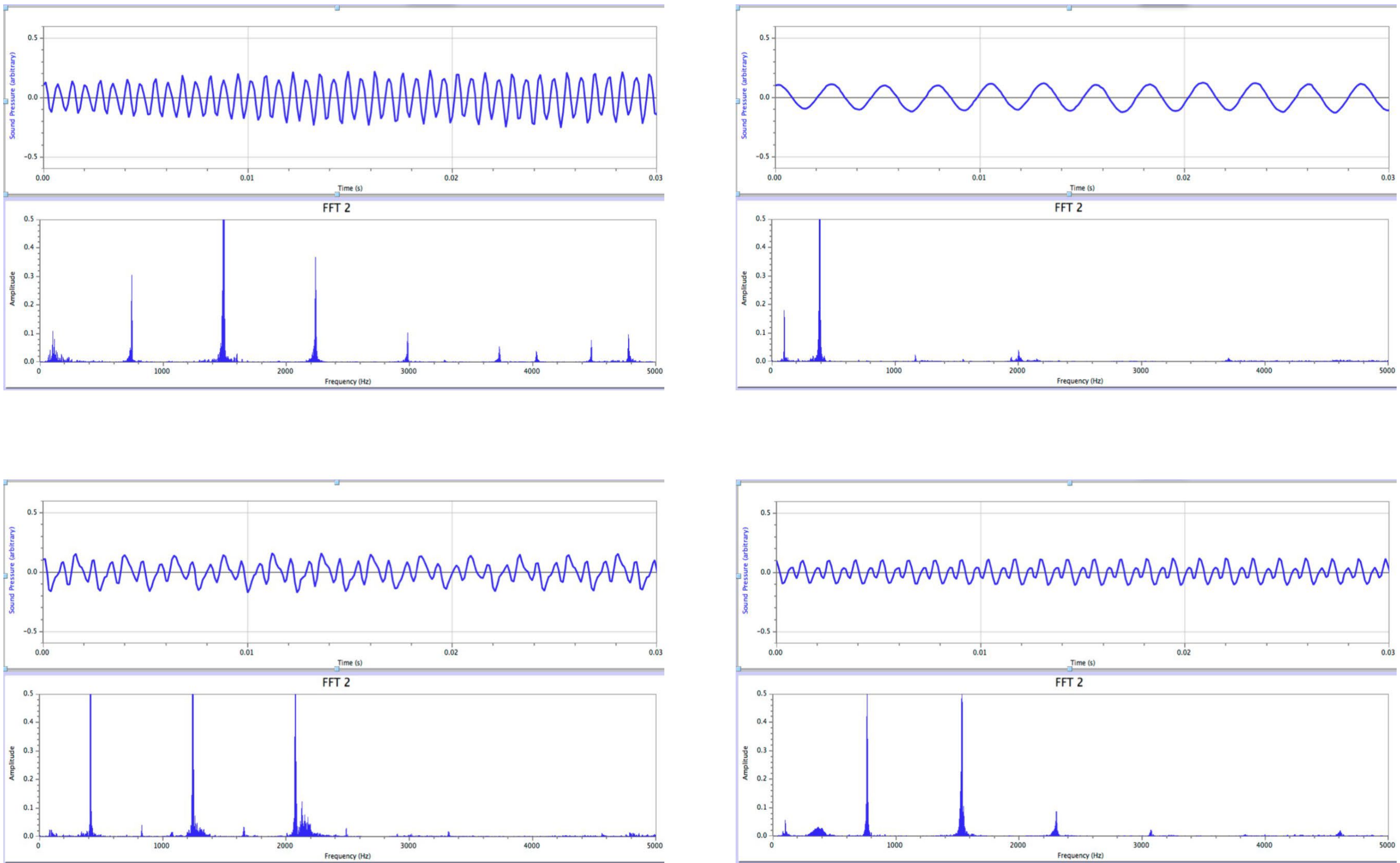
Callalli, sound spectra rank II, pipe numbers 31 front, 32 back, 32 front, and 33 back (clockwise from the top left)



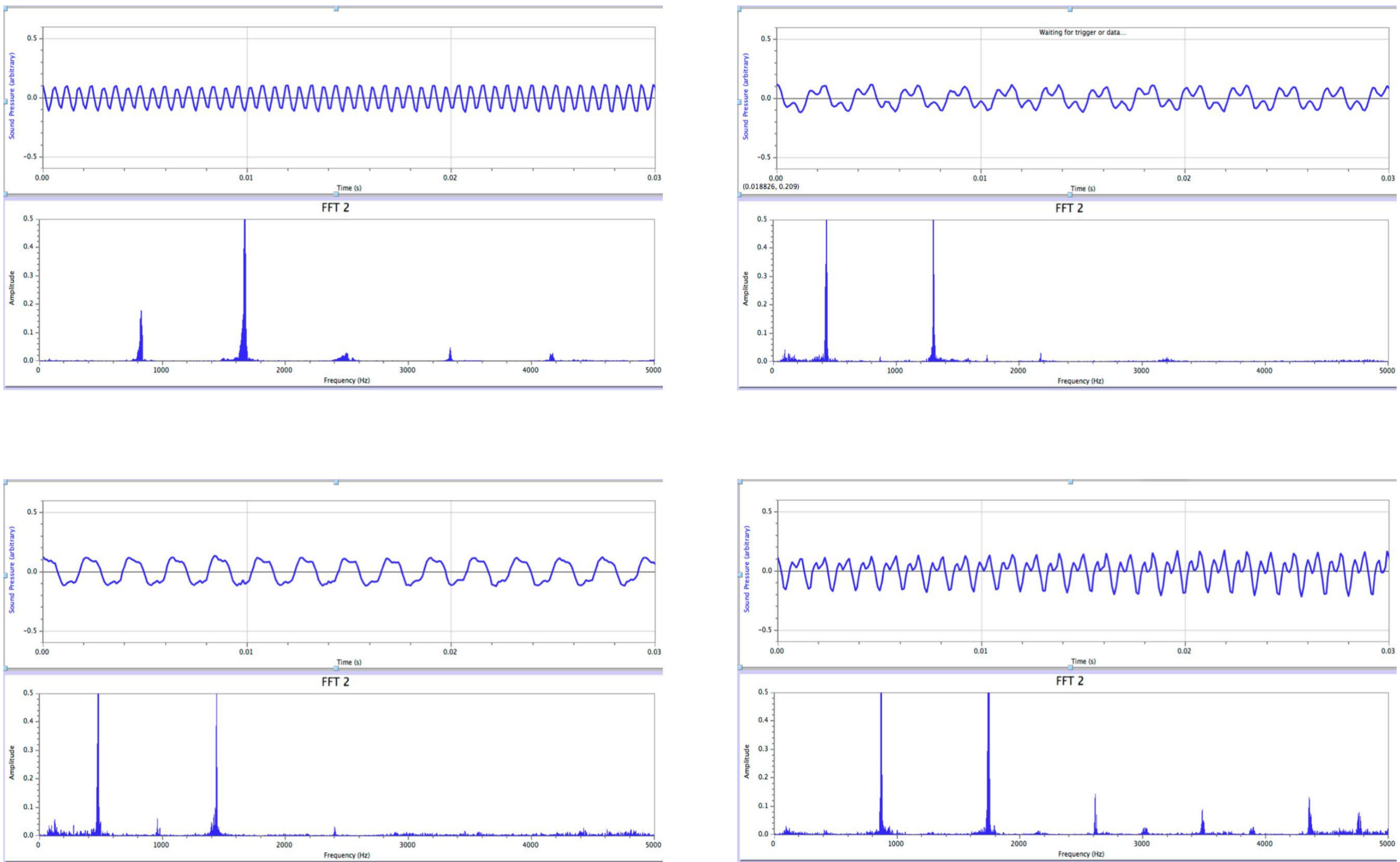
Callalli, sound spectra rank II, pipe numbers 33 front, 34 back, 34 front, and 35 back (clockwise from the top left)



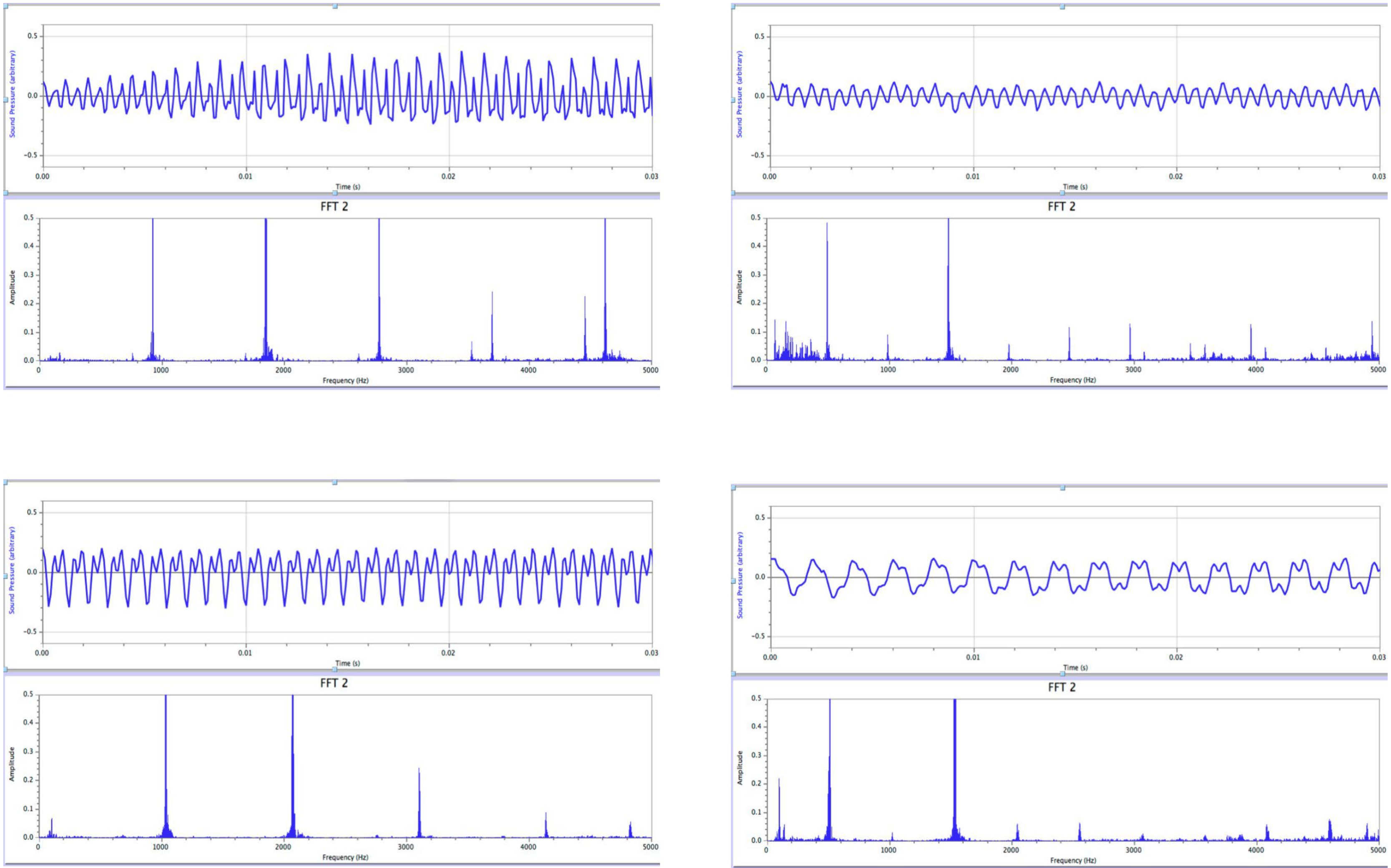
Callalli, sound spectra rank II, pipe numbers 35 front, 36 back, 36 front, and 37 back (clockwise from the top left)



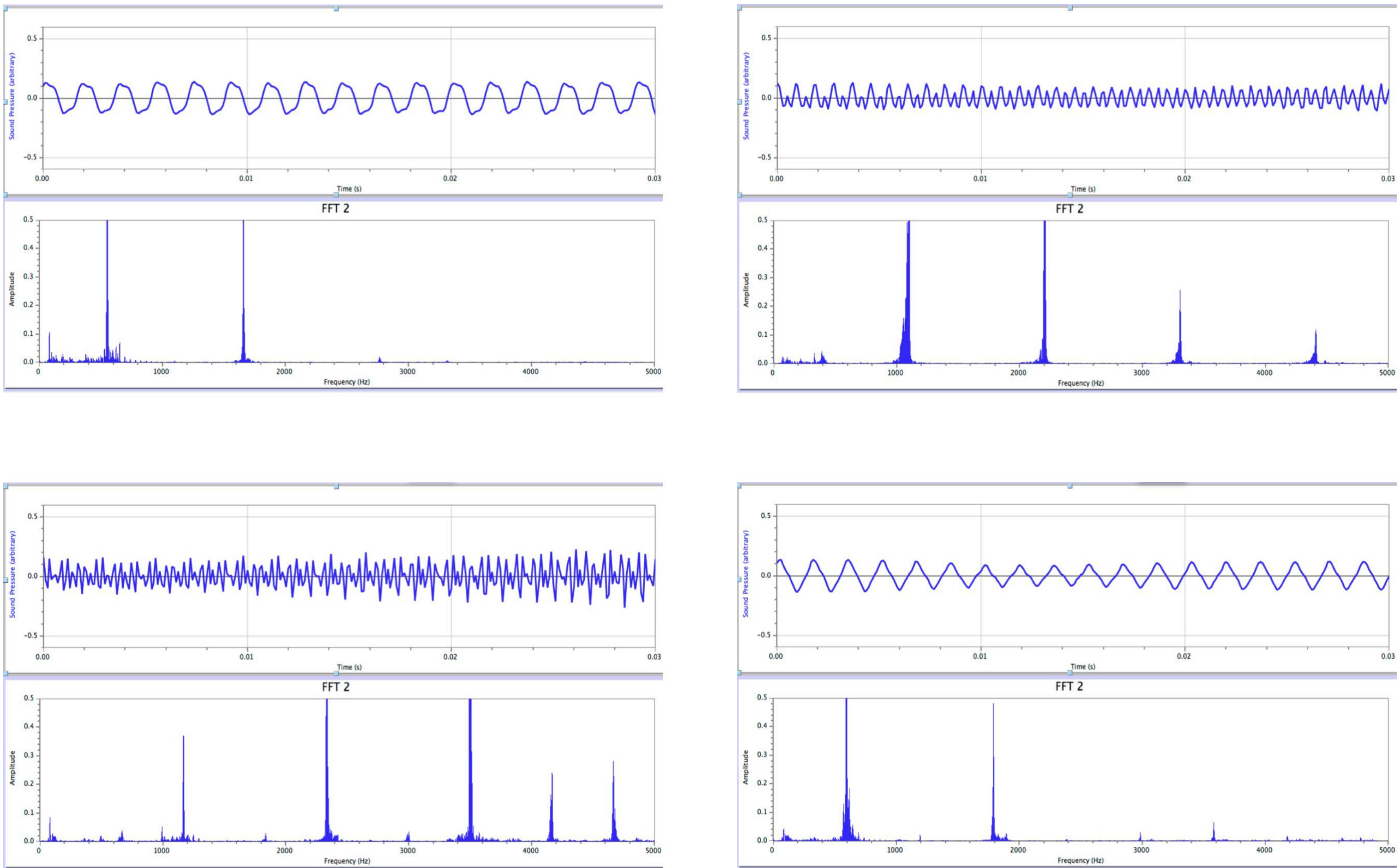
Callalli, sound spectra rank II, pipe numbers 37 front, 38 back, 38 front, and 39 back (clockwise from the top left)



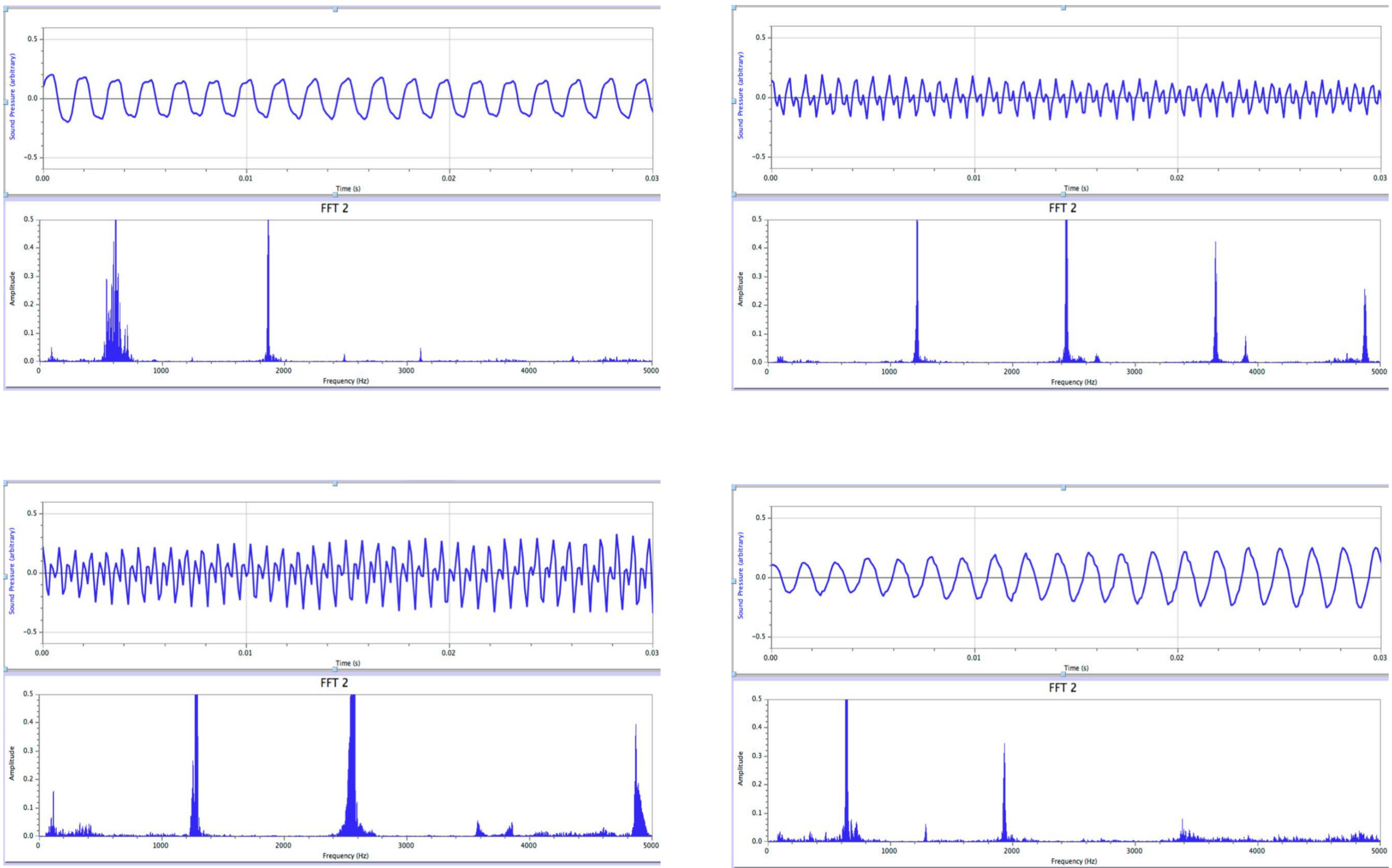
Callalli, sound spectra rank II, pipe numbers 39 front, 40 back, 40 front, and 41 back (clockwise from the top left)



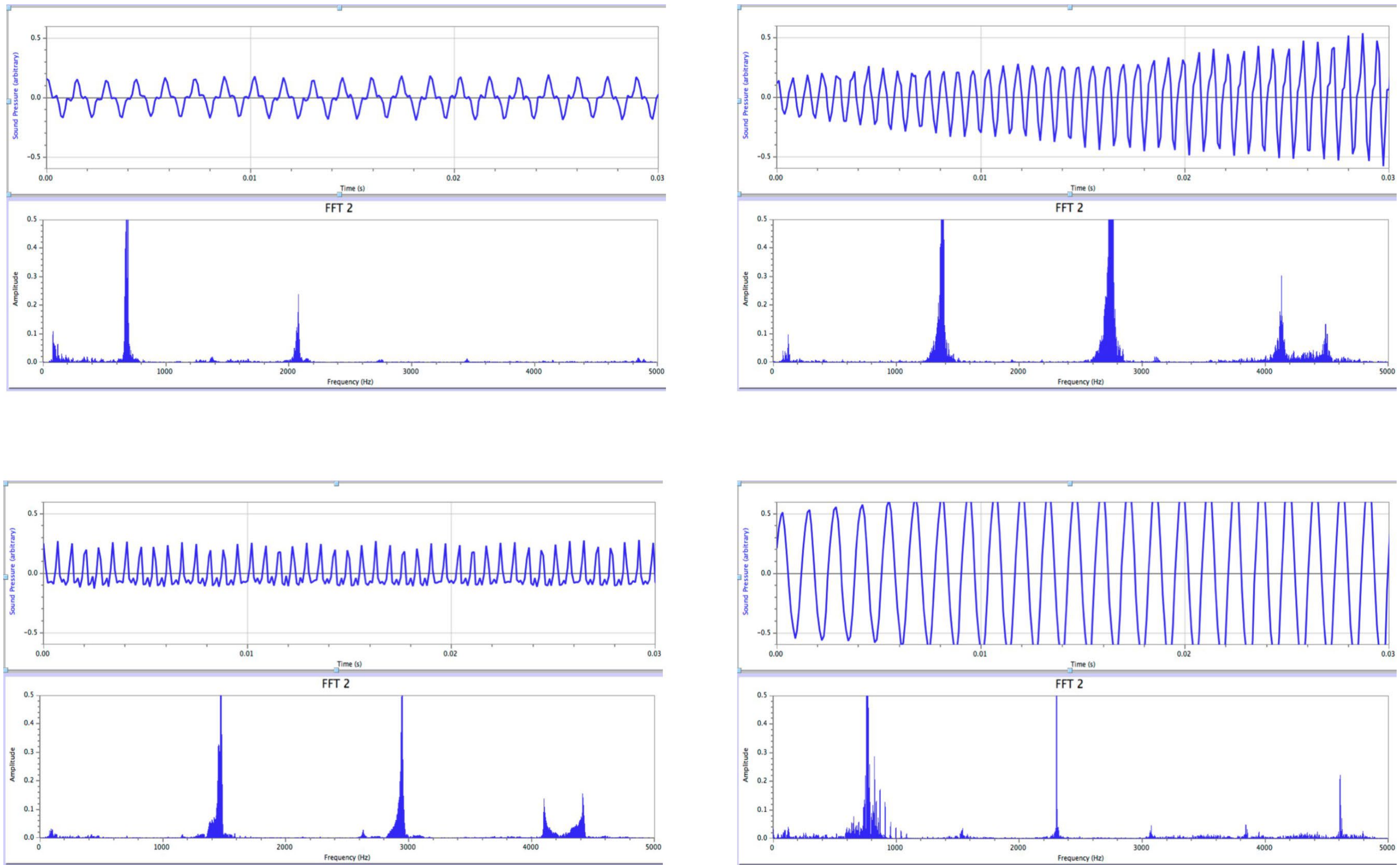
Callalli, sound spectra rank II, pipe numbers 41 front, 42 back, 43 back, and 43 front (clockwise from the top left)



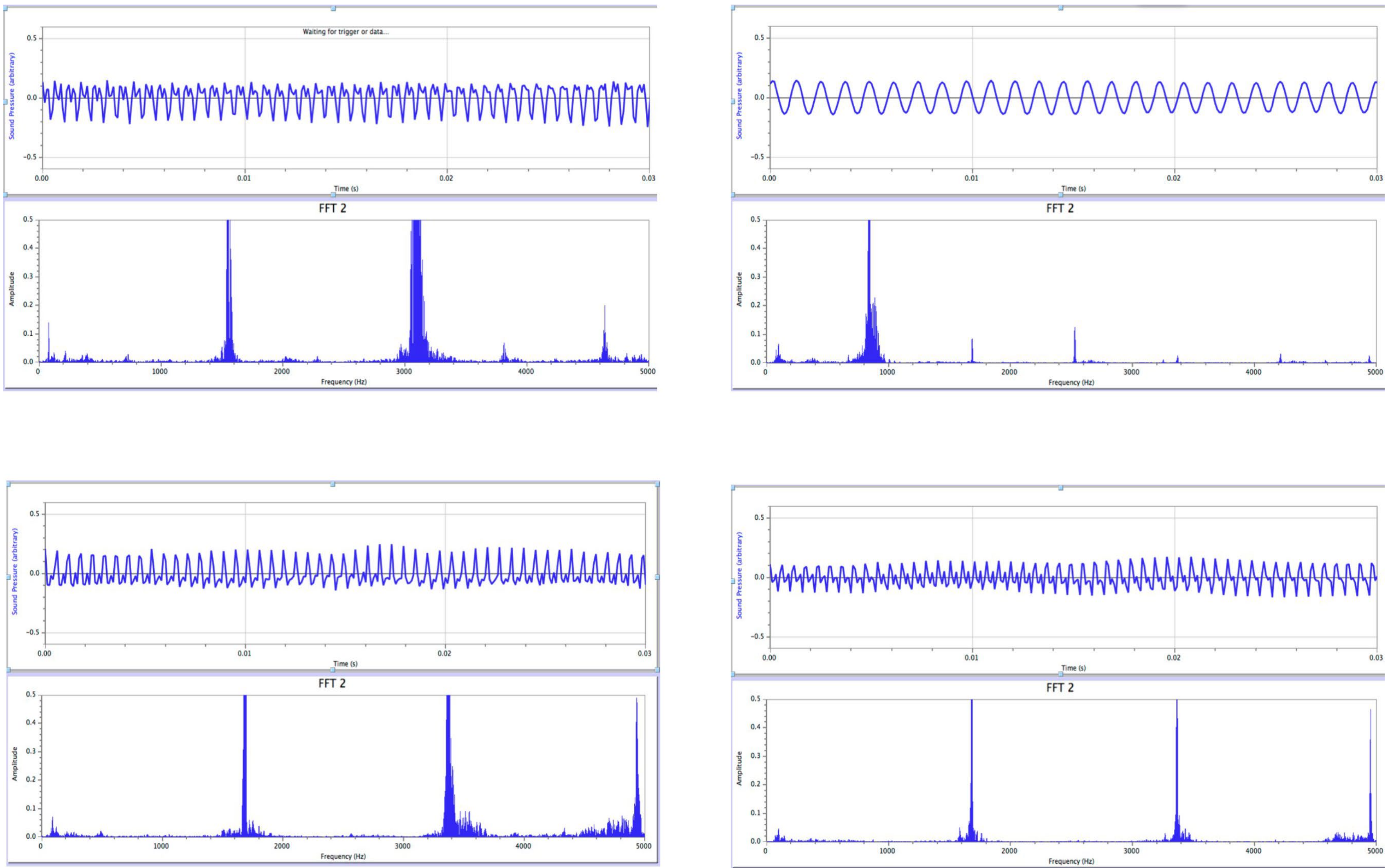
Callalli, sound spectra rank II, pipe numbers 44 back, 44 front, 45 back, and 45 front (clockwise from the top left)



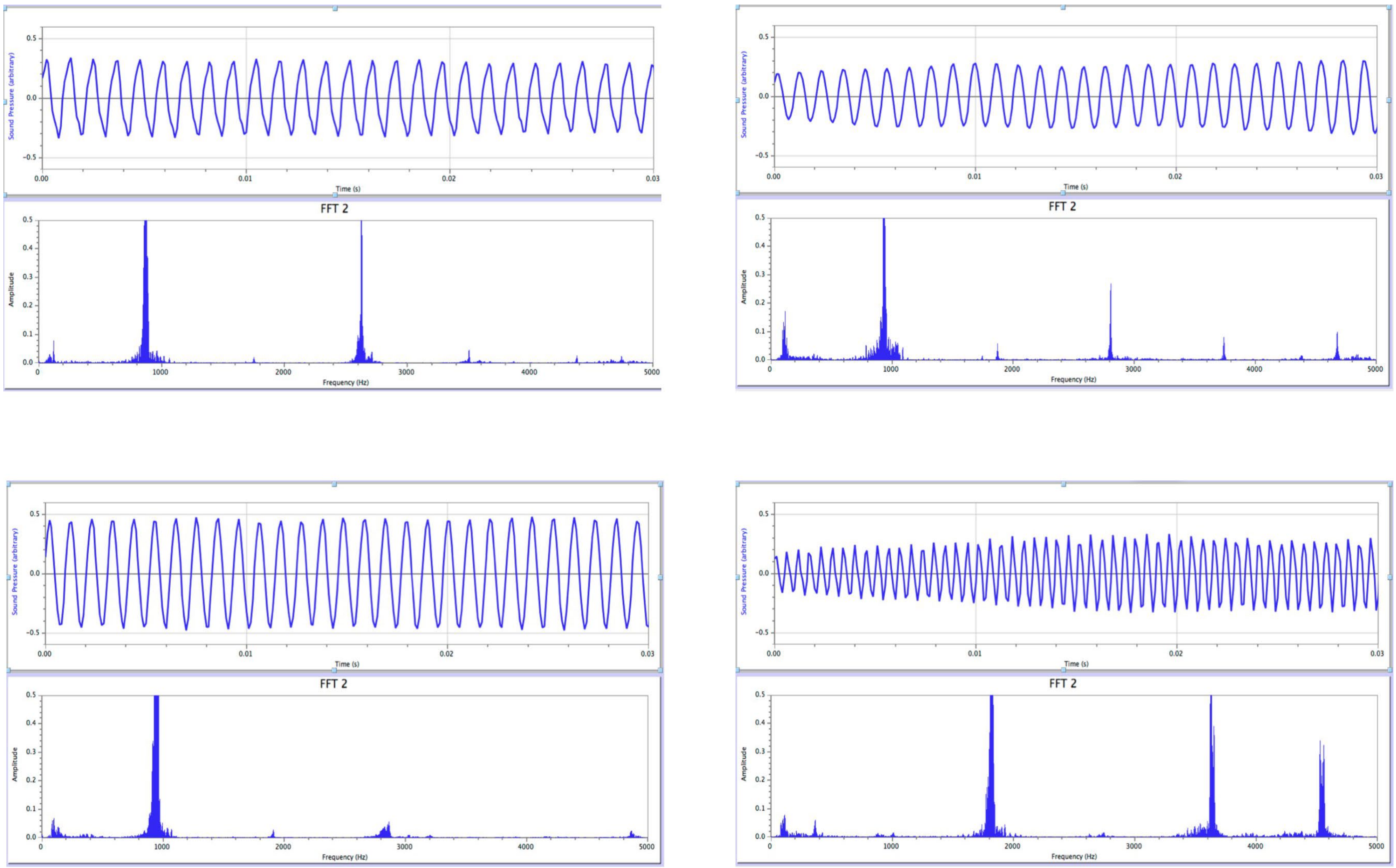
Callalli, sound spectra rank II, pipe numbers 46 back, 46 front, 47 back, and 47 front (clockwise from the top left)



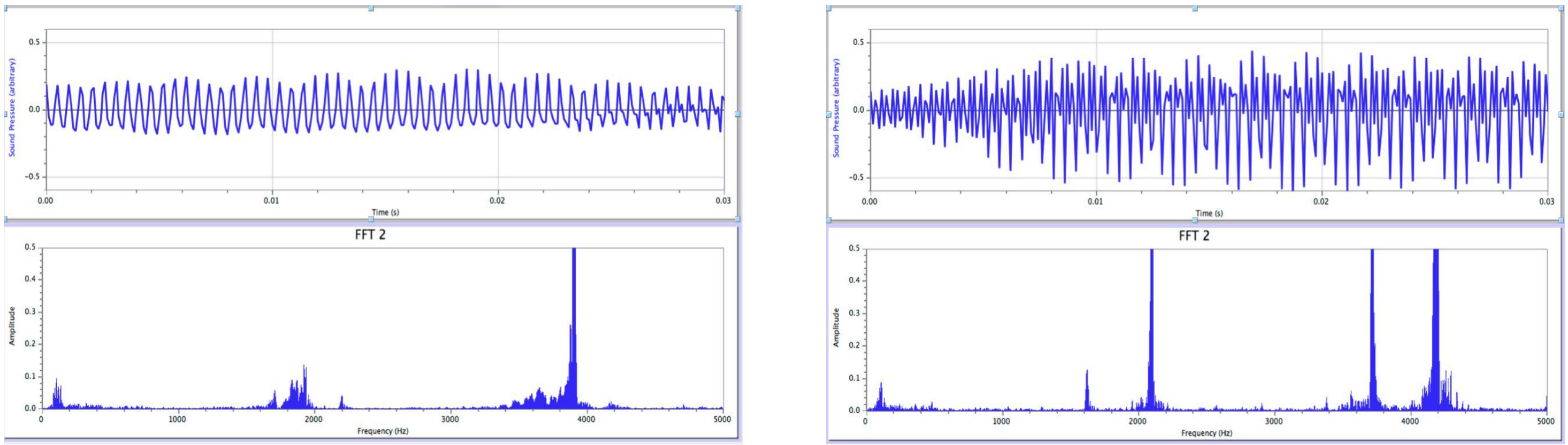
Callalli, sound spectra rank II, pipe numbers 48 back, 48 front, 49 back, and 49 front (clockwise from the top left)



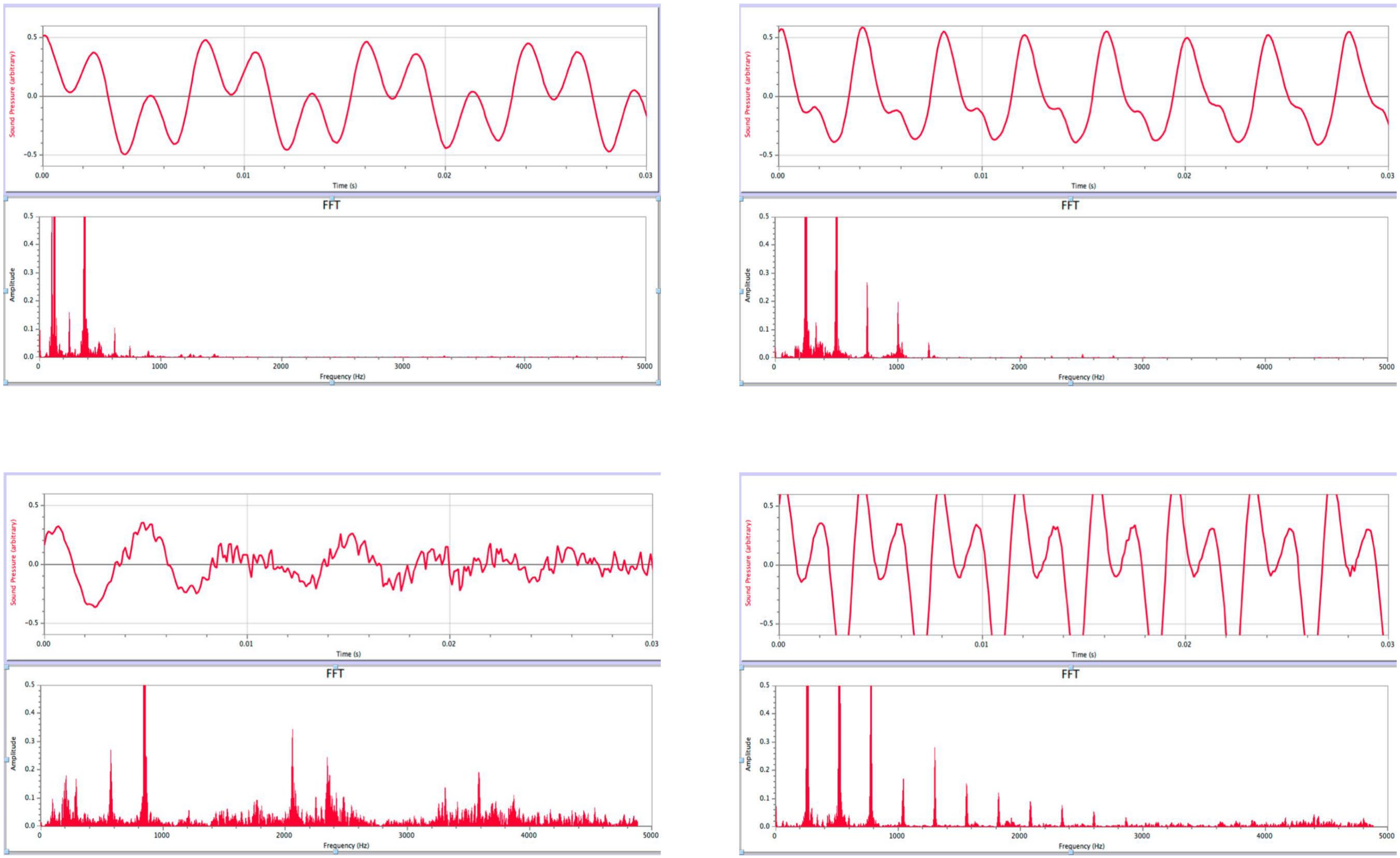
Callalli, sound spectra rank II, pipe numbers 50 front, 51 back, 51 front, and 52 front (clockwise from the top left)



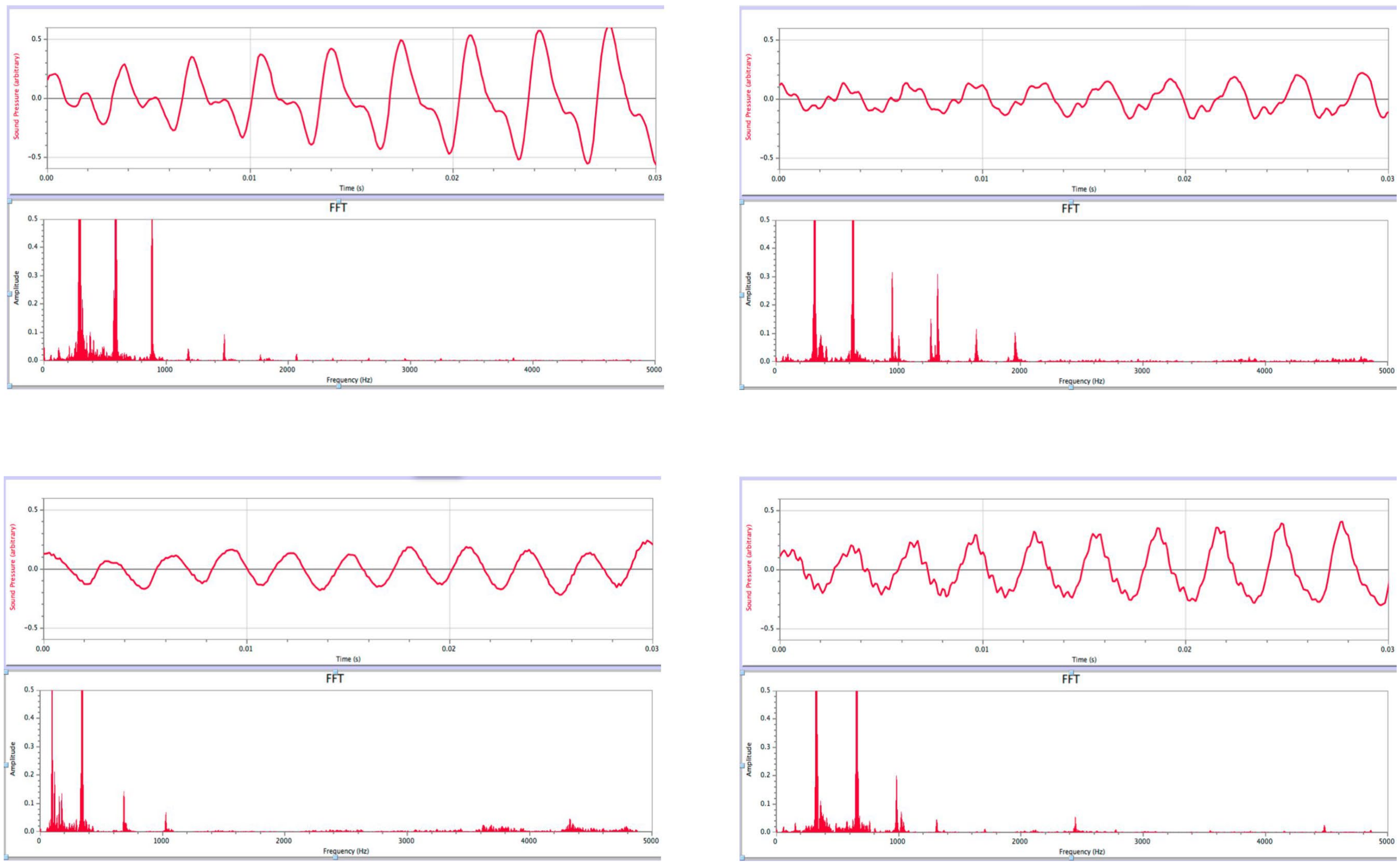
Callalli, sound spectra rank II, pipe numbers 52 back, 53 back, 53 front, and 54 back (clockwise from the top left)



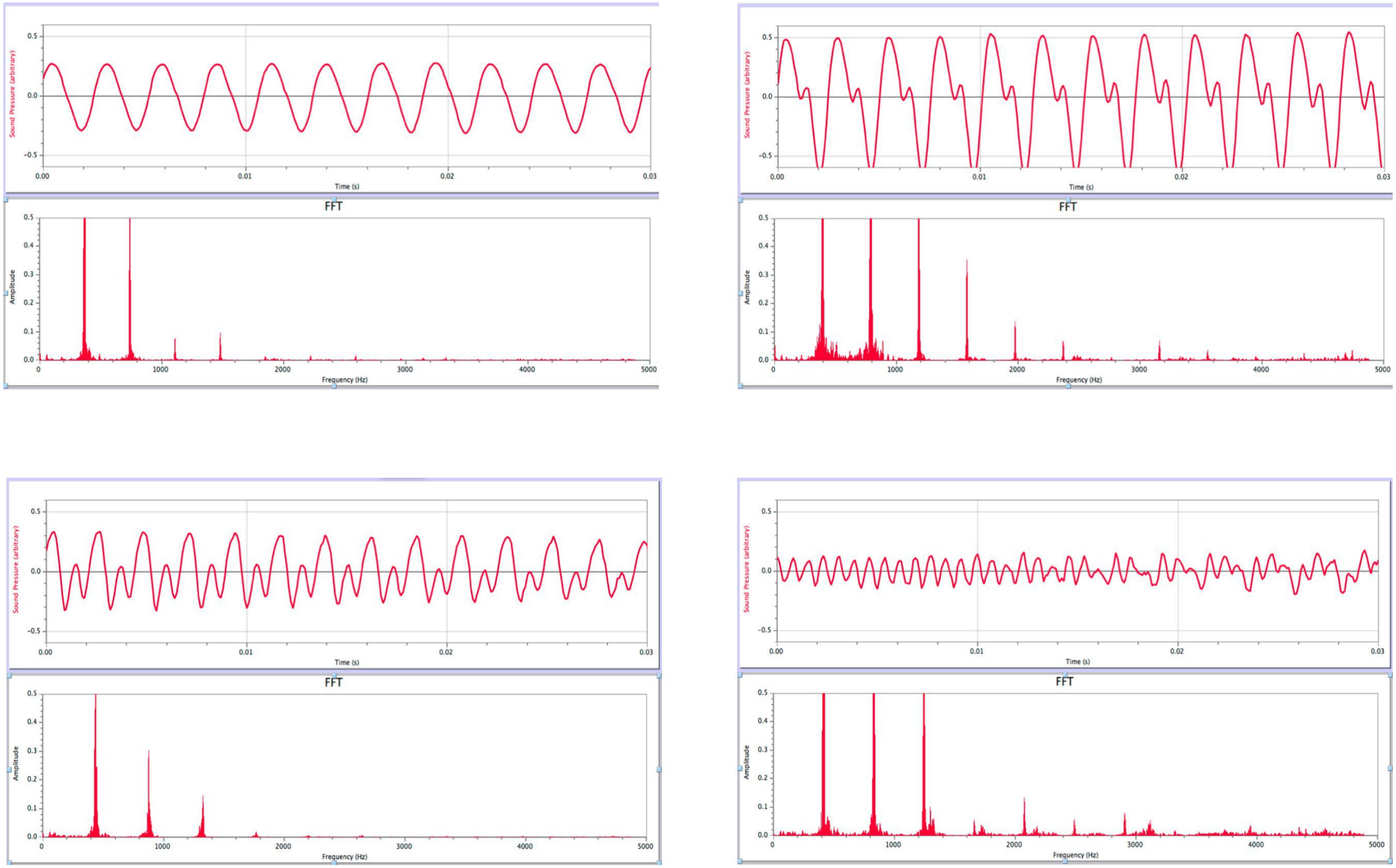
Callalli, sound spectra rank II, pipe numbers 54 front and 55 front (clockwise from the top left)



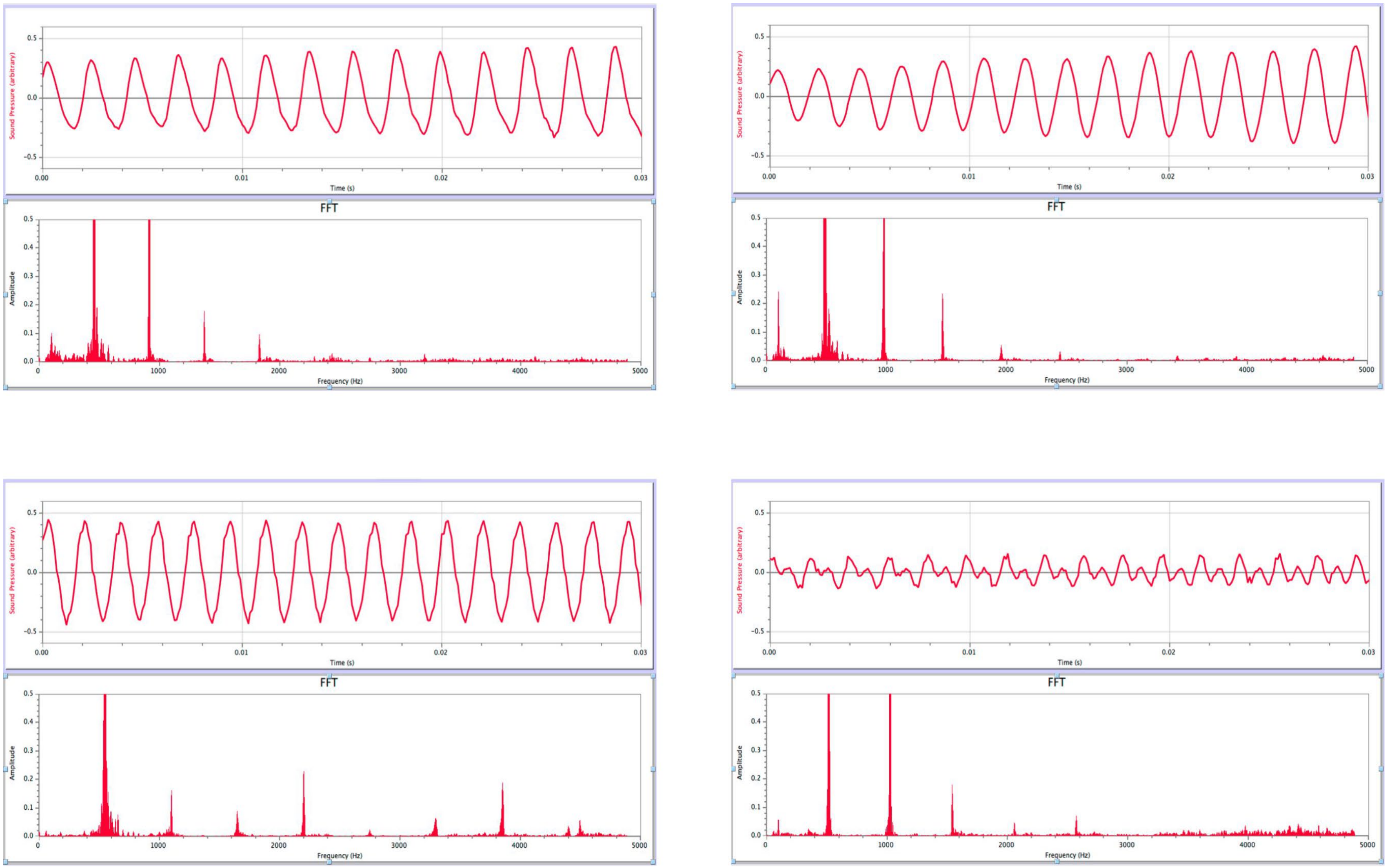
Callalli, sound spectra rank III, pipe numbers 4, 5, 7 and 8 (clockwise from the top left)



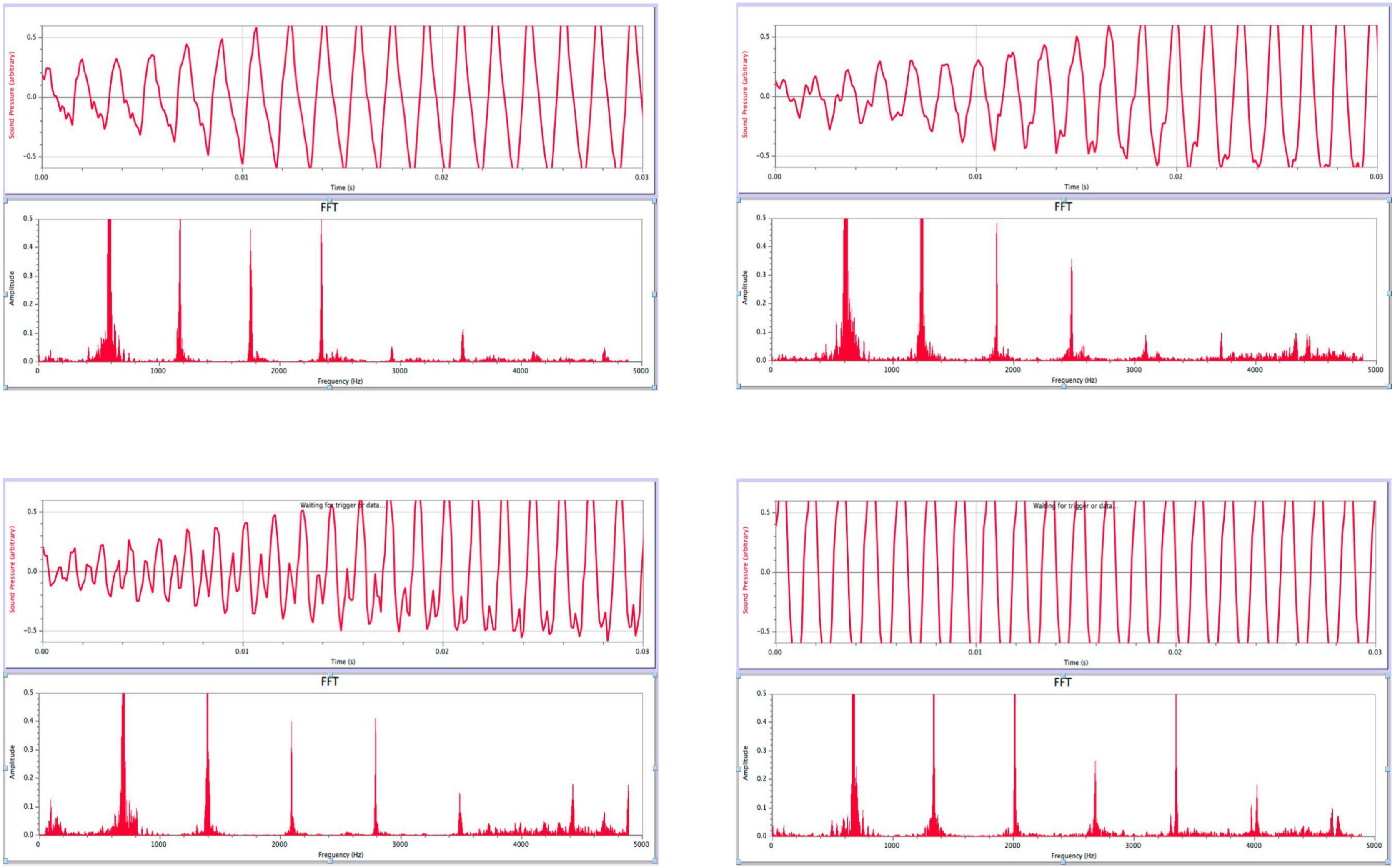
Callalli, sound spectra rank III, pipe numbers 9, 10, 11 and 12 (clockwise from the top left)



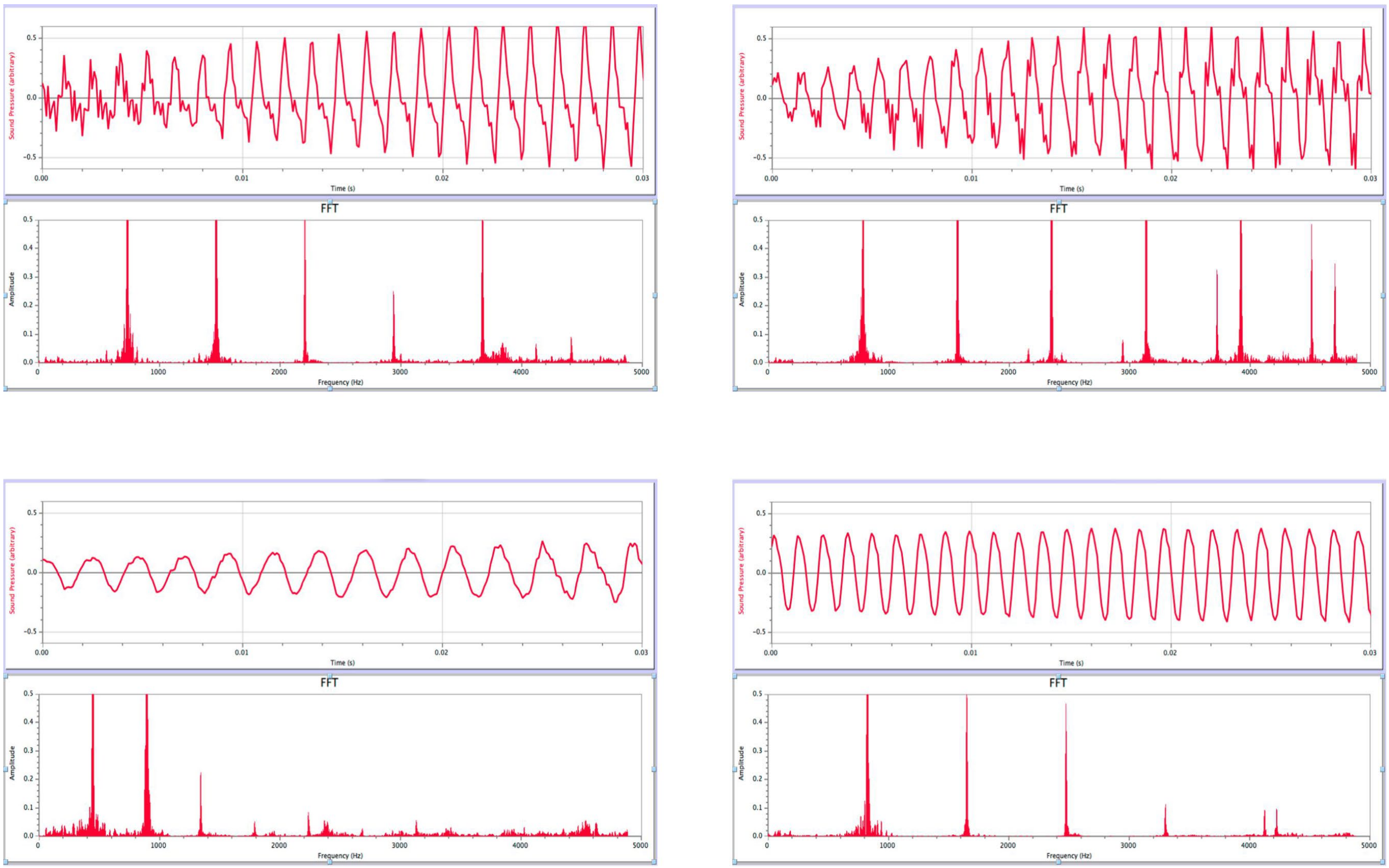
Callalli, sound spectra rank III, pipe numbers 13, 14, 15 and 16 (clockwise from the top left)



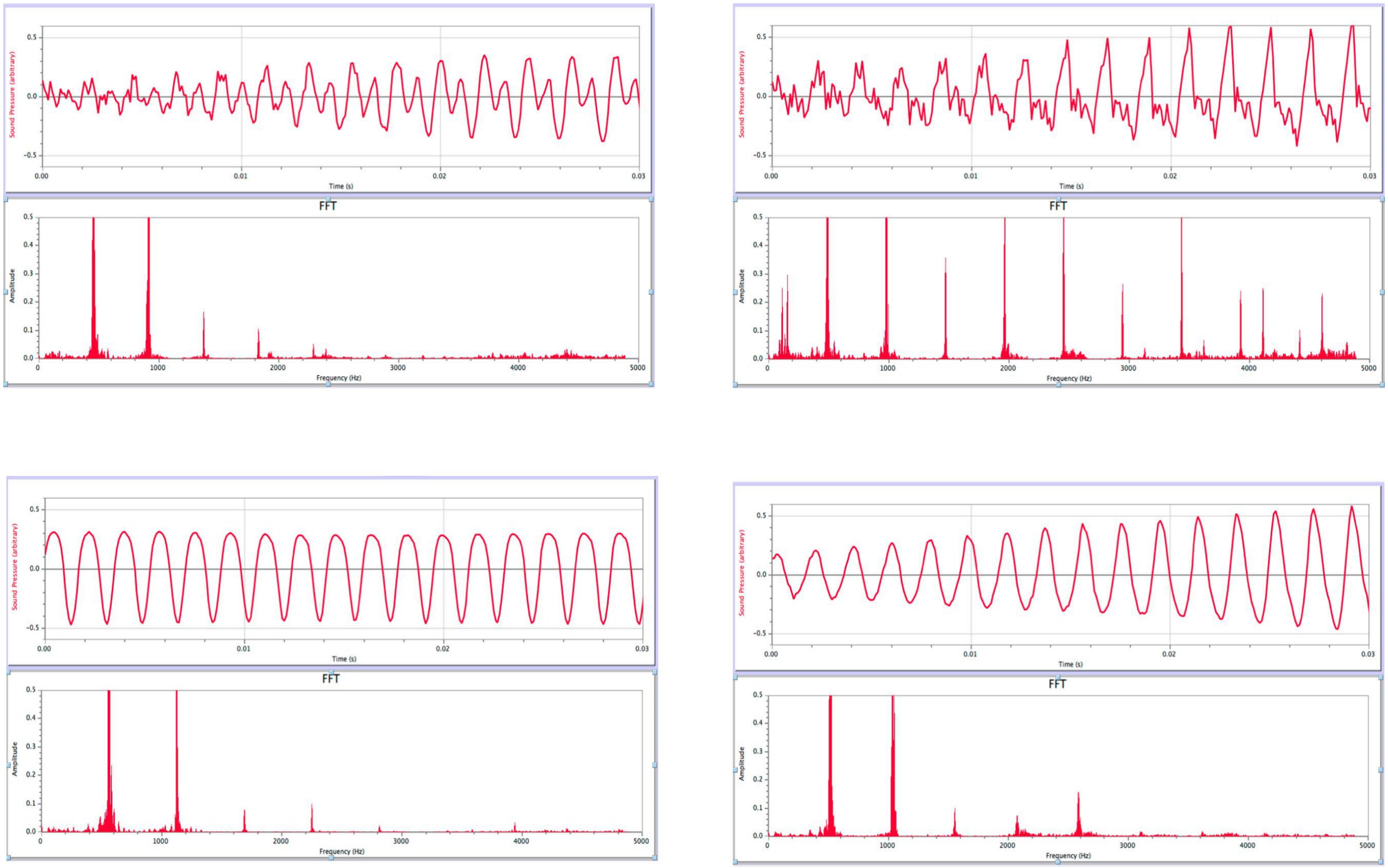
Callalli, sound spectra rank III, pipe numbers 17, 18, 19 and 20 (clockwise from the top left)



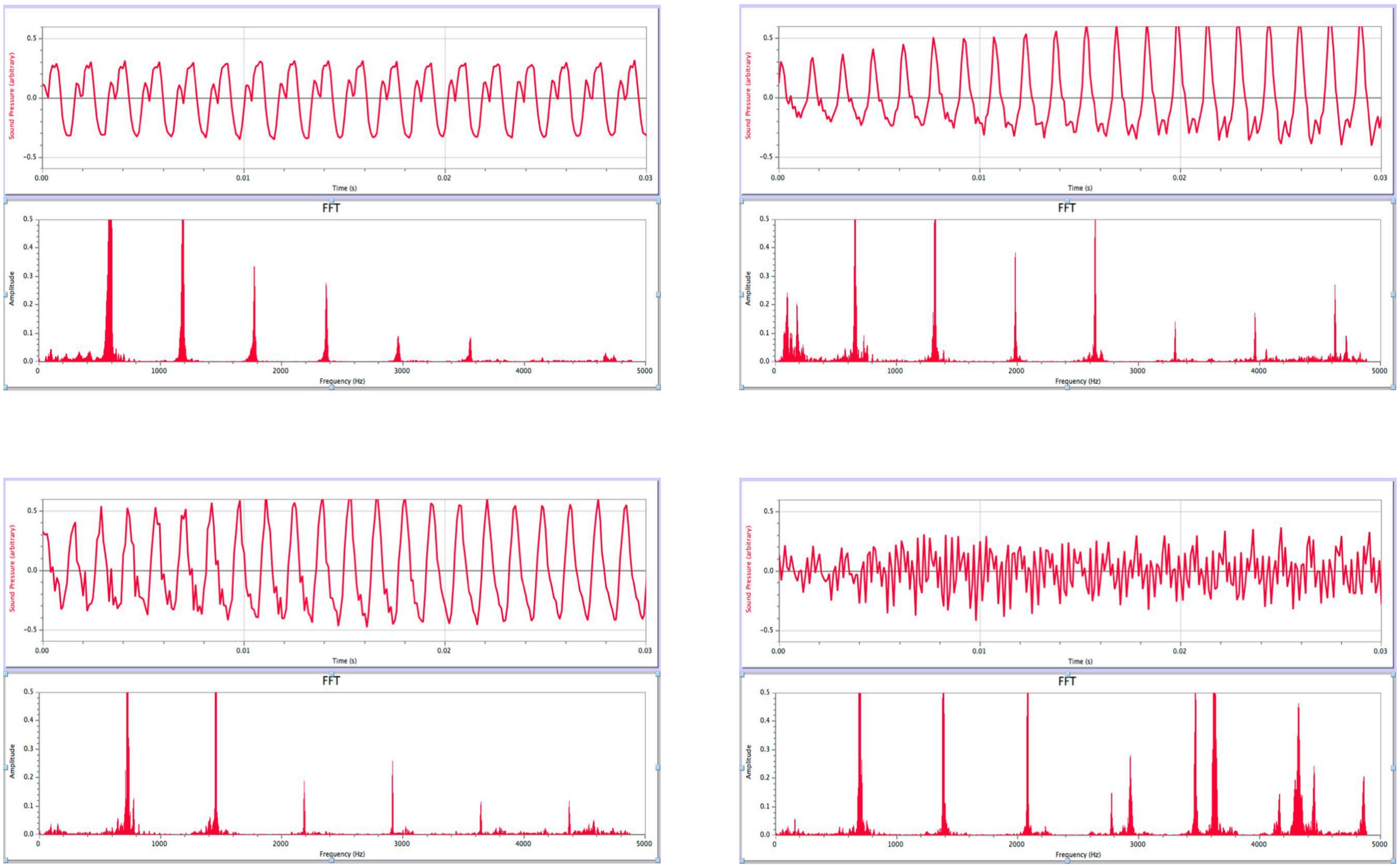
Callalli, sound spectra rank III, pipe numbers 21, 22, 23 and 24 (clockwise from the top left)



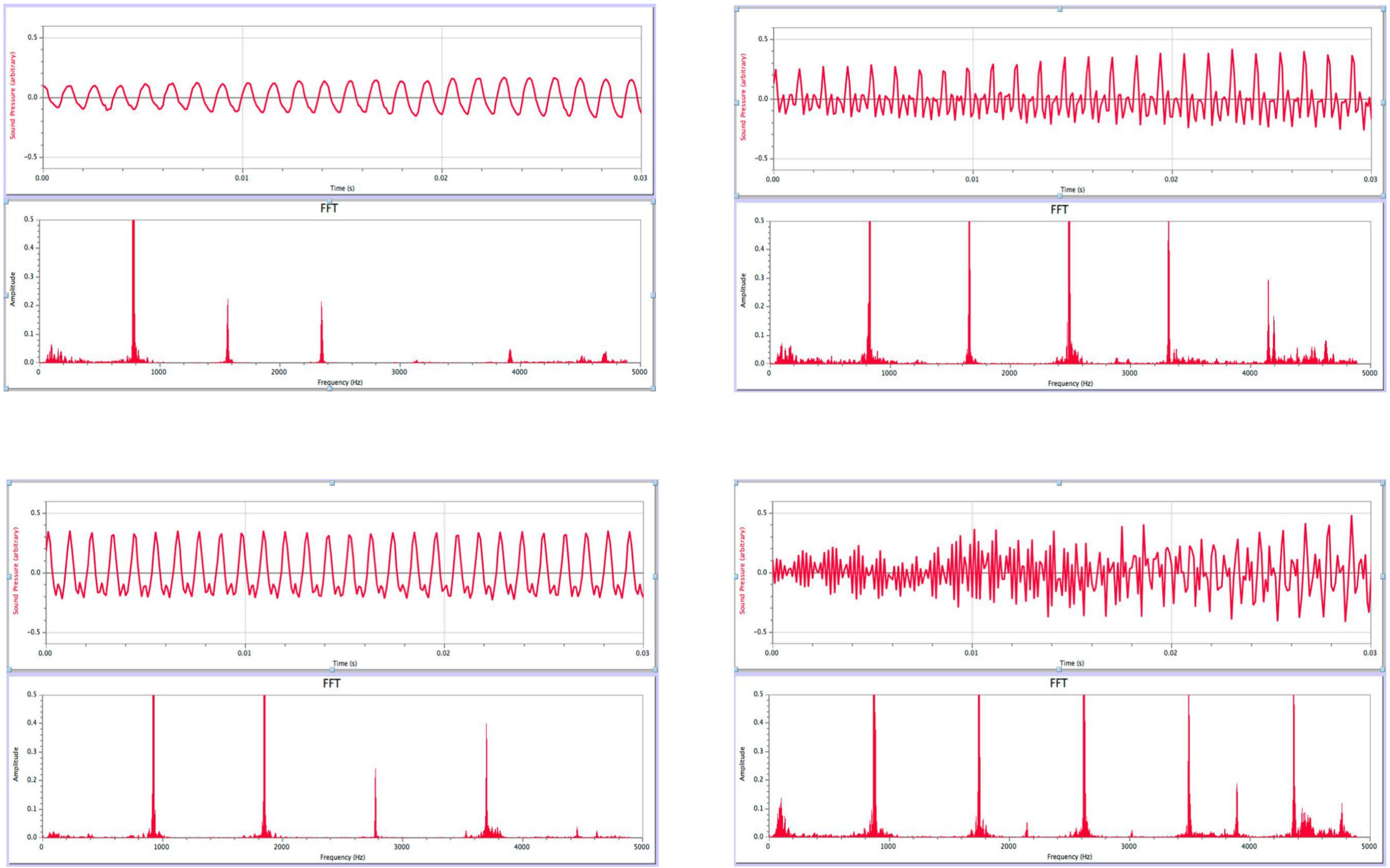
Callalli, sound spectra rank III, pipe numbers 25, 26, 27 and 28 (clockwise from the top left)



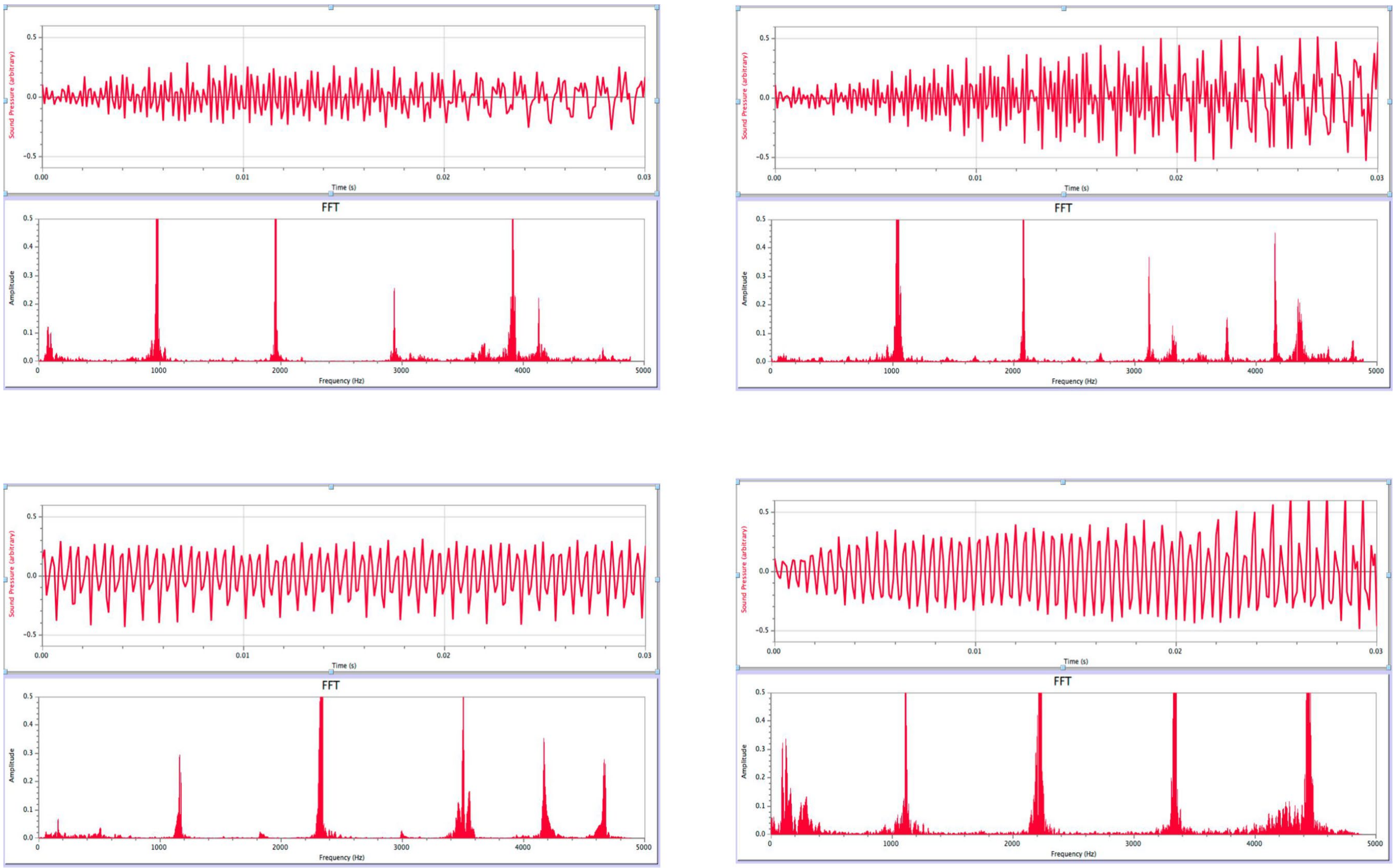
Callalli, sound spectra rank III, pipe numbers 29, 30, 31 and 32 (clockwise from the top left)



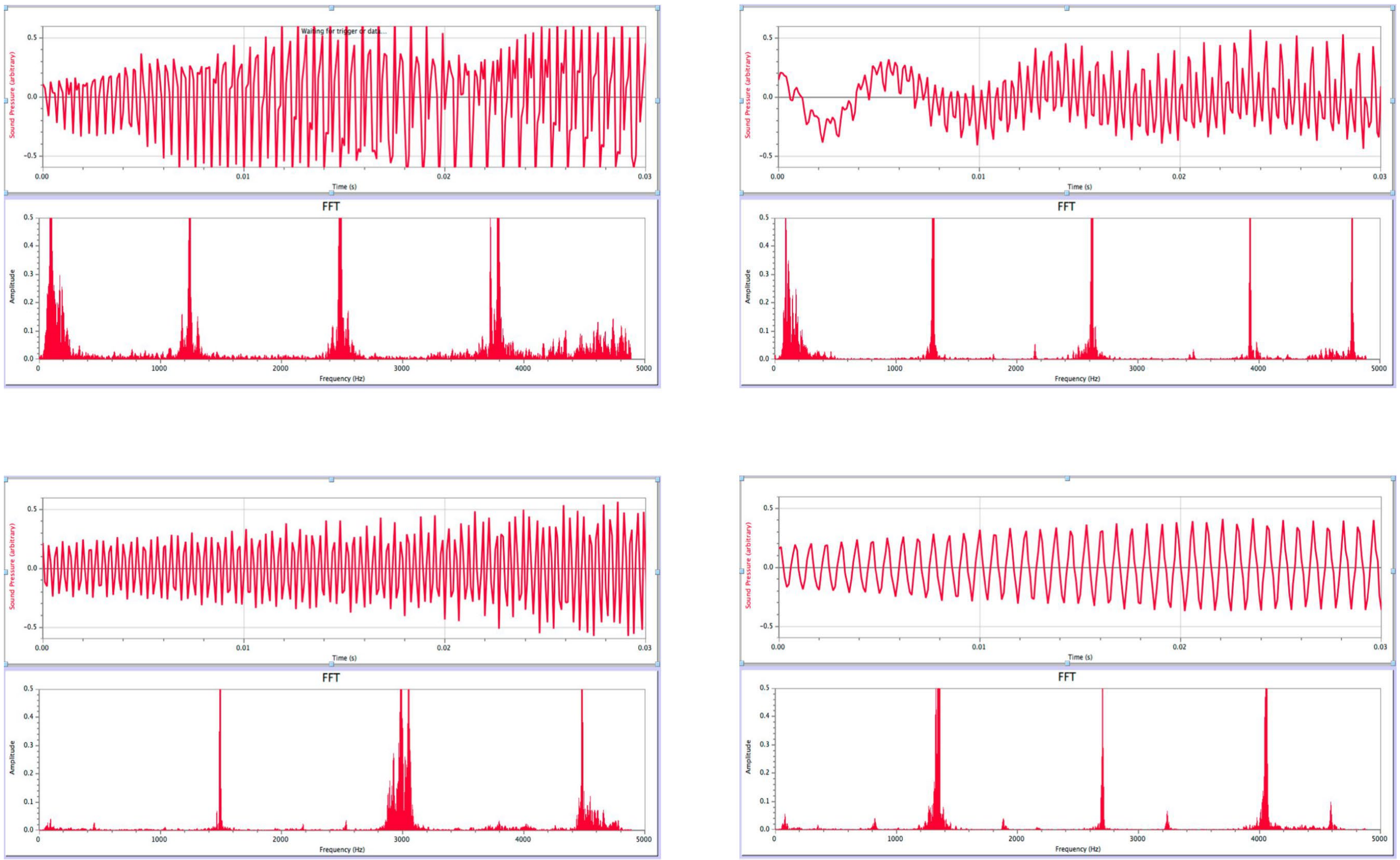
Callalli, sound spectra rank III, pipe numbers 33, 35, 36 and 37 (clockwise from the top left)



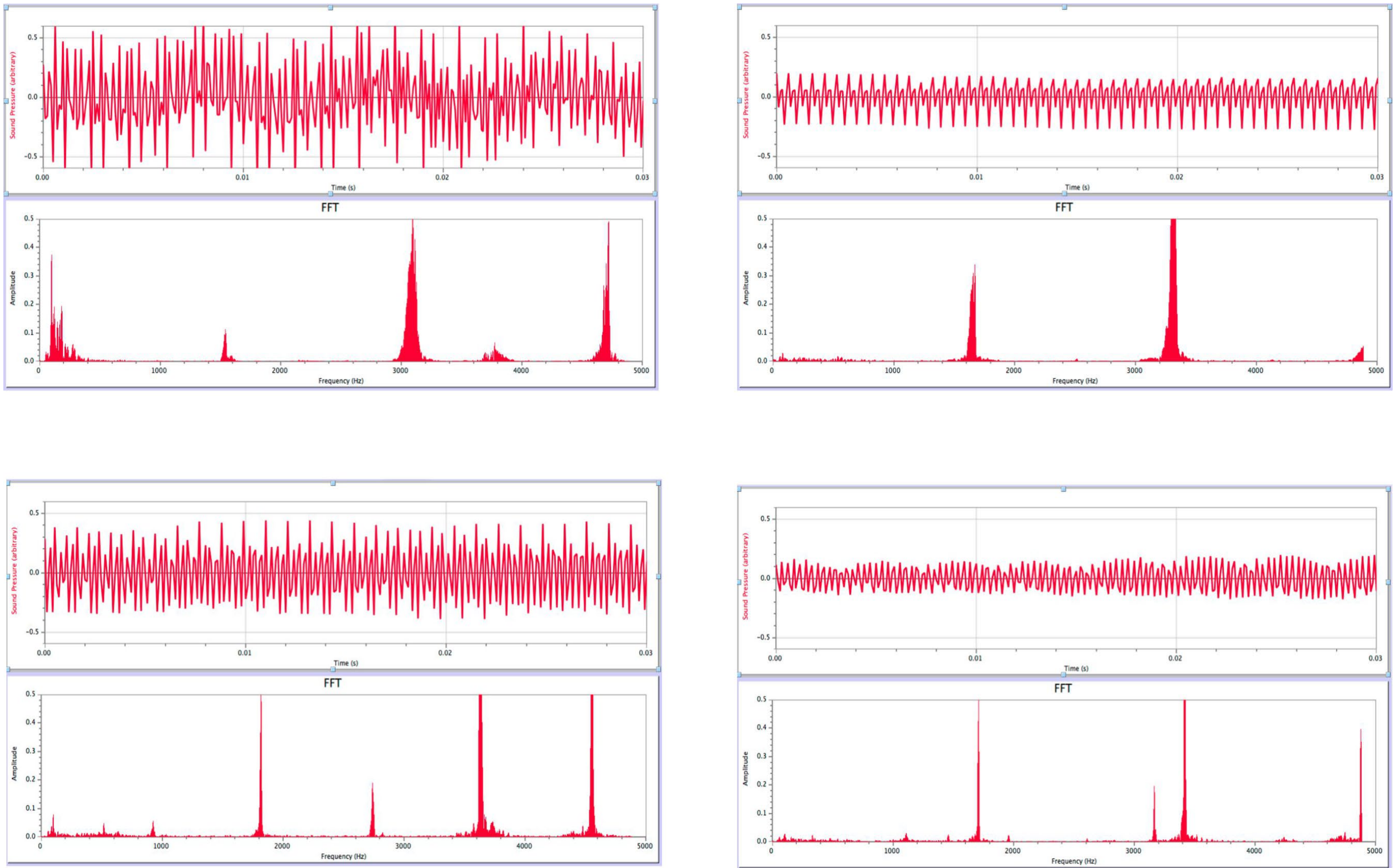
Callalli, sound spectra rank III, pipe numbers 38, 39, 40 and 41 (clockwise from the top left)



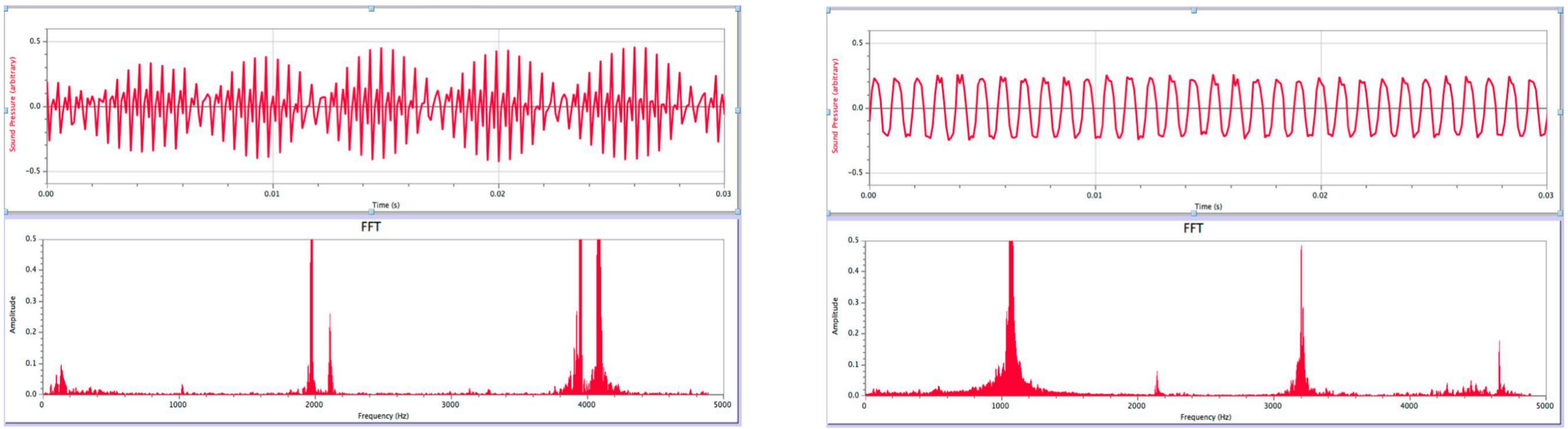
Callalli, sound spectra rank III, pipe numbers 42, 43, 44 and 45 (clockwise from the top left)



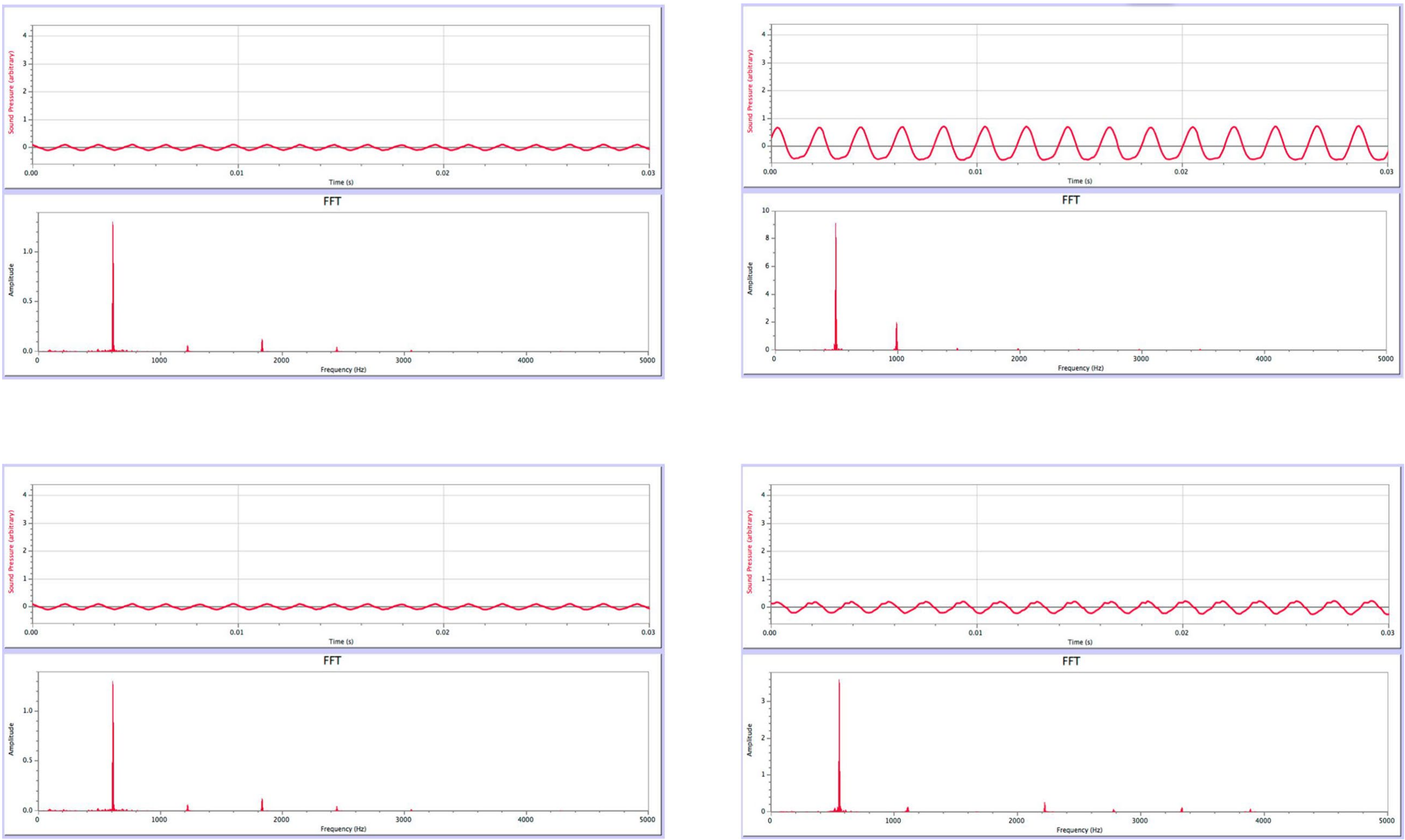
Callalli, sound spectra rank III, pipe numbers 46, 47, 48 and 49 (clockwise from the top left)



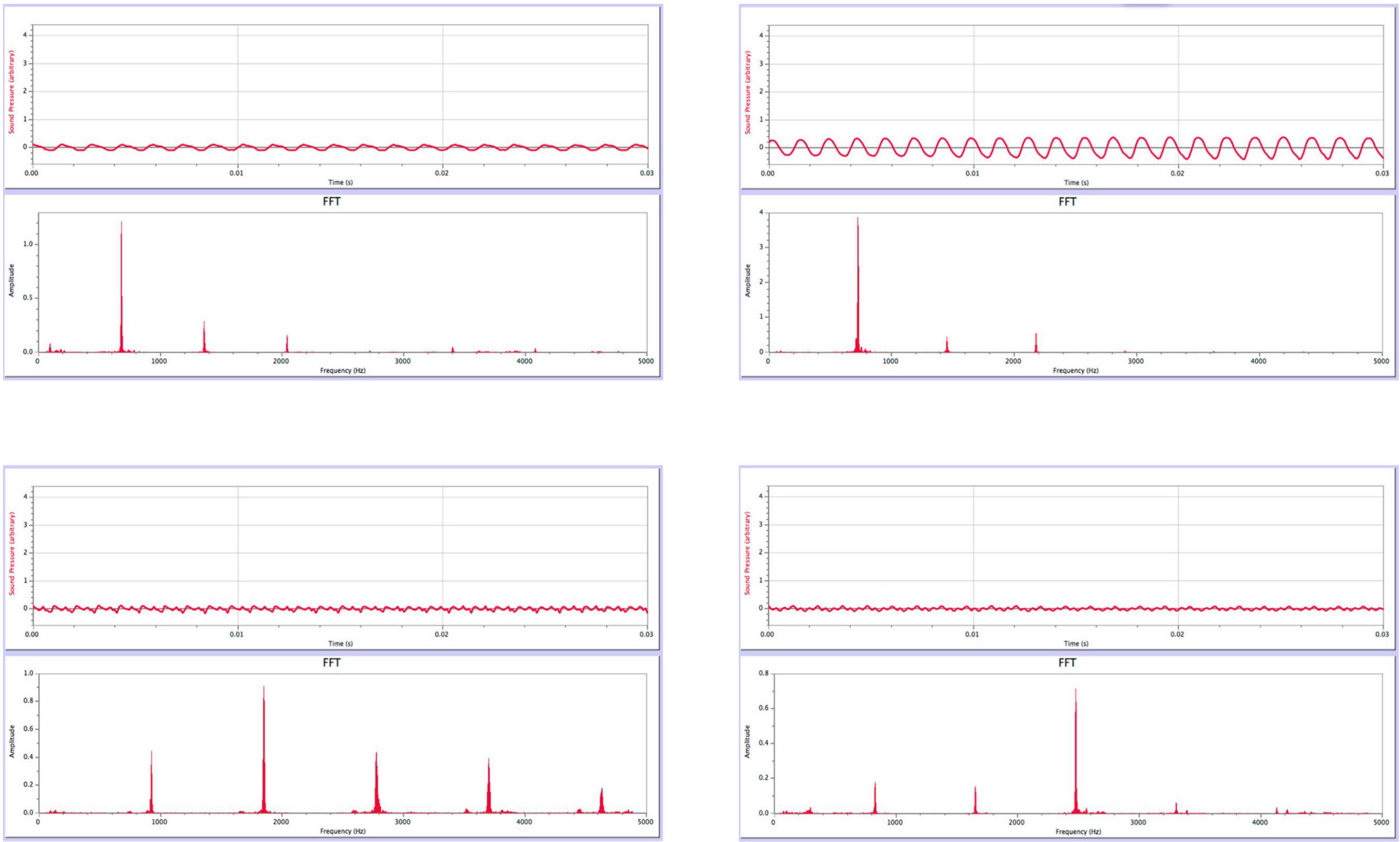
Callalli, sound spectra rank III, pipe numbers 50, 51, 52 and 53 (clockwise from the top left)



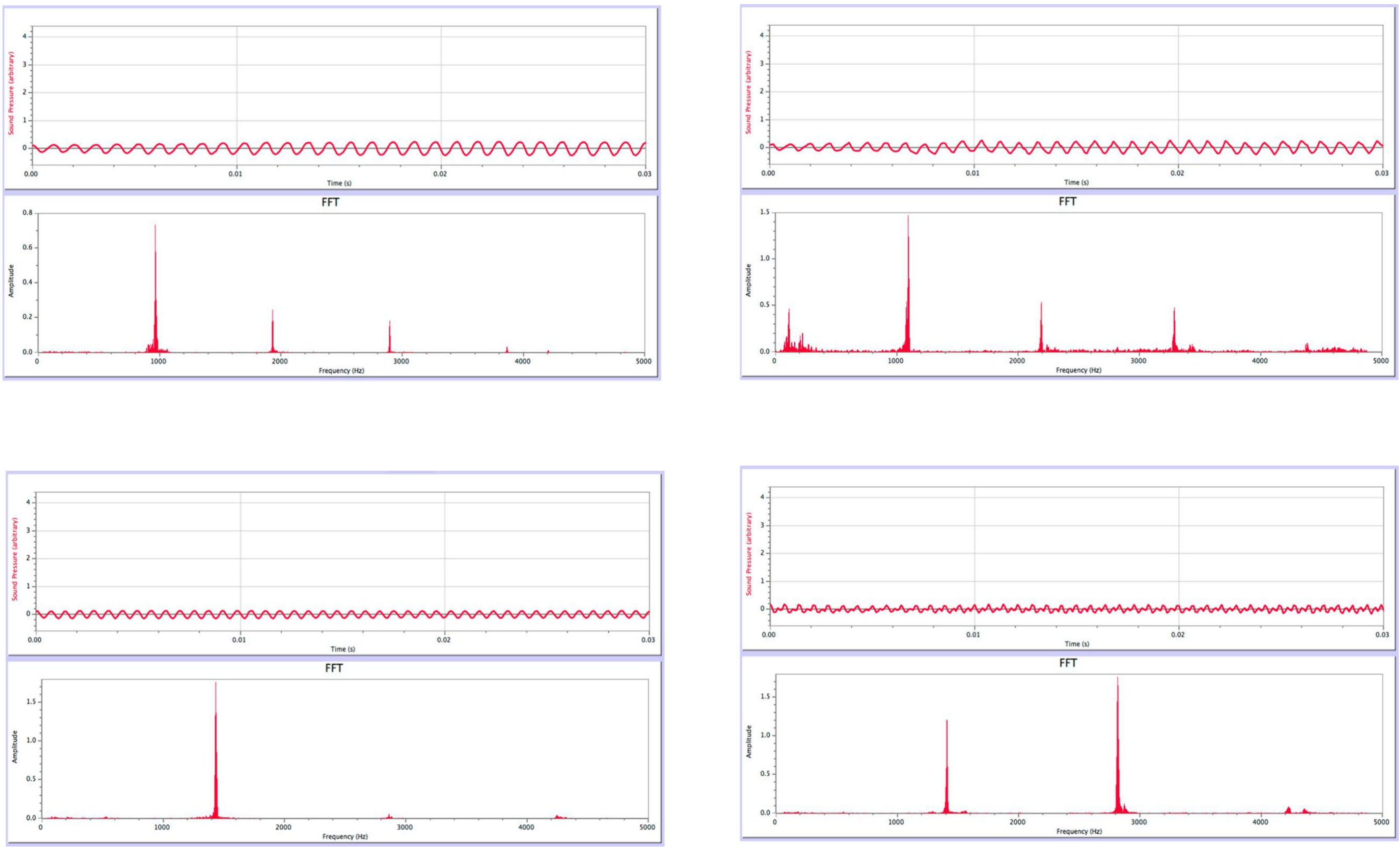
Callalli, sound spectra rank III, pipe numbers 54, 55 (clockwise from the top left)



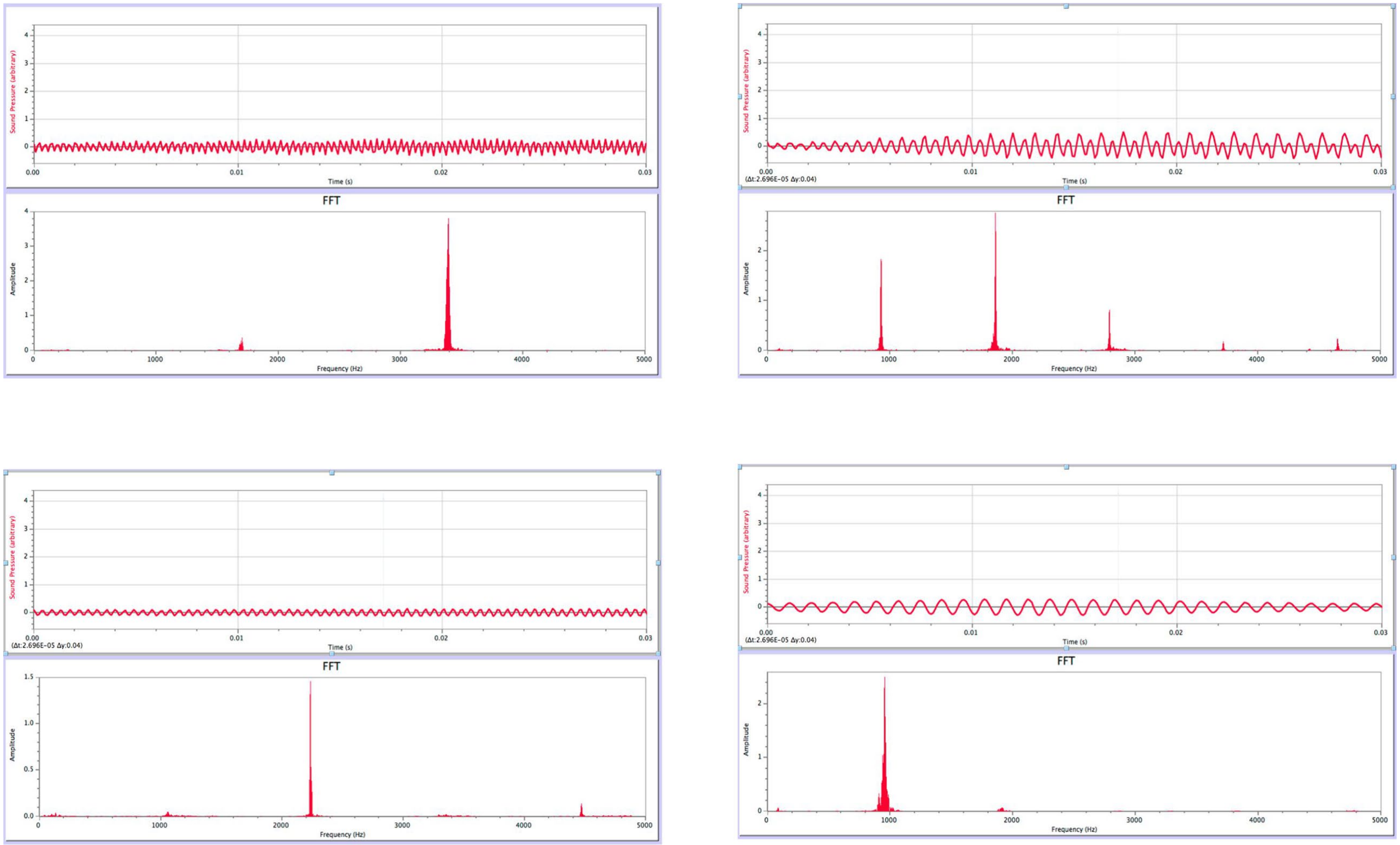
Callalli, sound spectra rank IV, pipe numbers 5, 6, 8 and 10 (clockwise from the top left)



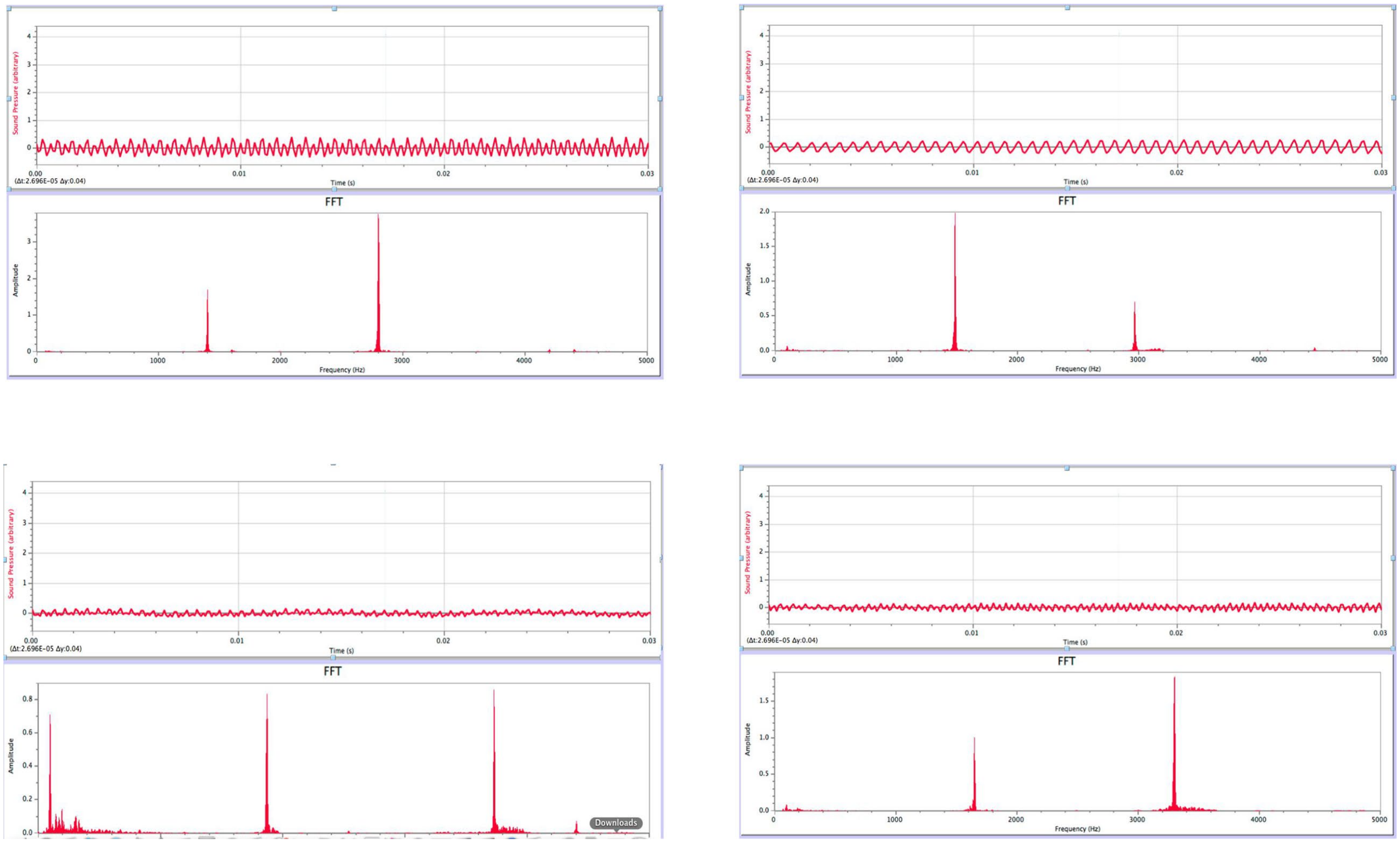
Callalli, sound spectra rank IV, pipe numbers 12, 13, 15 and 17 (clockwise from the top left)



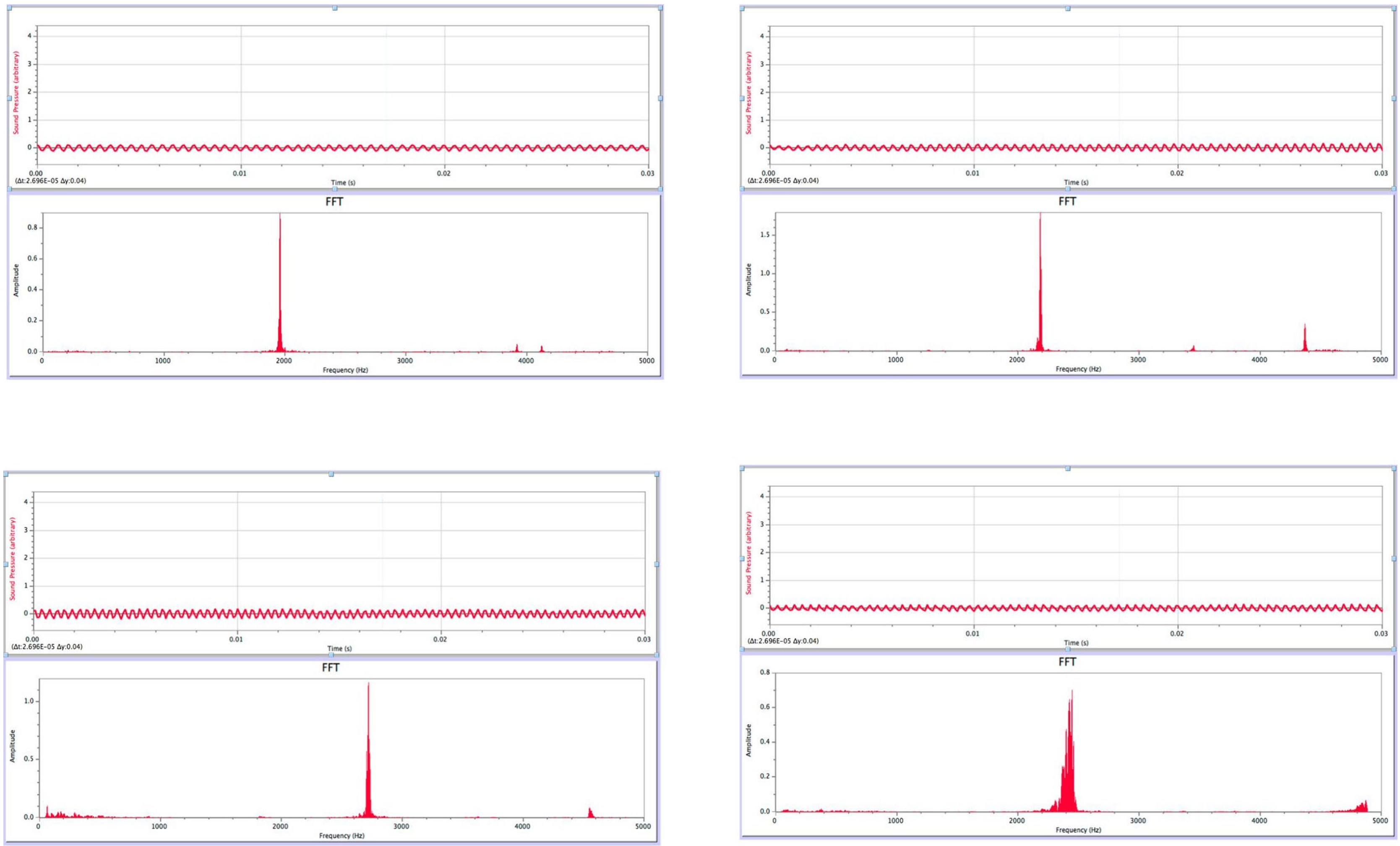
Callalli, sound spectra rank IV, pipe numbers 18, 20, 24 and 25 (clockwise from the top left)



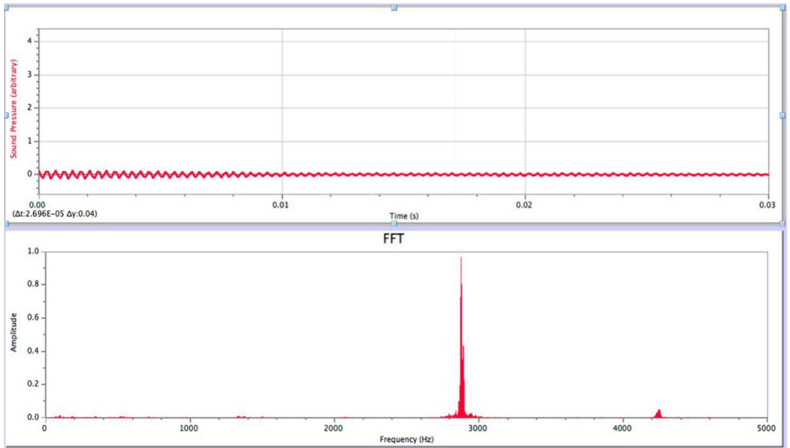
Callalli, sound spectra rank IV, pipe numbers 27, 29, 30 and 32 (clockwise from the top left)

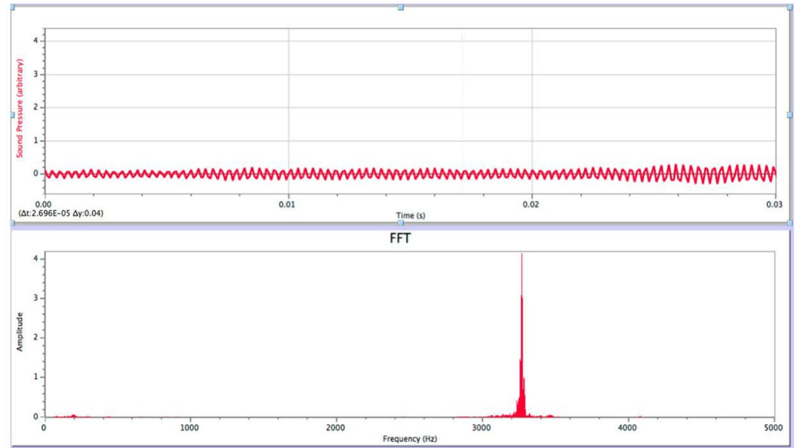


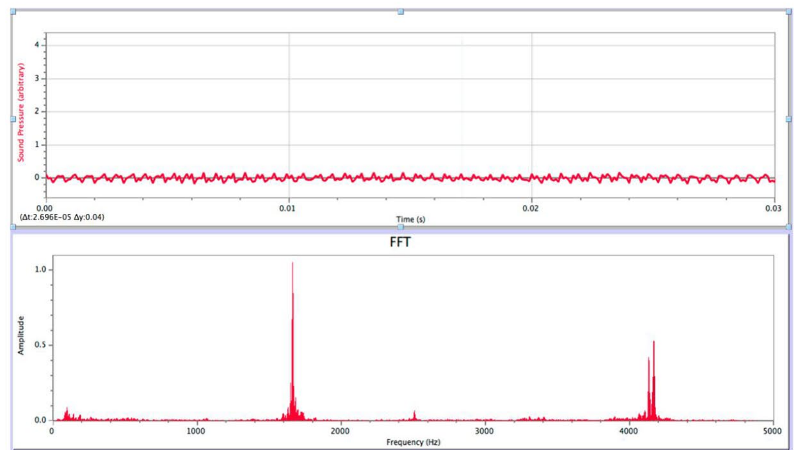
Callalli, sound spectra rank IV, pipe numbers 36, 37, 39 and 41 (clockwise from the top left)



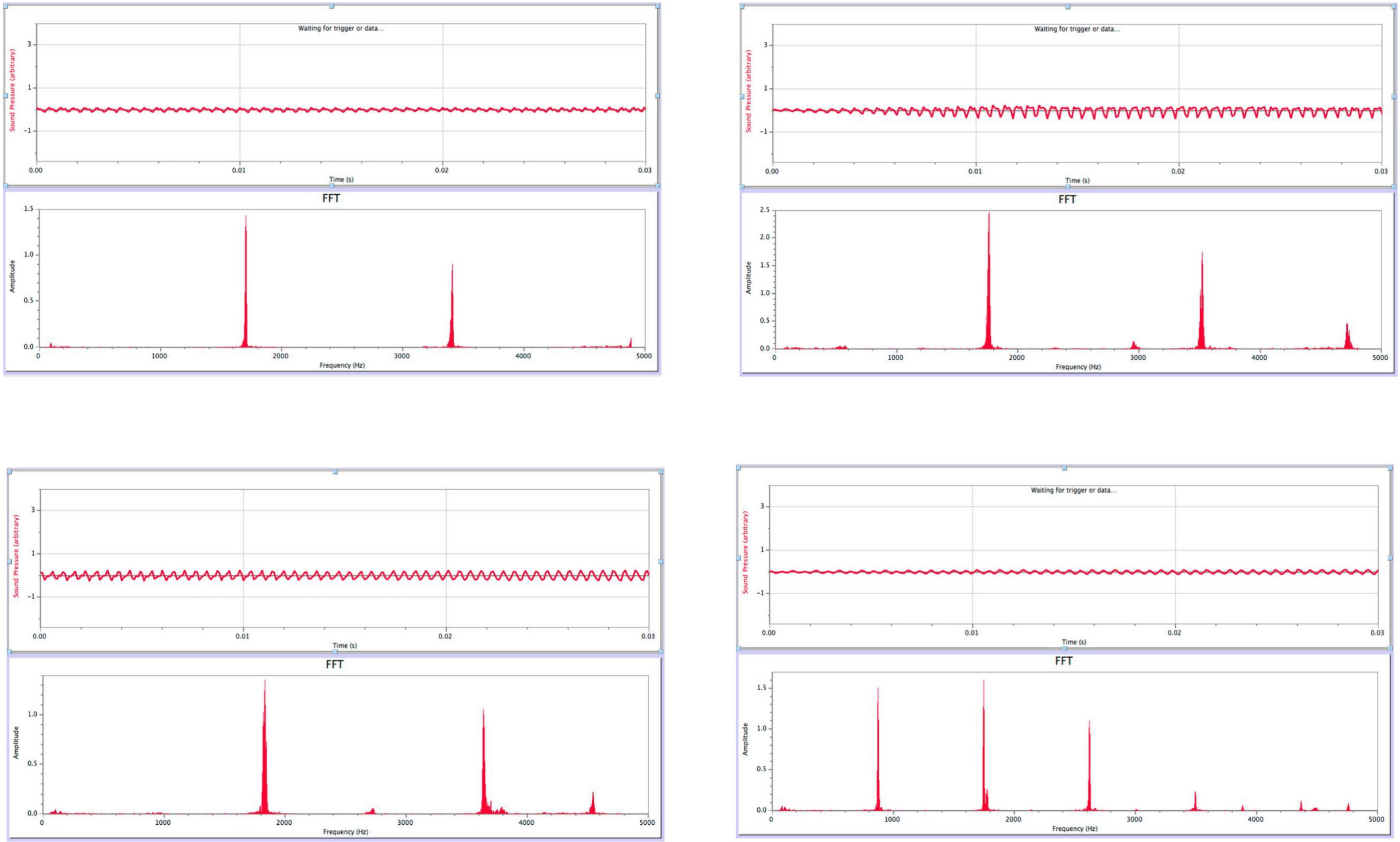
Callalli, sound spectra rank IV, pipe numbers 42, 44, 46 and 48 (clockwise from the top left)



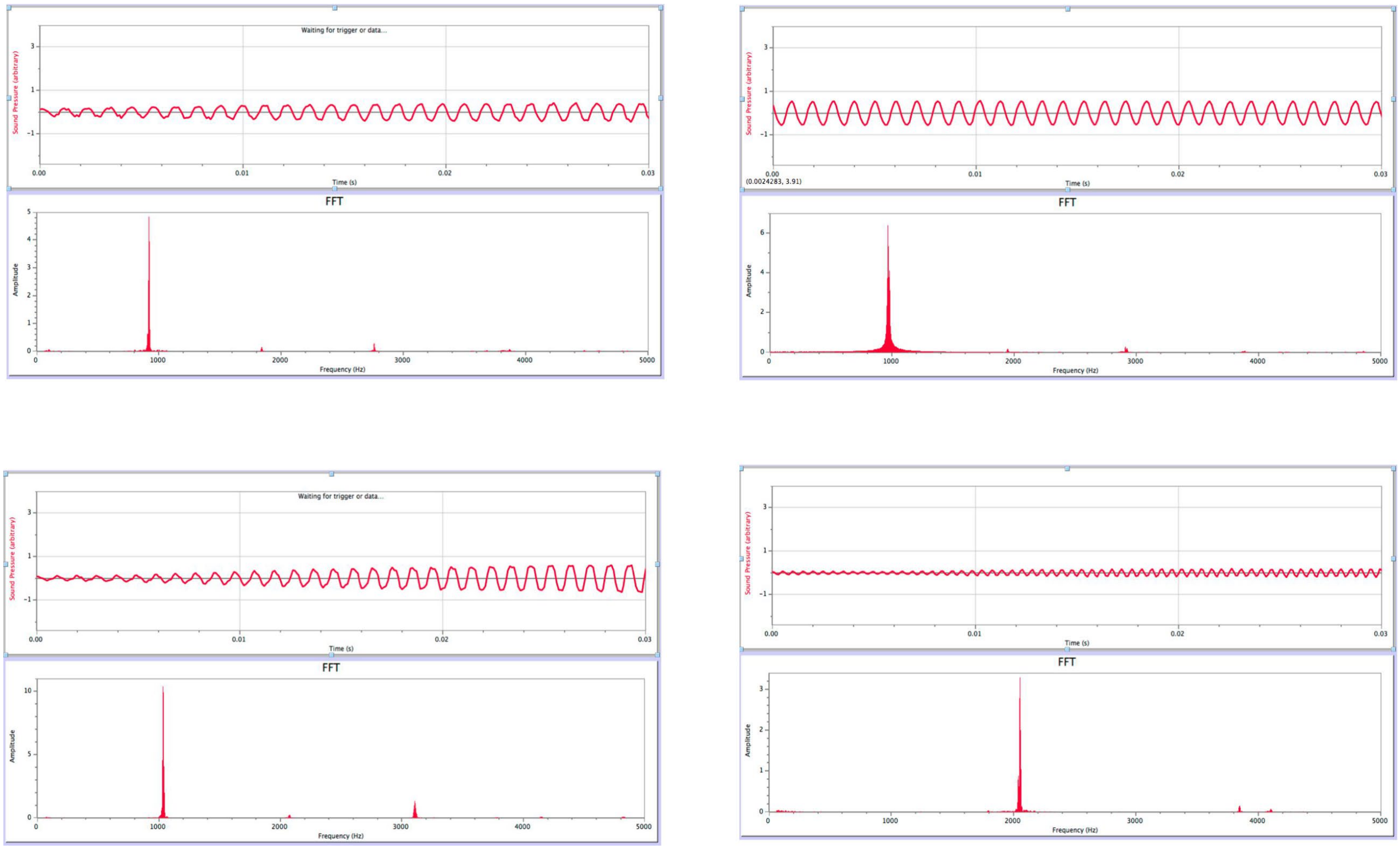




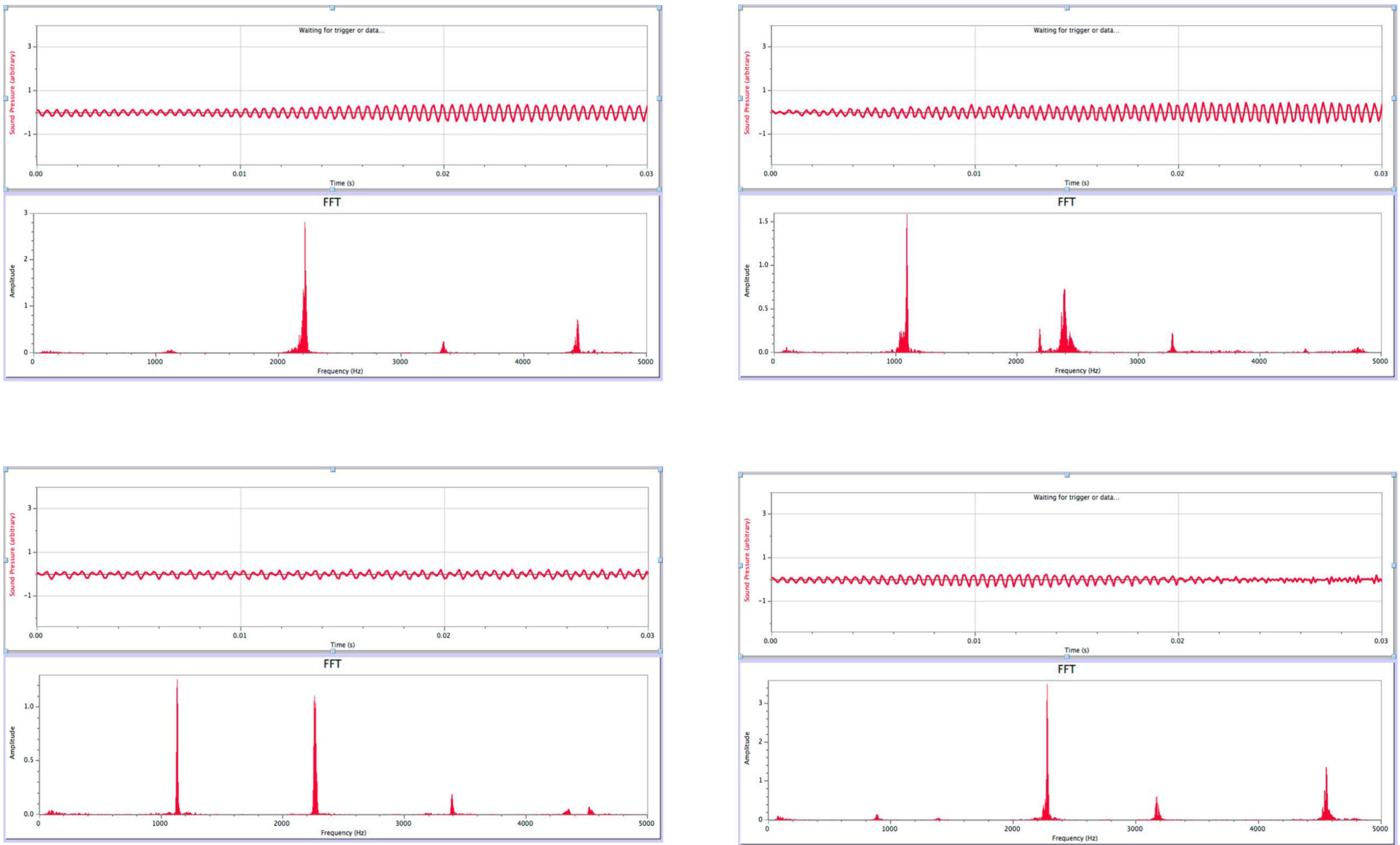
Callalli, sound spectra rank IV, pipe numbers 49, 51 and 55 (clockwise from the top left)



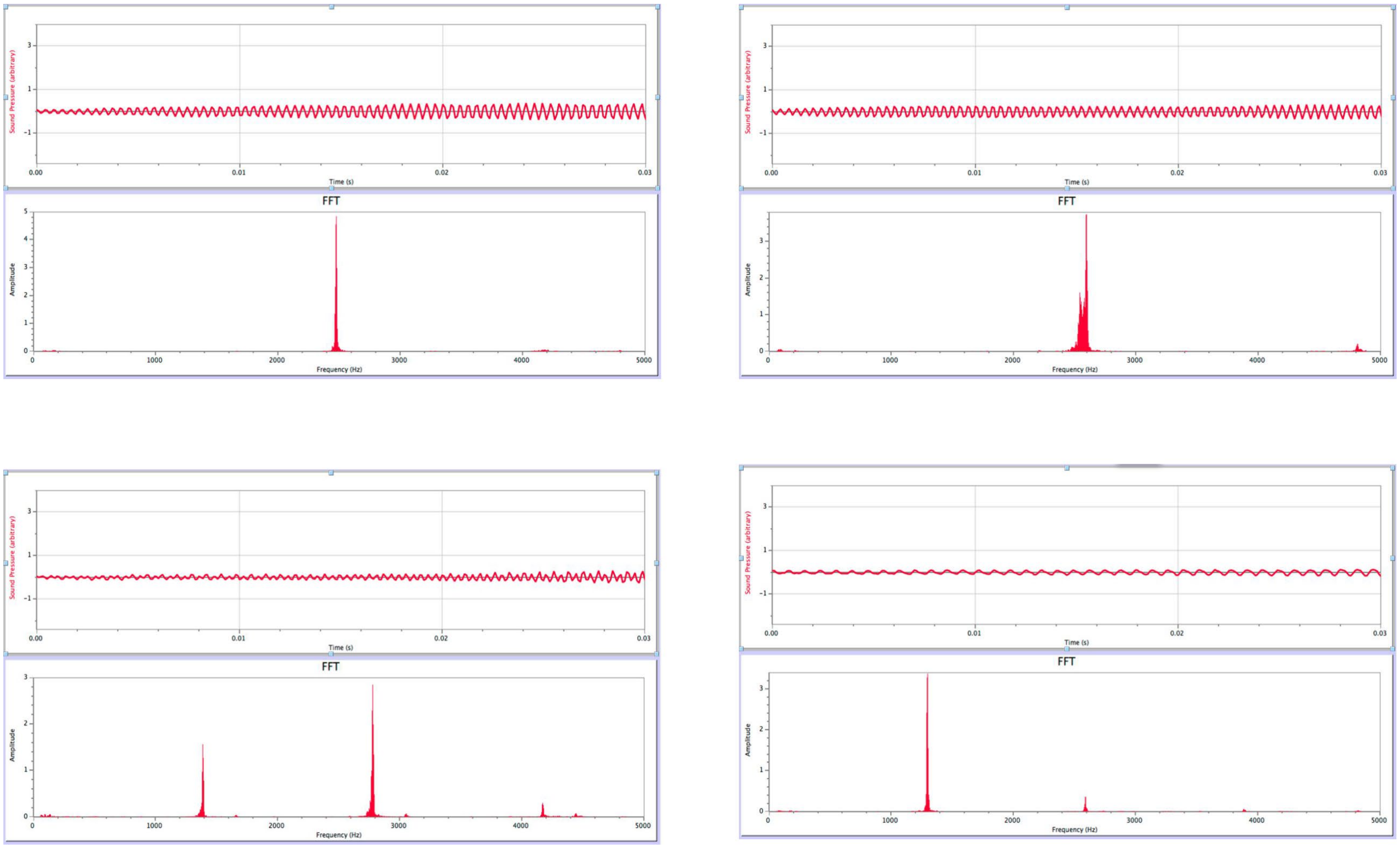
Callalli, sound spectra rank V, pipe numbers 3 back, 4 back, 4 front and 5 back (clockwise from the top left)



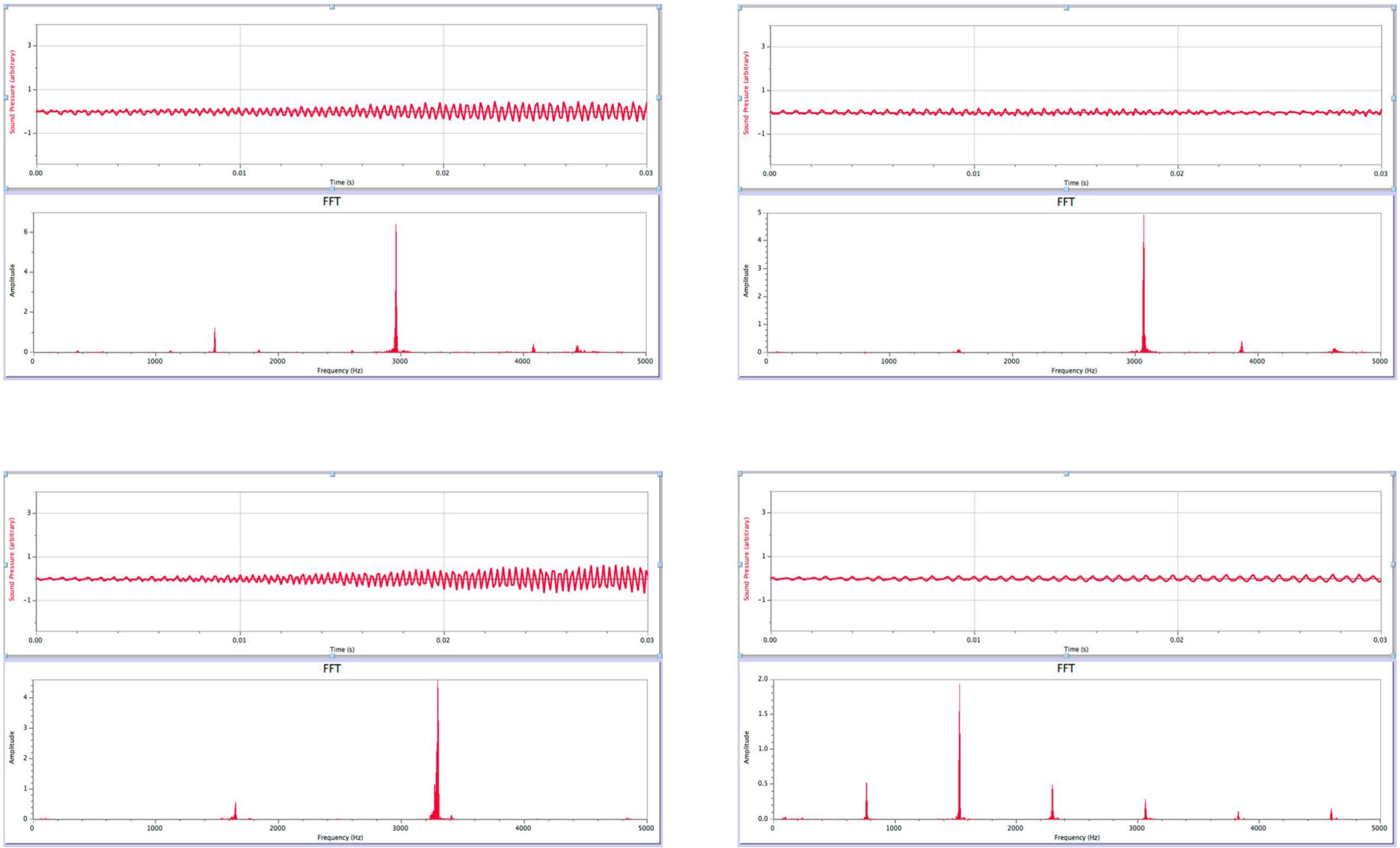
Callalli, sound spectra rank V, pipe numbers 5 front, 6 front, 7 back and 7 front (clockwise from the top left)



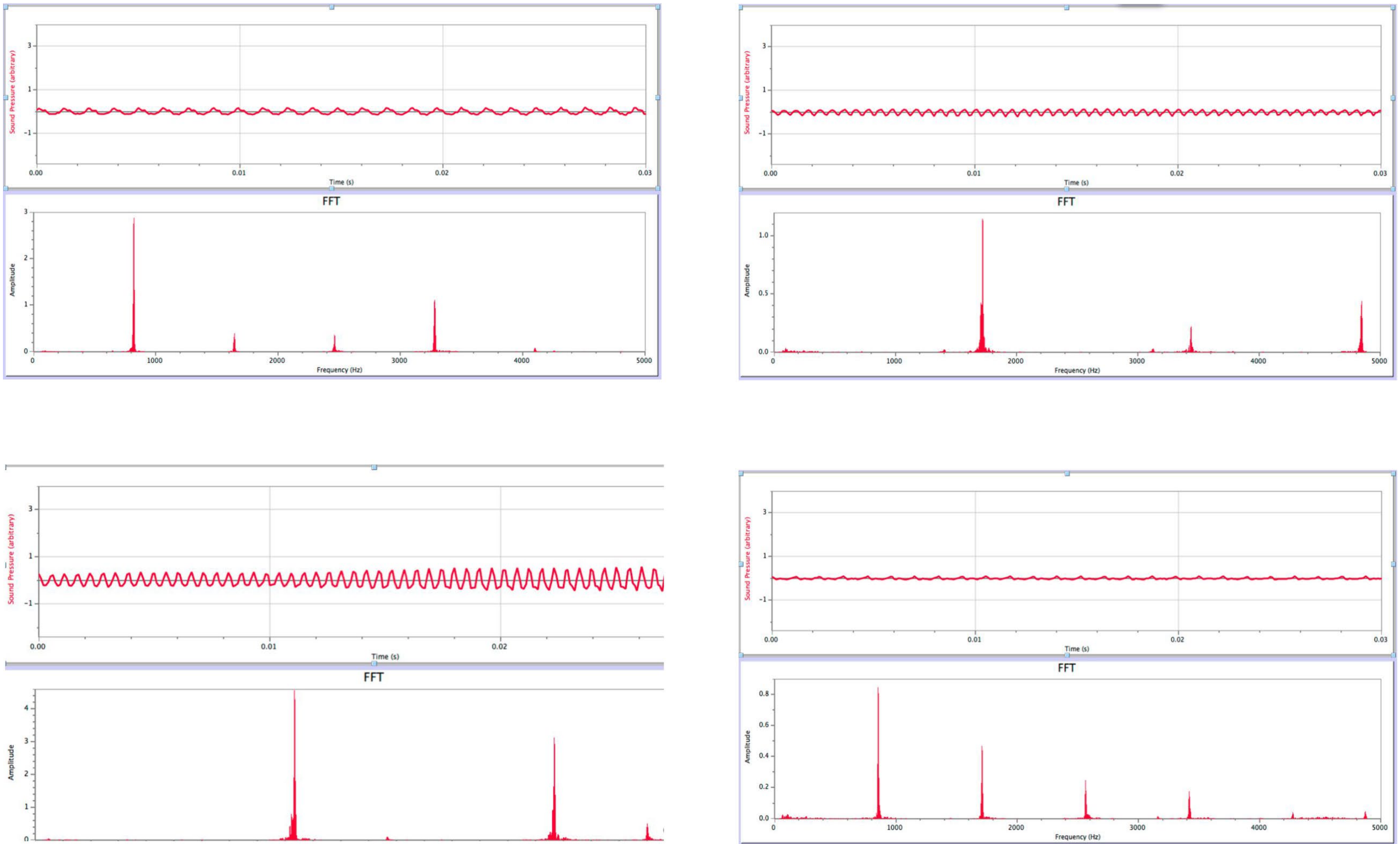
Callalli, sound spectra rank V, pipe numbers 8 back, 8 front, 9 back and 9 front (clockwise from the top left)



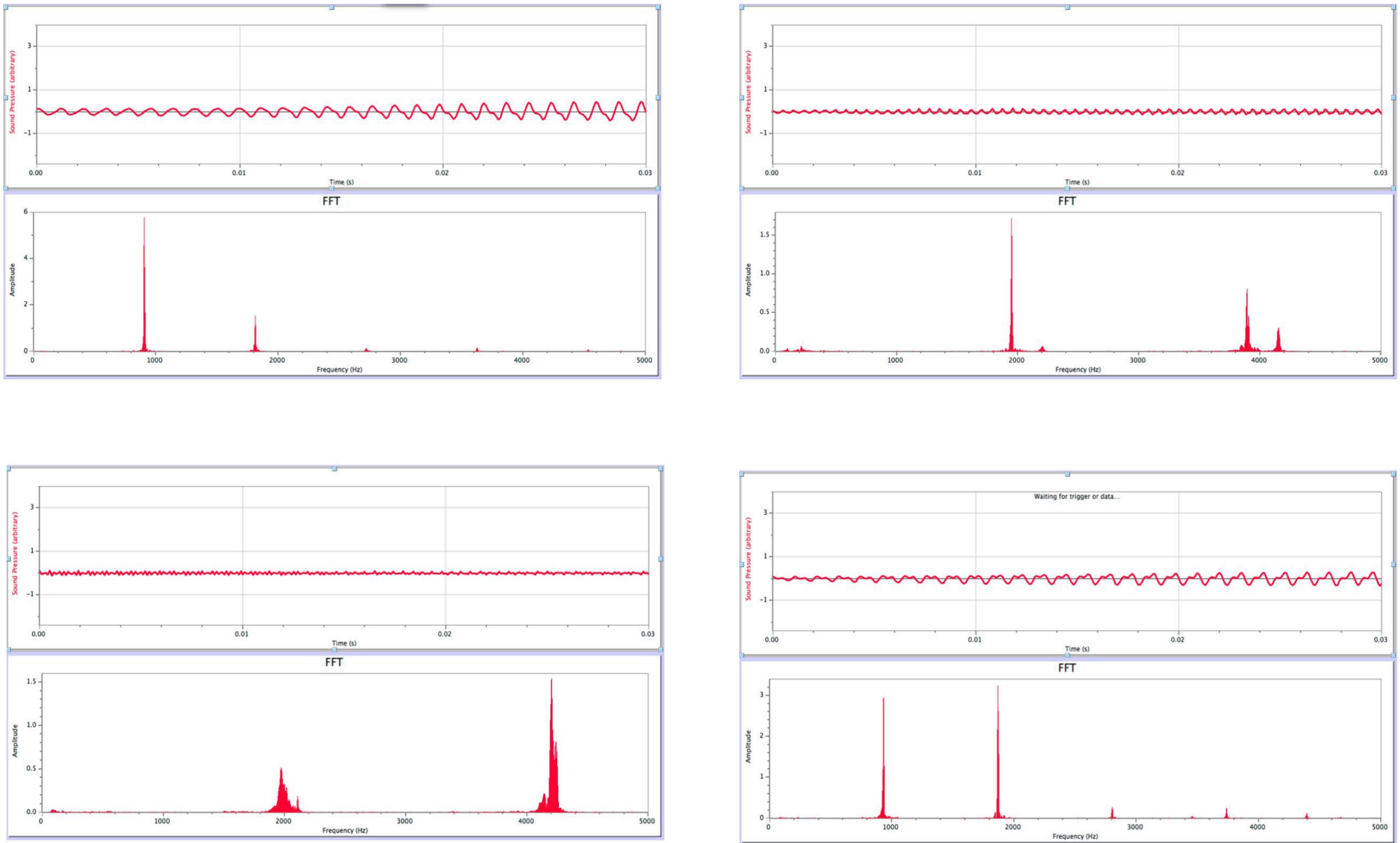
Callalli, sound spectra rank V, pipe numbers 10 front, 11 back, 11 front and 12 front (clockwise from the top left)



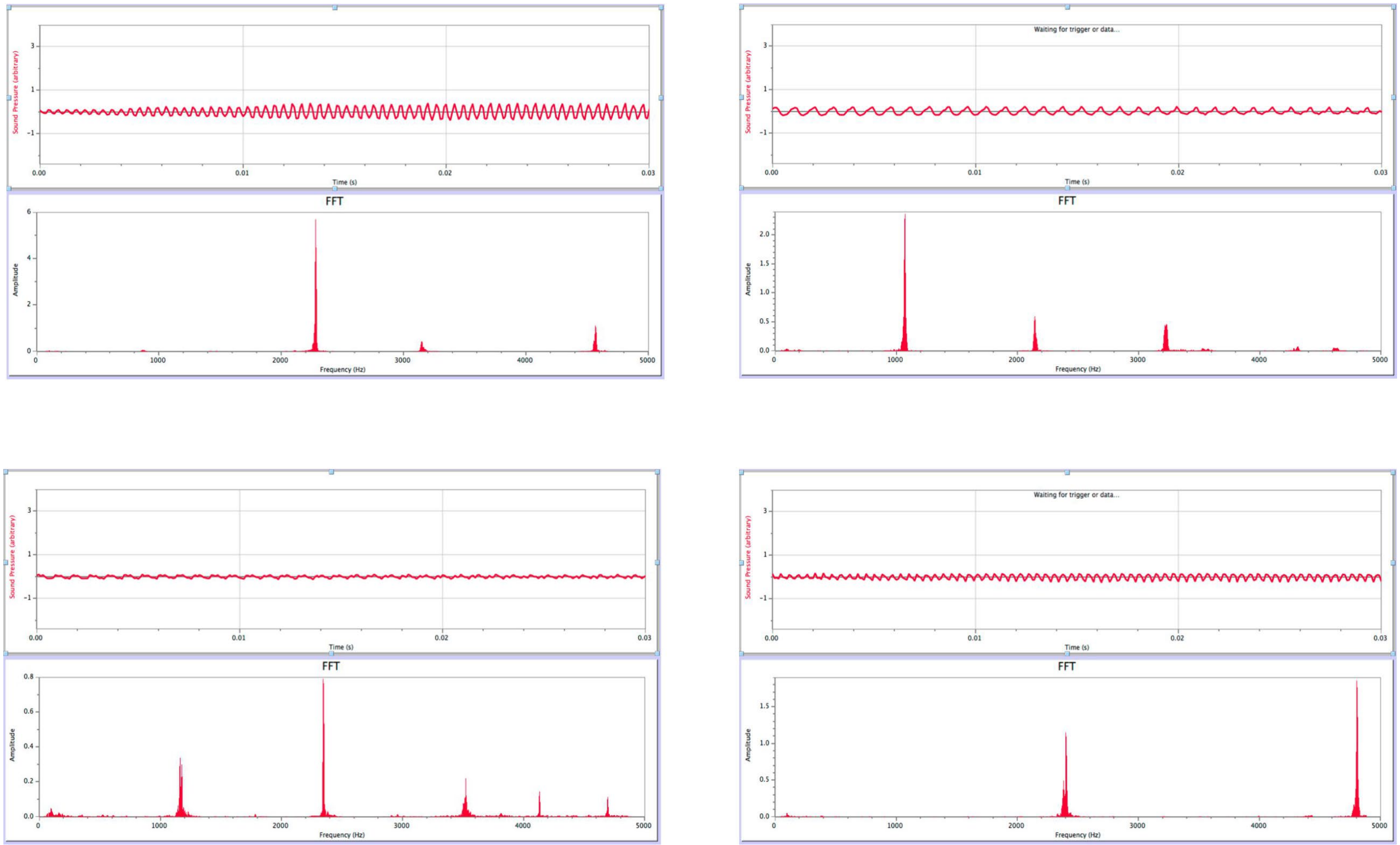
Callalli, sound spectra rank V, pipe numbers 13 back, 14 back, 14 front and 15 back (clockwise from the top left)



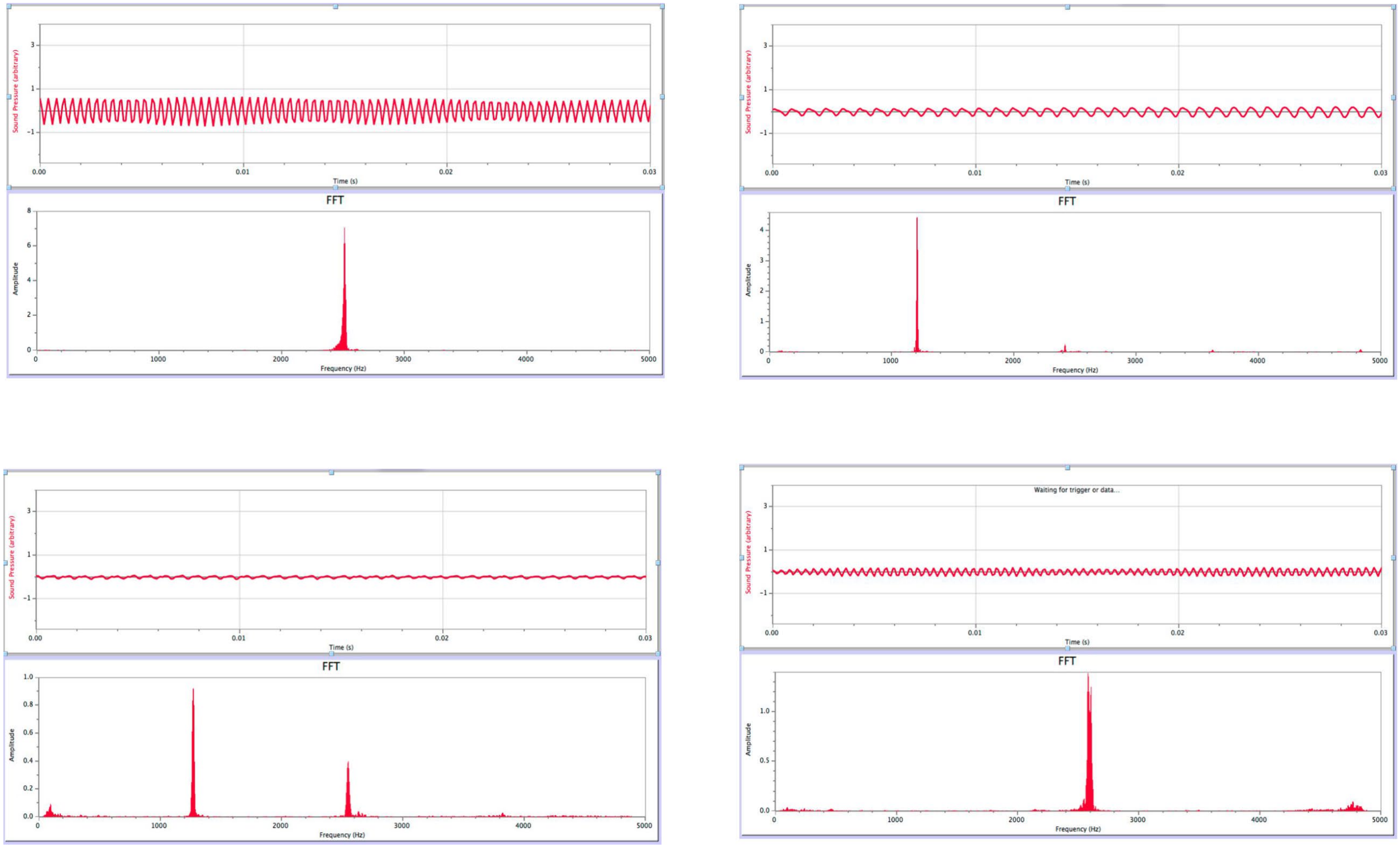
Callalli, sound spectra rank V, pipe numbers 15 front, 16 back, 16 front and 17 back (clockwise from the top left)



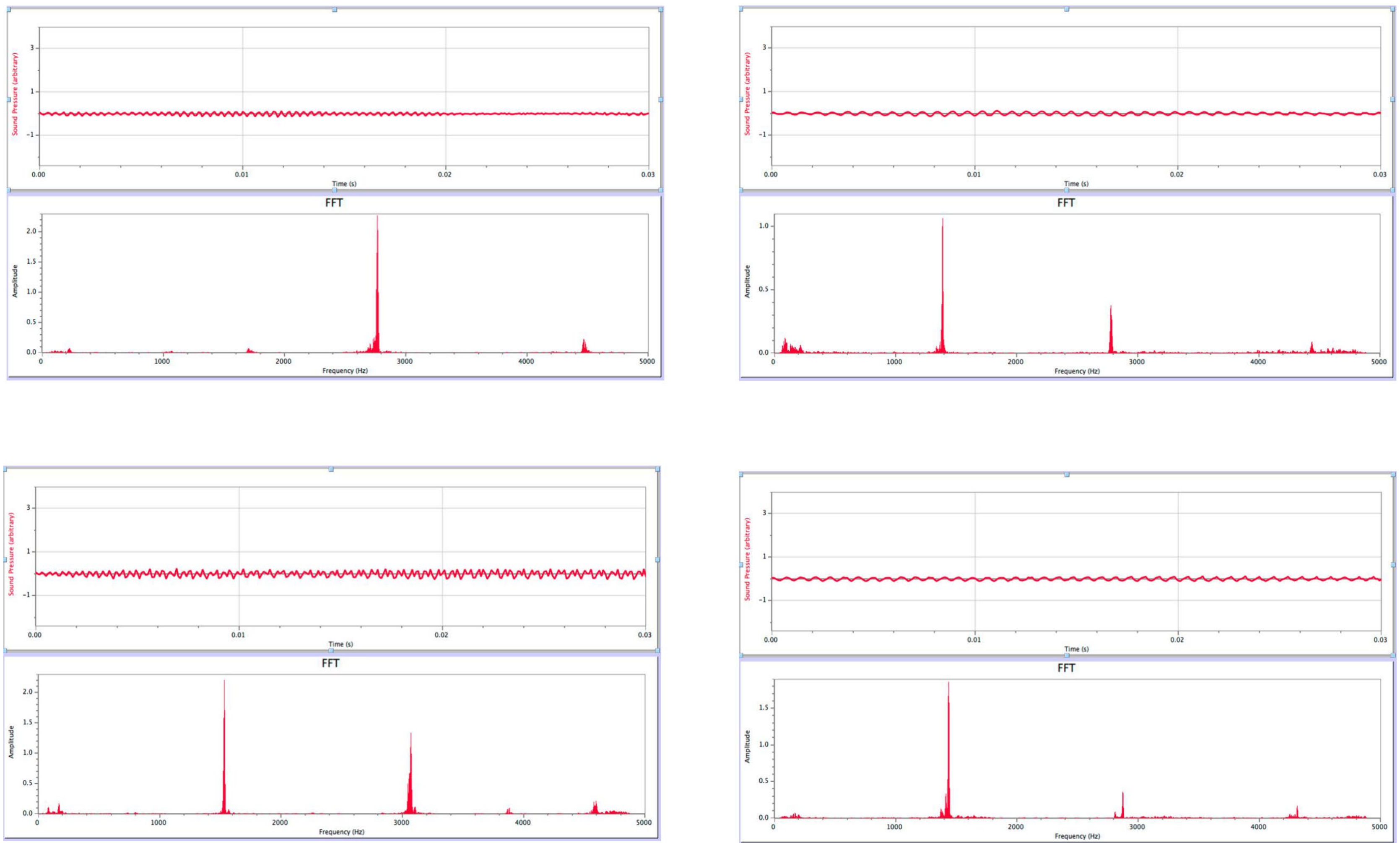
Callalli, sound spectra rank V, pipe numbers 17 front, 18 back, 18 front and 19 back (clockwise from the top left)



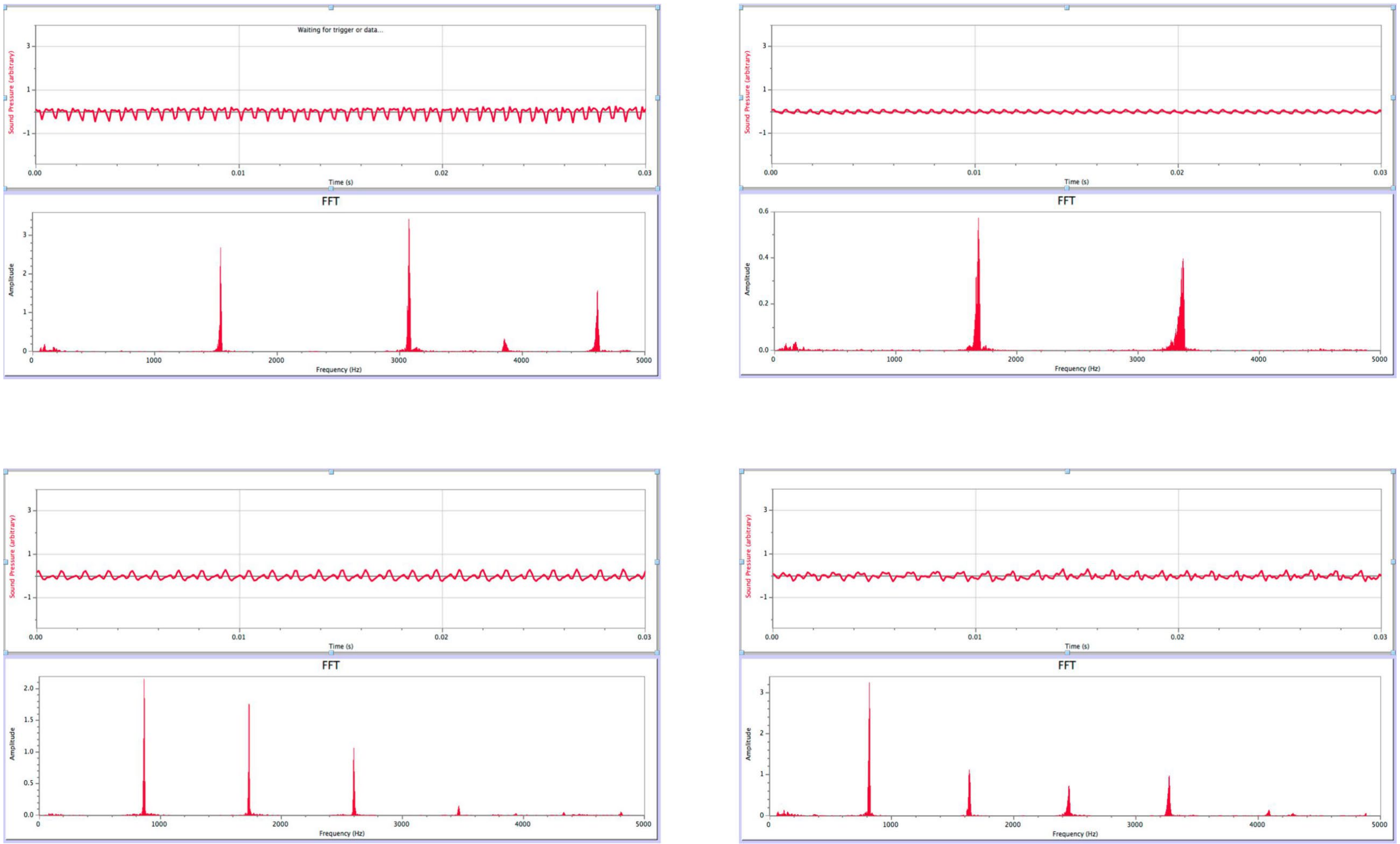
Callalli, sound spectra rank V, pipe numbers 20 back, 20 front, 21 back and 21 front (clockwise from the top left)



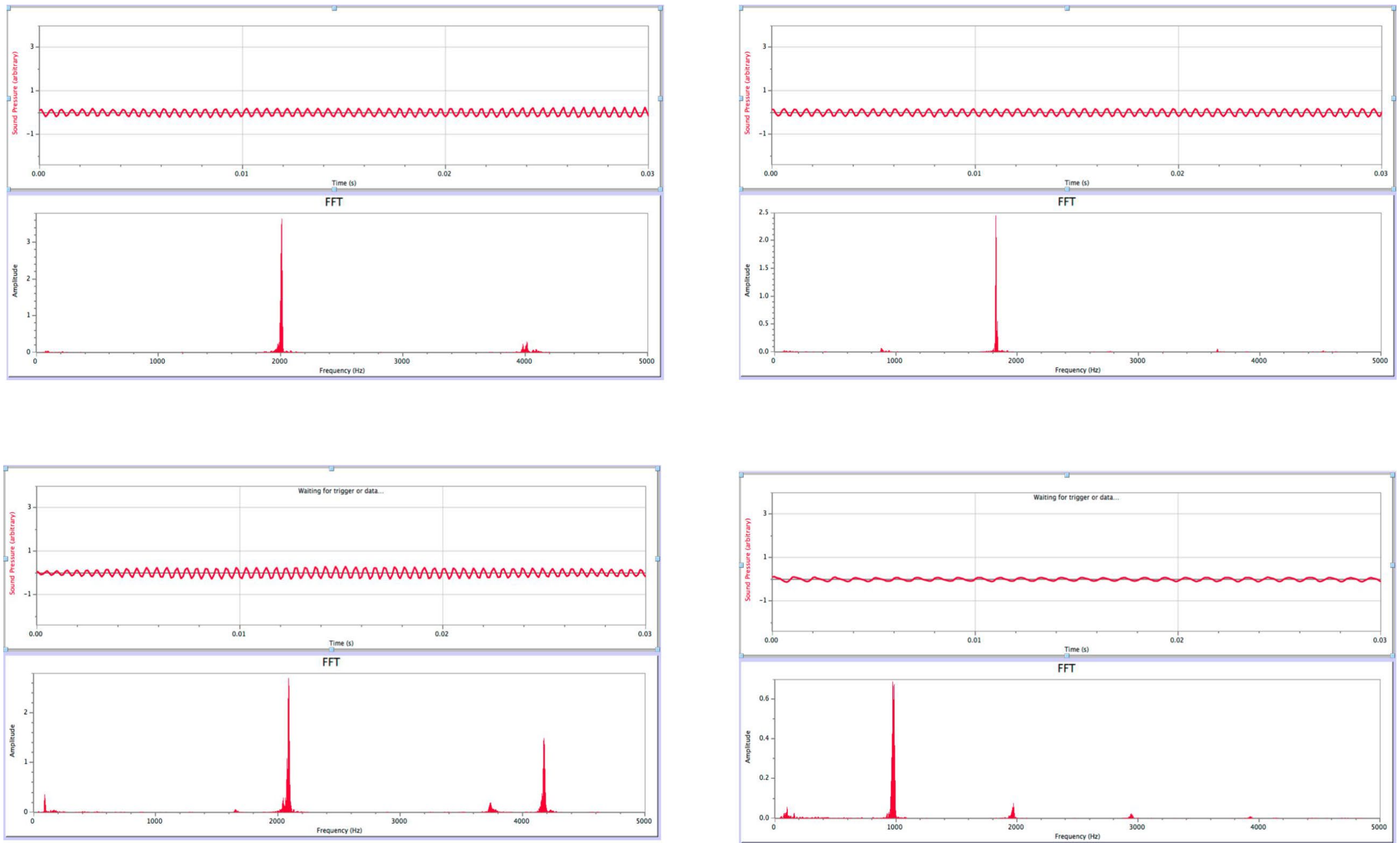
Callalli, sound spectra rank V, pipe numbers 22 back, 22 front, 23 back and 23 front (clockwise from the top left)



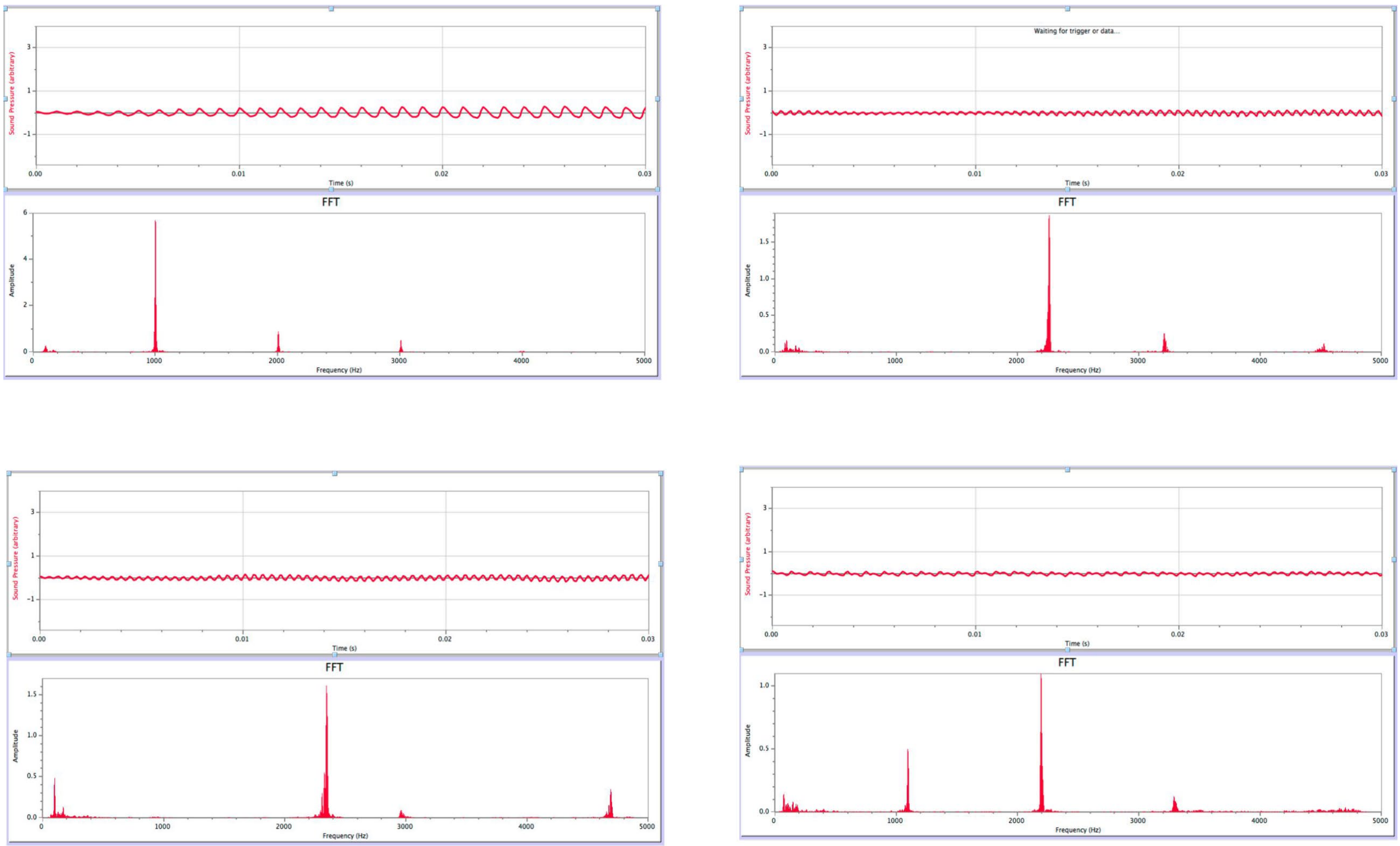
Callalli, sound spectra rank V, pipe numbers 24 back, 24 front, 25 front and 26 back (clockwise from the top left)



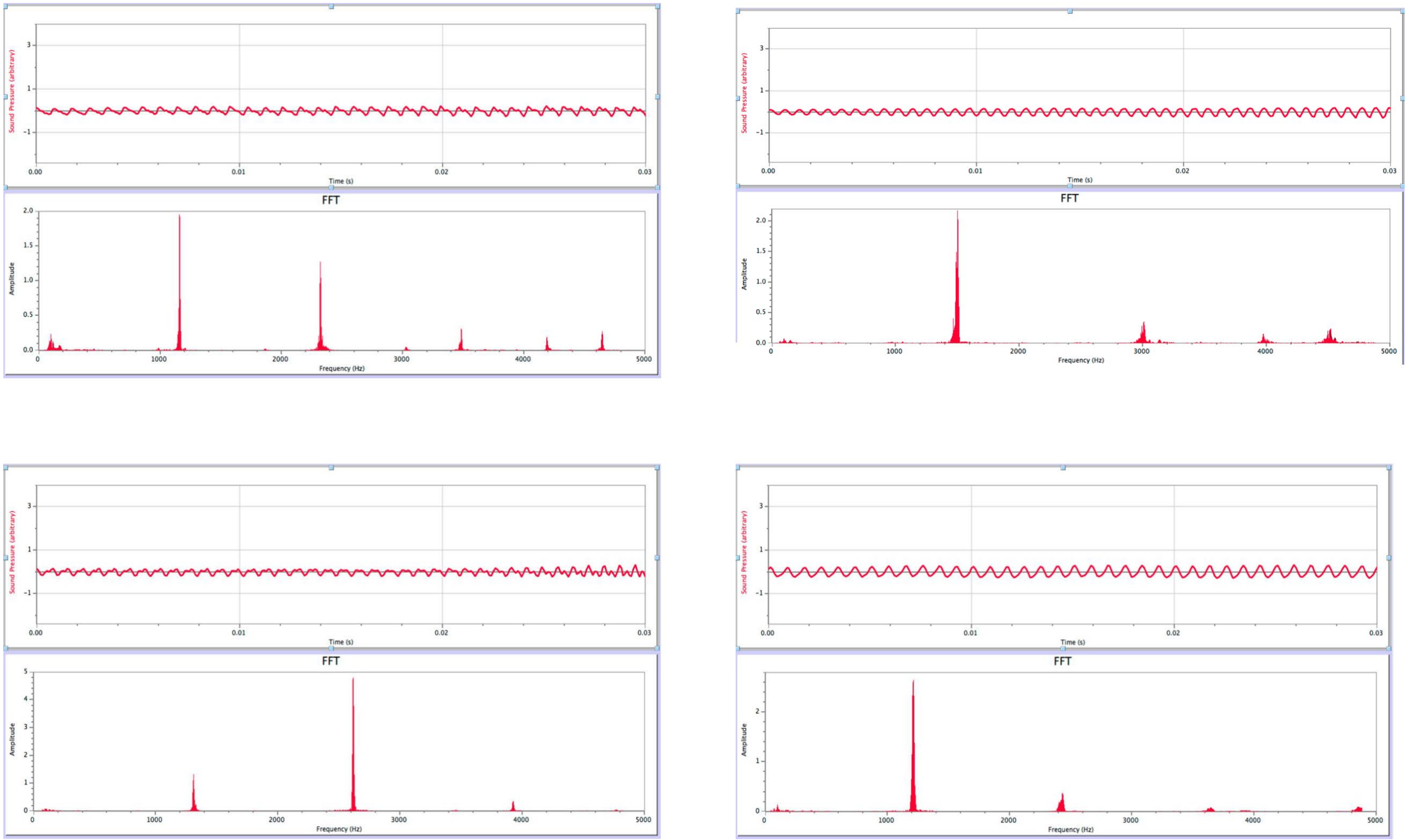
Callalli, sound spectra rank V, pipe numbers 26 front, 27 back, 27 front and 28 front (clockwise from the top left)



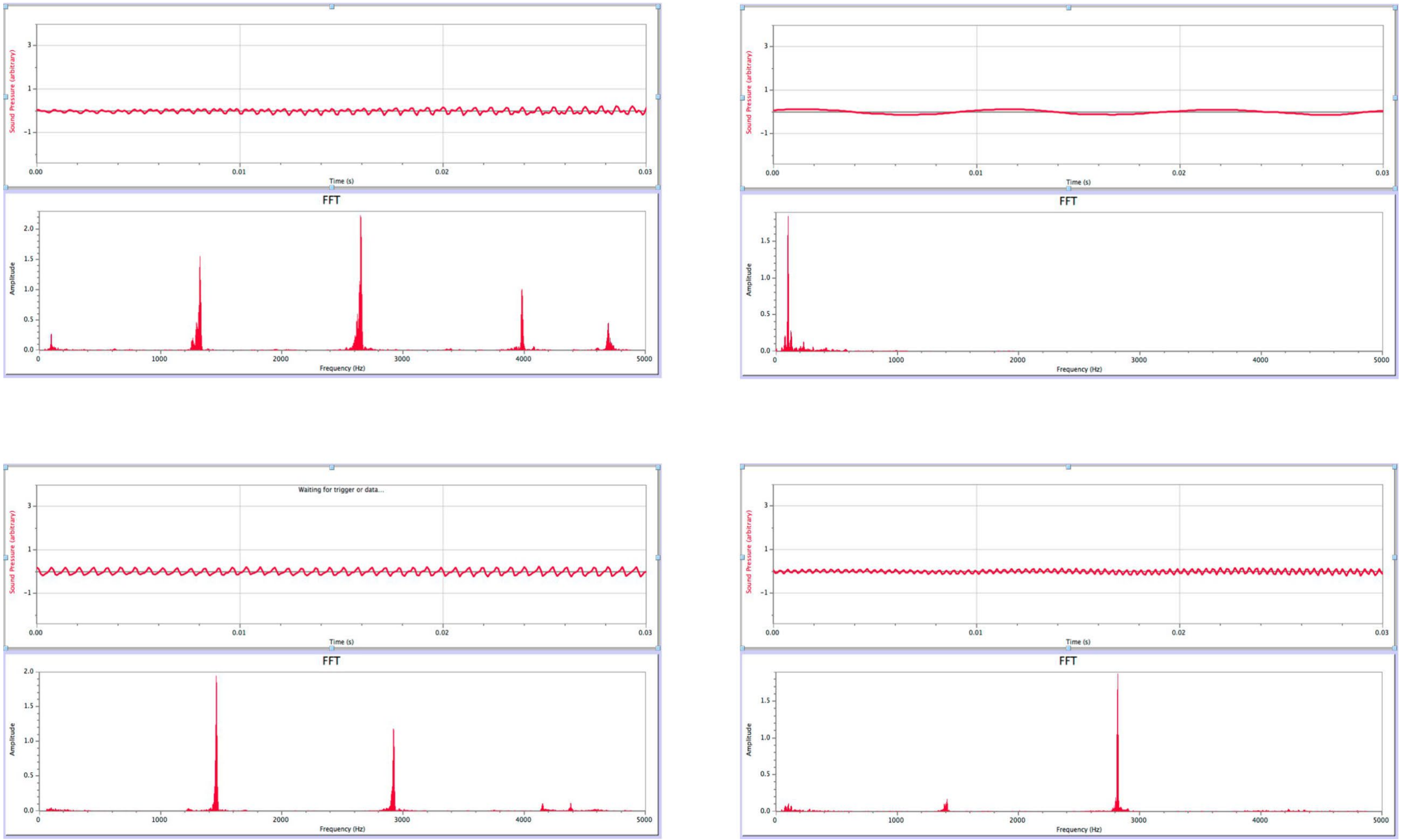
Callalli, sound spectra rank V, pipe numbers 29 back, 29 front, 30 front and 31 back (clockwise from the top left)



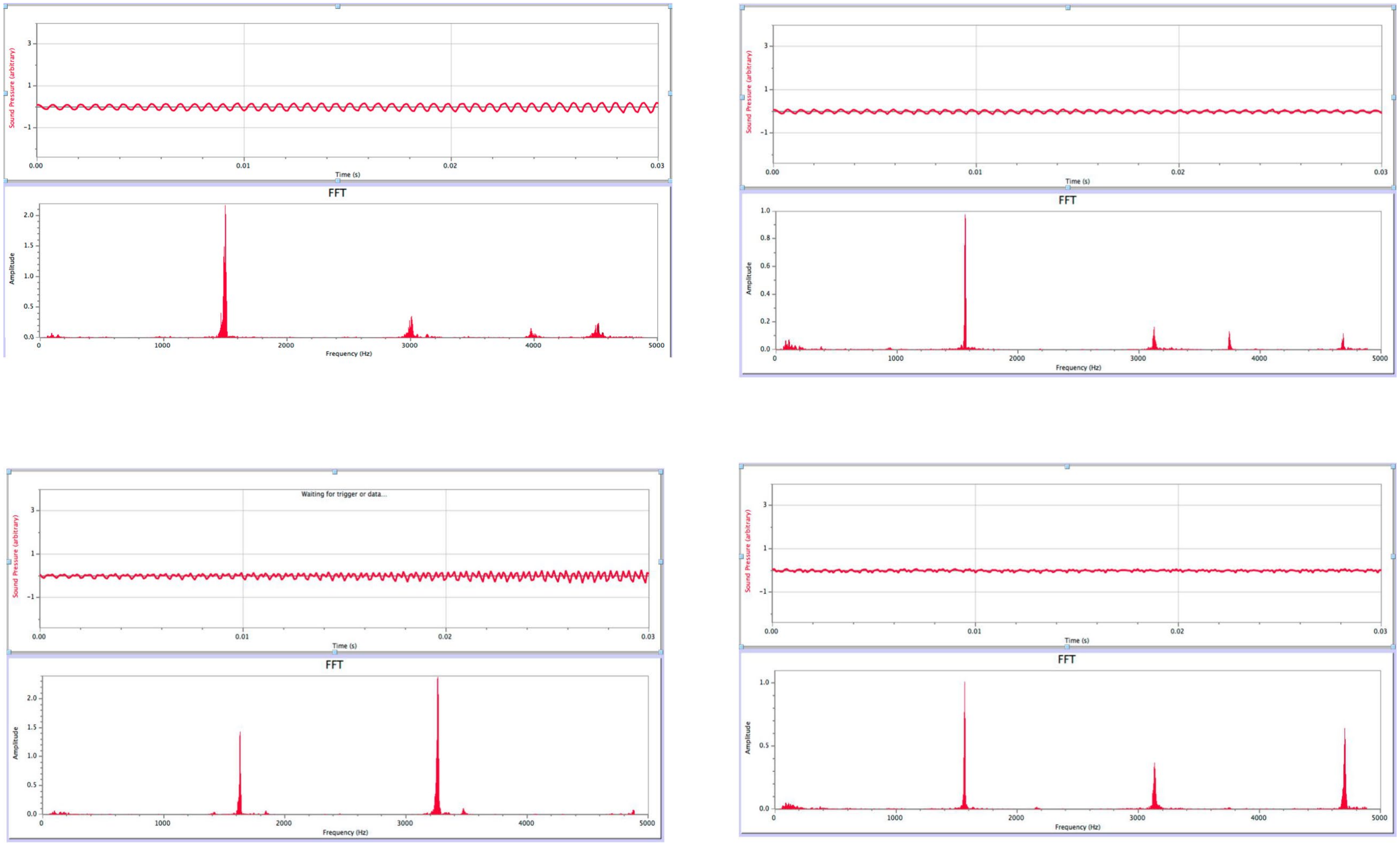
Callalli, sound spectra rank V, pipe numbers 31 front, 32 back, 32 front and 33 back (clockwise from the top left)



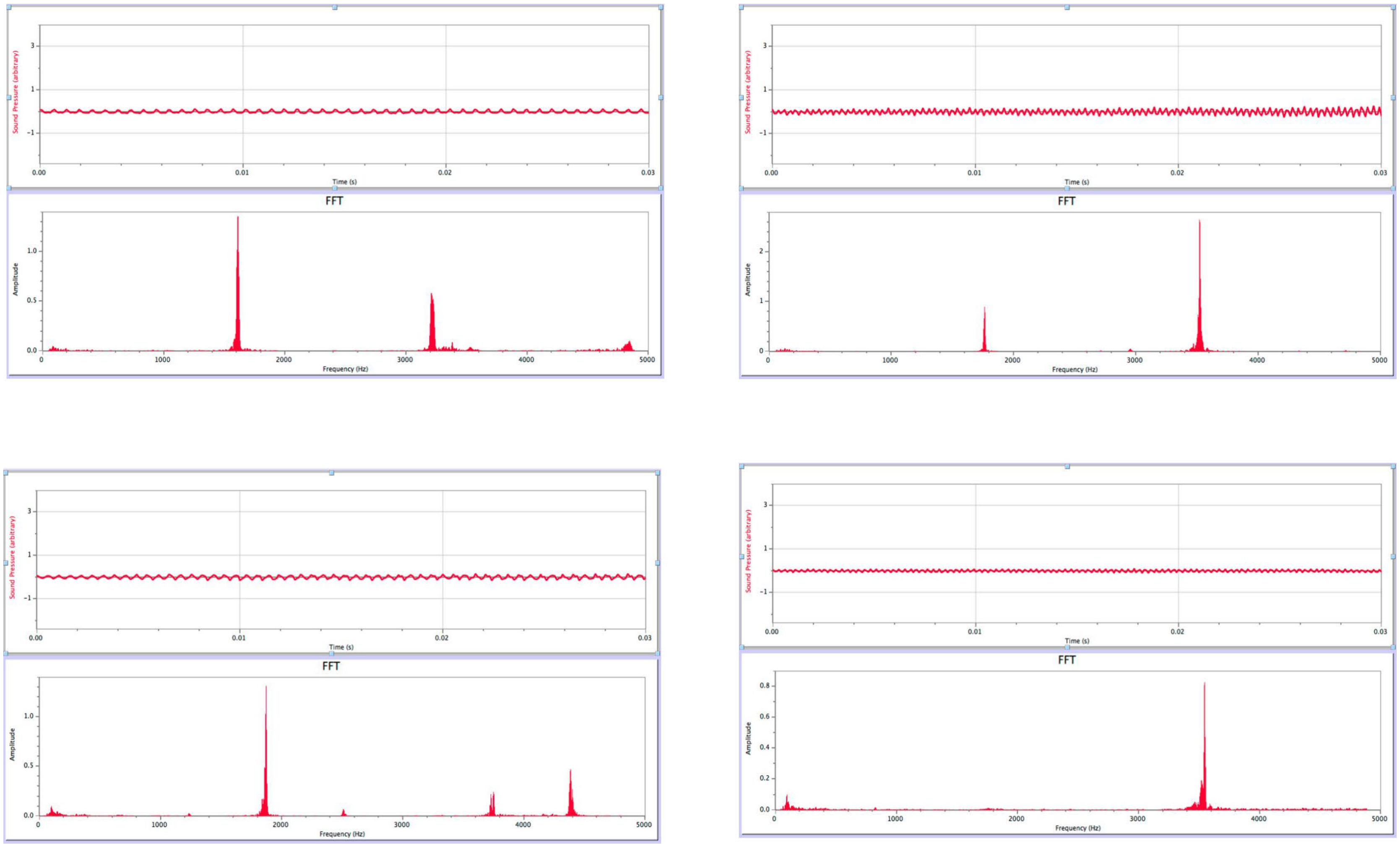
Callalli, sound spectra rank V, pipe numbers 33 front, 34 back, 34 front and 35 back (clockwise from the top left)



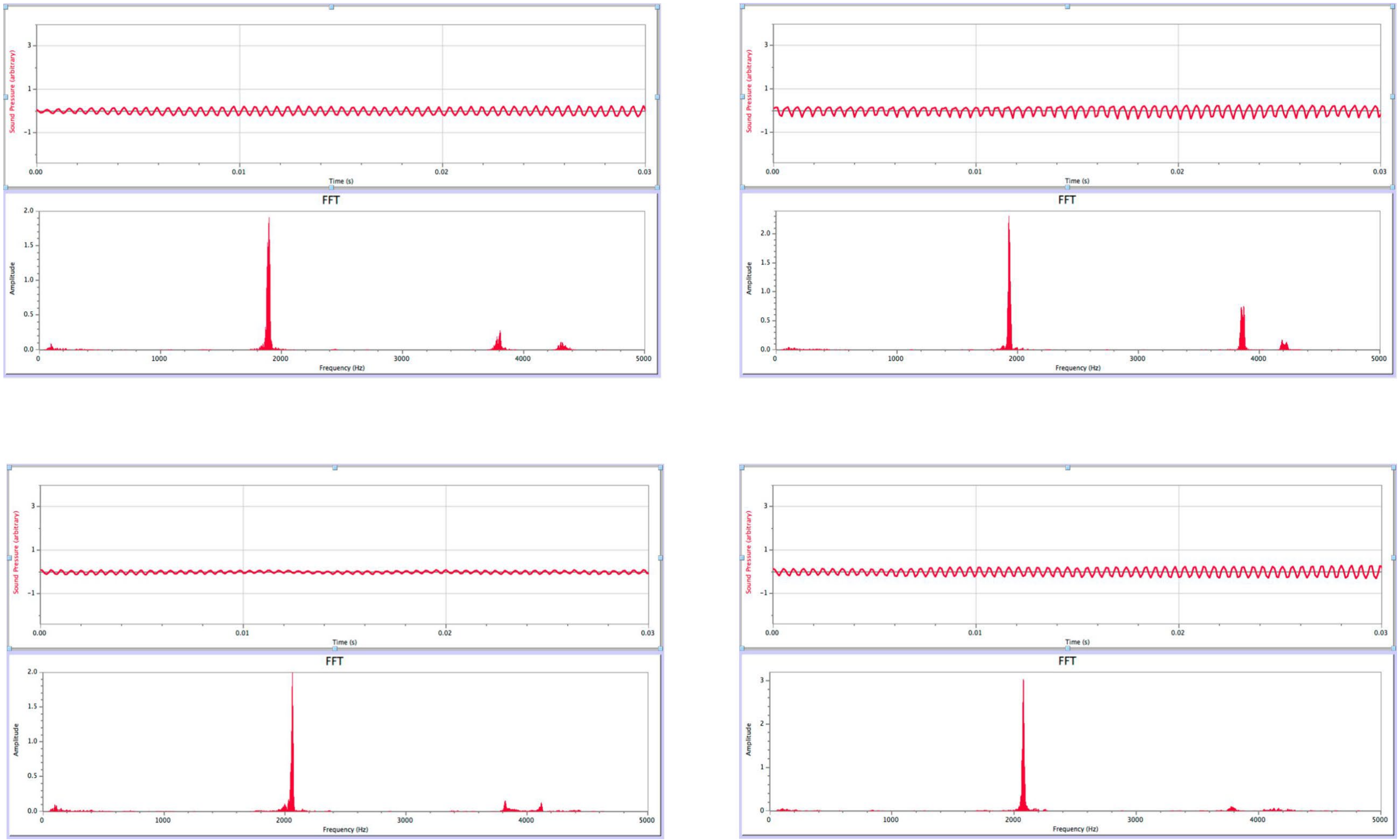
Callalli, sound spectra rank V, pipe numbers 35 front, 36 back, 36 front and 37 back (clockwise from the top left)



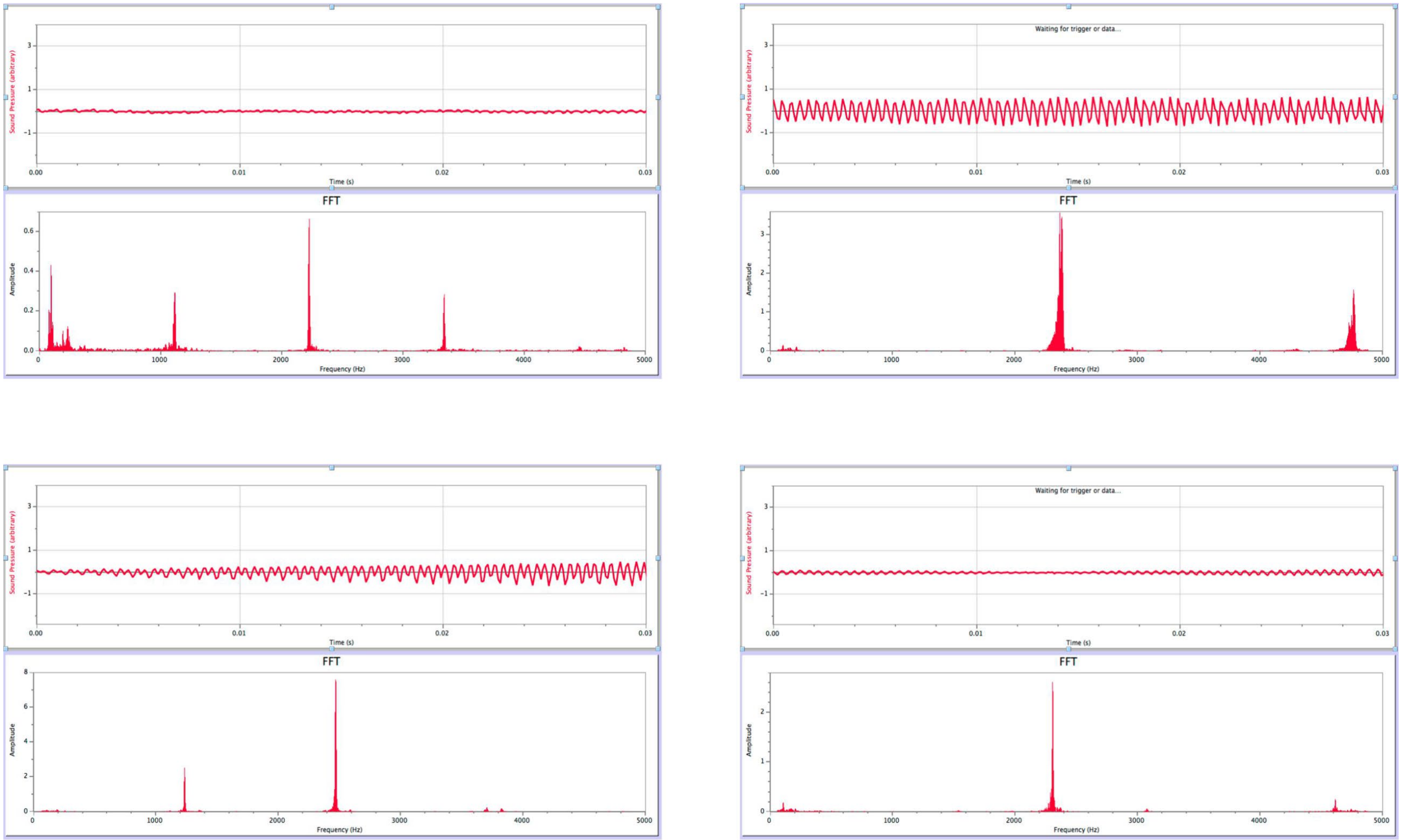
Callalli, sound spectra rank V, pipe numbers 37 front, 38 back, 38 front and 39 back (clockwise from the top left)



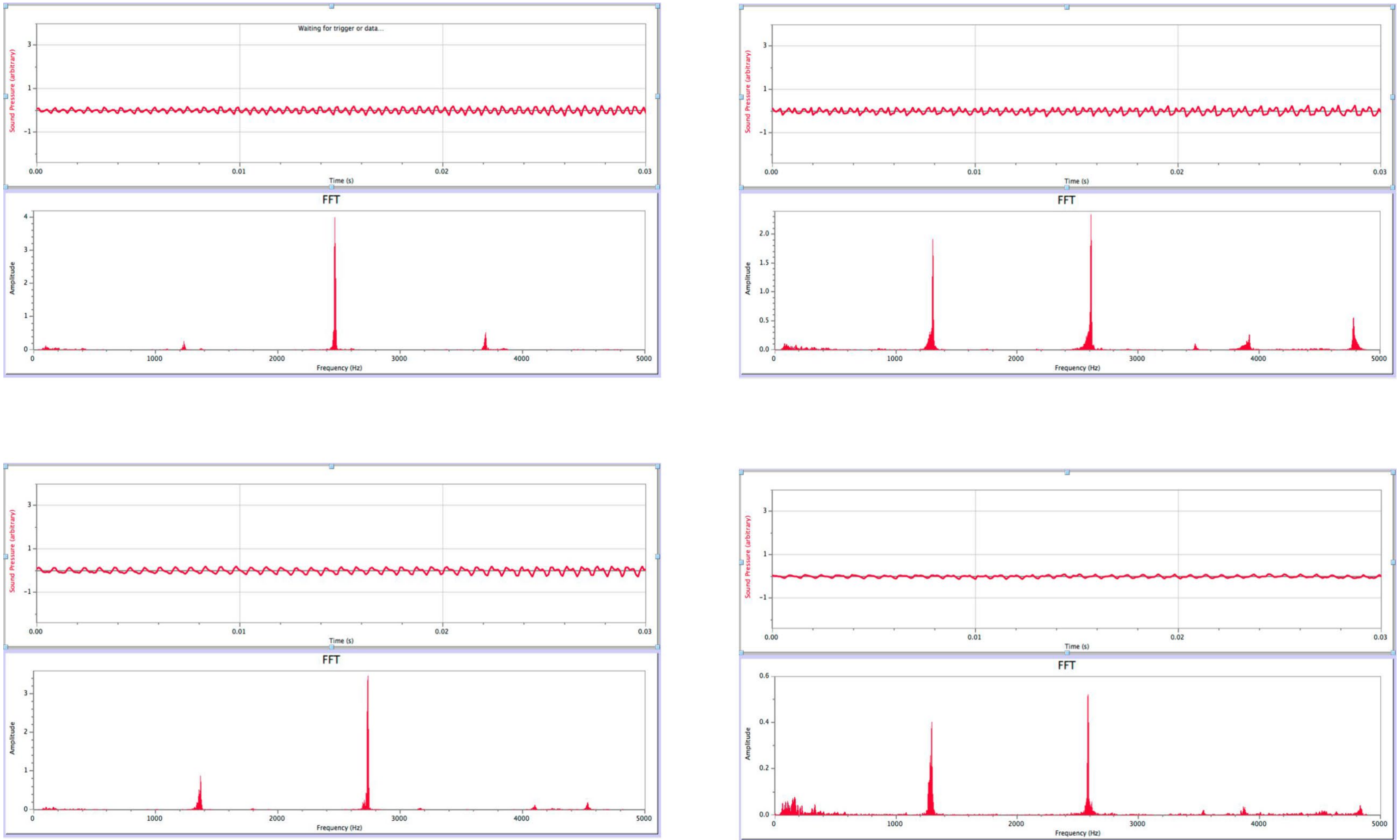
Callalli, sound spectra rank V, pipe numbers 39 front, 40 back, 40 front and 41 back (clockwise from the top left)



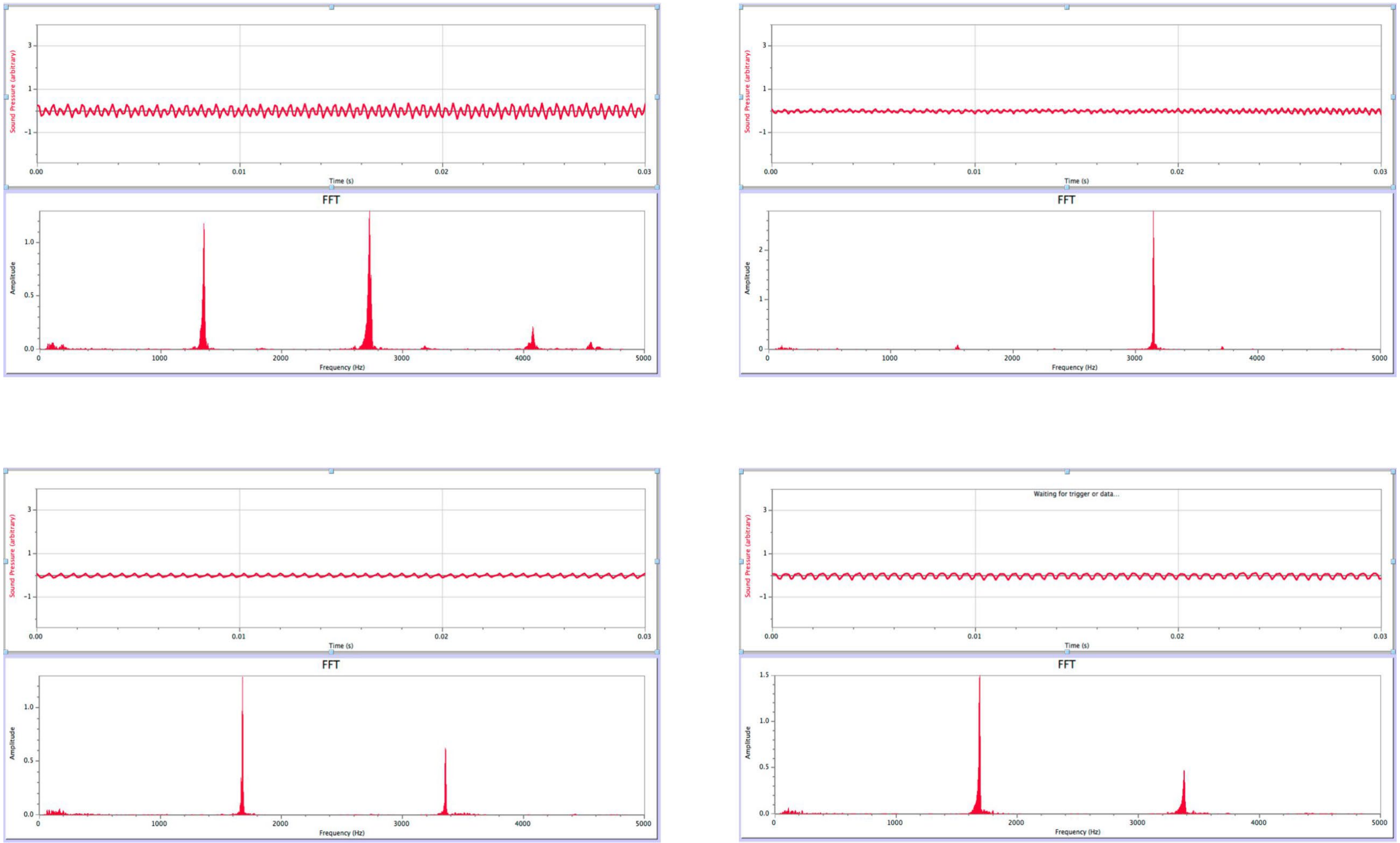
Callalli, sound spectra rank V, pipe numbers 41 front, 42 front, 43 back and 43 front (clockwise from the top left)



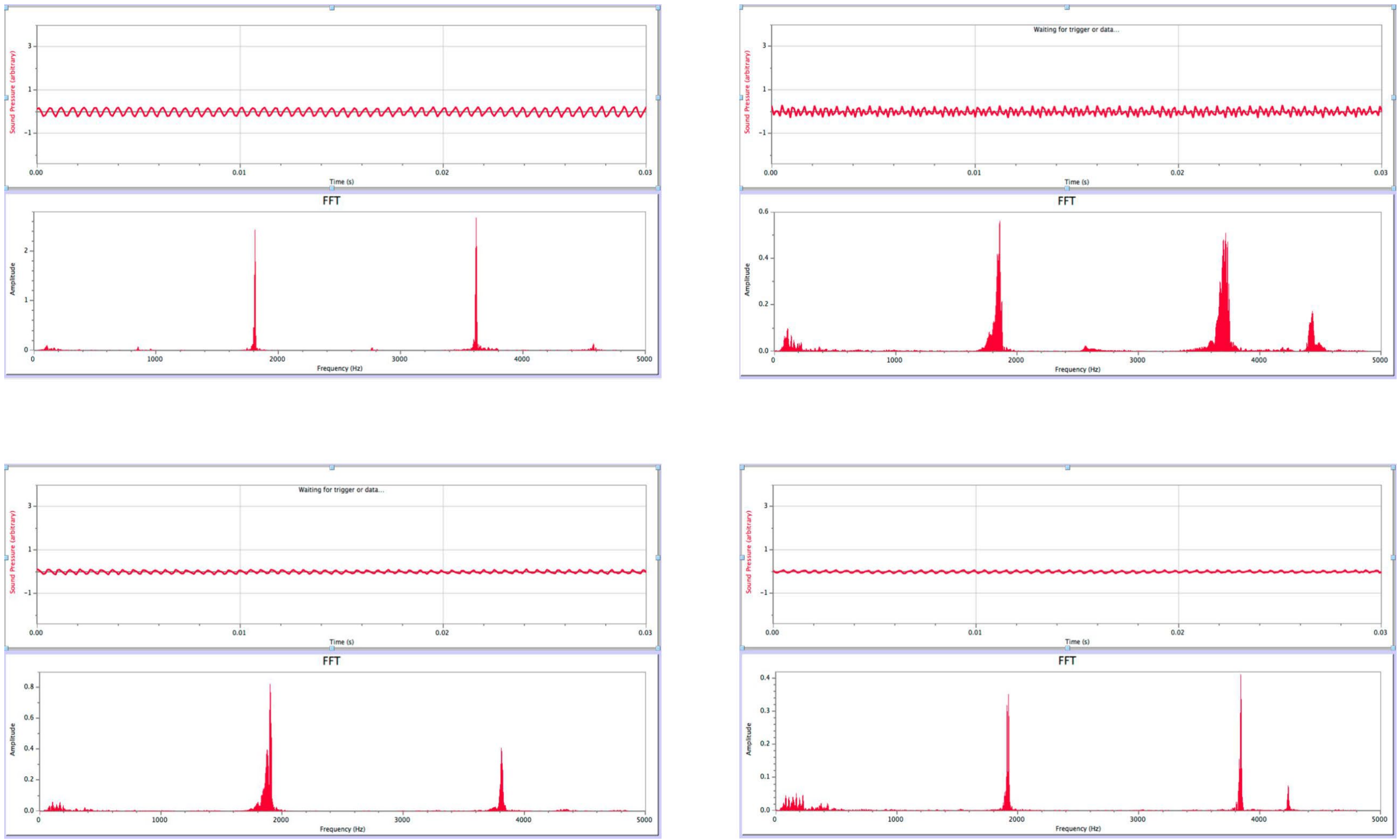
Callalli, sound spectra rank V, pipe numbers 44 front, 45 back, 45 front and 46 back (clockwise from the top left)



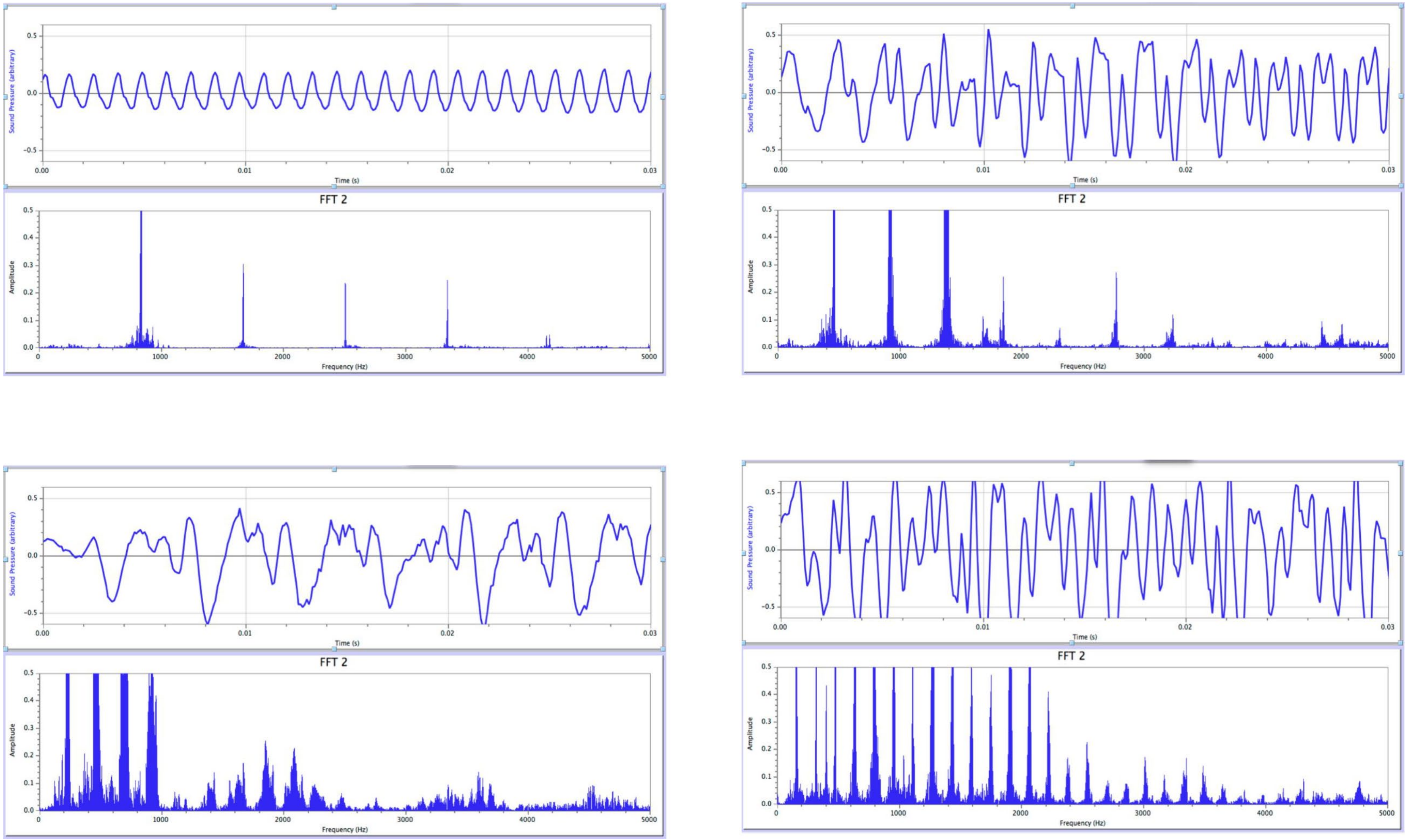
Callalli, sound spectra rank V, pipe numbers 46 front, 47 back, 47 front and 48 back (clockwise from the top left)



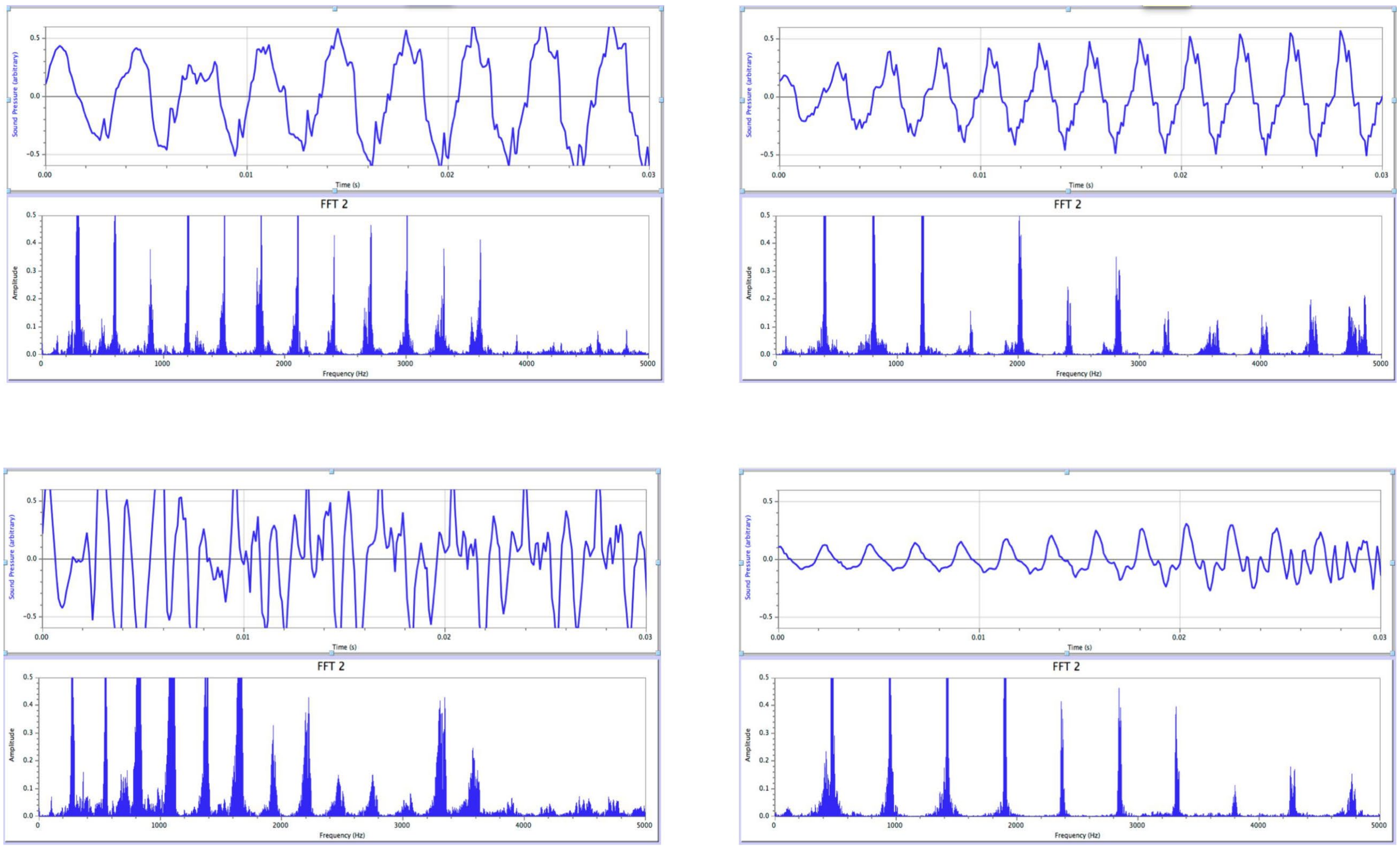
Callalli, sound spectra rank V, pipe numbers 48 front, 51 back, 52 back and 52 front (clockwise from the top left)



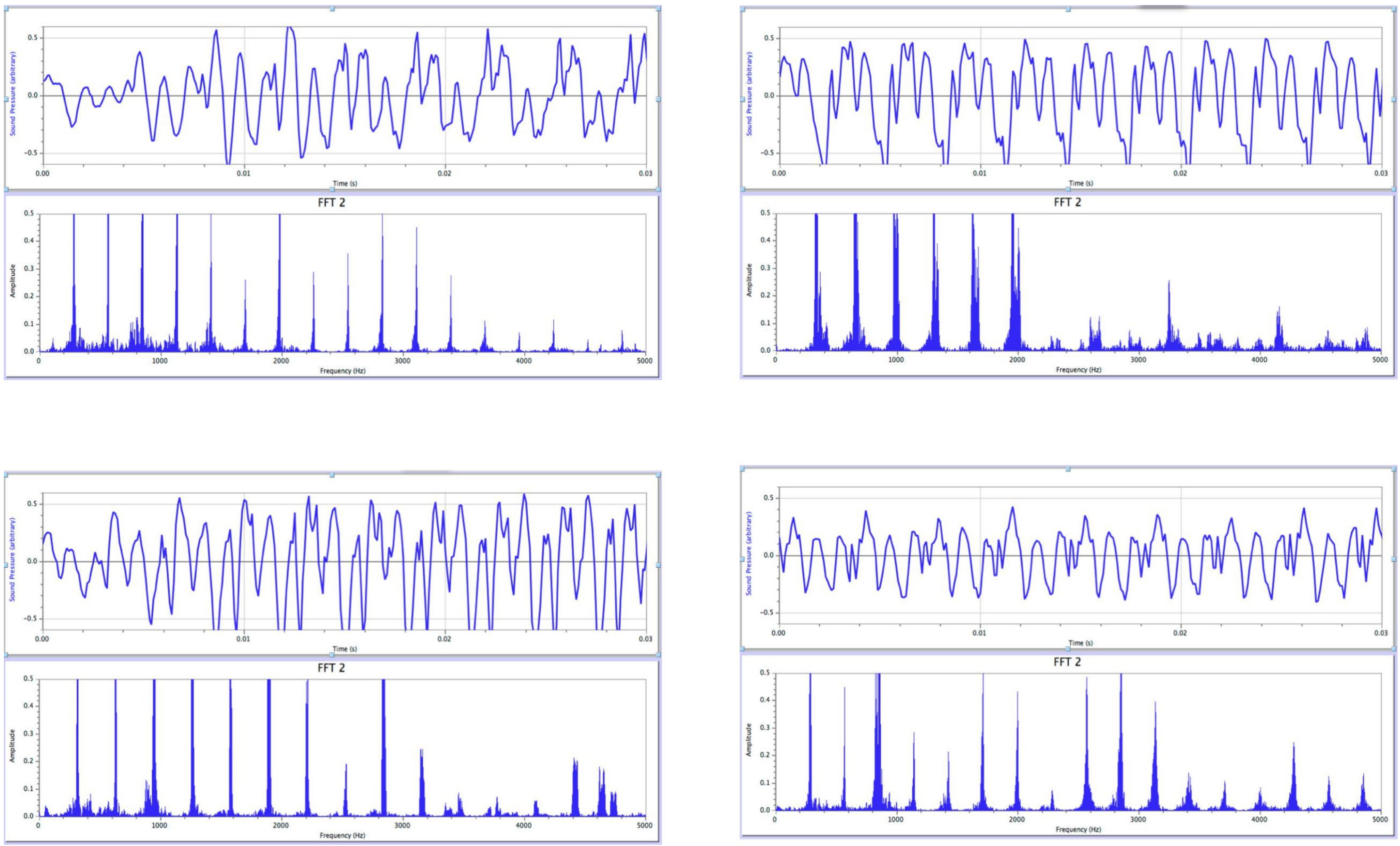
Callalli, sound spectra rank V, pipe numbers 53 back, 53 front, 54 back and 54 front (clockwise from the top left)



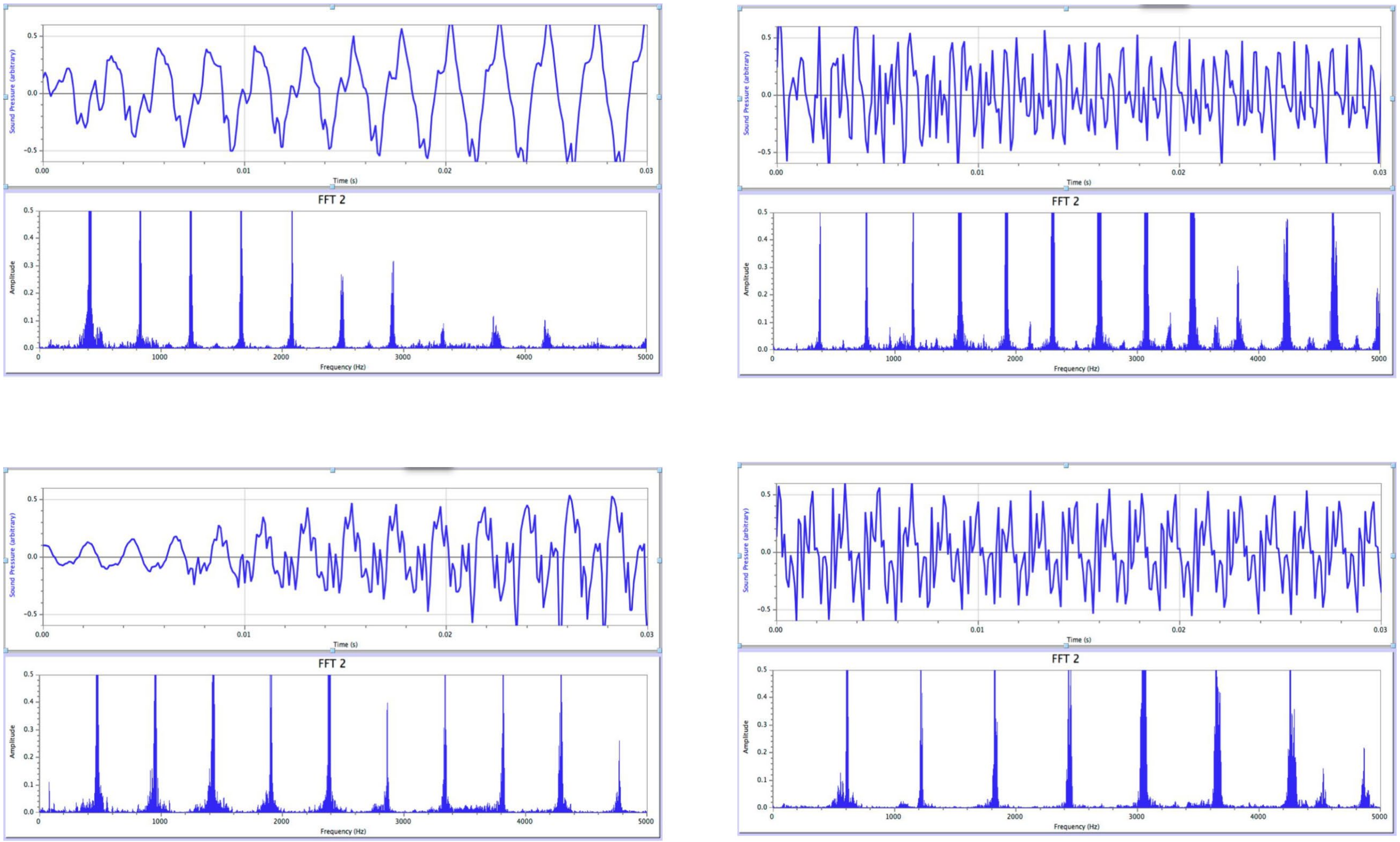
Callalli, sound spectra rank VI, pipe numbers 4, 16, 17 and 19 (clockwise from the top left)



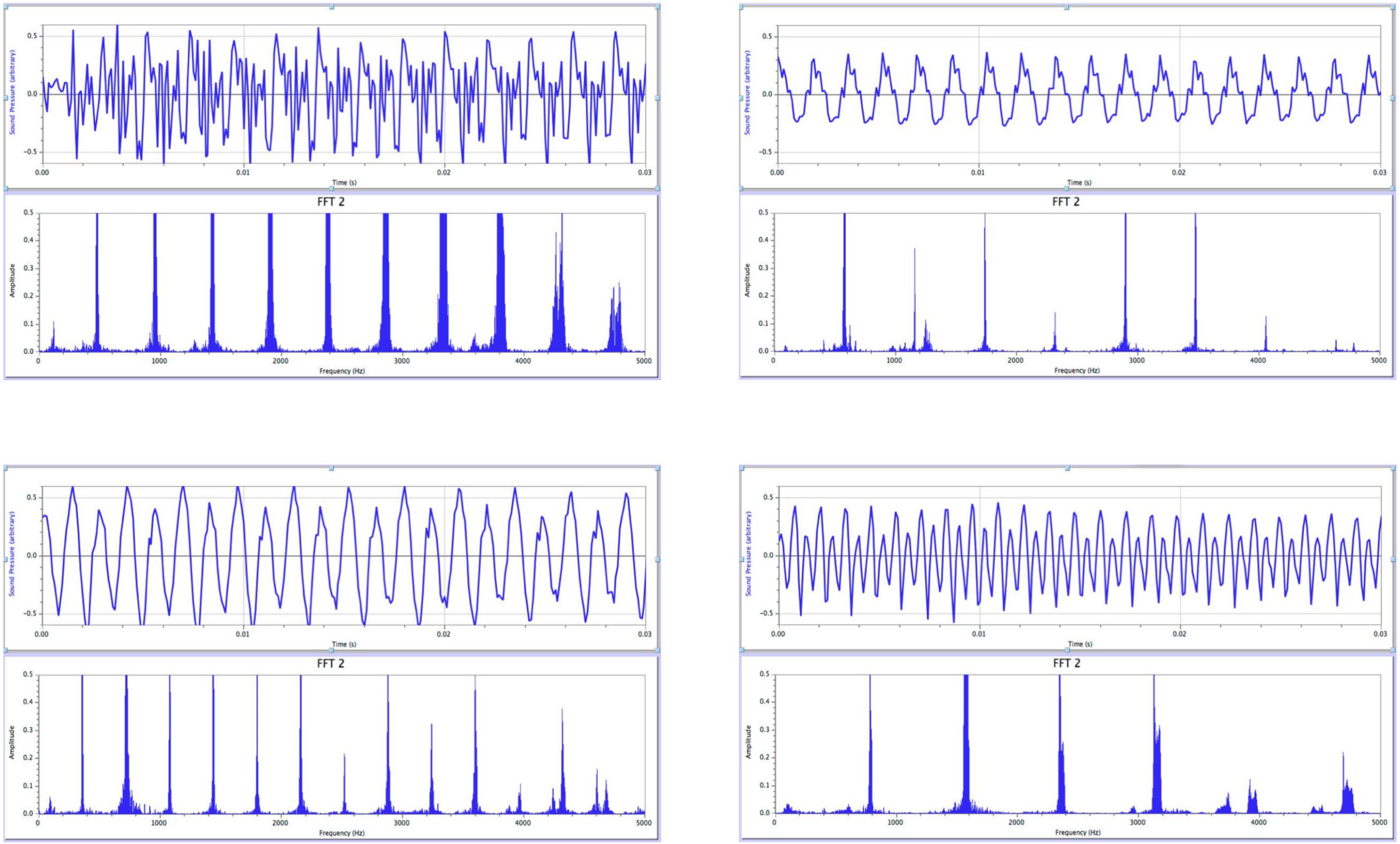
Callalli, sound spectra rank VI, pipe numbers 22, 26, 30 and 32 (clockwise from the top left)



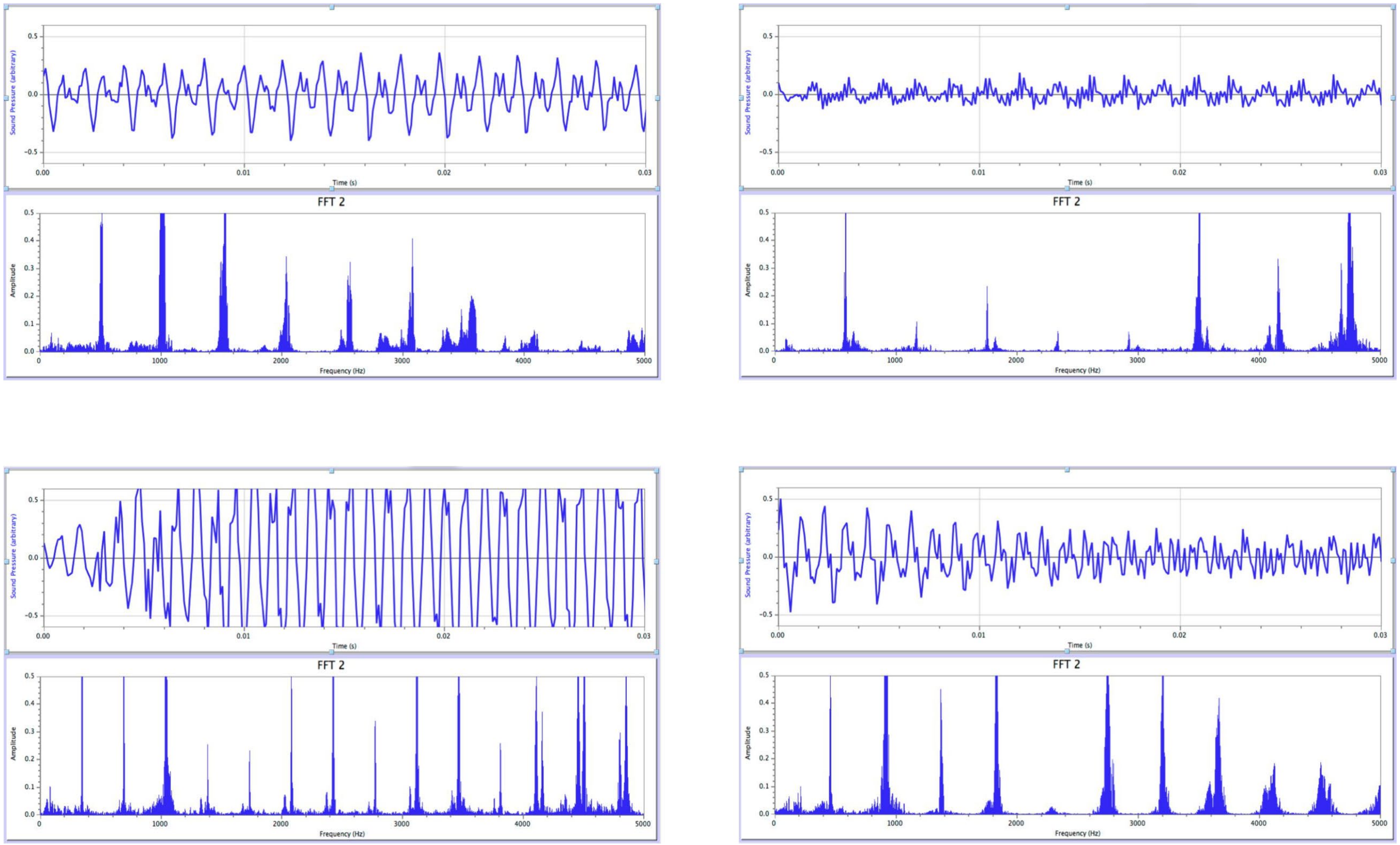
Callalli, sound spectra rank VI, pipe numbers 33, 34, 35 and 36 (clockwise from the top left)



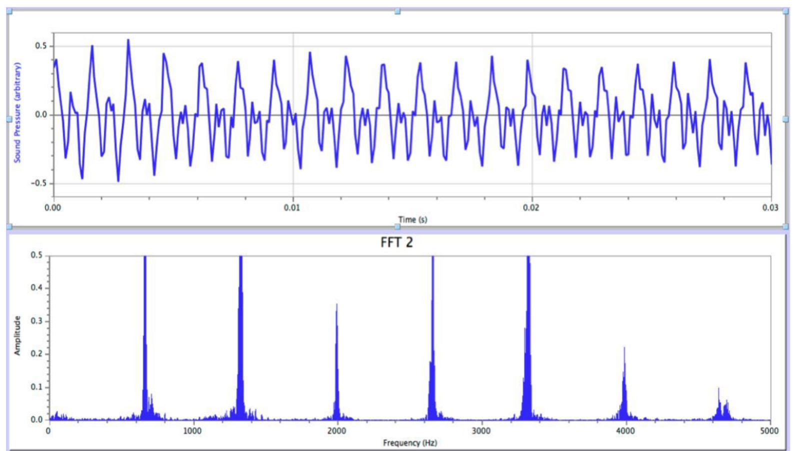
Callalli, sound spectra rank VI, pipe numbers 37, 39, 40 and 41 (clockwise from the top left)



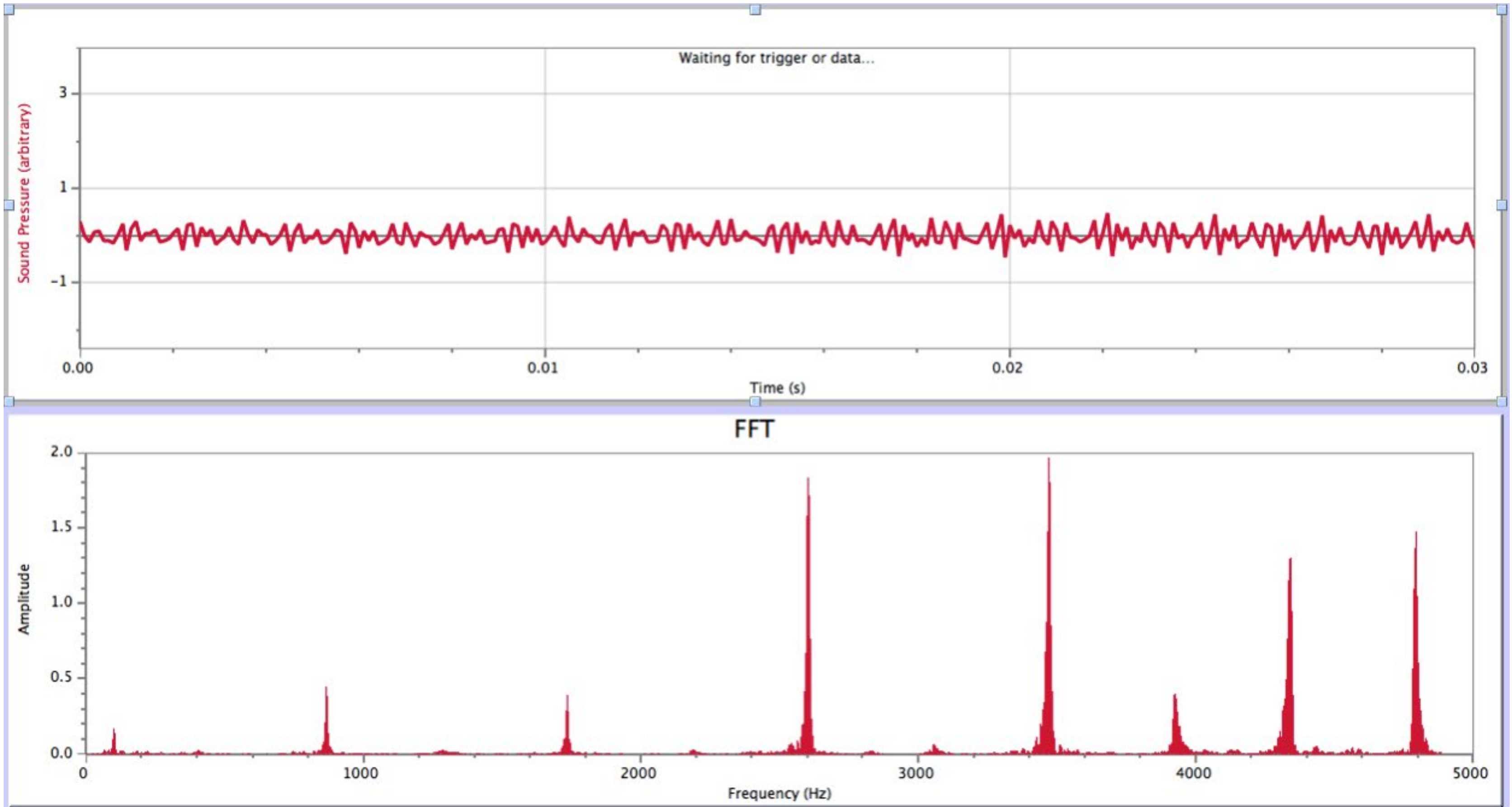
Callalli, sound spectra rank VI, pipe numbers 42, 44, 45 and 46 (clockwise from the top left)



Callalli, sound spectra rank VI, pipe numbers 47, 48, 50 and 53 (clockwise from the top left)



Callalli, sound spectrum rank VI, pipe number 54



Callalli, sound spectrum loose reed pipe

REFERENCES CITED

<u>Published Sources:</u>

Adlung, Jakob. *Musica Mechanica Organoedi*. Berlin, 1768. Edited by Christhard Mahrenholz. Kassel: Bärenreiter, 1961.

Adorno, Rolena. *Colonial Latin American Literature: A Very Short Introduction*. New York: Oxford University Press, 2011.

———. *Guaman Poma: Writing and Resistance in Colonial Peru*. Austin: University of Texas Press, 2000.

Adorno, Rolena, ed. *From Oral to Written Expression: Native Andean Chronicles of the Early Colonial Period*. Foreign and Comparative Studies, Latin American Series, No. 4. Syracuse, NY: Maxwell School of Citizenship and Public Affairs, Syracuse University, 1982.

Agricola, Martin. *Musica Instrumentalis Deudsch: Ynn welcher begriffen ist / wie man nach dem Gesange auff mancherley Pfeiffen lernen sol / auch wie auff die Orge l/ Harffen / Lauten / Geigen / vnd allerley Jnstrument vnd Seytenspiel / nach der rech-gegründten Tabelthur sey abzusetzen*. Wittenberg: Rhaw, 1529. Accessed March 30, 2019. http://conquest.imslp.info/files/imglnks/usimg/e/e8/IMSLP374799-PMLP604999-agricola_Musica_Jnstrumentalis_Deudsch_1529.pdf

Antegnati, Constanzo. *L'arte Organica Di Costanzo Antegnati (Brescia 1608)*. Edited by Renato Lunelli and Paul Smets. Magonza: Rheingold, 1958.

———. "Constanzo Antegnati: L'Arte Organica. Brescia 1608. Kapitel: Modo Di Registrar Li Organi." Translated by Roland Eberlein, n.d. http://www.walcker-stiftung.de/Downloads/Registrierungsanweisungen/Antegnati_Arte_Organica_Modo_di_registrar_1608.pdf.

Apel, Willi. *Geschichte der Orgel- und Klaviermusik bis 1700: mit einer Bibliographie*. Edited by Siegbert Rampe. Kassel: Bärenreiter, 2004.

Aracena, Beth K. "Viewing the Ethnomusicological Past: Jesuit Influences on Araucanian Music in Colonial Chile." *Latin American Music Review/Revista de Música Latinoamericana* 18, no. 1 (1997): 1–29.

Arnaut, Henri. *Les traités D'Henri-Arnault de Zwolle et de divers Anonymes* (Paris: Bibliothèque Nationale, MS. Latin 7295). Edited by Georges Le Cerf and Edmond-René Labande. Kassel: Bärenreiter, 1972.

"Asociación Tomás de Herrera: Para el Estudio y la Preservación de los Órganos Antiguos de la Región Andina." Accessed April 10, 2021. http://asociaciontomasdeherrera.blogspot.com/.

Asselin, Pierre-Yves, and Marie-Claire Alain. *Musique et tempérament*. Paris: Jobert, 2000.

Audsley, George Ashdown. *The Art of Organ-building: A Comprehensive Historical, Theoretical, and Practical Treatise on the Tonal Appointment and Mechanical Construction of Concert-room, Church, and Chamber Organs.* New York: Dodd, 1905.

Bach, Carl Philipp Emanuel. *Versuch über die wahre Art das Clavier zu spielen*. Edited by Wolfgang Horn. Facsimile Reprint. Kassel: Bärenreiter, 2003.

Backus, John. *The Acoustical Foundations of Music*. 2nd ed. New York: Norton, 1977.

———. "Acoustical Investigations of the Clarinet." *Sound: Its Uses and Control* 2, no. 3 (1963): 22–25.

———. "Acoustical Problems in the Bassoon." *The Journal of the Acoustical Society of America* 80, no. S1 (1986): 87.

———. "Behavior and Properties of Clarinet Reeds." *The Journal of the Acoustical Society of America* 33, no. 11 (1961): 1652.

———. "Influence of the Trumpet Mouthpiece on the Input Impedance of the Instrument." *The Journal of the Acoustical Society of America* 59, no. S1 (1976): 51.

———. "Multiphonic Tones in the Woodwind Instruments." *The Journal of the Acoustical Society of America* 62, no. S1 (1977): 43.

———. *Questions and Problems for the Acoustical Foundations of Music*. 2nd ed. New York: Norton, 1978.

———. "Re: Pseudo-Science in Music." *Journal of Music Theory* 4, no. 2 (1960): 221–232.

———. "Resonance Frequencies of the Clarinet." *The Journal of the Acoustical Society of America* 43, no. 6 (1968): 1272–1281.

———. "Resonances in the Bassoon." *The Journal of the Acoustical Society of America* 41, no. 6 (1967): 1608–1609.

Backus, John, and T. C. Hundley. “Generation of Harmonics in the Trumpet.” *The Journal of the Acoustical Society of America* 46, no. 1a (1969): 98.

———. “Trumpet Air-Column Overloading.” *The Journal of the Acoustical Society of America* 47, no. 1a (1970): 131.

———. “Wall Vibrations in Flue Organ Pipes and Their Effect on Tone.” *The Journal of the Acoustical Society of America* 39, no. 5a (1966): 936–945.

Baker, Geoffrey. “La ciudad sonora: música, fiesta y urbanismo en el Cuzco colonial.” In *La fiesta en la época colonial iberoamericana*, edited by Aurelio Tello, 49–71. Santa Cruz de la Sierra, Bolivia: Asociación Pro Arte y Cultura, 2008.

———. *Imposing Harmony: Music and Society in Colonial Cuzco.* Durham, NC: Duke University Press, 2008.

———. “Latin American Baroque: Performance as a Post-Colonial Act?” *Early Music* 36, no. 3 (2008): 441–448.

———. “Indigenous Musicians in the Urban ‘Parroquias de Indios’ of Colonial Cuzco, Peru.” *Il Saggiatore musicale* 9, no. 1/2 (2002): 39–79.

———. “Music at Corpus Christi in Colonial Cuzco.” *Early Music* 32, no. 3 (2004): 355–367.

———. “Music in the Convents and Monasteries of Colonial Cuzco.” *Latin American Music Review/Revista de Música Latinoamericana* 24, no. 1 (2003): 1–41.

———. “Organ builders in colonial Cuzco,” n.d., n.p. Accessed March 3, 2021. https://geoffbakermusic.wordpress.com/music-and-society-in-colonial-cuzco-peru/organ-builders-in-the-diocese-of-cuzco-during-the-colonial-period/.

———. “Parroquia, cofradía, gremio, *ayllu:* organización professional y movilidad en el Cuzco colonial.” In *Música y cultura urbana en la edad moderna*, edited by Andrea Bombi, Juan José Carreras López, and Miguel Ángel Marín, 183–184. Valencia: Universidad de Valencia, 2005.

———. “La vida musical de las doctrinas de indios del obispado del Cuzco,” *Revista Andina* 37 (2003): 181–205.

Baker, Geoffrey, and Tess Knighton, eds. *Music and Urban Society in Colonial Latin America*. Cambridge, UK: Cambridge University Press, 2011.

Bailey, Gauvin Alexander. *Art on the Jesuit Missions in Asia and Latin America, 1542–1773*. Toronto: University of Toronto Press, 1999.

———. *The Andean Hybrid Baroque: Convergent Cultures in the Churches of Colonial Peru*. Notre Dame: University of Notre Dame Press, 2010.

Baines, Anthony. *Musical Instruments through the Ages*. Harmondsworth: Penguin, 1963.

Banchieri, Adriano. *L'Organo Suonarino. With a New Introduction by Giulio Cattin*. Amsterdam: Frits Knuf, 1969.

Bedos de Celles, François. *The Organ-builder*. Translated by Charles Ferguson. Raleigh: The Sunbury Press, 1977.

Béhague, Gerard. *Music in Latin America: An Introduction*. Englewood Cliffs, NJ: Prentice-Hall, 1979.

Benade, Arthur H. *Fundamentals of Musical Acoustics*. New York: Dover, 1990.

———. *On Woodwind Instrument Bores*. New York: Acoustical Society of America, 1959.

Bendix, Regina. *In Search of Authenticity: The Formation of Folklore Studies*. Madison, WI: University of Wisconsin Press, 1997.

Berg, Richard E., and David G. Stork. *The Physics of Sound*. 3rd ed. Upper Saddle River, NJ: Pearson Prentice-Hall, 2005.

Bermudo, Fray Juan. *El libro llamado declaración de Instrumentos musicales.* 1555. Accessed March 30, 2019. http://imslp.org/wiki/El_libro_llamado_declaraci%C3%B3n_de_instrumentos_musicales_(Bermudo%2C_Juan).

Berry, Elizabeth Irene. "Arnolt Schlick's *Spiegel der Orgelmacher und Organisten*: A Translation and Consideration of Its Relationship to the Organ in the Sixteenth Century." PhD diss., University of Oregon, 1972.

Bhabha, Homi K. *The Location of Culture*. New York: Routledge, 1994.

Bie, Jos de. "Gottfried Silbermann." *Orgelkunst* 7 (1984): 23–27.

———. *Historische orgelstemmingen: theorie & realiteit*. Putte: Jos de Bie, 2004.

———. *Stemtoon en stemmingsstelsels*. Putte: Jos de Bie, 2001.

Bigenho, Michelle. *Sounding Indigenous: Authenticity in Bolivian Music Performance.* Hampshire: Palgrave MacMillan, 2002.

Bombi, Andrea, Juan José Carreras López, and Miguel Ángel Marín, eds. *Música y cultura urbana en la edad moderna*. Valencia: Universidad de Valencia, 2005.

Blacking, John. "Ethnomusicology and Prehistoric Music-Making." In *The Archaeology of Early Music Cultures*, edited by Ellen Hickmann and David W. Hughes, 329–335. Bonn: Verlag für Systematische Musikwissenschaft, 1988.

Blume, Friedrich, and Ludwig Finscher, eds. *Die Musik in Geschichte und Gegenwart: Allgemeine Enzyklopädie der Musik: 26 Bände in zwei Teilen*. Kassel: Bärenreiter, 1995.

Bormann, Karl. *Orgel- und Spieluhrenbau. Kommentierte Aufzeichnungen des Orgel- und Musikwerkmachers Ignaz Bruder (1829) und die Entwicklung der Walzenorgeln.* Veröffentlichung der Gesellschaft der Orgelfreunde 34. Zurich: Sanssouci-Verlag, 1968.

Brebos, Gilles. "Die Registrierungen für die vier Orgeln von Gilles Brebos 1579–86 im Kloster San Lorenzo el Real innerhalb des Escorial." Translated by Roland Eberlein, n.d. Accessed March 3, 2021. http://www.walcker-stiftung.de/Downloads/Registrierungsanweisungen/Registrierung_Escorial_1600ca.pdf.

Broggini, Norberto. "Baroque Pathways." Liner notes for *Missa de Lima.* K617, 1999, compact disc.

———. "Colonial organs in Cuzco (III) Xácaras, Chaconas & Marionas by Ruiz de Ribayaz." YouTube. Published July 26, 2011. Accessed March 30, 2019. https://www.youtube.com/watch?v=ftf5IxNsYv8.

Brown, Clive. *Classical and Romantic Performing Practice 1750–1900*. Oxford: Oxford University Press, 2004.

Brown, Howard Mayer, and Stanley Sadie. *Performance Practice: Music Before 1600*. Basingstoke: Macmillan, 1990.

———. *Performance Practice: Music After 1600*. Basingstoke: Macmillan, 1990.

Buchner, Alexander. *Musical Instruments: An Illustrated History*. New York: Crown, 1973.

Bunjes, Paul George. *The Praetorius Organ*. St. Louis: Concordia Publishing House, 1966.

Burns, Kathryn. "Unfixing Race." In *Histories of Race and Racism: The Andes and Mesoamerica from Colonial Times to the Present*, edited by Laura Gotkowitz, 57–71. Durham, NC: Duke University Press, 2011.

Bush, Douglas E., and Richard Kassel, eds. *The Organ: An Encyclopedia*. New York: Routledge, 2006.

Cabello, Joaquín Lois. “Tordesillas, Valladolid,” n.d. https://www.joaquinlois.com/en/organs/historic-organs-restauration/santa-maria-organ-tordesillas/.

Cadena, Marisol de la. “Indigenous Cosmopolitics in the Andes: Conceptual Reflections beyond ‘Politics.’” *Cultural Anthropology* 25, no. 2 (2010): 334–370.

———. *Indigenous Mestizos: The Politics of Race and Culture in Cuzco, Peru, 1919–1991*. Durham, NC: Duke University Press, 2000.

Carreras, Juan José, and Iain Fenlon, eds. *Polychoralities: Music, Identity and Power in Italy, Spain and the New World*. Kassel, Hess: Edition Reichenberger, 2013.

Carter, Stewart, and Jeffery Kite-Powell, eds. *A Performer’s Guide to Seventeenth-Century Music*. 2nd ed. Bloomington: Indiana University Press, 2012.

Charlitos1988. “TINKACHI—Rito.” YouTube. Published August 20, 2014. Accessed March 26, 2018. https://www.youtube.com/watch?v=EEig4FQrxH0.

Chase, Gilbert. *A Guide to the Music of Latin America*. 2nd ed. New York: AMS Press, 1972.

Claro Valdés, Samuel. “Contribución musical del obispo Martínez Compañón en Trujillo, Perú, hacia fines del siglo XVIII.” *Revista Musical Chilena* 34, no. 149–150 (January–June 1980): 18–33.

———. “Música dramática en el Cuzco durante el siglo XVIII y catálogo de manuscritos de música del Seminario de San Antonio Abad (Cuzco-Perú).” *Yearbook of the Inter-American Institute for Musical Research 5* (1969): 1–48.

———. “La música secular de Tomás de Torrejón y Velasco (1644–1728), algunas características de su estilo y notación musical.” *Revista Musical Chilena* 26, no. 117 (January–March 1972): 3–23.

———. *La música virreinal en el Nuevo Mundo*. Santiago de Chile: n.p., 1969.

Cohen-Aponte, Ananda. “Forging a popular art history: *Indigenismo* and the art of colonial Peru.” *Res: Anthropology and Aesthetics* 67–68 (2016/2017): 273–289.

“Concierto En La Catedral Con El Órgano De Loret.” *El Búho*, November 6, 2017. https://elbuho.pe/2017/11/concierto-la-catedral-organo-loret/.

"Conservation and Protection of the Historic Organs." Institute of Historic Organs Oaxaca Mexico. Accessed April 10, 2021. http://iohio.org.mx/eng/protection.htm.

Córdoba Salinas, Diego. *Crónica Franciscana de las provincias del Perú*. Edited by Lino Gómez Canedo. Washington, DC: Academy of American Franciscan History, 1957.

Cornejo Bouroncle, Jorge. *Derroteros de arte cuzqueño: datos para una historia del arte en el Perú*. Cuzco: Ediciones Inca, 1960.

Correa de Arauxo, Francisco. *Libro de tientos y discursos de musica practica y theorica de organo intitulado Facultad organica*. Alcalá de Henares: Antonio Arnao, 1626. Accessed March 30, 2019. http://conquest.imslp.info/files/imglnks/usimg/3/36/IMSLP292787-PMLP475113-parte1.pdf.

Cossío del Pomar, Felipe. *Peruvian Colonial Art: The Cuzco School of Painting*. New York: Wittenborn, 1964.

Craciun, Adriana, and Mary Terrall, eds. *Curious Encounters: Voyaging, Collecting, and Making Knowledge in the Long Eighteenth Century*. Toronto: University of Toronto Press, 2019.

Cummins, Tom. "Let Me See! Reading Is for Them: Colonial Andean Images and Objects 'como es costumbre tener los caciques Señores.'" In *Native Traditions in the Postconquest*, edited by Elizabeth Hill Boone and Tom Cummins, 91–148. Washington, DC: Dumbarton Oaks, 1998.

———. *Toasts with the Inca: Andean Abstraction and Colonial Images on Quero Vessels*. Ann Arbor: University of Michigan Press, 2002.

Cyr, Mary. *Performing Baroque Music*. Portland, OR: Amadeus Press, 1992.

Dean, Carolyn, and Dana Leibsohn. "Hybridity and Its Discontents: Considering Visual Culture in Colonial Spanish America." *Colonial Latin American Review* 12, no. 1 (2003): 5–35.

Diamond, Beverley, M. Sam Cronk, and Franziska von Rosen. *Visions of Sound: Musical Instruments of First Nations Communities in Northeastern America*. Chicago: University of Chicago Press, 1994.

Diruta, Girolamo. *Il Transilvano.* Facsimile reprint. Bologna: Forni, 1969.

———. *Il transilvano*. Edited by Edward J. Soehnlen and Murray C. Bradshaw. Buren: Knuf, 1983.

Dobyns, Henry F., and Paul L. Doughty. *Peru: A Cultural History.* Latin American Histories. New York: Oxford University Press, 1976.

Dodds, Michael. "Organ Improvisation in 17th-Century Office Liturgy. Contexts, Styles, and Sources." *Philomusica On-line* 11, no. 2 (2012). Accessed May 19, 2016. http://dx.doi.org/10.6092/1826-9001.11.1450.

Donahue-Wallace, Kelly. *Art and Architecture of Viceregal Latin America, 1521–1821*. Albuquerque: University of New Mexico Press, 2008.

Donington, Robert. *The Instruments of Music*. London: Methuen, 1970.

Dournon, Geneviève. "Organology." In *Ethnomusicology: An Introduction*, edited by Helen Myers, 245–300. New York: Norton, 1992.

Dube, Saurabh, ed. *Enduring Enchantments*. Durham, NC: Duke University Press, 2002.

Duffin, Ross W. *How Equal Temperament Ruined Harmony (and Why You Should Care)*. New York: Norton, 2008.

———. "Why I Hate Vallotti (or is it Young?)." *Historical Performance* 1 (January 2000). Accessed March 25, 2019. http://earlymusic.org/publications/historical-performance-online.

Durston, Alan. "Apuntes para una historia de los himnos quechuas del Cusco/Notes on the History of the Quechua Hymns of Cuzco," *Chungara: Revista de Antropología Chilena* 42, no. 1 (January–June 2010): 147–155.

Echevarría, Pedro de. "Die Registrierungsanweisung für die Orgel von Pedro de Echevarría 1772 in der Kathedrale Segovia." Translated by Roland Eberlein and Rudolf Walter. Accessed March 19, 2021. http://www.walcker-stiftung.de/Downloads/Registrierungsanweisungen/Registrierung_Segovia_Catedral_1772.pdf.

"Elevation - Temperature, Pressure and Speed of Sound." Engineering ToolBox. Accessed March 13, 2021. https://www.engineeringtoolbox.com/elevation-speed-sound-air-d_1534.html.

Ellerhorst, Winfred, and Gregor Klaus. *Handbuch der Orgelkunde*. Buren: Knuf, 1986.

Engramelle, Marie-Dominique-Joseph. *La Tonotechnie, ou, l'Art de noter les cylindres et tout ce qui est susceptible de notage dans les instrumens de concerts méchaniques (1775).* Reprint, Paris: Hermann, 1993.

Estebaranz, Ángel Justo, and Alfonso Ojeda Barrera. "Órganos, organeros y organistas en la iglesia de Santa María de Carmona (1507–1743)." *Laboratorio de Arte* 29 (2017): 155–76.

Estenssoro Fuchs, Juan Carlos. *Música y sociedad coloniales: Lima 1680–1830*. Lima: Colmillo Blanco, 1989.

"Festividades En Callalli." Sobre Peru, September 6, 2016. Accessed March 26, 2018. https://sobre-peru.com/2010/02/15/festividades-en-callalli/.

Fidom, Hans. *Diversity in Unity: Discussions on Organ Building in Germany between 1880 and 1918*. Dieren: Royal Dutch Organists Association, 2002.

———. *Hoe mooi huilt de wolf? Orgelstemmingen in de tijd van Albertus Anthoni Hinsz*. Groningen: Stichting Groningen Orgelland, 2005.

"Fiesta San Antonio de Callalli 2015." YouTube. Published September 5, 2015. Accessed March 26, 2018. https://www.youtube.com/watch?v=U11HTucNBaQ.

Fletcher, Neville H., and Thomas D. Rossing. *The Physics of Musical Instruments*. 2nd ed. New York: Springer, 2011.

Frescobaldi, Girolamo. "Avvertimenti al lettore." Preface to *Il Primo libro di Toccate e Partite d'Intavolatura di Cimbal (1628).* Accessed March 3, 2021. https://storiadellamusicafiore.com/2012/04/14/frescobaldi-avvertimento-al-lettore.

Fuente Charfolé, José Luis de la. "La música sacra en castilla en la baja edad media: Documentación sobre maestros de capilla, cantores, órganos y organistas de la catedral de cuenca (1195–1496)." *Anuario Musical* 71 (2016): 3–20.

Garrett, Lee R. "Adriano Banchieri's *Conclusioni nel suono dell'organo* of 1609: A Translation and Commentary." PhD diss, University of Oregon, 1972.

Gasta, Chad M. "Public Reception, Politics, and Propaganda in Torrejón's *loa* to La púrpura de la rosa, the First New World Opera." *Latin American Theatre Review* 37, no. 13 (Fall 2003): 43–60.

Gembero-Ustárroz, María. "Música en la Catedral de Lima en tiempos del arzobispo Mogrovejo (1581–1606): Gutierre Fernández Hidalgo, la Consueta de 1593, la participación indígena." *Resonancias: Revista de Investigación Musical* 20, no. 39 (November 2020): 13–41.

Gemert, Hans van. *Organos históricos del Perú = Historic organs of Peru*. Hillbrow, South Africa: H. van Gemert, 1990.

Gierveld, Arend Jan. *Inleiding tot de orgelbouw*. 3rd ed. Houten: Gereformeerde Organisten Vereniging, 1982.

———. *Het Nederlandse huisorgel in de 17de en 18de eeuw*. Utrecht: Vereniging voor Nederlandse Muziekgeschiedenis, 1977.

Giovani, Giulia. "'Ecco a Vostra Signoria quello che si è risoluto.' Sulla genesi delle cantate opera I di Giacomo Antonio Perti." *Rivista Italiana di Musicologia* 47 (2012): 124–155.

Girón, Sara, Lidia Álvarez-Morales, and Teófilo Zamarreño. "Church Acoustics: A State-of-the-Art Review after Several Decades of Research." *Journal of Sound and Vibration* 411 (2017): 378–408.

Glassie, Henry. "Tradition." *The Journal of American Folklore* 108, no. 430 (1995): 395–412.

Gonzales, Odi, Christine Mladic, and Emily F. Thompson. *Quechua-English-Spanish Dictionary.* New York: Hippocrene Books, 2017.

Guamán Poma de Ayala, Felipe. *El primer nueva corónica y buen gobierno*, Ms. Gammel Kongelig Samling (GKS) 2232, 4. Royal Library, Copenhagen, Denmark. Accessed March 30, 2019. http://www.kb.dk/permalink/2006/poma/info/en/frontpage.htm.

González Galván, Manuel. "El rostro oculto de la catedral de Oaxaca." *Anales del Instituto de Investigaciones Estéticas* 15, no. 58 (1987): 85–96.

Grases, Cristian. "Is It Really Just Baroque? An Overview of Latin American Colonial Choral Music." *The Choral Journal* 55, no. 2 (2014): 24–35.

Guss, David. "The Gran Poder and the Reconquest of La Paz." *The Journal of Latin American and Caribbean Anthropology* 11, no. 2 (2011): 294–328.

Gutierrez, Virgilio Galdo. *Educación de los Curacas: una forma de dominación dolonial*. Huamanga: Ediciones Waman Puma, 1982.

Haas, Robert. *Die Musik Des Barocks*. Wildpark-Potsdam: Akademische Verlagsgesellschaft Athenaion, 1928.

Hakalahti, Iina-Karita. "Maestro Francisco Correa de Arauxos (1584–1654) *Facultad orgánica* (1626) as a Source of Performance Practice." PhD diss, Sibelius Academy Helsinki, 2008.

Hammond, Frederick. "Frescobaldi's Instruments." Girolamo Frescobaldi: An Extended Biography. Accessed April 10, 2021. https://girolamofrescobaldi.com/11-frescobaldis-instruments/#_ftn53.

Harrold, Greg. "The Spanish Baroque Organ at Oberlin." *Vox Humana*. Accessed April 10, 2021. https://www.voxhumanajournal.com/harrold2019.html.

Haynes, Bruce. *A History of Performing Pitch: The Story of "A"* Lanham, MD: The Scarecrow Press, 2002.

Heilbron, J. L. *The Sun in the Church: Cathedrals as Solar Observatories*. Cambridge, MA: Harvard University Press, 1999.

Heurn, Johan van. *Volledige beschrijving van alle konsten, ambachten, handwerken, fabrieken, trafieken, derzelver werkhuizen, gereedschappen, enz.: ten deele overgenomen uit de beroemdste buitenlandsche werken; en vermeerderd met de theorie en praktijk der beste inlandsche konstenaaren en handwerkslieden*. Dordrecht: A. Blussé en Zoon, 1804.

Higgins, James. *Lima: A Cultural History*. New York: Oxford University Press, 2005.

Hill, John Walter. *Baroque Music: Music in Western Europe, 1580–1750*. The Norton Introduction to Music History. New York: Norton, 2005.

Hudson, Barton, and Louis Jambou. "Correa de Arauxo, Francisco." *Grove Music Online*. Accessed June 15, 2017. http://www.oxfordmusiconline.com/subscriber/article/grove/music/06556.

Hufford, Mary. "Interrupting the Monologue: Folklore, Ethnography, and Critical Regionalism." *Journal of Appalachian Studies* 8, no. 1 (2002): 62–78.

Hutchins, Carleen Maley, ed. *The Physics of Music: Readings from Scientific American*. San Francisco: W.H. Freeman, 1978.

"Iglesia de Lerma, Colegiata de San Pedro." In *Historic Organs of Spain*, 78. American Public Media, 2013. Accessed March 2, 2021. https://pipedreams.publicradio.org/tour/2013spain/2013pipedreams-posttrip.pdf.

Illari, Bernardo. "Myths and Realities of the Jesuit Reductions." Liner notes for *Zipoli, San Ignacio Vespers.* K617, 1992, compact disc.

———. "Recreating the Music, Reviving the Liturgy." Liner notes for *Roque Ceruti, Vêpres Solenelles de Saint-Jean Baptiste.* K617, 1998, compact disc.

———. "The Popular, the Sacred, the Colonial and the Local: The Performance of Identities in the Villancicos from Sucre (Bolivia)." In *Devotional Music in the Iberian World: 1450–1800: The Villancico and Related Genres*, edited by Tess Knighton. Aldershot: Ashgate, 2007.

"Información sobre pueblos y ciudades de Perú." Ciudades y Distritos del Perú. Accessed April 11, 2021. https://www.distrito.pe/.

Isacoff, Stuart. *Temperament: How Music Became a Battleground for the Great Minds of Western Civilization.* New York: Vintage Books Random House, 2001.

Jambou, Louis. *Evolución del órgano español: Siglos XVI-XVIII*. Oviedo: Universidad de Oviedo, 1988.

Jorgensen, Owen. *Tuning the Historical Temperaments by Ear: A Manual of Eighty-nine Methods for Tuning Fifty-one Scales on the Harpsichord, Piano, and Other Keyboard Instruments*. Marquette: Northern Michigan University Press, 1977.

Karosi, Balint. "1774 Italian Positive in Roccavione, Cuneo, Italy." YouTube. Published October 23, 2018. Accessed March 12, 2021. https://www.youtube.com/watch?v=nVHbBHwMbgA.

Kartomi, Margaret. "On Metaphor and Analogy in the Concepts and Classification of Musical Instruments in Aceh." *Yearbook for Traditional Music* 37 (2005): 25–57.

Kircher, Athanasius. *Musurgia Universalis.* Edited by Ulf Scharlau. Hildesheim: G. Olms, 1970.

Kloeckner, Phillip David. "Nineteenth-Century Organs in Peru and the Special Case of Innocente Foglia." DMA thesis, Rice University, 2002.

Klotz, Hans. *Über die Orgelkunst der Gotik, der Renaissance und des Barock: Musik, Disposition, Mixturen, Mensuren, Registrierung, Gebrauch d. Klaviere.* Kassel: Bärenreiter, 1975.

Knighton, Tess. *Devotional Music in the Iberian World: 1450–1800: The Villancico and Related Genres*. Aldershot: Ashgate, 2007.

———. "Music and Ritual in Urban Spaces: The Case of Lima, c. 1600." In *Music and Urban Society in Colonial Latin America*, edited by Geoffrey Baker and Tess Knighton, 21–42. Cambridge, UK: Cambridge University Press, 2011.

Koster, John. "Traditional Iberian Harpsichord Making in Its European Context." *The Galpin Society Journal* 61 (2008): 3–78.

Kuss, Malena, ed. *Music in Latin America and the Caribbean: An Encyclopedic History*. Austin: University of Texas Press, 2004.

Laukvik, Jon. *Historical Performance Practice in Organ Playing*. Stuttgart: Carus-Verlag, 1996.

Lehman, Bradley. "Bach's Extraordinary Temperament: Our Rosetta Stone: 1." *Early Music* 33, no. 1 (2005): 3–23.

León, Javier F. "National Patrimony and Cultural Policy: The Case of the Afroperuvian Cajón." In *Music and Cultural Rights*, edited by Andrew N. Weintraub and Bell Yung, 110–139. Urbana: University of Illinois Press, 2009.

León, Javier F., and Helena Simonett, eds. *A Latin American Music Reader: Views from the South*. Urbana: University of Illinois Press / Society for Ethnomusicology, 2016.

Lindner, Wolfgang. "Órganos coloniales e históricos del Perú y de la región del Cuzco." *Revista Andina* 42 (2006): 219–248. http://www.revistaandinacbc.com/wp-content/uploads/2016/ra42/ra-42-2006-08.pdf.

Madrid, Fernando Antonio de. "Fernando Antonio De Madrid: Cartas Instructivas Sobre Los Organos. Jaen 1790." Translated by Roland Eberlein. Accessed March 19, 2021. http://www.walcker-stiftung.de/Downloads/Registrierungsanweisungen/De_Madrid_Cartas_instructivas_1790.pdf.

Main, Jeremy. "A Vanished El Dorado." *Archaeology* 54, no. 2 (2001): 46–52.

Marcase, Donald Earl. "Adriano Banchieri, *L'Organo suonarino*: Translation, Transcription and Commentary." PhD diss, Indiana University, 1970.

Martínez Ulloa, Jorge. "Indigenous Music and Identity: Musical Spaces of Urban Mapuche Communities." In *Views from the South: A Latin American Music Reader*, edited by Javier F. León and Helena Simonett, 356–378. Urbana: University of Illinois Press, 2016.

Masini, Antonio. *Bologna Perlustrata (1666)*. Sala Bolognese: A. Forni, 1986.

Mattheson, Johann. *Der Vollkommene Kapellmeister, 1739: Faksimile-Nachdruck*. Edited by Margarete Reimann. Kassel: Bärenreiter, 1995.

May, Elizabeth. *Musics of Many Cultures: An Introduction*. Berkeley: University of California Press, 1980.

Mendoza, Zoila S. *Creating Our Own: Folklore, Performance, and Identity in Cuzco, Peru.* Durham, NC: Duke University Press, 2008.

———. "Defining Folklore: Mestizo and Indigenous Identities on the Move." *Bulletin of Latin American Research* 17, no. 2 (1998): 165–83.

———. "Performing Decency: Ethnicity and Race in Andean 'Mestizo' Ritual Dance." In *Music and the Racial Imagination*, edited by Ronald Radano and Philip V. Bohlman, 231–270. Chicago: University of Chicago Press, 2000.

Mignolo, Walter D. "Coloniality: The Darker Side of Modernity." In *Modernologies: Contemporary Artists Researching Modernity and Modernism*, edited by Sabine Breitwieser, Cornelia Klinger, and Walter D. Mignolo, 39–49. Barcelona: MACBA, 2009.

———. *The Darker Side of Western Modernity: Global Futures, Decolonial Options*. Durham, NC: Duke University Press, 2011.

Mischiati, Oscar. "Documenti sull' organaria padana rinascimentale. I: Giovanni Battista Facchetti." *L'organo* 22 (1984): 23–160.

———. "Facchetti, Giovanni Battista." In *Dizionario Biografico degli Italiani*. Istituto dell'Enciclopedia Italiana, 1925–2020. Accessed May 19, 2016. http://www.treccani.it/enciclopedia/giovanni-battista-facchetti_(Dizionario_Biografico)/.

Mischiati, Oscar, and Luigi Ferdinando Tagliavini. *Gli organi della Basilica di San Petronio in Bologna*. Bologna: Pàtron, 2013.

Monson, Craig A. *Disembodied Voices: Music and Culture in an Early Modern Italian Convent.* Berkeley: University of California Press, 1995.

Muinck, Henk de. "Veendamse musici en een uniek orgel." *Protestanse Kerkbode*, Leeuwarden, October 2018.

Mulholland, Mary-Lee. "*Mariachi*, Myths and *Mestizaje*: Popular Culture and Mexican National Identity." *National Identities* 9, no. 3 (2007): 247–264.

Muneta, Jesús. "Apuntes para la historia de la musica en la catedral de Albarracin (Teruel): los maestros de capilla y organistas." *Revista de Musicología* 6, no. 1/2 (1983): 329–372.

Murray, Peggy L. "Dancing in the Seminary: Reconstructing Dances for a 1749 Viceregal Peruvian Opera." PhD diss., Ohio University, 2015.

Nawrot, Piotr. "Lo autóctono y lo traído, fiesta en las misiones jesuíticas de guaraníes, moxos y chiquitos." In *La fiesta en la época colonial iberoamericana*, edited by Aurelio Tello, 231–259. Santa Cruz de la Sierra, Bolivia: Asociación Pro Arte y Cultura, 2008.

———. "Opera Production in the Jesuit Reductions." Liner notes for *Mission San Francisco Xavier: Ópera y Misa de los Indios.* K617, 2000, compact disc.

———. "Teaching of Music and the Celebration of Liturgical Events in the Jesuit Reductions." *Anthropos* 99, no. 1 (2004): 73–84.

Neumann, Frederick, and Jane Stevens. *Performance Practices of the Seventeenth and Eighteenth Centuries*. New York: Schirmer Books, 1993.

New China TV. "Ancient Dance Wititi of Peru Elated to Be UN Intangible Cultural Heritage." YouTube. Published December 2, 2015. Accessed March 19, 2021. https://www.youtube.com/watch?v=9H8RVFzgoPY.

Ocsa Ocsa, Zacarías. *Colca: maravilloso destino turístico*. Arequipa, Peru: Ediciones Colca Entertainment, 2010.

———. *La danza de los cóndores*. Tradiciones del Colca. Arequipa, Peru: Comercial Cueva Impresores, 2014.

———. *Misterioso romance de Ciro*. Tradiciones del Colca. Arequipa, Peru: Cueva Impresores, 2011.

———. *El sacerdote andino*. Tradiciones Arequipeñas. Arequipa, Peru: Comercial Cueva Impresores, 2015.

Olsen, Dale A. *The Music of El Dorado: The Ethnomusicology of Ancient South American Cultures.* Gainesville: University Press of Florida, 2002.

Olsen, Dale A., and Daniel A. Sheehy, eds. *The Garland Encyclopedia of World Music*: *South America, Mexico, Central America, and the Caribbean*, vol. 2. New York: Garland, 1998.

———. *The Garland Handbook of Latin American Music*. New York: Garland, 2000.

Oosterhof, A. P., and Arie Bouman. *Orgelbouwkunde: hand- en leerboek voor orgelbouwers, adviseurs bij orgelbouw, architecten en organisten.* Leiden: Spruyt, 1971.

Owen, Barbara, and Peter Williams, "Organ." *Grove Music Online*. Accessed March 13, 2021. https://www.oxfordmusiconline.com/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo-9781561592630-e-0000044010.

Palacios Sanz, José Ignacio. "La organería en Castilla y León en tiempos de Antonio de Cabezón." *Revista de Musicología* 34, no. 2 (2011): 285–316.

Palacios Sanz, José Ignacio, and José Rogelio Buendía. "Órganos y organeros en la provincia de Soria." *Revista de Musicología* 17, no. 1/2 (1994): 407–408.

Palma, Ricardo, and Lucilo Oriz. *Tradiciones Peruanas*, 3rd ed. Clásicos Troquel. Buenos Aires: Ediciones Troquel, 1963.

Pauly, Reinhard G. *Music in the Classic Period*. Prentice-Hall History of Music Series. Englewood Cliffs, NJ: Prentice-Hall, 1965.

Pepe, Edward C. "An Organ by Jorge de Sesma for Mexico City Cathedral." *Revista de Musicología* 29, no. 1 (2006): 127–162.

Plitnik, G. R. “Vibration Characteristics of Pipe Organ Reed Tongues and the Effect of the Shallot, Resonator, and Reed Curvature.” *The Journal of the Acoustical Society of America* 107 (2000): 3460–3473.

Polijakowksi, Max. Transcription of Correa de Arauxo’s *Quinto tiento del quarto tuono.* http://ks.imslp.info/files/imglnks/usimg/0/0d/IMSLP430569-PMLP699679-Quinto_tiento_de_quarto_tono_FO19.pdf.

Praet, Wilfried. *Orgelwoordenboek = Organ Dictionary*. Nieuwkerken, Belgium: CEOS, 2000.

Praetorius, Michael. *Syntagma musicum*. Wolfenbüttel, 1619. Edited by Wilibald Gurlitt. Reprint, Kassel: Bärenreiter, 1985.

Primialcon. “Tradicional corrida de toros en Callalli.” YouTube. Published January 20, 2015. Accessed March 26, 2018. https://www.youtube.com/watch?v=9TazsQbRapw.

Pykett, Colin. “The Frequency Spectra of Diapason Pipes.” Accessed March 3, 2021. http://www.colinpykett.org.uk/observations-on-organ-pipe-sounds-frequency-spectra.htm#Spectra-Diapasons.

Quantz, Johann Joachim. *Versuch einer Anweisung die flute traversiere zu spielen,* 3rd ed. Breslau: J.F. Korn, 1789. Edited and translated by Edward R. Reilly. 2nd ed. Boston: Northeastern University Press, 2001.

Radano, Ronald, and Tejumola Olaniyan, eds. *Audible Empire: Music, Global Politics, Critique.* Durham, NC: Duke University Press, 2016.

Ramos Yucra, Walter B. *Fragmentos históricos de la provincia de Caylloma*. Arequipa, Peru: n.p., 2018.

———. *Monografía y fuentes documentales sobre la historia del distrito de Callalli*. Arequipa, Peru: Publicon, 2018.

Reichling, Alfred, ed. *Mundus Organorum: Festschrift Walter Supper Zum 70. Geburtstag*. Berlin: Merseburger, 1978.

Reinburg, Peggy Kelley. *Arp Schnitger, Organ Builder: Catalyst for the Centuries*. Bloomington: Indiana University Press, 1982.

Reuter, Rudolf, and Hannelore Reuter. *Orgeln in Spanien*. Kassel: Bärenreiter, 1986.

Rios, Fernando. “The Andean *Conjunto*: Bolivian *Sikureada* and the Folkloric Musical Representation Continuum.” *Ethnomusicology Forum* 21, no. 1 (2012): 5–29.

Ritter, Jonathan. “Chocolate, Coconut, and Honey: Race, Music, and the Politics of Hybridity in the Ecuadorian Black Pacific.” *Popular Music and Society* 34, no. 5 (2011): 571–592.

Rodys, Ryszard. “Los maestros organistas de la catedral de Oaxaca, un grupo profesional poco conocido.” Instituto de Órganos Históricos de Oaxaca, A.C., 2009. Accessed March 25, 2019. http://iohio.org.mx/esp/documents/OrganeroscatedralRicardo.odt.pdf

———. “Órganos, organeros y organistas de la catedral de Oaxaca.” Unpublished manuscript, 2010. Accessed March 30, 2019. https://docs.google.com/document/d/1uccl3ifAfUIPWMTAH6txt37rO2GRr062E-56fuO9pRc/preview.

Rondón, Víctor, and Alejandro Vera. “A propósito de nuevos sonidos para nuevos reinos: prescripciones y prácticas músico-rituales en el área surandina colonial.” *Latin American Music Review/Revista de Música Latinoamericana* 29, no. 2 (2008): 190–231.

Rucz, Péter, Judit Angster, Fülöp Augusztinovicz, András Miklós, and Tim Preukschat. “Modeling Resonators of Reed Organ Pipes.” Paper presented at AIA-DAGA, Merano, Italy, 2013. Accessed March 3, 2021. https://www.researchgate.net/publication/298965962_Modeling_resonators_of_reed_organ_pipes

Sanguinetti, Giorgio. *The Art of Partimento: History, Theory, and Practice.* New York: Oxford University Press, 2012.

Santamaría, Tomás de. “Arte de tañer fantasia.” Accessed April 10, 2021. https://imslp.org/wiki/Arte_de_Ta%C3%B1er_Fantasia_(Santamar%C3%ADa%2C_ToT%C3%A1s).

Sas Orchassal, Andrés. *La música en la catedral de Lima durante el virreinato.* Lima: Universidad Nacional Mayor de San Marcos, 1972.

———. “La púrpura de la rosa,” *Boletín de la Biblioteca Nacional* 2, no. 5 (October 1944): 9.

Saunders, Frederick A. “Physics and Music.” *Scientific American* 179, no. 1 (1948): 32–41.

Schlick, Arnolt. *Spiegel der Orgelmacher und Organisten: Allen Stiften und Kirchen, so Orgeln halten oder machen lassen, hochnützlich, durch den hochberümten und kunstreichen Meister Arnold Schlick, pfaltzgräflichen Organisten, gewissenhaft verfasst.* 1511. Edited by Ernst Flade. Kassel: Bärenreiter Verlag, 1951.

Schneider, Thekla. *Die Namen der Orgelregister: Kompendium von Registerbezeichnungen aus alter und neuer Zeit mit Hinweisen auf die Entstehung der Namen und deren Bedeutung.* Kassel: Bärenreiter, 1970.

Schnoebelen, Anne. "Bologna, 1580–1700." In *The Early Baroque Era: From the Late 16th Century to the 1660s*, edited by Curtis Price, 103–120. Englewood Cliffs, NJ: Prentice Hall, 1993.

———. "Cazzati vs. Bologna: 1657–1671." *The Musical Quarterly* 57, no. 1 (1971): 26–39.

Simmons, Ozzie G. "The Criollo Outlook in the Mestizo Culture of Coastal Peru." *American Anthropologist* 57, no. 1 (1955): 107–117.

Slawson, Wayne. Review of *The Acoustical Foundations of Music*, by John Backus, and *The Technology of Computer Music*, by M. V. Mathews. *Journal of Music Theory* 13, no. 1 (1969): 148–151.

Small, Christopher. "Musicking — the Meanings of Performing and Listening. A Lecture." *Music Education Research* 1, no. 1 (1999): 9–22.

Snyder, Kerala J. *The Organ as a Mirror of Its Time: North European Reflections, 1610–2000.* Oxford: Oxford University Press, 2002.

Speerstra, Joel, ed. *The North German Organ Research Project at Göteborg University*. Göteborg, Sweden: Göteborg Organ Art Center, Göteborg University, 2003.

Steck, Daniel A. *Musical Temperament*. Revision 0.2.5. Eugene: University of Oregon, 2017. Accessed March 30, 2019. http://atomoptics-nas.uoregon.edu/~dsteck/teaching/temperament/temperament.pdf

Steel, David Warren. "Historic Organs of Oaxaca." Accessed March 30, 2019. http://home.olemiss.edu/~mudws/oaxaca/.

Stevenson, Robert. *Juan Bermudo*. The Hague: Martinus Nijhoff, 1960.

———. *Music in Mexico: A Historical Survey*. New York: Crowell, 1952.

———. "The Music of Colonial Spanish America." In *The Cambridge History of Latin America, Volume Two: Colonial Latin America*, edited by Leslie Bethell, 771–778. Cambridge, UK: Cambridge University Press, 1984.

———. *The Music of Peru: Aboriginal and Viceroyal Epochs,* Washington, DC: Pan American Union, 1960.

———. “A Note on the Music of Colonial Brazil.” In *The Cambridge History of Latin America, Volume Two: Colonial Latin America*, edited by Leslie Bethell, 779–803. Cambridge, UK: Cambridge University Press, 1984.

Stewart, Charles. *Creolization: History, Ethnography, Theory.* Walnut Creek, CA: Left Coast Press, 2007.

Stobart, Henry. “In Touch with the Earth? Musical Instruments, Gender and Fertility in the Bolivian Andes.” *Ethnomusicology Forum* 17, no. 1 (2008): 67–94.

———. *Music and the Poetics of Production in the Bolivian Andes.* Burlington, VT: Ashgate, 2006.

Stobart, Henry, and Ian Cross. “The Andean Anacrusis? Rhythmic Structure and Perception in Easter Songs of Northern Potosí, Bolivia.” *British Journal of Ethnomusicology* 9, no. 2 (2000): 63–92.

Stone-Miller, Rebecca. *Art of the Andes: From Chavín to Inca*. 2nd ed. London: Thames & Hudson, 2002.

Summer, William Leslie. *The Organ, Its Evolution, Principles of Construction and Use*. London: MacDonald and Co., 1952.

“The Free Online Labor Law Resource.” Federal and State Minimum Wage Rates for 2021. Accessed April 11, 2021. https://www.minimum-wage.org/.

Thurner, Mark. *History’s Peru: The Poetics of Colonial and Postcolonial Historiography*. Gainesville: University Press of Florida, 2011.

“TINKACHO—CALLALLI.” YouTube. Published February 20, 2013. Accessed March 26, 2018. https://www.youtube.com/watch?v=GgS-oEBRbqo.

“TINKACHO—CALLALLI PARTE 1.” YouTube. Published February 20, 2013. Accessed March 26, 2018. https://www.youtube.com/watch?v=nODEvpRJFxA.

Tomlinson, Gary. *Singing of the New World: Indigenous Voice in the Era of European Contact*. Cambridge and New York: Cambridge University Press, 2009.

Tomás de Santa María. *Libro llamado Arte de tañer fantasía, assi para tecla como para vihuela, y todo instrumento, en que pudiere tañer a tres, y a quatro vozes, y a más ... fue aprouado por el eminente musico de su Magestad Antonio de Cabeçon, y por Iuan de Cabeçon, su hermano*. Valladolid: Francisco Fernández de Cordova, 1565. Accessed March 2018. http://imslp.org/wiki/Arte_de_Ta%C3%B1er_Fantasia_(Santamar%C3%ADa,_Tom%C3%A1s)

Trommer, Thomas, Judit Angster, and András Miklós, "Roughness of Organ Pipe Sound Due to Frequency Comb." *The Journal of the Acoustical Society of America* 131, no. 1 (2012): 739–748.

Tucker, Joshua. "Permitted Indians and Popular Music in Contemporary Peru: The Poetics and Politics of Indigenous Performativity," *Ethnomusicology* 55, no. 3 (2011): 387–413.

Turino, Thomas. *Music as Social Life: The Politics of Participation*. Chicago Studies in Ethnomusicology. Chicago: University of Chicago Press, 2008.

———. "Nationalism and Latin American Music." *Latin American Music Review* 24, no. 2 (2003): 169–209.

———. "Somos el Perú: 'Cumbia Andina' and the Children of Andean Migrants in Lima." *Studies in Latin American Popular Culture* 9 (1990): 15–37.

Unesco. "Wititi Dance of the Colca Valley." YouTube. Published December 2, 2015. Accessed March 27, 2018. https://www.youtube.com/watch?v=gWaNe05Lr90.

Vanscheeuwijck, Marc. "Giovanni Paolo Colonna and Petronio Franceschini: Building Acoustics and Compositional Style in Late Seventeenth-Century Bologna." In *Towards Tonality: Aspects of Baroque Music Theory*, edited by Peter Dejans, 171–201. Leuven: Leuven University Press, 2007.

———. *The Cappella Musicale of San Petronio in Bologna under Giovanni Paolo Colonna (1674–95): History, Organization, Repertoire*. Brussels: Institut Historique Belge de Rome, 2003.

Vasquez Soto, Consuelo M., and Christian Omar Estrella Canaza. "Fragmentos de la historia del Distrito de Callalli." Thesis, Universidad Nacional San Agustín de Arequipa, 2010.

Vega Salvatierra, Zoila. "Maestros de capilla y organistas en la catedral de Arequipa en la época colonial." *Revista de Musicología* 31, no. 2 (2008): 315–332.

———. *Música en la Catedral de Arequipa 1609–1881: fuentes, reglamentación, ceremonias y capilla catedralicia*. Arequipa: Universidad Católica San Pablo, 2011.

———. "Siluetas en la oscuridad: el maestro de capilla Cayetano Rodríguez (Arequipa, Perú, Siglo XVIII). Ejemplo del uso de las fuentes no musicales en la reconstrucción de la historia de la música colonial de Sudamérica." *Resonancias: Revista de Investigación Musical* 40 (2017): 33–46.

Vizcardo, Janet. “El órgano de Loret, la joya de la catedral de Arequipa.” *RPP*, January 31, 2016. https://rpp.pe/peru/actualidad/el-organo-de-loret-la-joya-de-la-catedral-de-arequipa-noticia-645927.

Wade, Peter. *Race and Ethnicity in Latin America*. 2nd ed. New York: Pluto Press, 2010.

Waisman, Leonardo J. “La música en la definición de lo urbano: los pueblos de indios americanos.” In *Música y cultura urbana en la edad moderna*, edited by Andrea Bombi, Juan José Carreras López, and Miguel Ángel Marín, 159–176. Valencia: Universidad de Valencia, 2005.

———. “Urban Music in the Wilderness: Ideology and Power in the Jesuit *Reducciones*, 1609–1767.” In *Music and Urban Society in Colonial Latin America*, edited by Geoffrey Baker and Tess Knighton, 208–229. Cambridge, UK: Cambridge University Press, 2011.

Weidman, Amanda. “Listening to the Violin in South Indian Classical Music.” In *Theorizing the Local: Music, Practice, and Experience in South Asia and Beyond*, edited by Richard K. Wolf. Oxford: Oxford University Press, 2009.

Werckmeister, Andreas. *Andreæ Werkmeisters ... eigentliche Beschreibung wie und welcher Gestalt man die Orgelwercke von den Orgelmachern annehmen/probiren/untersuchen und denen kirchen liefern könne; auch was bey ... alten Wercks; so da zu renoviren vorfallen möchte; nothwendig in acht ... übersehen; mit gründlichen Ursachen bekräfftiget; und zum Druck befördert.* 1698. Munich: Bärenreiter, 1927.

———. *Werckmeister’s* Erweiterte und Verbesserte Orgel-Probe *in English*. Translated by Gerhard Krapf. Raleigh, NC: Sunbury Press, 1976.

Werlich, David P. *Peru: A Short History*. Carbondale: Southern Illinois University Press, 1978.

Williams, Peter. *The European Organ, 1450–1850*. London: B. T. Batsford, 1966.

Winter, Cecilia. “Los baúles de San Bartolo Yautepec: historia y presente entorno al patrimonio musical de una comunidad zapoteca.” *El Comején (Boletín de las Bibliotecas y Salas de Lectura del estado de Oaxaca)* 2, no. 6 (July–September 2012): 22–25.

Winter, Cicely, and Christopher Holman. “Historic Organs in Oaxaca, Mexico.” *Vox Humana*, 2018. Accessed March 25, 2019. https://www.voxhumanajournal.com/winter2018.html.

“Wititi Dance of the Colca Valley.” UNESCO Intangible Cultural Heritage. Accessed March 27, 2018. https://ich.unesco.org/en/RL/wititi-dance-of-the-colca-valley-01056.

Zager, Daniel. “Organ Improvisation: Historical Considerations from Theory and Practice.” Unpublished manuscript. Accessed March 3, 2021. https://www.higgs25esm.com/s/Zager-Organ-Improvisation.pdf.

Zamora, Lois Parkinson. “New World Baroque, Neobaroque, Brut Barroco: Latin American Postcolonialisms.” *PMLA* 124, no. 1 (2009): 127–142.

Unpublished Sources:

Cusco, Archivo Arzobispal del Cusco. Epoca Colonial. “Inventarios.” C20–3–49: Document about hiring a new organist for the Cathdral in Cuzco. 7 pages, unnumbered. Cuzco, 1808.

———. *Epoca Colonial.* “Inventarios.” Inventory of S. Francisco de Asís de Marcapata (1792).

———. *Epoca Colonial.* “Inventarios.” Inventory of Chinchaypuqio (1805).

———. *Epoca Colonial.* “Inventarios.” Inventory of San Juan Bautista de Tampampu.

Groningen, Groninger Archieven. *Hervormde gemeente Veendam*, 315–418, *Stukken betreffende de restauratie en het onderhoud van het orgel*, (1944–2007), restauratie 1987–1993, voorlopig rapport over orgel Veendam 25–3–1988.

———. *Hervormde gemeente Veendam*, 315–418, *Stukken betreffende de restauratie en het onderhoud van het orgel*, (1944–2007), restauratie 1987–1993, verslag gesprek Wiersema 14–7–1988.

Lima, Archivo San Francisco de Lima. *Crónica de la Provincia.* MSF–111.

———. *Diversos asuntos tocantes a la provincia.* I–R–5.

Michel, Mélodie. “Early Music in Mexico and the Overwhelming Success of a Resurging Patrimony.” Paper presented at the Musicking Early Music Conference 2018, Eugene, Oregon, May 2018.

Portilla Arriola, Sergio. E-mail to Natascha Reich. *Rv: Quote Opus 370*, November 8, 2017.

———. E-mail to Natascha Reich. *Rv: Quote Opus 370*, December 19, 2017.