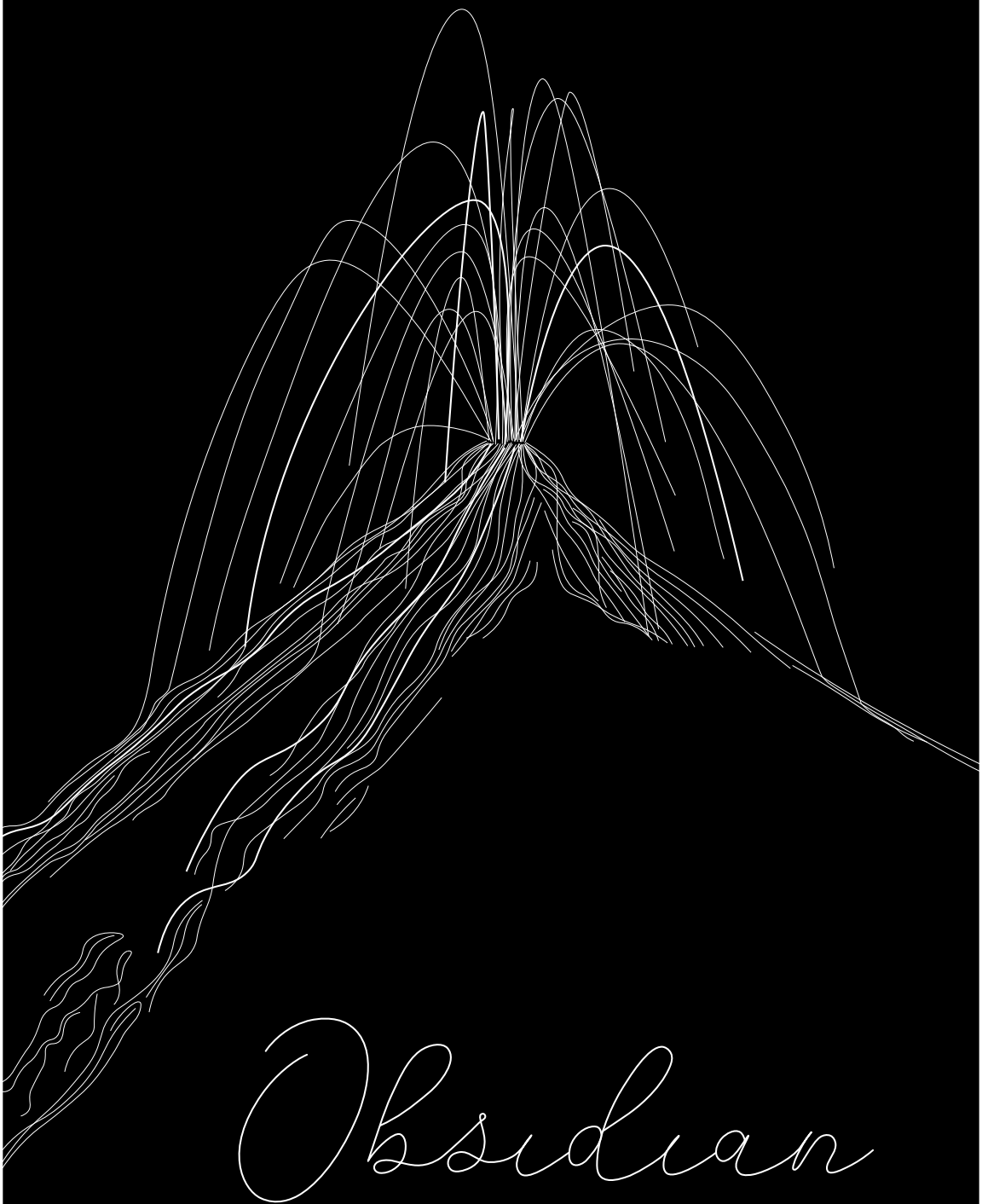




Obsidian

Material Intelligence

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Milwaukee

ISSN 2767-5246

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*There is a sort of natural Obsidian Glass,
which is rather to be rank'd among Stones, than Metals;
for 'tis as passive as the former,
enduring the graving Tool, and receiving Images,
and is diaphanous or pellucid,
transmitting (like Glass) all Forms and Shapes.*

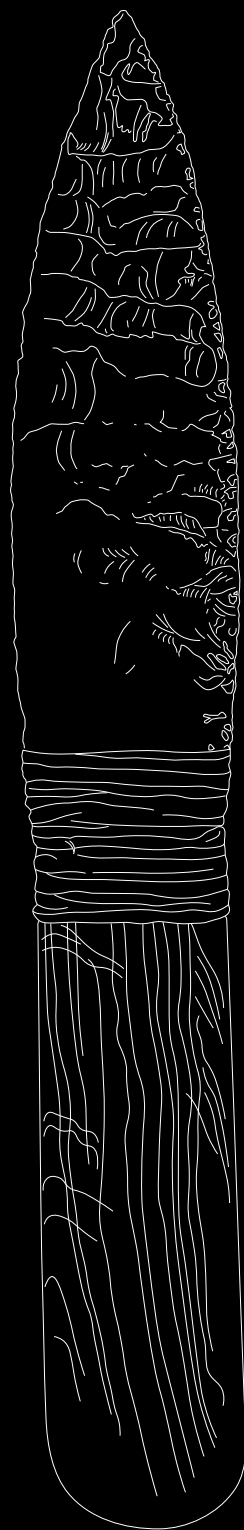
—Guido Pancirollus,
*The history of many memorable things
in use among the ancients, but now lost, 1727*



"The noonday sun shone down upon the fast green river; it had great, black chunks of lava with soft-looking edges piled along the shores, fallen there from the sides of the steep slopes on either side. The lava lined the canyon, making it unutterably dark in an unnatural kind of sunny way." This is Mabel Dodge writing, in *The Edge of Taos Desert*, the fourth and final installment of her memoirs. She had previously led a cosmopolitan existence, with her Fifth Avenue salon one of the great talking-shops of the avant garde. She was among the organizers of the famous Armory Show, in 1913, which introduced modern art to America. Four years later, ever restless, Dodge went west to find something else.

She found it. Having had quite enough of artistic innovation, she fell in love with New Mexico—settling in Taos, just by the ancient Pueblo there, and eventually marrying a Tiwa man called Antonio (Tony) Lujan. They would go on to attract artists and writers from far and wide, promoting Taos to them as a beautifully-preserved remnant of traditional culture. Her first impression of this new landscape (at least in her somewhat romanticized later telling), the volcanic material she saw along the Rio Grande, was like a premonition of this new life: "I stared, fascinated by it. Where the water had washed it for centuries, it was smooth and shone with a dark, lustrous polish that had something reptilian in it.... In this country, everything lives and moves and has its being."

Dodge little suspected it, but she was only the latest of many to be captivated by obsidian—and her own reflection in it. Though usually described as a stone, it is actually a naturally occurring glass, formed when magma forces itself



to the surface and then rapidly cools. Prevalent wherever volcanoes are active—on the south coast of Iceland, where there is a whole obsidian mountain called *Hrafninnusker*; across the Americas; in Anatolia, Italy, and the South Pacific—it has played an important cultural role since ancient times, practically, symbolically, and economically. Even as this issue of *Material Intelligence* was going to press, [a cache of 575 obsidian hand-axes](#) knapped (that is, chipped under pressure) into teardrop shapes for cutting, were discovered in the Awash valley of Ethiopia—evidence of a craft workshop that was active about 1.2 million years ago. For today’s archaeologists and historians, it is an indispensable trace of prehistoric settlement and exchange, providing evidence of communities from small villages up to whole cities, and the complex trade routes between them.

But Dodge didn’t know any of that. Like so many before her, obsidian seemed to her a completely enigmatic substance, emblematic of a “land of enchantment” (a phrase that appears on New Mexico license plates to this day). This attitude, in which European and American outsiders beheld this shining black glass and projected their own desires upon it, goes far back into history. The most famous of all obsidian artifacts is a relic of colonization: an Aztec mirror that came into the possession of John Dee, the famous alchemist-astrologer of the court of Elizabeth I. Now in the British Museum, it was originally looted (likely from the city of Tenochtitlán) following the military conquest led by Hernán Cortés in the 1520s.

[Recent geochemical analysis](#) has demonstrated that the obsidian used to make the mirror is from Pachuca, in the Sierra Las Navajas, one of the richest sources of the material in the Aztec empire. The object’s extremely smooth surface is the result not of natural cleaving, but slow and careful polishing using abrasive sand. Its large size and quality would have made this an exceptional artifact even in its original context (today, only eighteen such circular mirrors

are known). Among the Aztec, it would have been associated with the god *Tezcatlipoca*, whose name means “Smoky Mirror,” and would have served to ward off malevolent spirits and as a divination tool.

It’s not totally clear how or when Dee obtained the mirror — one theory is that he bought it in Bohemia in the 1580s — or what, if anything, he knew of the artifact’s usage among the Aztec. But we do know that he seems to have understood it as a sort of dimensional portal, a “shew-stone” or “scrying glass.” He collaborated with another self-declared magician named Edward Kelly, who claimed to be able to see angels in its reflective surface. The mirror was once in the collection of the eighteenth-century antiquarian Horace Walpole; an inscription its tooled leather case notes that it is “the black stone into which Dr. Dee used to call his spirits” and also quotes Samuel Butler’s 1663 play *Hudibras*: “Kelly did all his feats upon The Devil’s Looking Glass, a stone; Where playing with him at Bo-peep, He solv’d all problems ne’er so deep.”

Today, it may seem difficult to identify with Dodge and Dee’s exoticizing attitudes. Yet, as viewers of the megahit television series *Game of Thrones* will be aware, the idea of obsidian as a strange substance with powers of mysterious extent is still very much with us. The show features magical weapons made from ‘Dragon Glass,’ which was inspired by real-world obsidian and looks just like it, but is said to have been created by the fiery breath of the show’s signature flying lizards—though the prop swords, axes, and arrowheads you see on screen are actually made of urethane rubber. The technological sophistication of Native American people, almost needless to say, is nowhere credited or otherwise acknowledged by the series’ producers—no less than it was in John Dee’s magic circle, or in Luhan’s vision. We’re in the domain of the imagination here. George R. R. Martin, whose novels inspired *Game of Thrones*, has described his

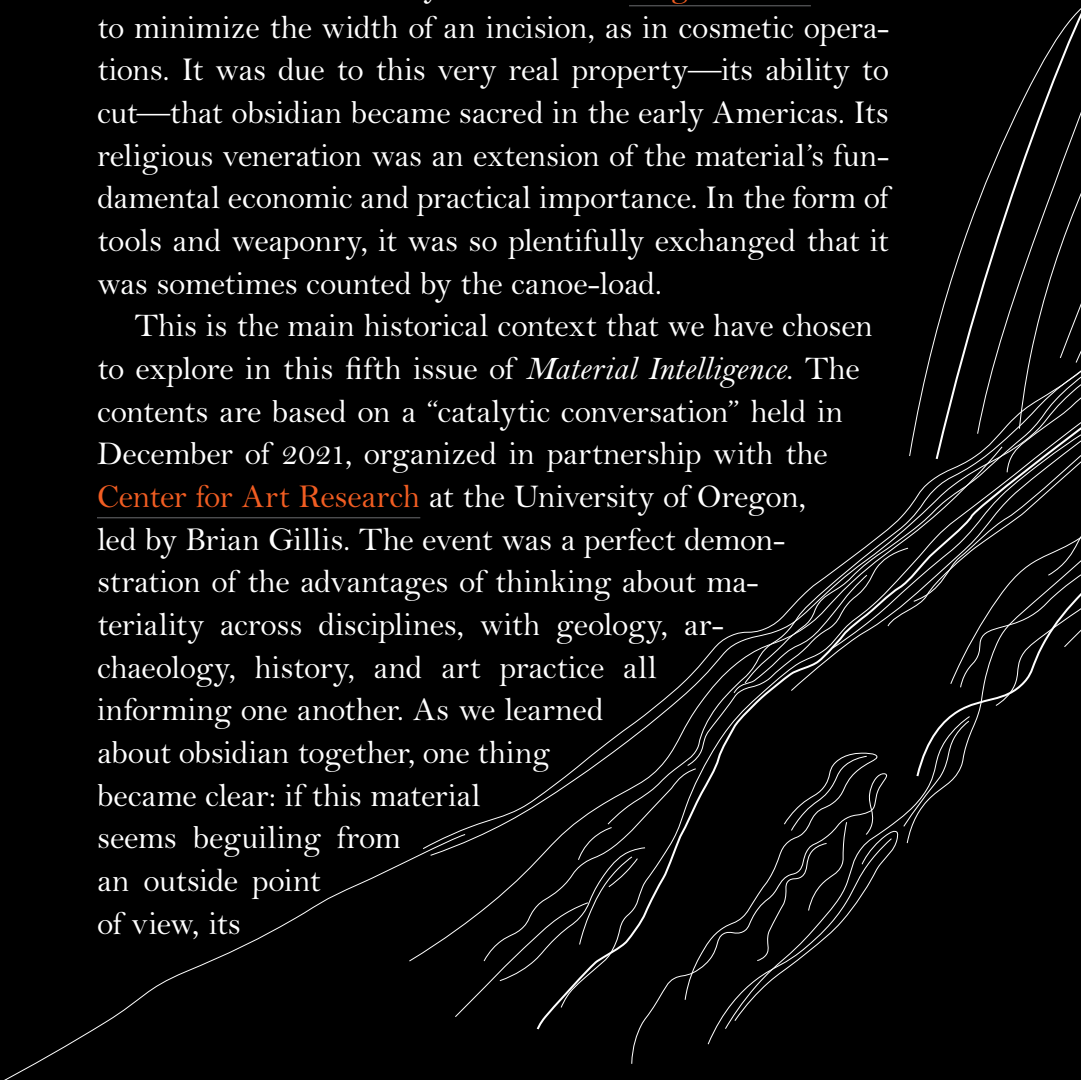


*Fantasy is silver and scarlet,
indigo and azure, obsidian veined
with gold and lapis lazuli.
Reality is plywood and plastic,
done up in mud brown and olive drab.
Fantasy tastes of habaneros
and honey, cinnamon and cloves,
rare red meat
and wines as sweet as summer.
Reality is beans and tofu,
and ashes at the end.*

It's an intriguing list, in which materiality itself is divided into two camps, the extraordinary and mundane. And if Martin's choices on either side of the ledger do make a certain amount of poetic sense, they also tacitly replicate longstanding patterns of cultural projection: the spell cast by other places and cultures. It is no coincidence that most of the materials he considers to be fantastical have inspired violent imperial expansion, here in the real world. The expedition Cortés prosecuted against the Aztec was a bloody quest for gold; the obsidian was an unexpected bonus prize.

Having said this, obsidian truly does have exceptional qualities – notably, its ability to hold a sharp edge, which surpasses that of any other naturally occurring material, even diamond. Still today it is used for [surgical tools](#) used to minimize the width of an incision, as in cosmetic operations. It was due to this very real property—its ability to cut—that obsidian became sacred in the early Americas. Its religious veneration was an extension of the material's fundamental economic and practical importance. In the form of tools and weaponry, it was so plentifully exchanged that it was sometimes counted by the canoe-load.

This is the main historical context that we have chosen to explore in this fifth issue of *Material Intelligence*. The contents are based on a “catalytic conversation” held in December of 2021, organized in partnership with the [Center for Art Research](#) at the University of Oregon, led by Brian Gillis. The event was a perfect demonstration of the advantages of thinking about materiality across disciplines, with geology, archaeology, history, and art practice all informing one another. As we learned about obsidian together, one thing became clear: if this material seems beguiling from an outside point of view, its

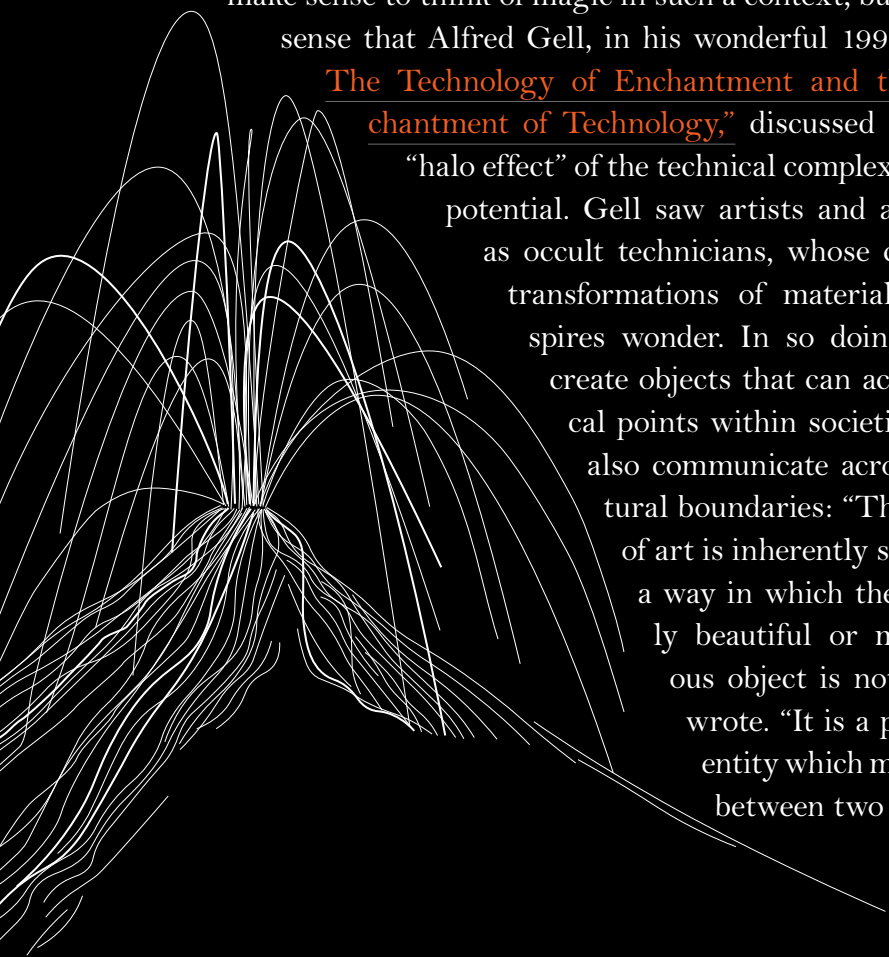


meanings become that much more profound through sustained exposure.

The fascination that Dee and Dodge felt for obsidian could not be anything but superficial. For the Aztec and other ancient American cultures, by contrast, spiritual and practical efficacy were inextricably bound together. It may still make sense to think of magic in such a context, but in the sense that Alfred Gell, in his wonderful 1992 essay

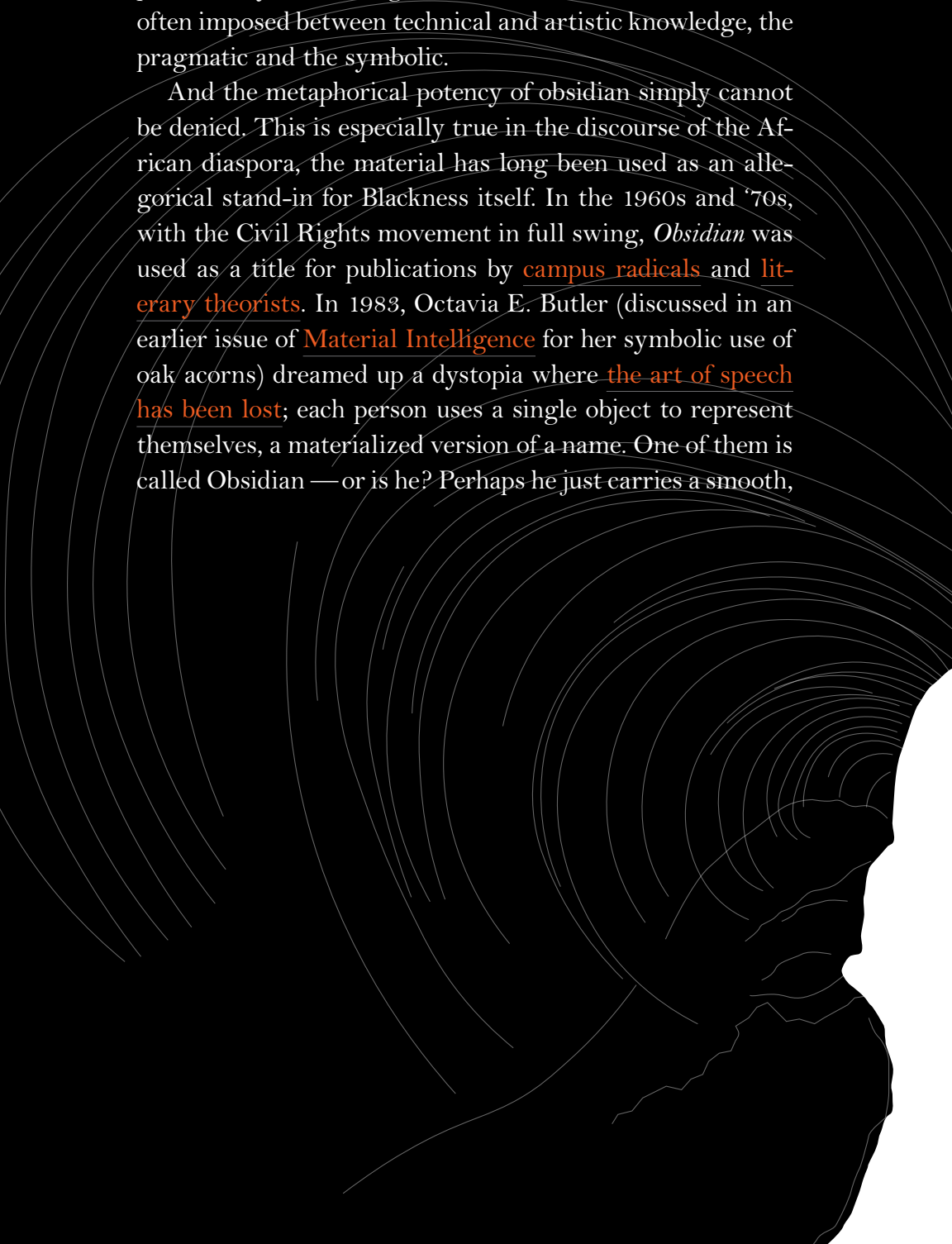
The Technology of Enchantment and the Enchantment of Technology,” discussed it: as a

“halo effect” of the technical complexity and potential. Gell saw artists and artisans as occult technicians, whose creative transformations of materiality inspires wonder. In so doing, they create objects that can act as focal points within societies, and also communicate across cultural boundaries: “The work of art is inherently social in a way in which the merely beautiful or mysterious object is not,” Gell wrote. “It is a physical entity which mediates between two beings,



and therefore creates a social relation between them.” This sort of connective enchantment, both within and across cultures, is an important aspect of material intelligence. An expansive way of thinking, it traverses the divides that are so often imposed between technical and artistic knowledge, the pragmatic and the symbolic.

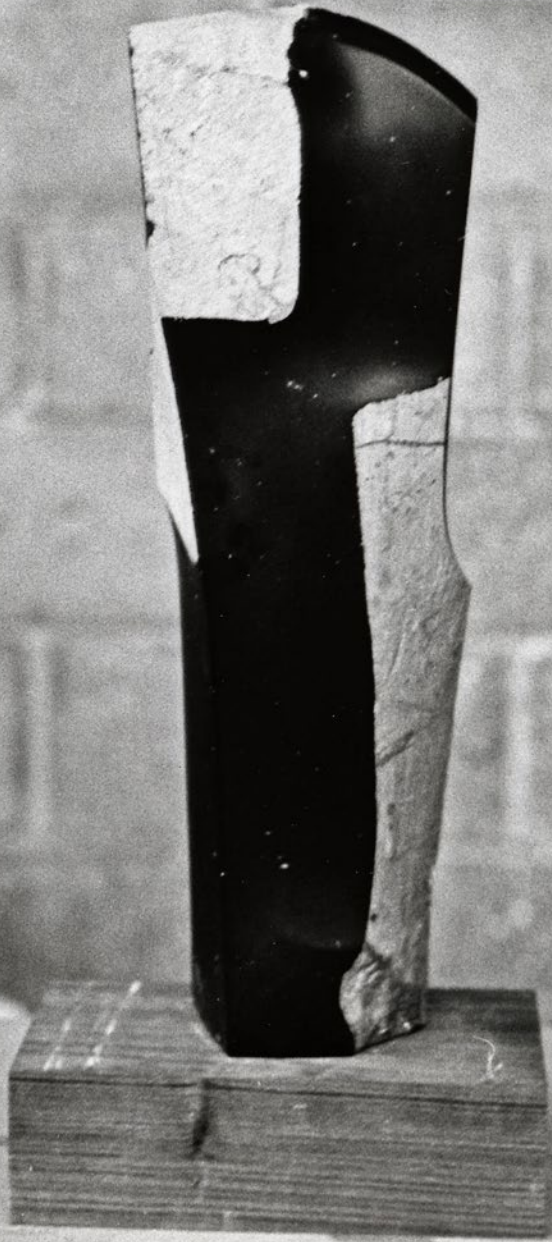
And the metaphorical potency of obsidian simply cannot be denied. This is especially true in the discourse of the African diaspora, the material has long been used as an allegorical stand-in for Blackness itself. In the 1960s and ‘70s, with the Civil Rights movement in full swing, *Obsidian* was used as a title for publications by campus radicals and literary theorists. In 1983, Octavia E. Butler (discussed in an earlier issue of Material Intelligence for her symbolic use of oak acorns) dreamed up a dystopia where the art of speech has been lost; each person uses a single object to represent themselves, a materialized version of a name. One of them is called Obsidian — or is he? Perhaps he just carries a smooth,



glassy, black rock with him wherever he goes. More recently, the Turner prize-nominated artist group Black Obsidian Sound System, or B.O.S.S., have explained their name by noting that “obsidian repels negative energy and discordant vibrations. It amplifies and transmits high frequencies and demonstrates the appearance of light within darkness.”

There is an obvious analogy being made here between obsidian and the Black body—like ebony wood, obsidian seems like a perfect match for slogans like “Black Power” and “Black is Beautiful.” There’s also a real material history being invoked here, that stretches all the way back to ancient Egypt, where obsidian was used both for religious and functional objects. California-born, Switzerland-based designer Ini Archibong refracts this history in his refined furniture, which incorporates obsidian and other forms of black glass, radiating a transcendent aesthetics founded in African spiritual traditions. Fred Wilson, similarly, in discussing his all-black Murano glass works, has knowingly reflected back on Aztec mirrors of the type that John Dee owned, musing on the “foreshadowing” embodied by such portentous objects.

This rich vein of thinking and making, which often ranges far afield from actual volcanic glass, shows how materially-inspired speculation can become its own associative tradition. These metaphorical invocations are intrinsic to material intelligence. Knowing the story of a substance fully requires not only understanding its physicality and formation—what, exactly, happens when a eutectic composed mostly of rhyolite crystallizes—but what humans make of this amazing stuff, both physically and imaginatively. No material better rewards such wide-ranging investigation than obsidian, which has, after all, exploded into the sphere of human activity as a result of deeply buried, incomprehensibly powerful forces. It’s understandable if, like Mabel Dodge, we feel that timeless energy is somehow captured in obsidian, and artifacts made from it.





Obsidian, the ancient stuff

Anita Grunder

Obsidian is natural glass that has cooled rapidly from magma: melted, liquid rock. What then is glass, and how is it special? Technically, it is a material cooled from a liquid into a solid, and lacks a regular atomic structure. When a magma rises in the Earth, the atoms in the liquid arrange themselves to be in balance with the new, cooler condition at the surface, resulting in crystallization. But if cooling happens too fast for the atoms to get themselves organized, then a glass will form.

Glass has an atomic structure somewhere between the long-range order of crystals and the disorder of liquids. What little structure it has is at the cubic nanometer scale, and is homogenous in all directions. The absence of a preferred breaking direction is why glass “spalls”—one can cleave thin flakes from the surface, leaving a shiny fresh surface and very sharp edges. The broken surface is ridged and rounded, giving a shell-like appearance called “conchoidal fracture.” A spalled edge can be only a few atoms thick (a few ten millionths of a centimeter), sharper than can be achieved by grinding. Such edges have served humankind as knives, axes, arrows, scrapers, and spearpoints in the past, and are used in specialty scalpels for very fine surgery today.

Obsidian is quenched mainly from rhyolite magma and so occurs only in plate tectonic environments where such volcanoes occur, namely continental rifts, subduction zones (where one geological plate dives under another), and intraplate continental hotspots. Rhyolite is 70 to 78% silica (SiO_2), by weight: silicon and oxygen, in the atomic proportion 1:2. Thin glassy margins are also common on fresh basalt flows, particularly underwater ones like those on Hawaii, where water quickly carries away the heat. Extensive glass deposits are comparatively uncommon in basalts, however; their melts have lower viscosity (that is, less resistance to flow) and greater tendency to arrange themselves into microcrystals during cooling. Other magma types with intermediate temperatures and silica content may also form





glass upon cooling. But the high silica content of rhyolites, and its relatively cool magma state (with pre-eruption temperatures near 700°C) make it the signature obsidian.

Another important attribute of rhyolite is that it commonly has high concentrations of elements that prefer to remain in melt, rather than crystallize. As a magma ascends in the Earth it may leave behind early crystallizing minerals, while still carrying melt-loving components like rubidium, niobium, zirconium, and thorium. The end point is a material highly enriched with these trace elements. Each rhyolite has its own unique proportion of these “impurities,” which in turn means that obsidians can be readily chemically fingerprinted. In some instances, rhyolite eruption occurred during human occupation. Precise dating of the resulting obsidian allows us to track the development of ancient trade routes.

Rhyolites are also noted for erupting explosively, owing to the overpressure of gasses trapped in the viscous melt. After explosive venting, an effusive lava-producing stage can lead to thick stubby flows or domes with thick glassy margins. Movement of the sticky lava causes abundant shear, which leads to flow layering: trapped gas bubbles or small crystals are segregated into different layers, resulting in a visible banding in the rock. If the lava moves too fast for the magma to respond in a fluid way, then it may break into chunks, particularly at the flow surface where the lava is cool, and so more brittle. The interior cools more slowly, and glass is replaced by micro-crystals. Hot gases may rise near the vent and cause oxidation—essentially rusting—of trace iron in the rhyolite, causing the obsidian to be red. Cannibalistic entrainment of fragments of lava by successive episodes of flow can give complex and beautiful textures. While most obsidian occurs in lavas, rhyolite deposits from explosive eruptions may weld together under their own heat and weight, fusing the pumice fragments, and produce thick glassy obsidian zones at their base.

Fresh obsidian is typically black (owing to very tiny needles of the iron oxide mineral magnetite) and has a shiny luster, which becomes more resinous, and dull in appearance, as the glass absorbs water from the atmosphere. In scientific parlance, we say that the absorption of water causes a “hydration rind” on the obsidian. The thickness of this rind can be used to estimate the age of a flow, or even of a complete artifact, if one knows the water diffusion rate into the glass, which in turn depends on the climate and the composition of the obsidian.

The physical properties of obsidian, a hardness greater than that of ordinary steel and the ability to cleave to a fine edge, have made obsidian a prized material for millennia. The sheer beauty of this shiny, glassy material also draws us in. It may be black, red, orange, green, gray, clear and even rainbow; partly crystallized obsidian can be speckled with white, yielding a “snow-flake” obsidian. A special kind of natural glass can be also formed without volcanic processes, by meteorite impact. The resulting spray of melt freezes to make blobs and beads of glass called tektites, colloquially known as “cosmic obsidian.” Every rock shop will feature an array of these various obsidians, in all colors and textures, speaking eloquently to our continued fascination with this ancient material.

At the corrida we'll sit in the shade
And watch the young torero stand alone
We'll drink tequila where our grandfathers stayed
When they rode with Villa into Torreon
Then the padre will recite the prayers of old
In the little church this side of town
I will wear new boots and an earring of gold
You'll shine with diamonds in your wedding gown
The way it is long but the end is near
Already the fiesta has begun
The face of God will appear
With his serpent eyes of obsidian

—Bob Dylan, *Romance in Durango*, 1975





Ancestral toolstone

Thomas J. Connolly

For as long as there have been tools, tools have been made from obsidian. Many archaeologists study the mechanical properties of this volcanic stone to better understand ancient toolmaking practices: the artful reduction of stone blocks to produce functional cutting and piercing implements (an obsidian edge can be sharper than surgical steel). Beyond this, obsidian has qualities that make it an especially useful material for piecing together cultural history. Here I look at two qualities: its physical weathering properties, which provide us with a means of dating archaeological deposits; and its chemical makeup, which allows us to map patterns of land use and trade across the ancient landscape.

From the moment the surface of piece of obsidian is freshly exposed through knapping, water molecules are diffused or ‘adsorbed’ into the surface. Over time, this process forms a visible rind under magnification, allowing us to estimate the

20



Examples of cached production bifaces;
 top rows: Obsidian Cliffs; Dittman cache, Willamette Valley;
 bottom rows: Paul's Fire cache, Western Cascades.
 Courtesy of Thomas J. Connolly.

age of the stone. The rate of penetration into the artifact surface slows as it progresses, so rind development is not linear, but must be mathematically modeled. And while the shape of the hydration curve is largely predictable, many factors—primarily prevailing temperature—affect the actual speed of the process, so site-specific hydration rates must be determined.

One way to calibrate obsidian's hydration rate is by pairing hydration rind thickness values (measured in microns; a micron is 1/1000 of a millimeter) with radiocarbon dates. This allows us to assign approximate calendar ages to rind thickness. Measuring a large quantity of artifacts in this way can provide a good outline of a site's occupation history. For example, at Cascadia Cave, an important site in the mountains of western Oregon, it is possible to determine that while earlier and later site visits occurred, the site was most intensively occupied between about 10,000 and 4,500 years ago.

Obsidian is also critically important in helping to understand social relationships in ancient times, such as commodity conveyance zones and trading networks. Before being erupted from a volcanic vent, molten lava picks up trace residue from the native rock in the walls of the magma chamber. Once extruded and hardened into obsidian, the stone retains a distinctive trace element profile of minerals that are unique to this precise location. Thus, each obsidian source has a unique geochemical profile.

Using both obsidian hydration dating and geochemical identification, obsidian artifacts can be used to track ancient trade patterns. This may be studied through a site-centered view: Where across the landscape did a particular group of people travel? Or a source-centered view: Where did the obsidian from a given flow travel, either through trade or simply by being carried?

An example of the latter is the mapping of obsidian artifacts from two of the most widely used sources in the Pacific Northwest during ancient times. Newberry Volcano is

located in central Oregon, east of the Cascade Range, while the Obsidian Cliffs source is on the western slope of the Cascades, near its summit. The occurrence of artifacts from these sources strongly shows directional flows to the north. Newberry obsidian traveled primarily along the Deschutes River basin, passing through the regional trading center and Native fishery Celilo Falls on the Columbia River. Obsidian Cliffs obsidian was carried through the Western Cascades and Willamette Valley to Willamette Falls and Chinook trading centers in the Portland Basin. From these ancient commercial centers, some Oregon obsidian continued north into lands bordering the Salish Sea (i.e., the Puget Sound-Gulf of Georgia region). Very little from these sources was conveyed to the south.

Obsidian from the northern end of the exchange network, meanwhile, confirms that nearly a quarter of obsidian identified at archaeological sites in British Columbia is from four key Oregon sources: Obsidian Cliffs, Newberry Volcano, and two others east of Newberry, Glass Buttes and Whitewater Ridge. These sources are arrayed in an arc at the southern edge of the Columbia Plateau in central Oregon, and reflect a systematic mining and distribution enterprise maintained by Native tribes of the Pacific Northwest.

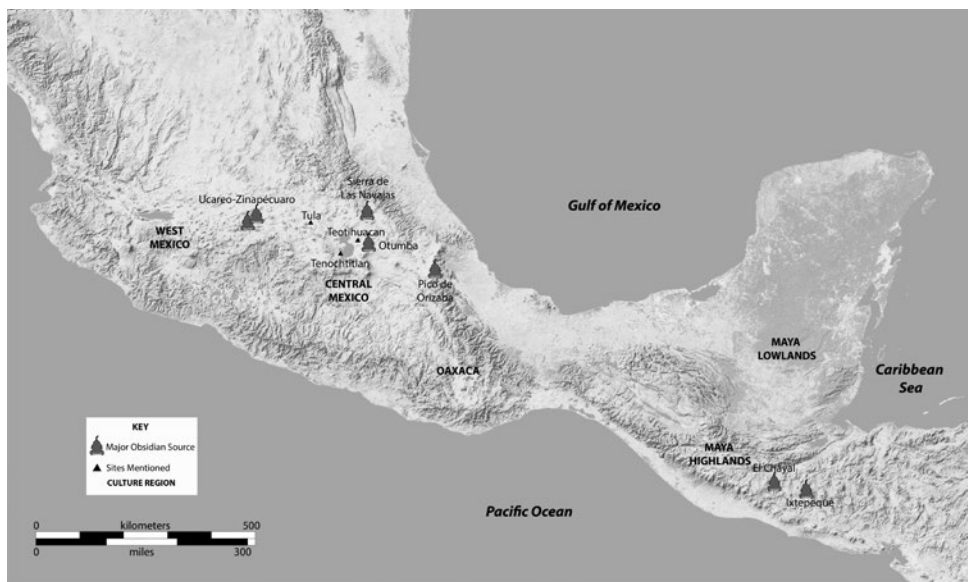
Obsidian was transported as a trade commodity in standardized forms. There have been dozens of caches of formed quarry “blanks” or biface found in the Deschutes Basin, the northern Oregon Cascades, and in the Willamette Valley. The number of items in such caches might range from a dozen to thousands. The large-scale uniform production and distribution of these forms is evidence of a surprisingly large enterprise for the distribution of obsidian tool stone. This evidence helps us to appreciate both the scale of the exchange network and its great antiquity. For many thousands of years, indigenous people manufactured obsidian tools, crucial to survival, in a way that can only be described as an industrial-scale commercial enterprise.





Obsidian in Mesoamerica

Alejandro Pastrana and David M. Carballo



Prehispanic Mesoamerica was a diverse place, occupied by cultures such as the Aztec, Maya, Mixtec, Toltec, and Zapotec. Yet the region was unified by certain common features: an agricultural economy based on maize; fundamental religious concepts such as a pantheistic worldview that did not make clear distinctions between the natural and supernatural; and technological knowledge, based in the transformation of certain materials. Foremost among these was obsidian.

Mesoamerican material culture was mostly without utilitarian metals. There was limited use of bronze and no use of hard metals such as iron or steel. Some soft metals were worked—copper, tin, lead, pyrite, silver, and gold—but typically only for ornamental or religious objects. Instead, prehispanic tools were made of organics, like fibers, wood, bone, and hides, and various minerals, of which obsidian was pre-eminent. With its vitreous matrix and some microcrystals, it holds a brittle but extremely sharp edge—the sharpest edge known in nature, in fact. Other stones were used too, among them basalt, rhyolite, pumice, chert, chalcedony, and rock crystal. Mesoamericans shaped these materials in a variety of ways, chipping away at their edges, grinding them down, polishing their surfaces.



Though obsidian is a superior tool stone, working it is not without its challenges. From the perspective of an artisan, gas bubbles and particles introduced during the flow of lava are “impurities” that can deviate the intended fracturing of the glass. The best-quality obsidian, distinguished by its conchoidal (shell-like) ripple pattern, fractures cleanly and predictably.

Obsidian working is a subtractive technology. Mesoamericans used a range of methods—direct and indirect percussion, pressure, and friction—but always with the aim of decreasing the quantity of parent material. It was a gradual process, with friction applied using progressively harder or more abrasive implements. Fortunately, this way of working also resulted in accumulations of debris, which are helpful for contemporary analysts such as ourselves, who study ancient artisanship.

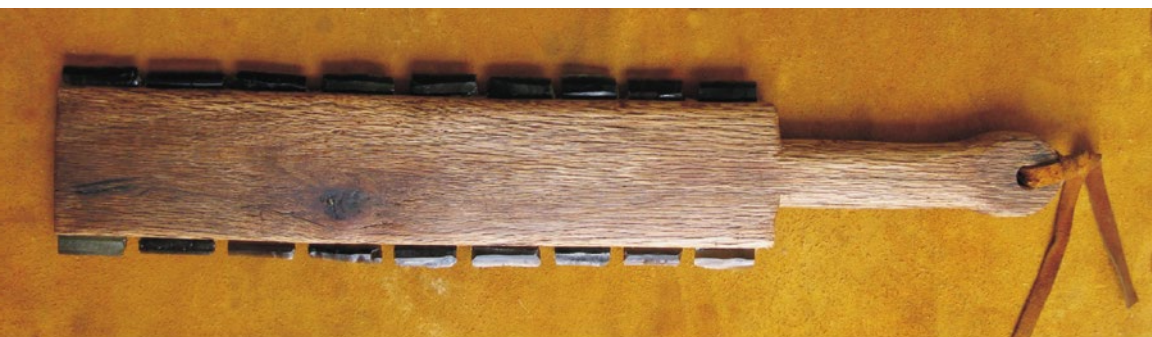
The center of Mesoamerica—the central highlands of present-day Mexico—is its most volcanic region. Obsidian was a widely available raw material there, and also had a potent ritual and symbolic significance. It was used not only to fashion weaponry and everyday tools, but also adornments, scepters, and mirrors ascribed with supernatural powers.

28 There seems to have been a conceptual link between the

material's potential for violence—the subduing or sacrificing of an enemy—and crystal-ball like powers of divination. This connection is exemplified in deities such as Tezcatlipoca (Smoking Mirror) and Itzpapalotl (Obsidian Butterfly). One of the avatars of Tezcatlipoca, a high god in the Mexica-Aztec pantheon, was simply called Itztli, also the Nahuatl word for an obsidian blade, and was associated with the ice and hail of central Mexico's towering volcanoes, from which the glass was mined. The material's associations with cold, cutting wind were conceived metaphorically as a form of divine justice.

Those obsidian mines were also strategically vital, and played an important part in Mesoamerican power politics. The largest and most powerful polities that dominated central Mexico—first Teotihuacan, then the Toltec capital of Tula, and finally the Aztec capital of Tenochtitlan—concentrated primarily on the exploitation of a few mines, particularly one at Sierra de Las Navajas, located in the modern Mexican state of Hidalgo, which yielded a homogenous green-golden glass. The Purépecha (or Tarascan) empire of west Mexico, and the Maya highlands of southern Mexico and Guatemala, also controlled their own obsidian mines. Cultures lacking such resources—such as the Maya lowlands, Gulf of Mexico, and Oaxaca—engaged in long-distance trade to acquire the stone, offering other local materials of theirs in return.

Most Mesoamerican obsidian is gray-black in color but some has a mahogany hue, due to the presence of oxidized ferromagnesium microcrystals. The obsidian from Sierra de Las Navajas was valued both for its quality and for its color, which was associated with vegetation and fertility, in its translucent green incarnation, or the sun, when more crystalized and golden in tone. It was traded widely throughout Mesoamerica, beginning with the rise of the powerful and prestigious pre-Aztec city of Teotihuacan. The later Toltec and Aztec civilizations continued the exploitation and exchange





of this prized obsidian. They also introduced new production techniques of grinding and polishing, creating lustrous and highly reflective products—notably round mirrors that fascinated Europeans.

Following the incursion of the conquistadors and the establishment of colonial New Spain, Mesoamerican artisans continued to produce obsidian implements for decades, but were slowly steered towards mining and working iron, silver, and other metals valued by the colonizers. This new chapter brought the florescence of Indigenous obsidian-working to a close, as Mesoamericans applied their craft to a burgeoning global economy that prioritized metals. Skilled obsidian working still lives on today, however, in artisanship directed towards the tourist trade and to forms of holistic wellness that associate the material with heat and other energies. But we must not forget that obsidian once had a pivotal role in support of the complex worldviews, technologies, and militaries of Indigenous cities and empires.





Two blades

Joe Scott

At the beginning of the world, Kingfisher rows his black glass boat; sets off to find the riches and money for his bride. After a rough landing, Fox takes pieces of this boat of stone and drops them by the mountain. Those stones, shining and mighty, spend the rest of Creation waiting patiently for the Human Beings to emerge, through a shaking earth, under rough weather.

From miles distant, the *chunk chunk chunk* of hammerstones travels downwind from the quarries in the high cliffs. Up there, men with tough hands chip glass walls into blank blades. This will be treasure for the people along the rivers below. Among these flat hand-shaped discs, two long and heavy matching points take shape. Fine and rare, they are set aside.

Later on, fasting as he travels, a man on a sacred pilgrimage carries the twin prizes, held safe in a wrapping of reeds. He sets a smooth pace, traveling north for ceremony. For three days and two nights, he runs footpaths across mountains, to a broad valley and oak grassland, homeland of the Human Beings.

Along bright rushing water, Headman inspects the runner's wares. His status secured by his wisdom and skill, he holds the two blades side by side. First left, then right, he sees them with humble eyes. They are beautiful. With brief words and strands of white shells, the blades become family. Blessed and careful-made medicine, they become sacred all over again.



Ducking low and turning once through a round doorway, the People gather inside a house of split sugar pine boards. Under Creator's close eye, medicine sets the world new again. The gospel sends words over the rhythm of a tapping staff. In song, the Women and the Men jump out and glide. The dance moves smooth along a curved line, floating fine feathers and soft ringing shells. A bright crackle of cedar fire on

a stone hearth makes tall shadows. Cast on the wall behind, the Ancestors watch and wait. "Make good on your promise and the world will be new again." For ten days and ten nights, Headman dances out front. His wealth held up on display, his prize blades glint in bright cedar flames. In hands thrust out at ancient foes, the blades sing and dance along.

From father to son, hand to hand, the stories of these precious blades pass along the long curve of generations. These remembered words carry time and change, a life of precious objects from the beginning of the world. Then impossible events tear the fabric of the land and set wrong the timeline. Another people arrive from far-off, strange places. First hard times, then war, then a long walk to a dark and unknown destination. Fathers, sons, mothers, and daughters take along only what they can carry.

Lonely and broken, a tired and injured man nearly loses hope. This strange place rains and makes him hungry. He carries two cold black blades, wrapped safe in reeds. His hope feels near spent, but his heart tells him better. Even this cold world, under the eyes of Creator, can be made whole again. The People gather and shelter around new cedar fires. Time to dance again.

I duck low and turn once through a round doorway. Curving along and around a hearth of river stones, the People half-surround a roaring fire. A forest perfume of cedar waters the eyes. Gentle blue smoke sifts among the blanketed seats, rising back toward the low angled plank roof. Tiny yellow pins of spark roll and straighten as heat catches, drawing them up and out through the opening above.

The sun drops low and lays bright slices of sunset through the boards as it sets.

Behind a paisley curtain, the men and boys share a small room under dim incandescence. Among the youngest, toddlers are tended by big brothers and cousins. Wraps of ringtail and bright abalone are secured with strips of leather.

36 Great drapes of sinew-strung dentalium and beads weigh

heavy around our necks; these are ancient strands of shell money. Tall feather headdresses of eagle, flicker, hawk, and velvet are tied tight above our foreheads. The Dancemaker looks us over as our faces are striped with charcoal. Before we slip into ceremony, a dance staff of yew taps a careful heartbeat, and we sing together in low voices.

Alongside us, in a room to the right, the women are singing, too. Their doeskin skirts are heavy with pine nuts, beads, and shells, sewn in with family hands and treasured for generations. Tight, finely woven caps of spruce root and hazel flash the old patterns; House Ladder, Quail Tail, and Morningstar. Feather-tied wands are set lightly in their hands, ready for the rhythm of the old songs.

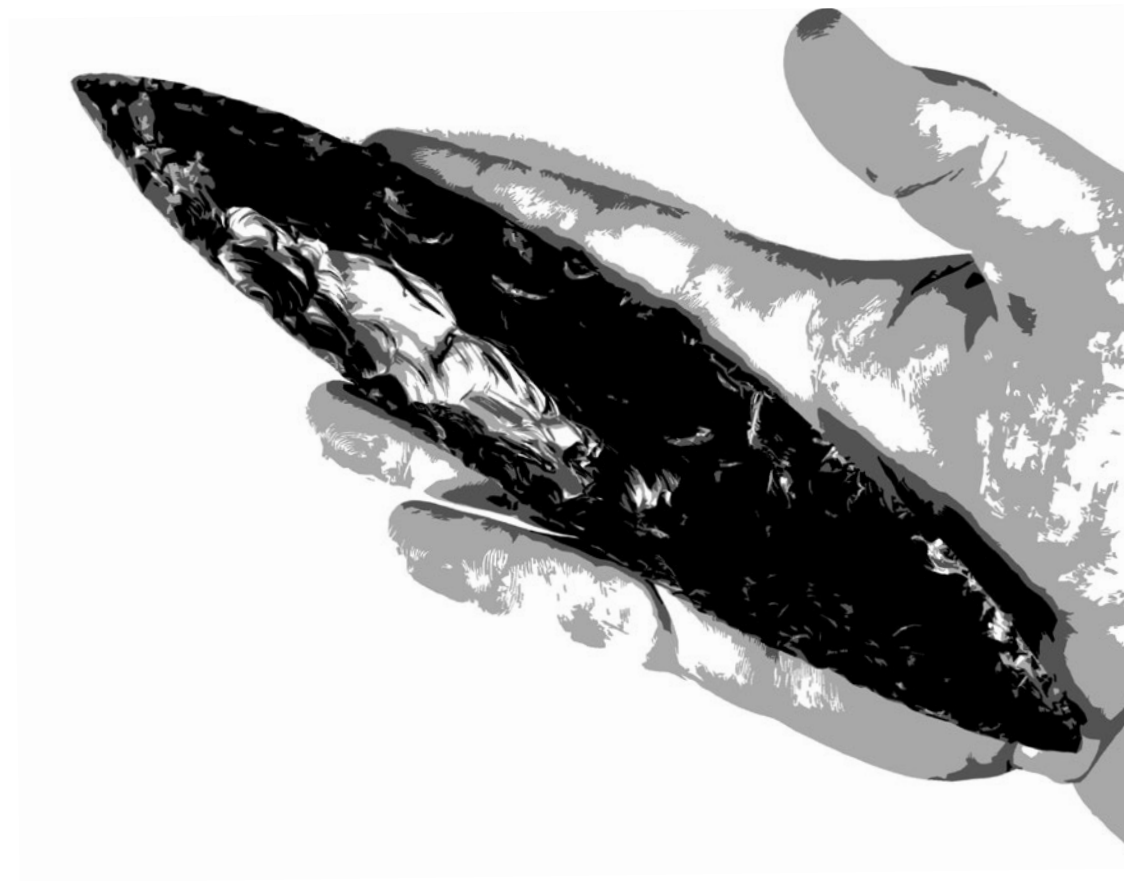
The men line up with the tallest in the center, and we are ready to join the spirits. Dancemaker guides us out this side door, and I see rows of lighted faces. Around and down onto the warm wooden floor, we pass the fire with our stretched hands and align ourselves. Front facing with otter fur quivers, we flash our woodpecker scarlet and flicker feathers and listen for the women. The rising rhythmic shush of gentle shells swinging on skirts signals their arrival. Gliding along the far side of the dancehouse, they circle around and down across that warm floor to join us.

A tap tap tap, and the songs begin. The gospel joins with spark and firelight as our ancient language rises up and out and far into the sky above to join the midwinter stars. I am moving my foot in chorus, rising and falling with the words. Dancemaker calls me, and it's time to dance out front. Ch'ee-naa-svt-naa-see-ya.

I step forward toward the soft golden fire, the heat drawing me towards it. Eyes raised to meet a quick updraft of crackling sparks, I hold up my hands. There in the firelight are two obsidian blades. Fine hewn and ancient, treasures from our ancestors. I dance left, then right; three times. Thrust out at ancient foes, the blades sing and dance along.



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Negro como mi corazón

Amanda Forment



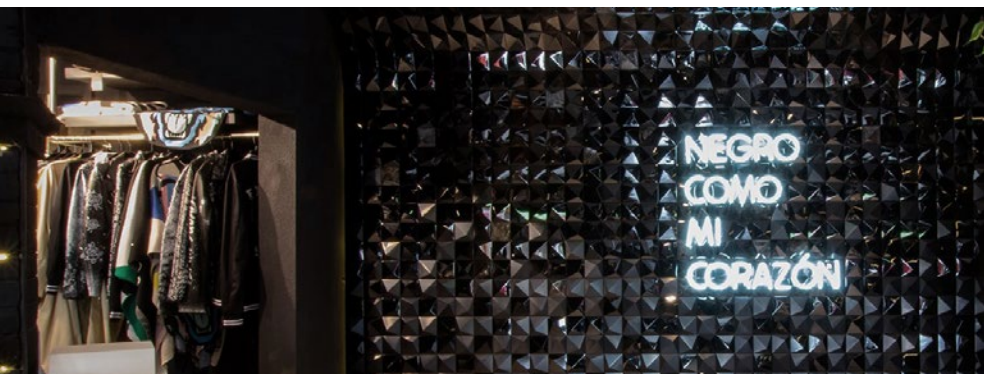
A black obsidian circle, elegant and smooth, balances on a rustic pedestal made of the same material, unprocessed. A pair of smaller golden circles crown the top. The design evokes a black sun, or perhaps an eclipse—one heavenly body momentarily obscured by two others. While made largely of stone, the object has a two-dimensional quality: it is flattened, geometric, and stripped of any ornamentation.

Most people will recognize this form, in a heartbeat, as the silhouette of Mickey Mouse. Taller de Obsidiana created it in

honor of the famous rodent's 90th birthday. Yet sometimes a mouse is not just a mouse. This one reflects Taller's technical ingenuity and embrace of contemporary culture—their bridging of past, present, and future—through obsidian.

Taller de Obsidiana was founded in Teotihuacán, northeast of Mexico City, by brother and sister Gerardo and Topacio Cuevas. This was fairly recent, in 2014, but the atelier's history crosses three generations. Silviano Cuevas, Gerardo and Topacio's grandfather, started a lapidary practice specializing in obsidian in 1957. He created replicas of archaeological findings from the Teotihuacan Valley, becoming a pioneer in the dissemination of the craft. Silviano's son, J.E. Gerardo Cuevas, carried on his father's business, becoming an expert obsidian sculptor in his own right. Gerardo says that his father "always had a more innovative spirit" than his grandfather, though his modernization of the atelier was partly out of sheer economic necessity. J. E. Gerardo's studies at the Technical School enabled him to experiment and create specialized machinery for more refined and intricate objects. He always emphasized geometry, precision, perfect angles, and the utmost attention to detail in his work.

The third generation of the Cuevas family are continuing the family tradition today. Gerardo recalls "growing up among stones;" obsidian was an integral element of their lives and they were keenly aware of the infinite possibilities in the material. Nonetheless, they initially decided to pursue







other careers, Gerardo as a graphic designer and publicist, and Topacio as an architect and interior designer. Gerardo admits he never wanted to work with obsidian. When he was young, his father made him spend all his vacations in the workshop: “very reluctantly I helped him in the process. I realized I didn’t like being there very much, there was lots of dust and mud.” Yet, both siblings ended up returning to obsidian, applying their professional backgrounds to the family business, and expanding into uncharted territories. They dedicated themselves fully to the project: “it turned into love.”

Just like love, obsidian can be complex and capricious. Obsidian is typically 5 to 5.5 on the Mohs mineral scale, harder than marble. Yet it is still a delicate material, as well as extremely sharp. “Cutting is like the defense of obsidian,” Gerardo says. “It is very precious, very beautiful, and you have to treat it with great respect because of how dangerous it is, and because of its colors which come directly from the center of the earth.”

The obsidian-making process for Taller begins when the stone is cut. The conditions have to be ideal: if the stone stays in the sun too long, it can get too hot and cause internal fissures, but if it cools down too much, it can break or crack. In modern obsidian production, the stone is typically cut with diamond discs. Taller has innovated this step, and instead uses diamond wires for large-scale pieces. Once shaped, obsidian is carved, polished with sandpaper, and glossed with solvents to reach its maximum shine and smoothness.

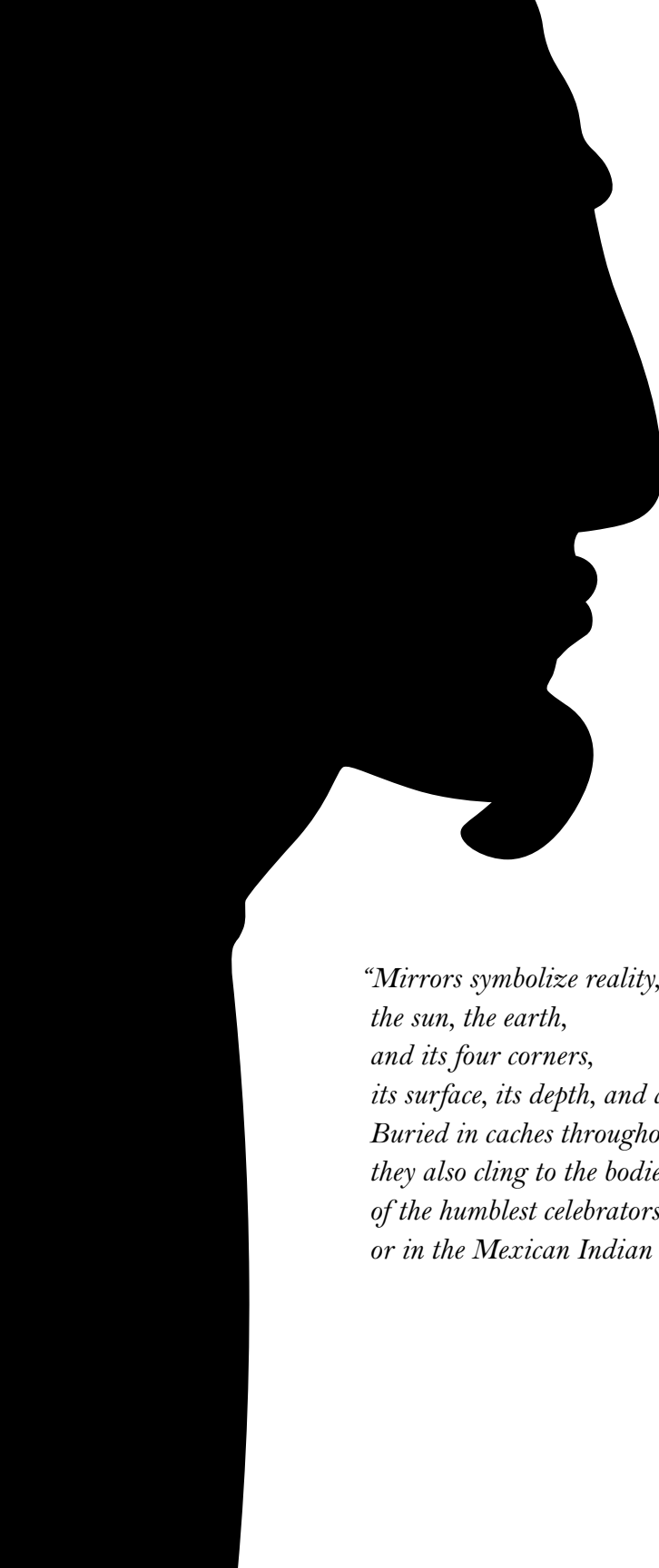
Gerardo considers Taller a design studio as well as a craft workshop “an artisan always goes hand in hand with design, their objects are created from the heart”—and the process used there involves sketching and modeling the pieces, which are then reproducible in series. The siblings design together, often in discussion with their father. “We design like our dad, we like geometry, and let go of the pre-Hispanic legacy,” he says. But this has brought challenges in terms of the market: in Teotihuacán, “design was not sold, only



handicrafts, people were not used to seeing design pieces at other price points.”

As a way to signal their aesthetic aspirations, Gerardo and Topacio decided to open a brick-and-mortar design store in the house that had been their grandfather’s and then their father’s. Its façade and interiors are black, an ode to their favored material. Inside, they created one of their masterpieces, an obsidian wall made from more than a thousand pieces in two finishes, matte black and shining silver, a tribute to the great pyramid of the sun and the moon of Teotihuacán. On the wall is a neon sign reading “negro como mi corazón”—the motto of Casa Obsidiana.

In the *Popol Vuh*, the foundational text of the Maya, it is said that gods created man from maize. In the words of Gerardo, “if our skin is made of corn, why not? Our heart is made from obsidian. It is hard yet fragile, like the human heart.”



*“Mirrors symbolize reality,
the sun, the earth,
and its four corners,
its surface, its depth, and all of its peoples.
Buried in caches throughout the Americas,
they also cling to the bodies
of the humblest celebrators in the Peruvian highlands
or in the Mexican Indian carnivals.*



*As the people dance, with scissors hanging
from their legs and arms and bits and pieces
of mirrors embedded in their headdresses,
they now reflect the world, salvaging this reflection
of their identity, which is more precious than the
gold they gave Europe in exchange.*

*Are they not right? Is not the mirror both a reflection
of reality and a project of the imagination?"*

—Carlos Fuentes, *The Buried Mirror*, 1992



Holding time

Monique Péan

Upon the untimely death of my sister Vanessa seventeen years ago, temporality—already a fascination—became an obsession. I've since explored over seventy countries across all seven continents to learn about material culture and ancestral knowledge from indigenous communities. My goal has been to learn from our past so we can improve our present, and help right the course of our collective future—not just how we can protect the Earth, but also embrace and strengthen our shared humanity.

Throughout my travels across the globe, I've sought out ancient materials that facilitate connections outside of space-time. One that has left a lasting impression on me is obsidian.

Obsidian, a volcanic glass that forms from the rapid cooling of a silica rich lava flow, connects disparate civilizations separated by large distances across time. Scientists have recently dated organized obsidian use by early hominins to the Pleistocene Era based on findings at Melka Kunture, a grouping of monumental sites along the upper Awash valley of Ethiopia. It is incredibly centering to hold obsidian in one's hands, knowing that this vitrified material was used by our distant predecessors over 1.2 million years ago, and subsequently by many civilizations.

My first encounter with obsidian was on Easter Island, a remote Polynesian island in the South Pacific—one of the most magical places on Earth. When I first visited in 2016, I had the honor of learning from the indigenous Rapa Nui people, of whom there are only 3,512, as of the last population

census in 2017 conducted by Chile's National Institute of Statistics. They shared stories about their families, ancestors, and the breathtaking land that is their home. As I explored the island, with its mystical and inspiring natural beauty, I witnessed its vulnerability to climate change and rising ocean levels.

Looming over the island's fate are the famed moai, monumental stone sculptures which the native people believe were created to honor significant ancestors. They were given eyes of coral or shell, inlaid with obsidian. The moai had already been dislodged and overturned by the time of European contact; some were buried up to their sharply defined chins.

While the moai are the most recognized art form of the Rapa Nui, I was also taken by the plethora of obsidian present throughout the island, from the rocky shores to the sides of the roads and along rolling hills. The sculptural qualities and reflections of this ancient vitrified lava draw you in; as you begin to interact with this kinetic material, you instantly recognize the history and knowledge that it embodies.

There are dissenting opinions about the history of Easter Island. The first European reports, dating to the late eighteenth century, suggested that there had been a brutal war, and that the indigenous seafaring population had killed one another using obsidian weaponry. This theory (presented by Jared Diamond, among others) is a cautionary tale about ecological stewardship, that deforestation and overfishing gradually made the island uninhabitable and caused the conflict. It's now thought, however, that obsidian was used predominantly for agricultural cultivation and the decline in population may have been due to disease brought to Easter Island by Europeans—a very different but equally important lesson about the impact of globalism.

According to the Journal of Island and Coastal Archaeology, obsidian deposits on Easter Island were originally formed by volcanic activity during the island's final eruptive phase, specifically from Rano Kau, one of the three shield



volcanoes that created the island. Discovering these deposits upon their arrival, the Rapa Nui people created shallow quarries to excavate the volcanic material. Viewing these pieces up close, I could make out the subtle curves that the Rapa Nui carved into some of the obsidian to create their tools, between about 1200 and 1860. These artifacts offer archaeologists a wealth of information on ancient technologies, economies, and cultural practices.







I was particularly drawn to a variation that I found on Easter Island, commonly referred to as “cosmic obsidian”. This type of partially crystallized obsidian features white, spherical inclusions of cristobalite within the dark obsidian foundation, evoking our Universe. Also known as “snowflake obsidian,” it forms in portions of volcanic glass where high temperatures cause the obsidian to undergo devitrification: portions of the initially amorphous composition organize

into larger, visible crystal formations. Although the cosmic obsidian on Easter Island is volcanic in origin, there are other locations around the globe where it forms as a result of lightning strikes and meteor impacts. In these incredible instances, which truly deserve to be called “cosmic,” intense heat transfer melts the existing material upon impact, followed by rapid cooling and crystal formation.

Only indigenous community members can work with obsidian from the island. I felt very privileged to collaborate with Rapa Nui artisans to make unique works of art, rather than serial production. The goal was to highlight their culture, history, and techniques, rather than exploit their resources and make them my own. These exceedingly rare sustainable materials, gathered without the human and environmental toll of mining, contain eons of knowledge and connect us with our origins.

In my own work, which spans many different mediums—sculpture, objects, jewelry, furniture, and painting, I have sought to take experiences like the ones I had on Easter Island, and imbue them into objects that help us to understand our origins and purpose. Working with a variety of environmentally responsible materials rooted in the deep past, like meteorites and small pieces of fossilized dinosaur bone, from which I make pigments, I aim to converge the past with the present to strengthen our sense of belonging.

I find great solace, strength, and a sense of calm interacting with these ancient, intelligent materials. Obsidian is a vessel for inner exploration. It provides a chance to reset and connect with nature, the Earth, deep time, and one another.





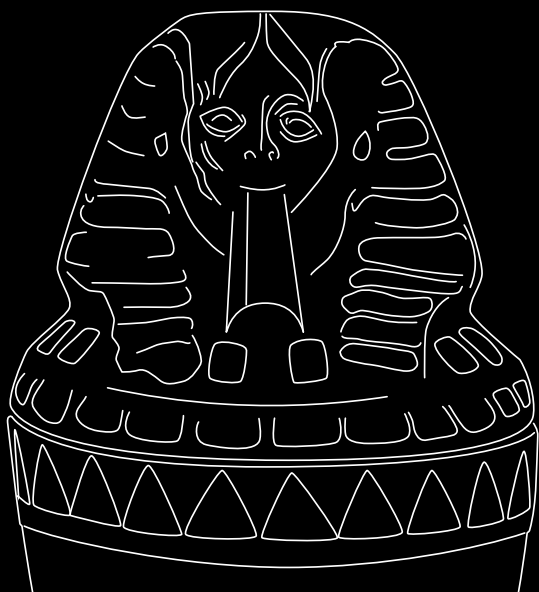
Contributors

David Carballo, PhD., is Professor of Anthropology, Archaeology, and Latin American Studies at Boston University, where he also serves as Assistant Provost for General Education. He specializes in the archaeology of Mesoamerica, especially central Mexico, and has research interests in urbanism, households, lithics, collective action, and community engagement. Two of his publications relating to obsidian are *Obsidian and the Teotihuacan State: Weaponry and Ritual Production at the Moon Pyramid* (2011) and *Obsidian Reflections: Symbolic Dimensions of Obsidian in Mesoamerica* (ed., 2014).

Thomas J. Connolly, PhD., is Director Emeritus of the Archaeological Research Division at the University of Oregon. Research interests include hunter-gatherer-fisher societies and incipient agriculture, lithic studies, geoarchaeology, cultural resource management, fiber artifacts and basketry, and historical archaeology. He has authored or co-authored fifteen books and monographs along with many articles and technical reports documenting cultural resources in Oregon and beyond.

Gerardo and Patricio Cuevas are the founders of *Taller de Obsidiana*, a design studio that has become a bridge between the ancient use obsidian and contemporary culture. Based in the Valley of Teotihuacan in the State of Mexico, they strive to represent their locality at an international level. The studio has developed innovative techniques to process obsidian since its founding in 2014, culminating in pieces that combine culture, design and tradition.

Amanda Forment is a Curatorial Assistant in the Department of Architecture and Design at the Museum of Modern Art, New York. She is currently working on an exhibition on modern design in Latin America. Previously she was a Curatorial Fellow at the Cooper Hewitt, Smithsonian Design Museum. She received her MA in History of Design and Curatorial Studies from Parsons School of Design/Cooper Hewitt.



Anita Grunder, PhD., is a volcanologist who works on the origin and storage conditions of magmas in diverse tectonic settings, from continental extension in Oregon and Nevada, to subduction in the Cascades and the Andes, to intraplate hotspot volcanism in the Pacific Northwest. She is retired from 35 years of teaching and research at Oregon State University, where she also served as associate dean of academic programs in the College of Earth Ocean and Atmospheric Sciences.

Alejandro Pastrana, PhD., is an archaeologist and a pioneer in the geo-archaeological investigation of obsidian deposits in Mexico. His research has focused from 1980 to the present on the mining, knapping, and distribution of obsidian in Central Mesoamerica. He has also studied the effects of the volcanic eruption at the archaeological site of Cuicuilco, Mexico City. Since 1974 he has been a researcher at the Instituto Nacional de Antropología e Historia (National Institute of Anthropology and History) in Mexico City, Mexico.

Monique Péan is an artist and activist based in New York City who explores the tangibility of time, cosmic history, being and identity within the mediums of sustainable objects, sculpture, and painting to investigate the intersections of materiality, temporality, metaphysics, nature and culture. She is known for her structural work featuring rare sustainably gathered elemental materials including fossilized dinosaur bone and extraterrestrial specimens, ranging in age from tens of thousands to billions of years old. Péan received her B.A. in Philosophy, Political Science and Economics from the University of Pennsylvania.

Joe Scott is a traditional ecologist, cultural fire practitioner, and lifelong Tribal teacher and learner. A member of the Confederated Tribes of Siletz Indians, Scott lives and studies on Kalapuya Illahee where he serves as Curriculum Director for the Traditional Ecological Inquiry Program. He partners with regional land stewards to serve tribal families to support environmental stewardship, promote food sovereignty, and explore traditional ways of knowing through the exploration of Indigenous ecological science.



*The observable universe hides
behind its smooth obsidian
dress, & all we can do is grasp
at it in myths & figures, see
what sticks,*

*Give all our best language
to the void.*

—Joshua Bennett,
Owed to Pedagogy, 1995

Credits

iv. *The Obsidian Skerry*, Sigmundur Andr sson (Icelandic), Hrafninnuskur, Iceland, 2011, courtesy of artist.

1. Courtesy of Friedman Benda and Ini Archibong. Photography by Andreas Zimmermann.

10. *Untitled*, Isamu Noguchi (American, 1904–1988), 1981, Obsidian, The Noguchi Museum Archives, 02294  The Isamu Noguchi Foundation and Garden Museum, New York / Artists Rights Society (ARS) New York.

14. *View of the Big Obsidian flow at Newberry Volcano*, Oregon.

Courtesy of the photographer, Adam Sawyer.

19. *Pepi I from Hierakonpolis*, Egyptian, Sixth Dynasty, ca. 2,300 B.C., Copper, limestone, and obsidian, The Egyptian Museum, JE 33034, Scala / Art Resource, New York.

21. Examples of cached production bifaces; top rows: Obsidian Cliffs; Dittman cache, Willamette Valley; bottom rows: Paul’s Fire cache, Western Cascades. Courtesy of Thomas J. Connolly.

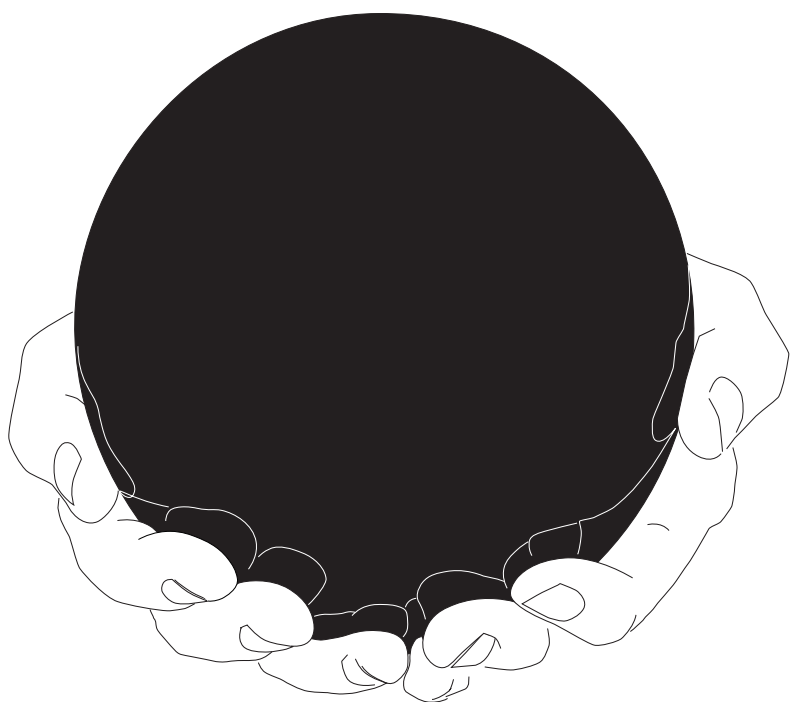
24. Amulet, Egyptian, Late Period, Incised obsidian, The British Museum, EA59500,   The Trustees of the British Museum.

25. Obsidian furniture attachment, Roman, Early Imperial, Augustan, ca. 25 BCE–10 CE, Obsidian, The Cesnola Collection, Purchased by subscription, 1874–76, The Metropolitan Museum of Art, 74.51.5871.

27. Map of Mesoamerica with locations of major obsidian sources and sites.

28. Sierra de Las Navajas; left: prehispanic mine shaft; right: block of obsidian with characteristic green-golden hue. Photo by coauthor, Alejandro Pastrana.

30. Reproduction of an Aztec *machuahuitl*, a broadsword with obsidian blades inset into the sides of a wooden handle. Photo by coauthor, Alejandro Pastrana.



31. Replica of an Aztec obsidian mirror. Photo by coauthor, Alejandro Pastrana.
32. Courtesy of Taller de Obsidiana.
35. John Bradford with obsidian blades, ca. 1897; Siletz Reservation; Oregon Views Collection no. 17; Special Collections Division, University of Washington Libraries; negative number NA1510a.
38. Lola Alvarez Bravo, *hands of Lola Alvarez Bravo with piece of obsidian*, 1950s. Center for Creative Photography, University of Arizona Lola Alvarez Bravo Archive; 93.6.23.
40. *Mickey 90* by Taller de Obsidiana; Courtesy of the studio.
41. Interior of Casa Obsidiana, San Martín de las Pirámides, Teotihuacán, Mexico. Courtesy of Taller de Obsidiana.
42. Courtesy of Taller de Obsidiana.
43. Courtesy of Taller de Obsidiana.
45. Topacio and Gerardo Cuevas. Courtesy of Taller de Obsidiana.
47. Inspiration for this drawing is a sculpture from Easter Island; *Moai Tangata*, obsidian, wood, and gold metal.
48. Courtesy of Monique Péan and Michael Morrison.
51. Necklace; carved cosmic obsidian, Widmanstätten pattern meteorite slice, and 18 carat recycled white gold. Courtesy of Monique Péan and Brittany Meyer
52. Visiting the Rano Kau volcano crater, 2016. Courtesy of Monique Péan and Michael Morrison.
54. Monique Péan holding ancient obsidian on Easter Island, 2016. Courtesy of Monique Péan and Michael Morrison.
56. Obsidian furniture attachment, Roman, Early Imperial, Augustan, ca. 25 BCE–10 CE, Obsidian, The Cesnola Collection, Purchased by subscription, 1874–76, The Metropolitan Museum of Art, 74.51.5871.
57. *Christ in the Garden of Olives*, Bartolomé Esteban Murillo (Seville, 1617–1682), ca. 1670, Oil on obsidian, Louvre, INV 931, © RMN-Grand Palais / Art Resource, New York.
59. *Carved obsidian canopic jar*.
64. *Obsidian mystic's ball*.

Illustrations, Wynne Patterson.

