Kelly Jazvac
Rock Record

September 9 – October 15, 2017

FIERMAN presents *Rock Record,* a solo exhibition by Canadian artist Kelly Jazvac. *Rock Record* features found materials presented both as art objects and as scientific evidence that plastic pollution has irrevocably changed Earth. The show centers on *plastiglomerate* – a term collaboratively coined by Jazvac, geologist Patricia Corcoran, and oceanographer Charles Moore in 2013—a new type of stone first described on Kamilo Beach, Hawaii, and later identified on beaches around the globe.

Plastiglomerate is a hybrid stone produced when plastic debris melts and fuses with naturally-found sediment such as sand, shells, rock, and wood. For several years, Jazvac has presented these stones in art galleries and museums, emphasizing their poetic, affective, and pedagogical potential. Through their simultaneously natural and artificial forms, each plastiglomerate works to visualize the dense entanglements of human consumption and the environments that adapt and react to our overwhelming presence.

However, these stones are not simply, nor primarily, artworks. They are also scientific evidence of how anthropogenic materials are altering Earth's geology, as explained by Jazvac, Corcoran, and Moore in a co-authored scientific paper published in 2014. They argue that plastiglomerate has the potential to sink into Earth's strata: due to the increased density of this plastic-sediment fusion, as plastiglomerate becomes buried, so too will the material be preserved for centuries to come. Both Corcoran and Jazvac are founding members of an interdisciplinary research team that considers the ways in which art and culture can contribute to scientific research. This team works collaboratively to make largely unseen aspects of plastic pollution visible. In doing so, they aim to expand environmental protection efforts by thinking through issues in a cross-disciplinary manner: scientifically, culturally, and politically.

For this exhibition, the original hybrid stones studied through these collaborations are included in an installation with other found objects. The new combination follows connective threads between the production of plastic products that travel through flows of global hypercapitalism – across borders and oceans, washing up on beaches to become plastiglomerate – and attitudes to the commercialization of resources that help to perpetuate environmentally harmful cycles of production. Ultimately, the exhibition works to make visible the earthly consequences of irresponsible pursuits of capital.

As an installation presented in a commercial gallery, the exhibition comes with three conditions of sale: the installation may only be acquired by a public institution that supports the potential of plastiglomerate to continue to impact and inform visitors; it may not be deaccessioned without consultation with the artist regarding the relocation of the specimens; and it may not be displayed in a context that argues for the mass production of plastiglomerate as a new resource.

Jazvac's work has been written about in *e-flux*, *Hyperallergic, The Brooklyn Rail, Art Forum,* and *The New Yorker,* among other publications. The aforementioned co-authoried paper on plastiglomerate has received extensive media coverage, including *The New York Times, National Geographic,* and *Science Magazine.* A book on plastiglomerate as an artwork is forthcoming in October; it explores the ways in which the project can model future research methods for environmental contamination. Centrally, the book considers culture, not only science, as a crucial site of knowledge and understanding. In an interview in the book, geologist Patricia Corcoran is asked what she would want scientists to know before the collaborate with an artist. She responds," I would want the scientist to know that they're going to look at things in a way that have not looked at anything before."

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An anthropogenic marker horizon in the future rock record

Patricia L. Corcoran, *Dept. of Earth Sciences, University of Western Ontario, London, Ontario, Canada, N6A 5B7, pcorcor@uwo.ca;* ***Charles J. Moore,*** *Algalita Marine Research Institute, Long Beach, California, 90803-4601, USA; and* ***Kelly Jazvac,*** *Dept. of Visual Arts, University of Western Ontario, London, Ontario, Canada, N6A 5B7*

ABSTRACT

Recognition of increasing plastic debris pollution over the last several decades has led to investigations of the imminent dangers posed to marine organisms and their ecosystems, but very little is known about the preservation potential of plastics in the rock record. As anthropogenically derived materials, plastics are astonishingly abundant in oceans, seas, and lakes, where they accumulate at or near the water surface, on lake and ocean bottoms, and along shorelines. The burial potential of plastic debris is chiefly dependent on the material's density and abundance, in addition to the depositional environment. Here, we report the appearance of a new "stone" formed through intermingling of melted plastic, beach sediment, basaltic lava fragments, and organic debris from Kamilo Beach on the island of Hawaii. The material, herein referred to as "plastiglomerate," is divided into in situ and clastic types that were distributed over all areas of the beach. Agglutination of natural sediments to melted plastic during campfire burning has increased the overall density of plastiglomerate, which inhibits transport by wind or water, thereby increasing the potential for burial and subsequent preservation. Our results indicate that this anthropogenically influenced material has great potential to form a marker horizon of human pollution, signaling the occurrence of the informal Anthropocene epoch.

INTRODUCTION

Plastics, or synthetic organic polymers, are lightweight, durable products that are used for a number of consumer and non-consumer goods (Barnes et al., 2009). As anthropogenically derived materials, plastics only began to appear in the 1950s, with production and disposal rates increasing steadily over the past 60 years (Ryan and Moloney, 1993; Moore, 2008). Combined with abysmal rates of recovery, a massive amount of plastic debris has accumulated in Earth's waterways and along shorelines (Derraik, 2002; Thompson et al., 2004; Corcoran et al., 2009; Law et al., 2010). These plastics have been proven dangerous to marine organisms and seabirds through ingestion, entanglement, and disruption of feeding patterns (Laist, 1997; Eriksson and Burton, 2003; Boren et al., 2006; Gregory, 2009; Aloy et al., 2011). In addition, adsorption of persistent organic pollutants (POPs) onto plastics (Mato et al., 2001; Endo et al., 2005; Rios et al., 2007, 2010) enhances the potential for bioaccumulation from ingested microplastics into fish. The unknown effect on apex predators, such as humans, is a major concern. These POPs, such as polychlorinated biphenyls (PCBs), can cause serious health effects, as they have been shown to be endocrine-disrupting chemicals and carcinogens (Bergman et al., 2013).

The degradation of plastic material is a slow process that can occur mechanically, chemically (thermo- or photo-oxidative), and to a lesser degree, biologically (Kulshreshtha, 1992; Shah et al., 2008; Cooper and Corcoran, 2010). The persistence of plastic in the environment has been estimated to be in the range of hundreds to thousands of years, although longevity can increase in cool climates and where material is buried on the ocean bottom or under sediment (Gregory and Andrady, 2003). A recent study examining the accumulation of marine ocean debris at depths of 25–3971 m over a 22-year period shows that 33% of all debris in Monterey Bay, California, USA, is composed of plastic litter (Schlining et al., 2013). Similar results from other localities reveal that much of plastic debris is below the water surface (Goldberg, 1997; Galgani et al., 2000; Keller et al., 2010). This debris may be composed of high-density plastics or low-density plastics with fouled surfaces (Ye and Andrady, 1991; Goldberg, 1997; Gregory, 2009; Lobelle and Cunliffe, 2011). Given the low water temperatures and decreased exposure to UV light at greater depths within and below the photic zone, sunken plastic debris has good potential to persist and eventually form part of the rock record. On beaches, plastic debris, such as resin pellets, fragments, and expanded polystyrene up to 11 mm in size, may be preserved within the upper 5 cm of beach sediment (Kusui and Noda, 2003). Claessens et al. (2011) identified microplastics in beach sediment cores at depths down to 32 cm. In addition, Fisner et al. (2013), in their study of polycyclic aromatic hydrocarbons in pellets, were able to locate plastic debris at sediment depths as great as 1 m. However, we found no visible loose plastic fragments at depths >10 cm in sand on Kamilo Beach, Hawaii. Given the beach's constant exposure to the northeasterly trade winds, much of the small (<10 cm), lightweight plastic debris is blown to the backshore environment, where it becomes trapped in vegetation. On a beach as dynamic as Kamilo, preservation of plastics in the sediment column could occur where trapped sediment is covered with sand or where a polymer is combined with a much denser material. We observed the results of this density increase on Kamilo Beach, where great quantities of melted plastic have mixed with the substrate to create new fragments of much greater density, herein referred to as "plastiglomerate."

CHARACTERISTICS OF KAMILO BEACH

The location of the Hawaiian Islands within the North Pacific subtropical gyre makes them vulnerable to acting as sinks for plastic debris (Moore, 2008). The anticyclonic movement of surface ocean currents within the gyre results in preferential

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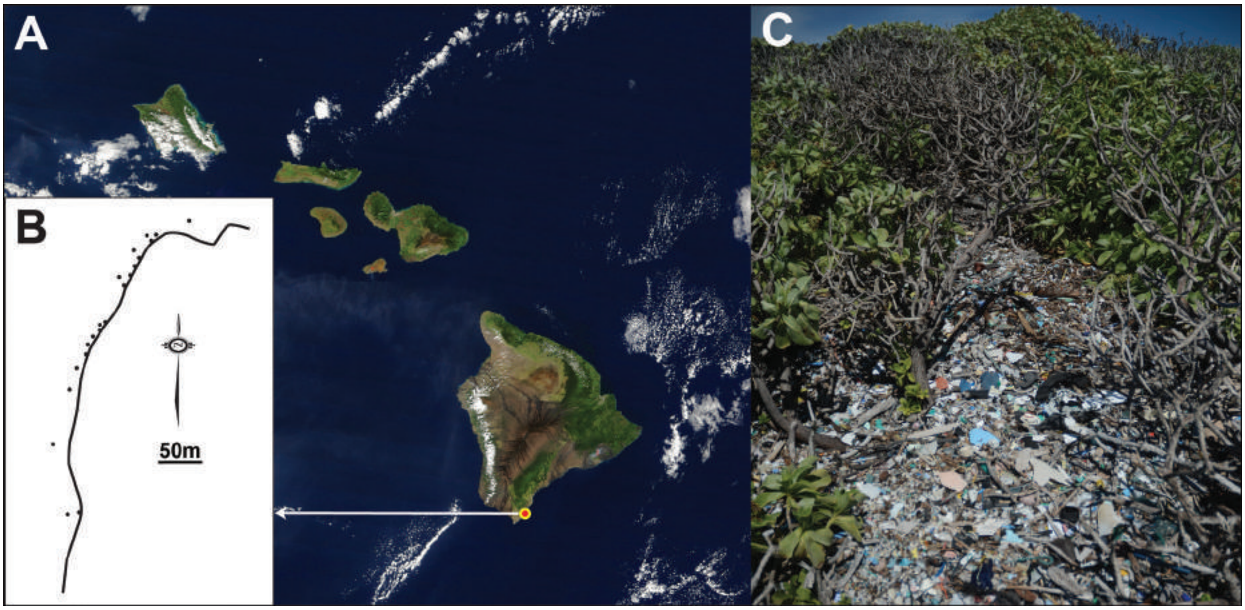

Figure 1. Location and characteristics of Kamilo Beach. (A) Location of Kamilo Beach along the southeast shore of the island of Hawaii (satellite image of 13 Dec. 2002, available at http://visibleearth.nasa.gov). (B) Sampling locations along the Kamilo Beach shoreline (Pacific Ocean east of the dark line). (C) Plastic "confetti" trapped within vegetation.

deposition of marine debris along the eastern and southeastern windward shorelines of the major Hawaiian Islands (Corcoran et al., 2009; McDermid and McMullen, 2004). Kamilo Beach, located on the southeastern tip of the island of Hawaii, is notable for its accumulation of vast amounts of marine debris (Moore, 2008) (Figs. 1A and 1B). Typical plastic debris include derelict fishing gear, including nets, oyster spacer tubes and buoys; food and drinking containers; resin pellets; and abundant multi-colored fragments or "plastic confetti" (Fig. 1C). The main stretch of Kamilo Beach is ~700 m long, and its northern termination is marked by a rocky headland jutting 300 m oceanward at low tide. The beach is accessible by four-wheel drive vehicle only, and it is an ~12 km drive from the nearest paved road. The remoteness of the beach plays an important role in the formation of a potential plastiglomerate marker horizon, as most visitors camp for extended periods of time and build fires for cooking and warmth. In addition, regular, organized beach clean-ups are difficult.

FORMATION OF PLASTIGLOMERATE ON KAMILO BEACH

We use the term plastiglomerate to describe an indurated, multi-composite material made hard by agglutination of rock and molten plastic. This material is subdivided into an in situ type, in

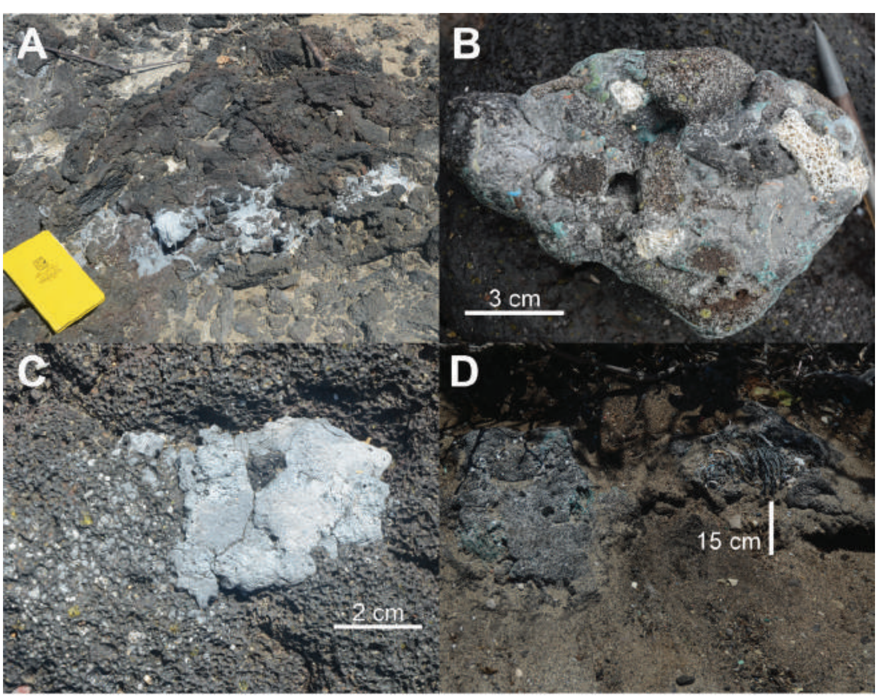

Figure 2. Characteristics of the two types of plastiglomerate. (A) In situ plastiglomerate wherein molten plastic is adhered to the surface of a basalt flow. Field book is 18 cm long. (B) Clastic plastiglomerate containing molten plastic and basalt and coral fragments. (C) Plastic amygdales in a basalt flow. (D) Large in situ plastiglomerate fragment. Adhered molten plastic was found 15 cm below the surface. Note the protected vegetated location.

which plastic is adhered to rock outcrops, and a clastic type, in which combinations of basalt, coral, shells, and local woody debris are cemented with grains of sand in a plastic matrix (Figs. 2A and 2B). Of the 21 sample locations containing plastiglomerate on Kamilo Beach, in situ plastiglomerate was identified at nine. Partially melted polymers adhered to basalt outcrops included fishing nets, piping, bottle caps, and rubber tires. Locally, molten plastic had infilled vesicles in volcanic rock, thereby forming plastic amygdales (Fig. 2C). The largest surface exposure of in situ plastiglomerate was 176 × 82 cm, which was evident only following removal of 15 cm of beach sediment (Fig. 2D). Beach sand and woody debris were locally adhered to the plastic surfaces. Based on its location in more sheltered regions of the beach or within depressions of volcanic rock outcrops, in situ plastiglomerate is interpreted to represent campfire debris.

Clastic plastiglomerate fragments, >2 cm in size, were collected from 21 locations along Kamilo Beach. In addition, we measured the abundance and sizes of angular, clastic plastiglomerate fragments in a quadrat measuring 5 m × 5 m. Partially buried, fractured, in situ plastiglomerate at the center of the quadrat is interpreted as the source of the angular fragments. One hundred and sixty-seven fragments were identified, ranging in size from 2.0 to 22.5 cm, with 55% represented by fragments <4.5 cm. In contrast to the angular nature of the fragments within the quadrat, clastic plastiglomerate fragments found closer to the water and along the strandline were rounded (Fig. 2B) as a result of abrasion in the foreshore environment. A total of 205 fragments sampled from Kamilo Beach displayed different combinations of coral pebbles, plastic, basalt pebbles, woody debris (including charcoal, nuts, and seeds), and sand (including shell fragments) (Fig. 3A). Angular fragments <4 cm in size mainly comprised the sand-plastic group, whereas larger angular fragments were predominantly composed of sand, plastic, basalt pebbles, and woody debris. This discrepancy may be a result of the preferential weathering of organic woody debris and charcoal from the larger fragments, leaving smaller fragments devoid of organic material.

Although plastic debris in some plastiglomerate fragments was melted beyond recognition, we were able to identify distinct types of plastic in most samples. Plastic types included netting/ropes, pellets, partial containers/packaging, lids, tubes/pipes, and "confetti" (Figs. 4A–4D). The latter plastic type was most abundant, as it represents the embrittled remains of intact products, such as containers (Fig. 3B). Partial containers and lids were preserved and were identified in 22% of all fragments. Approximately 20% of the samples contained evidence of fishing-related debris, as indicated by netting, ropes, nylon fishing line, as well as remnants of oyster spacer tubes. We observed that some of the plastiglomerate had been buried by sand and organic debris, as well as having been trapped within vegetation, which demonstrates the potential for preservation in the future rock record.

We measured the bulk density of 20 clastic plastiglomerate fragments sampled from Kamilo Beach. Bulk density of the clastic fragments ranged from 1.7 to 2.8 g/cm^3, with the highest values determined from fragments rich in basalt pebbles. The measured bulk densities show that plastiglomerate has greater potential to become buried and preserved in the rock record than plastic-only particles, which typically have densities in the range of 0.8–1.8 g/cm^3 (Kholodovych and Welsh, 2007).

SOURCE OF MOLTEN PLASTIC

Although the island of Hawaii is volcanically active, the recorded locations of flowing lava over the past century are not coincident with the location of Kamilo Beach. Therefore, the plastiglomerate we sampled from Kamilo Beach cannot be the result of molten lava and polymer interaction. These plastiglomerate fragments were formed anthropogenically. Burning plastic debris in an open environment results in the release of chemical substances, such as carbon monoxide, polycyclic aromatic hydrocarbons, and dioxins (EPA, 2013). These pollutants can cause neurological symptoms, cancer, and hormonal disruptions in humans. In this regard, Kamilo Beach provides an example of an anthropogenic action (burning) reacting to an anthropogenic problem (plastics pollution), resulting in a distinct marker horizon of the informal Anthropocene epoch. Although campfire burning is responsible for the plastiglomerate on Kamilo Beach, it is conceivable that the global extent of plastic debris could lead to

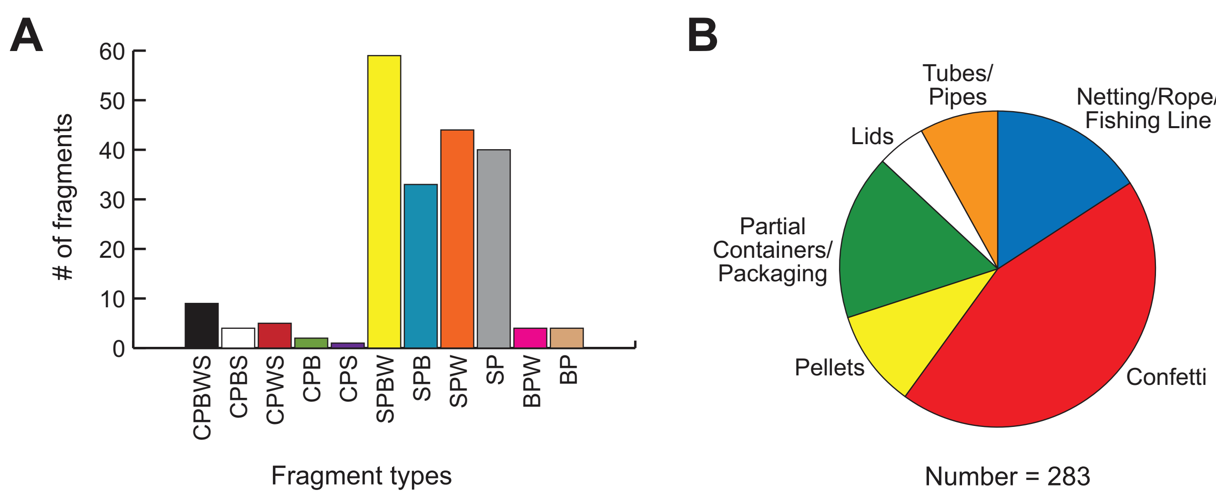

Figure 3. Diagrams illustrating the types of plastiglomerate and relative percentages of adhered plastic fragments. (A) Material composing the sampled plastiglomerate: B—basalt clasts; C—coral fragments; P—plastic; S—sand and sand-size shelly fragments; W—woody debris. (B) Pie diagram showing the relative abundance of different plastic products in plastiglomerate.

Figure 4. Photographs of clastic plastiglomerate on Kamilo Beach. (A) Subrounded fragment containing basalt clasts, molten plastic, yellow rope, and green and red netting. (B) Portions of black and green plastic containers adhered to basalt fragments and connected by netting. (C) Fragment containing plastic pellets and "confetti" with woody debris. (D) Adhered mixture of sand, black tubing, a bottle lid, "confetti," netting, and part of a plastic bag.

similar deposits where lava flows, forest fires, and extreme temperatures occur.

INFORMAL ANTHROPOCENE EPOCH

According to the geologic timescale, we are currently living in the Holocene epoch. However, Crutzen and Stoermer (2000) proposed the term "Anthropocene" to represent the period of time between the latter half of the 18th century and the present day. Although other workers have considered the onset of this informal epoch to have occurred at slightly different times (Ruddiman, 2003; Doughty et al., 2010), researchers agree that the Anthropocene is a time span marked by human interaction with Earth's biophysical system (Zalasiewicz et al., 2011; Syvitsky, 2012). Geological evidence used in supporting this assertion comes from Holocene ice cores and soil profiles. For example, methane concentrations measured in ice cores display an increase at ca. 5000 yr B.P., which contrasts with the expected decline in CH_4 at that time, based on the orbital-monsoon cycle theory (Ruddiman and Thomson, 2001). Ruddiman and Thomson propose that this anomalous rise in CH_4 can be linked to early agricultural practices in Eurasia. In addition, an increase in atmospheric CO_2 at ca. 8000 yr B.P., as determined from ice cores, was explained by Ruddiman (2003) as a result of early forest clearance.

Soil profiles from peat bogs in Norway indicate an increase in lead concentrations in Europe over the past 300 years (Dunlap et al., 1999). Lead concentrations prior to ca. 1950 AD are attributed to mining activities, whereas a second Pb compositional signature in soil younger than 1950 AD is consistent with atmospheric lead derived mainly from combustion of leaded gasoline. Certini and Scalenghe (2011) suggested that anthropogenic soils are the "golden spikes" for the Anthropocene because they contain evidence of soil management practices for enhancing fertility. Examples include terracing, and formation of mixed charcoal, manure, plant debris, and animal bones.

Atmospheric compositions and soil management practices are only two indicators of anthropogenic activity, but relatively few examples of solid, human-made materials are preserved in the sediment record (Zalasiewicz et al., 2008). Even rarer are items that are correlatable on a global scale. Given the ubiquity of non-degradable plastic debris on our planet, the possibility of their global preservation is strong. Our study presents the first rock type composed partially of plastic material that has strong potential to act as a global marker horizon in the Anthropocene.

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ENVIRONMENT

Future Fossils: Plastic Stone

By RACHEL NUWER JUNE 9, 2014

Researchers have collected samples of plastiglomerate rock material from the polluted Kamilo Beach in Hawaii. Patricia Corcoran

Plastic first became widespread in the mid-20th century. Since then, about six billion tons have been manufactured. Much of that has ended up as trash, and nobody knows what will become of it.

Now researchers have discovered an unexpected way that some plastic waste is persisting: as a new type of stone.

The substance, called plastiglomerate, is a fusion of natural and manufactured materials. Melted plastic binds together sand, shells, pebbles, basalt, coral and wood, or seeps into the cavities of larger rocks to form a rock-plastic hybrid. The resulting materials, researchers report in the journal GSA Today, will probably be long-lived and could even become permanent markers in the planet's geologic record.

“Most conventional plastic is relatively thin and fragments quickly,” said Richard Thompson, a marine biologist at Plymouth University in England, who was not involved in the research. “But what’s being described here is something that’s going to be even more resistant to the aging process.”

Plastiglomerate was discovered in 2006 by Charles Moore, a sea captain and oceanographer at the Algalita Marine Research Institute in Long Beach, Calif. Mr. Moore was surveying plastic washed up on Kamilo Beach, a remote, polluted stretch of sand on Hawaii’s Big Island.
Like other southeastern shorelines in the Hawaiian archipelago, Kamilo Beach accumulates garbage because of how currents circulate. Spotting the odd plastic-covered rock assemblages, Mr. Moore took a few photographs and collected some specimens.

The significance of that discovery was not realized until 2012, when Patricia Corcoran, an earth scientist at Western University in Ontario, invited Mr. Moore to give a lecture about plastic pollution. He included the plastic conglomerates in one of his slides, although he had no name for them. Intrigued, Dr. Corcoran decided to fly to Hawaii to see the strange anthropogenic stones for herself.

At Kamilo Beach, she and a colleague sampled 21 sites on a 2,300-foot strip. They collected all plastic-rock specimens with a diameter of about an inch or more.

Most of the melted plastic was hard to identify, but traces of nets, ropes and lids appeared in some stones. They collected 205 pieces, ranging from the size of a peach pit to the diameter of a large pizza.

At first, Mr. Moore hypothesized that lava from the nearby Kilauea volcano created the plastiglomerates, but flows have not approached the beach for at least a century. Interviews with local residents revealed a more likely explanation: bonfires.

Kamilo Beach’s sand is laced with degraded pollutant particles called “plastic confetti.” This makes it virtually impossible to find a bonfire spot free of plastic waste, Dr. Corcoran said.

She also heard that some locals intentionally burned plastic in an effort to get rid of it.

Kamilo Beach’s plastiglomerates are probably not unique. Plastic is found around the world, as are bonfires. And in some developing countries, people regularly burn garbage to dispose of it.

“I’m sure people have seen plastiglomerates in other places and just haven’t reported them or given them a name,” Dr. Corcoran said.

Because scientists define rocks as things formed by natural processes, she prefers to label the new materials as stones. This distinction does not affect plastiglomerates’ longevity, however.

Many scientists believe the planet has entered a new geological era, the Anthropocene, in which human activity is leaving a vast and durable imprint on the natural world. Along with building materials, tools and atmospheric signatures, plastiglomerates could be future markers of humanity’s time on earth.

“Plastics and plastiglomerates might well survive as future fossils,” said Jan Zalasiewicz, a geologist at the University of Leicester in England, who was not involved in the discovery.

“If they are buried within the strata, I don’t see why they can’t persist in some form for millions of years.”

A version of this article appears in print on June 10, 2014, on Page D5 of the New York edition with the headline: Future Fossils: Plastic Stone.

SundayReview | EDITORIAL

From Ocean to Beach, Tons of Plastic Pollution

By **THE EDITORIAL BOARD** JUNE 14, 2014

Like diamonds, plastics are forever. The tons dumped into the ocean float around, swirling on currents, breaking into smaller bits, never going away. Scientists have identified huge gyres of plastic in the Pacific. There is an Eastern Garbage Patch, between Hawaii and California; a Western Garbage Patch, off Japan, and a patch between them called the Subtropical Convergence Zone, north of Hawaii.

The patches are misunderstood to be visible islands of debris; you can't actually see them from a boat or plane. They are more like vast, soupy concentrations of flotsam, some of it large, some tiny, all indigestible, sickening and killing fish, birds, whales and turtles.

What you can see is what washes ashore, as countless tons of plastic do on the Hawaiian Islands, which stick up like the teeth of a comb in the middle of the northern Pacific, snagging what drifts by.

On the southern tip of the Big Island of Hawaii, deep ocean currents rub against the remote and rocky shoreline. Volunteers regularly make a long, hot trip to clean the beaches, hauling away fishing nets, lines and traps, toys, shoes, buckets and bottles. Some of the fishing debris is shipped to a Honolulu power plant and incinerated. Some is left on the beach, and more always appears.

The Hawaii Wildlife Fund, which organizes the cleanups, estimates that they have removed about 169 tons of garbage in the last 11 years from a 10-mile stretch of Hawaii Island alone, and that about 15 tons to 20 tons of new trash comes ashore each year. On May 24, two dozen people went out again.

They collected 1,312 pounds of trash, including:

191,739 plastic fragments

562 bottle or container caps

93 toothbrushes

64 beverage bottles

48 hagfish traps

35 buoys and floats

3 refrigerator doors

3 G.I. Joe Real American Hero toys

On a nearby beach at Kamilo Point, geologists have identified a new kind of plastic-infused rock, in areas where the plastic is so abundant in the sand and soil you can’t avoid burning it in campfires. A paper published this month by the Geological Society of America suggests that “plastiglomerate” will someday be part of the fossil record, marking the geological era that some call the Anthropocene, for the human influence.

On Monday in Washington, the State Department will be holding an ocean conference. The topics are ocean acidification, sustainable fishing and marine pollution. The nations represented include the Seychelles, St. Lucia, Kiribati, Palau, Chile, Togo, Norway and New Zealand. Significant progress on healing the oceans is not expected.

The next cleanup is July 13 at Kamilo Point. The effort may seem futile, but at least people are doing something, like the volunteers working along shorelines in the Northeast, Texas, the Pacific Northwest and the Great Lakes.

World leaders, meanwhile? The nations of an increasingly plasticized planet? They are drifting in circles.

A version of this editorial appears in print on June 15, 2014, on Page SR10 of the New York edition with the headline: Notes From the Plasticene Epoch.

Science AAAS

Left behind. A sample of plastiglomerate, collected on Kamilo Beach in Hawaii. Patricia Corcoran

Rocks Made of Plastic Found on Hawaiian Beach

By Angus Chen Jun. 4, 2014 , 1:00 PM

Plastic may be with us a lot longer than we thought. In addition to clogging up landfills and **becoming trapped in Arctic ice**, some of it is turning into stone. Scientists say a new type of rock cobbled together from plastic, volcanic rock, beach sand, seashells, and corals has begun forming on the shores of Hawaii.

“The article is intriguing and fascinating,” says geophysicist Douglas Jerolmack of the University of Pennsylvania, who was not involved in the work. “If these things can be preserved, then they might be a nice marker around the world of when humans came to dominate the globe and leave behind their refuse in mass quantities.”

Geologist Patricia Corcoran of the University of Western Ontario in London, Canada, and Charles Moore, captain of the oceanographic research vessel Alguita, stumbled upon the new rocks on a beach on the Big Island of Hawaii. These stones, which they’ve dubbed “plastiglomerates,” **most likely formed from melting plastic in fires lit by humans who were camping or fishing**, the team reports this month in GSA Today. Although anywhere there is a heat source, such as forest fires or lava flows, and “abundant plastic debris,” Corcoran says, “there is the potential for the formation of plastiglomerate.” When the plastic melts, it cements rock fragments, sand, and shell debris together, or the plastic can flow into larger rocks and fill in cracks and bubbles to form a kind of junkyard Frankenstein.

Corcoran says some of the plastic is still recognizable as toothbrushes, forks, ropes, and just “anything you can think of.” Once the plastic has fused to denser materials, like rock and coral, it sinks to the sea floor, and the chances it will become buried and preserved in the geologic record increase.

Corcoran and her team canvassed Kamilo Beach on the Big Island for more of the rocks and found plastiglomerate in all 21 sites they surveyed. She says people have already found plastiglomerate on another Hawaiian island, and she expects there to be much more on coastlines across the world. Plastiglomerate is likely well distributed, it’s just never been noticed before now, she says.

Jerolmack agrees. “All around the world where there’s trash being openly burned in mass quantities, you can imagine there are even larger melted plastic deposits” where plastiglomerate could form.

The discovery adds to the debate about whether humanity’s heavy hand in natural processes warrants the formal declaration of a new epoch of Earth history, the **Anthropocene**, says paleontologist Jan Zalasiewicz of the University of Leicester in the United Kingdom, who was not involved in the study. Plastics in general are so pervasive that they’ve been documented in a number of surprising places, including ingested in wildlife and on the sea floor. The mass of plastic produced since 1950 is close to 6 billion metric tons, enough to bundle the entire planet in plastic wrap. Combine plastic’s abundance with its persistence in the environment, and there’s a good chance it’ll get into the fossil record, Zalasiewicz says. “Plastics, including plastiglomerates, would be one of the key markers by which people could recognize the beginning of the Anthropocene.”

How long the plastic will endure remains a matter of debate, however. Jerolmack says he doubts the material will stick around in the fossil record. After all, plastic melts, and rocks often pass through hellish depths and temperatures through tectonic processes and burial. Geologist Philip Gibbard of the University of Cambridge in the United Kingdom says he imagines that plastics might “revert back to a source of oil from whence they came, given the right conditions of burial.” But Zalasiewicz and Corcoran say that isn’t true for all the plastic. Some of the material can be preserved as a thin carbon film, much like the way fossil leaves are preserved. Zalasiewicz says that in some rare cases, in that etch of carbon “you may well be left the shape for a flattened plastic bottle.”

The Atlantic

Half of All Plastic That Has Ever Existed Was Made in the Past 13 Years

Plastic production is rapidly accelerating, according to an ambitious new paperÑbut only 9 percent of it gets recycled.

SARAH ZHANG | JUL 19, 2017 |

In 2014, scientists found a new kind of of “stone” on the beaches of Hawaii. It was made of sand, organic debris, volcanic rock, all swirled together with melted plastic. So they proposed the name “plastiglomerate” and they suggested that, as plastic lasts pretty much forever, these stones could be a marker of the Anthropocene in the rock record. In the future, our time might be defined by our use of plastics.

Which is not particularly hard to imagine, given the ubiquity of plastics. Now, for the first time, researchers have published a sweeping, public, and in-depth accounting of all plastic that has ever been made in the entire world. The number is so big as to defy human comprehension: 8,300 million metric tons since 1950. Of this, 6,400 million metric tons has outlived its usefulness and become waste; 79 percent of that waste is sitting in landfills or the natural environment, 12 percent has been incinerated, and just 9 percent has been recycled.

Donald Loepp, editor of the industry paper *Plastics News*, called the study an “impressive report.” It’s something that many people have speculated about, he says, but no one had published such a thorough accounting until now.

Perhaps the most eye-popping statistic in the study is how quickly plastic production has been accelerating in just this millennium. The world has made as much plastic in the past 13 years it did in the previous half-century. “I think [that’s] the number that captures it best,” says Roland Geyer, an industrial ecologist at the University of California, Santa Barbara and an author on the study. We’re still rushing headlong into the plastic age.

Geyer and his team rely on both publicly available information and industry reports that they purchased for the study. They begin their analysis in the year 1950, when plastic started entering civilian life. During World War II, the military was starting to find uses for plastic. “The way the war disrupted trade, for example, with natural rubber supplies from southeast Asia or the silk supply out of Japan, affects how tires are made, how parachutes are made, and tread for boots," says Rebecca Altman, a writer and environmental historian. "The stage was set for plastics to really take off after the war."

"Plastic recycling just suffers from poor economies"

It's worth considering how much the rise of plastic is tied to the rise of oil and gas. Around this time, the United States began using a lot more oil. Oil is easy to make into plastic, and and it is cheap to do so. These economic forces helped create a new category of product: the disposable, single-use plastic packaging.

Packaging is now the largest plastic market, and it's still tied to fossil fuels. In June, *The Wall Street Journal* reported on how the United States' natural gas boom was translating into cheaper plastic pellets. The Dow Chemical Company wants to send its plastic pellet to places like Brazil, where it's betting that a rising middle class will want the convenience of single-use plastic baby-food containers. Developing countries in South America and Asia account for much of the recent growth in plastics consumption.

These economic forces also govern how plastic gets recycled—or doesn't. It's often cheaper just to make virgin plastics, especially if you need plastic of a certain hardness or durability. Plus, there are so many different types of plastics that need to be sorted. "Plastic recycling just suffers from poor economics," says Geyer.

It wasn't always obvious that petroleum-based plastics would dominate. In the early 20th century, scientists experimented with plastics made from plant-derived carbon-based molecules. Henry Ford unveiled the "soybean car" in 1941. The car had a hard plastic shell, made of soybean fiber. The field of chemurgy—dedicated to turning agricultural materials into industrial products—rose and quickly fell, thanks to the ascendance of petroleum. It's come full circle in a way. Now there are bioplastics, made out of biological materials like corn starch.

I Asked Geyer if he thought we would eventually move beyond petroleum-based plastics, given a long-term move away from fossil fuels.

"Unfortunately, my answer will be no," he said. He gave two reasons. First, plastic production uses only a tiny fraction of the fossil fuel that we currently use for energy, so there will be plenty to go around for a long time. And second, he's not convinced that bioplastics have less of an environmental impact. They aren't necessarily more biodegradable, and they divert crops away from food. Since large-scale agriculture also relies on fossil fuels for fertilizer, there's no way to go completely fossil fuel-free yet. So our plastic age goes on. We will keep adding plastiglomerate to the geological record of the Anthropocene.

e-flux

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Kirsty Robertson

Plastiglomerate

Plastiglomerate sample/ready-made collected by geologist Patricia Corcoran and sculptor Kelly Jazvac at Kamilo Beach, Hawai'i, 2012. Photo: Kelly Wood. Courtesy of the artist.

> The conditions that obtained when life had not yet emerged from the oceans have not subsequently changed a great deal for the cells of the human body, bathed by the primordial wave which continues to flow in the arteries. Our blood in fact has a chemical composition analogous to that of the sea of our origins, from which the first living cells and the first multicellular beings derived the oxygen and the other elements necessary to life … The sea where living creatures were at one time immersed is now enclosed within their bodies.
>
> —Italo Calvino, *Blood, Sea*[1]

What is a beach actually? It is marginalia, a footnote to the essay that is the ocean. Beaches are many things and can range from rocky outcrops to lush vegetation. But the sandy beach of popular imagination is made up of sediment, of particles coming from eroded coral reefs in the ocean, sediment from the sea floor, eroded sections of the continental shelf, or weathered and eroded rocks from nearby cliffs.[2] In Hawai'i, volcanic basalt sometimes contributes to the mix, creating black beaches of small-to-tiny particles that are eroded by the constant, lapping wave action of the ocean. Beaches are far from sedentary. They are in constant motion, as wind and water wear away at rocks, coral, shells, and other matter. They also stretch across time as certain minerals, such as quartz and feldspar, are chemically stable and strong enough to last well through erosion, often forming the base of beaches millennia old.[3] When plastics are released into the ocean, they join this process, being broken down into smaller and smaller parts and adding to the sand mixture on almost all coastal beaches. Note: an archive of pure sand is an impossibility. No wonder that sand is often seen to flow through time, through the glass timer, to ebb and flow, to move liquidly across the face of the Earth.

This and all subsequent images: plastiglomerate samples/ready-mades collected by geologist Patricia Corcoran and sculptor Kelly Jazvac at Kamilo Beach, Hawai'i, 2012. Photos: Jeff Elstone. Courtesy of the artist.

Kamilo Beach, Hawaii is a node where the ocean gets rid of foreign substances. The beach has long been known as a way station: stories are told that pre-contact, native Hawai'ians used the beach to harvest logs that had drifted into Kamilo from the Pacific Northwest, and that shipwrecked bodies often turned up there.[4] Currently, Kamilo is a terminal point in the circulation of garbage. The beach and adjacent coastline are covered in plastic: as much as 90 percent of the garbage accumulated in the area is plastic. So much garbage collects here that Kamilo Beach can be found on *Atlas Obscura*'s compendium of bizarre and obscure places to visit, where it is described as "constantly covered in trash like some sort of tropical New York City gutter."[5] It is a site of immense efforts at cleanup organized by the Hawaii Wildlife Fund, a group that must constantly contend with the ocean's supply of new materials.

In 2012, geologist Patricia Corcoran and sculptor Kelly Jazvac travelled to Kamilo Beach, following a tip from oceanographer Charles Moore that the beach was covered in a plastic-sand conglomerate. Moore suspected nearby volcanoes were to blame. In fact, the plastic and beach detritus had been combined into a single substance by bonfires. Human action on the beach had created what Corcoran and Jazvac named "plastiglomerate," a sand-and-plastic conglomerate. Molten plastic had also in-filled many of the vesicles in the volcanic rock, becoming part of the land that would eventually be eroded back into sand.

The term "plastiglomerate" refers most specifically to "an indurated, multi-composite material made hard by agglutination of rock and molten plastic. This material is subdivided into an in situ type, in which plastic is adhered to rock outcrops, and a clastic type, in which combinations of basalt, coral, shells, and local woody debris are cemented with grains of sand in a plastic matrix."[6] More poetically, plastiglomerate indexically unites the human with the currents of water; with the breaking down, over millennia, of stone into sand and fossils into oil; with the quick substration of that oil into fuel; and with the refining of that fuel into polycarbons—into plastic, into garbage. From the primordial muck, to the ocean, to the beach, and back to land, plastiglomerate is an uncanny material marker. It shows the ontological inseparability of all matter, from the micro to the macro.

Following the research excursion to Kamilo Beach, Corcoran and Jazvac argued in *GSA Today* that plastiglomerate was evidence of a plastic marker horizon that could contribute to the naming of a new era. The naming and dating of the Anthropocene, an as-yet formally unrecognized and heavily debated term for a geologic epoch evidencing human impact on the globe, relies "on whether humans have changed the Earth system sufficiently to produce a stratigraphic signature in sediments and ice that is distinct from that of the Holocene epoch."[7] While it is incontrovertible that humans have impacted the planet, the strata to measure that impact in the global geological record remains controversial. Is the signature change a layer of plastic sediment from the mid-twentieth century's "Great Acceleration" of population growth? Does it begin with the Industrial Revolution's massive deposits of CO2 into the atmosphere? Or perhaps it is lithospheric, with evidence found in the rise of agriculture some twelve thousand years ago? Maybe the start date of the Anthropocene can be traced to a single day, that being the first nuclear test—the Trinity test—in 1945, which deposited an easily measured layer of artificial radioactivity into the global soil.[8] The term “Anthropocene” remains stable/unstable, “not-yet-official but increasingly indispensable,” writes Donna Haraway; near “mandatory” in the humanities, arts, and sciences, if not elsewhere.[9] Whichever (if any) start date is chosen, plastiglomerate—a substance that is neither industrially manufactured nor geologically created—seems a fraught but nonetheless incontrovertible marker of the anthropogenic impact on the world; it is evidence of human presence written directly into the rock.

After collection, the samples gathered at Kamilo Beach were analyzed so as to categorize the plastics and the natural sediments that together created the plastiglomerate whole. Following this, Jazvac showed the plastiglomerate in art exhibitions as sculptural ready-mades, to demonstrate human impact on nature. Finally, museums, among them the Yale Peabody Museum, the Het Nieuwe Instituut (Rotterdam), and the Natura Artis Magistra (Amsterdam), reached out to collect and display the samples as specimens that captured changing natural history. These three paths bring up a number of questions. What does it mean to understand part of the geologic record as a sculptural object? Can art make visible a problem too large to otherwise understand? What can we learn from approaching the fraught term “Anthropocene” as a creative undertaking on a massive scale, even if the end result of that creativity is the demise of a hospitable environment for most species? What can art tell us that stratigraphy cannot?

Cynical Smog and Mermaid's Tears

The invention of plastic is so recent. Its rapid accumulation is as young as it is overwhelming. Considered against Earth's five-billion-year life span, it appears to arrive and cover the world in one simultaneous instant, unfolding through time and space into a future we cannot yet see. Noted for its convenience and durability, plastic emerged in part as a promise to displace other products that relied on animal remains and natural resources: bone, tortoiseshell, ivory, baleen and whale oil, feathers, fur, leather, cork, and rubber. "As petroleum came to the relief of the whale," stated one pamphlet advertising celluloid in the 1870s, so "has celluloid given the elephant, the tortoise, and the coral insect a respite in their native haunts; and it will no longer be necessary to ransack the earth in pursuit of substances which are constantly growing scarcer."[10]

Invented just after the turn of the twentieth century, the mass production of the synthetic organic polymers of plastic only began in the 1950s. Bakelite®, Styrofoam®, and Nylon® gave way to thermoplastic polymers, which could be molded and melted and remolded.[11] Roland Barthes starts his meditation on plastic in *Mythologies* by noting, “Despite having names of Greek Shepherds (Polystyrene, Polyvinyl, Polyethylene), plastic … is in essence the stuff of alchemy.” Plastic is the “transmutation of matter,” the transformation of primordial sludge into the modern, malleable, and convenient. Every fragment of plastic contains the geologic memory of the planet: “at one end, raw, telluric matter, at the other, the finished, human object.”[12] Barthes wasn’t actually thinking about oil when he wrote this; rather, he was focused on the idea that plastic could be seemingly made into anything. He was taken with the plasticity of plastic, and unconcerned with the backstory or future impact. Plastic allowed for social mobility, increased consumption, and a seemingly bright, hygienic, and accessible future for all.

Plastic soon shed its utopian allure, becoming hard evidence for the three c’s—the triple threat of capitalism, colonialism, and consumerism—as well as a kind of shorthand for all that was inauthentic and objectionable about postwar everyday life. Plastic was just the latest evidence of bio-cultural cynicism. As earlier forms of extraction—such as the exploitation of rubber from trees and animals for their products—became unfeasible, the continued expansion of the three c’s was made possible through new forms of extraction, such as resource mining and oil-field development.[13] While the site of exploitation may have moved, the underlying patterns of accumulation, colonization, and consumption remained unchanged.

Was Barthes correct in saying that plastic can be made into anything? In the past, it might have been assumed that “nature” was the one thing that could never be made from plastic. Plastiglomerate suggests that this is no longer the case. It is an ecological paradox such that the mind struggles to separate its plasticity from its telluric oily past. Take, for example, a sample collected from Kamilo Beach that is clearly a lighter and sand. And yet it is not. These are not two substances glued together, but multiple substances that are one another. The lighter was likely one of the billion plus made in China and Taiwan each year from parts sourced all over the world.[14] It had already traveled the globe prior to ending up on Kamilo Beach, where it melted, along with other microplastic flakes and confetti, into a single substance, a glomerate with a history as long as the sand and as short as the invention of plastic polymer in a war-time laboratory in the 1950s. As Pam Longobardi writes, “Plastic objects are the cultural archeology of our time, a future storehouse of oil, and the future fossils of the Anthropocene.”[15]

Plastic production has quintupled globally since the 1970s to 265 million tons per annum in 2010.[16] As Heather Davis notes, plastic is immensely destructive, ecologically devastating both in the intensity of resource extraction required to make it (a staggering 8 percent of the world's oil production goes into the manufacture and production of plastics) and in its disposal.[17] The few minutes or days in which it might be used as a takeaway container, a lighter, or a toothpaste tube belies both the multimillion-year process of its making, and the tens of thousands of years it is expected to last before breaking down, finally, into its molecular compounds.[18] In its plastic state, it is usually quickly disposed of, making its way to landfills, but also into sewers or streams, where it often ends up in waterways and on shorelines.[19]

Plastic is not the irreducible product that was once thought. Plastics do not biodegrade, but in water, solar radiation on the surface leads to photodegradation, which is amplified by embrittlement and fragmentation from wave action.[20] The plastics in the ocean are mostly particles smaller than one centimeter in diameter, commonly called microplastics, but more poetically referred to as "mermaid's tears." Although only 0.1 percent of plastics production is thought to end up in the vast islands of microplastic debris in the world's oceans, plastics are nonetheless the primary source of marine pollution. Highly durable, these microplastic fragments will last for hundreds or thousands of years.[21] Notes Davis, "After digging up the remains of ancient plants and animals, we are now stuck with the consequences of these undead molecules, the ones that refuse to interact with other carbon-dependent life forms."[22]

Most plastiglomerate is made from abstract "plastic confetti," "the embrittled remains of intact products."[23] The lighter-conglomerate is exceptional for the legibility of the lighter as a human-made object. Where ropes, nets, jars, toothbrushes, bottle caps, can lids, and cigarette lighters can be recognized, plastiglomerate becomes figurative, realistic. The plastic aspect gains a longevity and aesthetic vibrancy that it would not otherwise have. The combination of rock sediment and plastic creates a charismatic object, a near luminous granite, pockmarked with color. Plastiglomerate is trace evidence of human-nature interaction: plastic is made by an anthropogenic action, and plastiglomerate is made by a series of anthropogenic gestures that create fascinating, disquieting objects.

Five Gyres

Consider the subtleness of the sea; how its most dreaded creatures glide under water, unapparent for the most part, and treacherously hidden beneath the loveliest tints of azure. Consider also the devilish brilliance and beauty of many of its most remorseless tribes, as the dainty embellished shape of many species of sharks. Consider, once more, the universal cannibalism of the sea; all whose creatures prey upon each other, carrying on eternal war since the world began.

Consider all this; and then turn to the green, gentle, and most docile earth; consider them both, the sea and the land; and do you not find a strange analogy to something in yourself?

—Herman Melville, *Moby Dick*

Whose lighter was it? A smoker in Los Angeles? Possibly in Tokyo? Maybe in Ojai? Or perhaps someone rivers and canyons away.[24] Upstream in a thousand human settlements where a lighter can be bought and thrown away. Perhaps on the western coast of North America. Perhaps on the eastern coast of Asia. The lighter ends up in the gutter. It waits for a storm. The water takes it. It ends up in the sewage. In the sliver of water. In the river. In the bay. In the ocean. In the Kuroshio Current. In the great churning mass of the Pacific from where somehow, in a storm, in the winds, it ends up on Kamilo Beach in Hawai'i.

Or possibly, more likely, someone drove over the rocky terrain of the Hawai'ian Island, hiked in to a deserted and plastic-strewn beach, lit a fire to keep warm, and left the lighter behind. One more piece of plastic on the sand. This is how it is with objects. They are mostly mute about their journeys, though most of them have traveled much farther than any of us.

Covering almost 70 percent of the Earth's surface, "oceans define, sustain and characterize the planet's ecology. More than half of our oxygen supply is produced by the microscopic plant life that suffuses the earth's oceans, though for how much longer is unknown. This is where all life on this planet began and if it dies it will take all of us with it."[25] After leveling off between six and seven thousand years ago, oceans and seas have provided a sense of constancy, a rhythm to the Earth's movement through space. Whereas on land, humans built up from agricultural settlements to choking cities, the seas seemed relatively changeless, bringing death and fear in the form of storms, attacks, the transport of enslaved captives, and sunken ships, but also providing seemingly endless navigable passages full of life and profit (for the few)—a largeness full of largesse. But now, through the loss of megafauna from overfishing and habitat destruction, massive pollution, and high levels of phosphorus and nitrogen flowing into the oceans due to fertilizer use, dumping, and climate change, oceans are under extreme threat. As the oceans heat up, coral reefs are dying, and "jellyfish have bloomed to such an extent they threaten to extinguish all other ocean life. They are an organic form of junk."[26] Overfishing has decimated many populations, particularly of large animals such as whales, dolphins, sharks, turtles, and blue fin tuna. Oil and gas exploration threatens fragile ecologies across the globe, ranging from the Arctic to the Gulf of Mexico to the tip of Argentina, and nearly all major bodies of water in between. And on top of all of this, garbage and effluents pour into the oceans at ever increasing rates.[27]

It is not known how much plastic waste oceans and waterways currently hold. Measurements were last taken in the 1970s, and even then they were largely guesswork and focused entirely on "visible" plastics, that is, those floating on the surface. Current estimates range in the order of tens of thousands of tons of plastic in surface waters of open oceans.[28] But plastics floating on the surface represent but a small fraction of the total, and that total is difficult to ascertain because microplastics below a certain size (half a centimeter) are largely absent on the surface of the oceans. We don't know why.[29] Additionally, as Ian Buchanan writes, microplastics form "a 'strange attractor' for all the toxic scum floating elsewhere in the ocean."[30] The microbial communities that flourish on plastic microfragments are present "at a density and diversity much greater than that of the surrounding ocean water."[31] Perhaps mistaking the small fragments for food, marine life eats these toxic microfragments, at which point they enter the food chain, "completing the vicious circle of toxins out and toxins in."[32]

The constant movement of the Earth, the tide, and winds produces ocean currents that act at surface and depth in roughly unchanging patterns over thousands of years, affecting land temperature, the movement of water, and now, the movement of pollution detritus.[33] The same currents that are used by the shipping industry to map the fastest passages across the globe, the same currents that opened the world to the age of plunder and colonization in the fifteenth century, currently churn the detritus of that system into smaller and smaller fragments of microplastic. As Cózar et al. write, "[the] large-scale vortices act as conveyor belts, collecting the floating plastic debris released from the continents and accumulating it into central convergence zones."[34] The Coriolis effect, deflecting air along curved paths against the Earth's rotation, has created five gyres, one in each ocean—five giant slow-moving vortexes determined by the circulation patterns of wind curl and torque.

The Great Pacific Garbage Patch, centered in the Northern Pacific Gyre, is a combination of ocean currents, climate change, and unchecked plastic pollution. As plastics move from source to ocean in the Pacific they get caught up in the ocean's currents until a veritable soup of mermaid's tears churns. Though huge in size (often compared to "the size of Texas"), the tiny size of plastic particles and the fact that they are below surface means that the garbage patch is invisible to the naked eye. Perhaps the five gyres overwhelm all forms of thought in their destructive totality. Trying to describe the indescribable nature of the thinness of plastic sludge in the ocean, Max Liboiron has called it "plastic smog," less like a garbage patch and more like insidious but invisible pollution.[35]

Vibrant Matter

If the gyres are largely invisible, the release of surface plastics and microplastic fragments to Kamilo Beach, where they are combined with sand into plastiglomerate, presents an interesting visual dilemma. Susan Schuppli writes, “It seems we still need visual evidence before we can act as moral agents. This regime of visibility is a huge challenge. How do we act as ethical agents when there are all kinds of events that don’t produce coherent visual evidence?”[36] We might ask the same question of this newly demarcated substance. As a geological artifact, plastiglomerate is an indicator of human impact on the ecology of the Earth. As an artwork, plastiglomerate makes the familiar unfamiliar. It reifies the unfathomable, consolidating and attesting to difficult-to-substantiate material and social-political issues. Plastiglomerate is a remainder, a reminder, an indicator of the slow violence of massive pollution. It brings together deep geological time and current consumerism. It also takes on the properties of what Jane Bennett calls “vibrant matter,” a lively thing made by certain actions and off-gassing in its own strange geological matrix.[37]

When it comes to using plastiglomerate as part of a plastic marker horizon in determining the potential start date of the Anthropocene, there is more at stake than simply whether or not the International Commission on Stratigraphy and the International Union of Geological Sciences can agree that we have met all of the criteria to define a new epoch. The hubris behind self-naming an era is inescapable. As Métis scholar Zoe Todd reminds us,

> The current framing of the Anthropocene blunts the distinctions between the people, nations, and collectives who drive the fossil-fuel economy and those who do not. The complex and paradoxical experiences of diverse people as humans-in-the-world, including the ongoing damage of colonial and imperialist agendas, can be lost when the narrative is collapsed to a universalizing species paradigm.[38]

The history of plastics, tied up as it is in colonization and resource extraction, clearly illustrates the unevenness at the heart of defining the Anthropocene. Additionally, the way that the Anthropocene tends to be used as always-already underway highlights a distinction, and by proxy a hierarchy, between humans and nonhumans (or “more-than-humans”) that perpetuates a nature-culture divide and suppresses ways of understanding the world that might be more relational than taxonomic. Todd writes, “I think that the danger in any universal narrative or epoch or principle is exactly that it can itself become a colonizing force.”[39] She reminds us that Indigenous knowledges have space for the connection of all matter, while by contrast, settler knowledge requires the vibrant matter of a plastic stone to tell this story.[40]

If we are in a period highly impacted by human presence, it is worth remembering that the land is ahead of us in time, already aware of and influenced by the processes of extraction and depletion whose effects are often only recognized too late. But so too, human actions are part of a complex series of incursions that affect more-than-human critters, the land, the air, and even the depths of oceans and substrates of soil. The same is of course true of plastic pollution. Plastics are bought and discarded in much larger quantity in the Global North, but the gyres ensure that the distribution of microplastics in fact affects nonhumans prior to humans, while floating plastic depots tend to accumulate in areas without the resources to clean them up or hide them, and in the bellies and digestive tracts of those who would not recognize such a foreign substance as not being edible.

Plastiglomerate clearly demonstrates the permanence of the disposable.[41] It is evidence of death that cannot decay, or that decays so slowly as to have removed itself from a natural lifecycle. It is akin to a remnant, a relic, though one imbued with very little affect. As a charismatic object, it is a useful metaphor, poetic and aesthetic—a way through which science and culture can be brought together to demonstrate human impact on the land. Thus, to understand plastiglomerate as a geological marker is to see it as unchanging. Plastiglomerate speaks to the obduracy of colonialism and capitalism. The melted veins of plastic that actually become the rock speak to how difficult it is to undo unequal relations of destruction. The scraping out of plastic from the rock, melting down to separate the plastic from the sand, would result most obviously in the destruction of the new object and likely also the destruction of its constituent parts.

Nevertheless, plastiglomerate is a seductive substance, attracting artists to both collect and display it, and to make it. What does turning plastiglomerate into an artwork do? To understand it as art is, potentially, to see it as a call to action. But that latter interpretation demands seeing it as art made by the Earth, with humans only as anonymous actors, as midwives lighting the fires on the beach. After all, it is made from the most banal of substances: rock and plastic, both easily available and easily melded into one. Most artists *making* plastiglomerate are doing so as a commentary on human-made pollution. Although there are plenty of artists using plastic to comment critically on waste, labor, and production, it appears that those specifically drawn to plastiglomerate seem rather to be oddly inspired by it, occasionally even going so far as to erroneously report that volcanic action creates plastiglomerate, and that this in turn is evidence of “nature adapting to technological surplus.”[42] Such statements are categorically incorrect, and hint at how, if the Anthropocene is a narcissistic category, then the art world is the mirror. To make such an object in order to question its making seems a deeply problematic tautology, implicated in an impulse that sees the Anthropocene as a kind of celebratory mechanism for human interaction with the world. It suggests a constant search for new and novel material with which to make a mark, a gesture that is cognizant of capitalism’s love of the new, even as it replicates it. Such impulses also echo Jodi Dean’s perceptive analysis of a faction of the global left who experience a certain *jouissance* at being in the know—to find satisfaction in evidence of catastrophic climate change while doing nothing to stop it (or actively perpetuating it). “Anthropocenic enjoyment,” she calls it.[43]

But why should finding plastiglomerate and displaying it as a ready-made be any different? Plastiglomerate is what Heather Davis calls “accidentally or incidentally” aesthetic.[44] It is precisely the facticity of plastiglomerate, its infrangibility, its constituent components and analysis as both artwork and geological specimen that make it fascinating. Plastiglomerate demonstrates an already existent artistic relationship between human and planetary action that can't really be improved by rendering that relationship as solely human. Or perhaps more disturbing still, it demonstrates the Anthropocene as a performance, an artwork with the end act of planetary destruction.

The extensive life span of thermoplastics and rock do not need any further intervention to illustrate their force. Perhaps, as Jazvac does when she shows the plastiglomerate as ready-made sculpture, we need to delve into what we already have, using plastiglomerate as object, sample, metaphor, talisman, and evidence. Following on Todd, Jazvac remarks on her uneasiness with the way that she is often described as having "discovered" plastiglomerate, a word that has strong colonial connotations, and that imagines a manufactured landscape as something like a frontier to explore and possess. Every time plastiglomerate is shown, Jazvac notes, it is evidence of removing and describing something from a land that is not hers—an action that is misunderstood and perpetuated constantly in the coverage and use of plastiglomerate as material. Perhaps, then, it is an anticolonial and a feminist action to refuse to see plastiglomerate as an ideal object or substance that can be discovered, extracted, gathered, and used to bolster careers in a capitalist system or to highlight the "newness" of an anthropogenic substance.[46]

Refusal is a radical gesture in the contemporary art world, and drawing attention to the complexity of plastiglomerate as a ready-made that is more than a ready-made, that is more than a new material, challenges the

> extractive gaze … of the explorer, the prospector, the cartographer or the lumberjack [that] reduces nature to what Martin Heidegger (1977) called a "standing-reserve," a cache of inert matter to be dammed, dug up, cut down, flattened out, raised up, divided and sub-divided, harvested, photographed, mapped, assayed, bought, and sold and generally manipulated in order to serve all-too-human purposes.[45]

An extractive and capitalist gaze renders plastiglomerate as matter and metaphor all too closely connected to a romanticization of the Anthropocene. As Jazvac understands, the ways landscapes are idealized, used, and viewed are ideological.

Understood in this way, plastiglomerate has multiple overlapping identities. Pushing the metaphoric understanding of its ontological nature as far as possible, perhaps we can find in the chemical chains of synthetic polymers melded with the craggy scraps of sand a useful theoretical model of the molecular, in line with that of the plant-life rhizome (Deleuze and Guattari) that so dominated Anglo scholarship in the 1990s and 2000s.[46] The ready-made geologic being of plastiglomerate speaks to more than pollution: also geology, the deep time of Earth, colonization, human-animal knowledges, currents of water, and the endless unfolding and collapse of life on Earth. We might conclude that “we have come into existence with and because of so many others, from carbon to microbes to dogs. And all these creatures and rocks and air molecules and water all exist together, with each other, for each other. To be a human means to be the land and water and air of our surroundings.”[47]

I would like to thank Kelly Jazvac and Kelly Wood for their help with this text. *It was written in my role as writer for the project Understanding Plastics Pollution: Interdisciplinary Collaboration and Forensic Methodology, developed by the Great Lakes Plastics Pollution Think Tank at Western University, Canada*.

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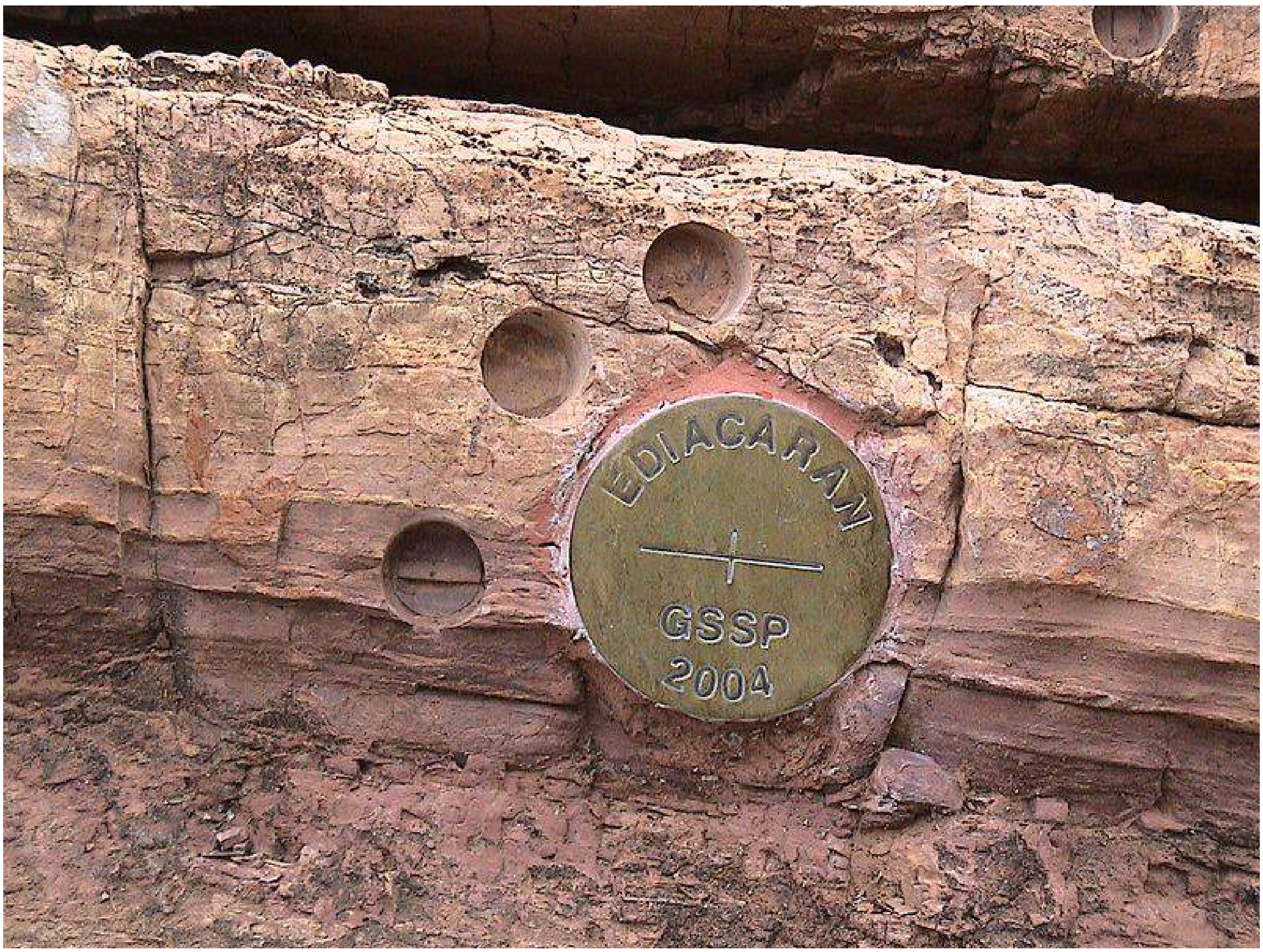
LIVING IN THE ANTHROPOCENE | THE AGE OF HUMANS

Where in the World Is the Anthropocene?

Some geologists believe we’ve entered a new era. Now they have to search for the rocks that prove it



Many boundaries between geologic eras are marked by physical golden spikes. This one, in South Australia, marks the end of the Ediacaran period, 635 million years ago. (Bahudhara/Wikimedia Commons - CC BY-SA)

By Hannah Waters
smithsonian.com
August 30, 2016

Sixteen years ago, a pair of scientists introduced a new word that would shake up the geologic timeline: the Anthropocene. Also known as the "Age of Humans," the idea was first mentioned in a scientific newsletter by Nobel Prize-winning, atmospheric chemist Paul Crutzen and renowned biologist Eugene Stoermer. The duo enumerated the many impacts of human activities on the planet, outlining human induced carbon and sulfur emissions, the global run off of nitrogen fertilizers, species extinctions and destruction of coastal habitats.

Considering these vast changes, they declared the Holocene (our current 11,000-year-old geologic epoch) over. The Earth had entered a new geologic era, they said. This week, scientists are meeting to present their evidence of this new chapter of geological time to the International Geological Congress in Cape Town, South Africa.

Since it was introduced, the Anthropocene concept has resonated throughout the sciences and humanities. It's forced people to confront how, in so little time, our species has irreversibly transformed Earth's climate, landscapes, wildlife and geology.

"Many people are using [the term] because it sums up in a word and an idea the total scale and extent of how the Earth's system is changing because of humans," says Jan Zalasiewicz, a University of Leicester geologist who pieces together Earth's history using fossils.

As he watched the Anthropocene idea proliferate, he wondered whether there was some geological truth to it. Could today's soils and sediments be distinct from those laid down in the Holocene? Are they distinct enough to name a new geologic epoch?

"The important thing is that the Earth system is changing," says Zalasiewicz. "From the point of geology, it doesn't matter whether it's humans causing it, or if it's a meteorite, aliens from outer space or even my cat masterminding change to the planet."

In 2008, he gathered a group of geologists, and together they published a list of possible geological signs of human impact in *GSAToday*, the magazine for the Geological Society of America. The group concluded that the Anthropocene is "geologically reasonable" and warranted further investigation.

But declaring a new geologic epoch is no small task. The official inclusion of the Anthropocene would be a major revision to the Geologic Timescale—the hulking calendar of time that divides Earth's 4.6-billion-year history into chapters. The boundaries between each of these chapters are marked by shifts in the composition of glacial ice, tree rings, coral growth bands, seafloor and lake sediments among other layered geologic formations, found consistently throughout the world. "All of these layers contain signals within themselves, which reflect the life and the times around them, the chemical, biological and physical signals," says Zalasiewicz. If the rocks have changed, the world must have changed, too.

Perhaps the most well known boundary is that between the Mesozoic and Cenozoic—also known as the Cretaceous-Paleogene or K/Pg boundary and formerly as the K-T boundary. Some 66 million years ago, an asteroid struck the Earth and killed off the non-avian dinosaurs. Since comets and asteroids are rich in the element iridium, and it's rare on Earth, a fine layer of iridium marks this event in the geologic record around the world. On every continent, paleontologists find fossils of large dinosaurs and certain plankton species below that stripe of iridium; above it, they find a distinct suite of plankton and no traces of non-avian dinosaur fossils. The iridium layer separates the Mesozoic, the dinosaur-filled era of life, from the Cenozoic, when mammals began taking over.

Though the iridium stripe can be found worldwide, the boundary's official location is outside El Kef, Tunisia. There, in 2006, geologists hammered a golden spike into a hillside that displayed the telltale signs of the K/Pg boundary to serve as a reference point. Ideally, each boundary between chapters on the Geologic Timescale will have its own "golden spike" placed into an existing rock face or core (from glacial or marine sediment). Strict rules govern the boundaries and golden spikes, overseen by the International Commission on Stratigraphy within the larger International Union of Geological Sciences, lest the Geologic Timescale be swept away by fads in geology or in politics.

In 2008, the IUGS contacted Zalasiewicz with the request that he form a new committee to look into the idea of the Anthropocene. He gathered a diverse set of researchers, including geologists, climatologists, chemists, paleontologists and historians, dubbing the crew the Anthropocene Working Group (AWG). Over the past eight years, they furiously compared notes and gathered data to make their formal recommendation for the start of the Anthropocene. The group tallied up the various proposals to choose the one that best fit, publishing a summary of their work earlier this year in the journal *Science*.

The signal that received the most attention was the radioactive fallout from nuclear tests, which left a prominent layer of plutonium in sediments and glacial ice. Even though thermonuclear weapons were not tested everywhere in the world, their evidence is global. “Once the fallout could get into the stratosphere, it was then distributed right around the planet very quickly over weeks or months,” says geologist Colin Waters of the British Geological Survey and secretary of the AWG. “Plutonium is barely present naturally; it’s very, very rare. So as soon as you start to see this increase, then you know that you’ve got 1952.” The radioactive signal disappears in 1964 after countries agreed to test nuclear devices underground.

A number of other signals also cluster around the year 1950 in what the AWG calls “The Great Acceleration,” when human population, resource use, industry and global trade took off. It’s then that many anthropogenic signals that once were local became truly global, and perhaps global enough to signify the Anthropocene. Here are some of those signals:

- **Concrete** has been around since the Roman Empire, but “volumetrically most of the concrete ever produced has been since 1945 or 1950,” says Waters. That makes it a recognizable modern material. The downside? Concrete is uncommon in the oceans and absent from glacial ice so the signal isn't universal, he says.
- Plastics were first introduced in the 1800s, but today there are more plastics around than ever before. Production expanded from 2 million tons in 1950 to 300 million tons in 2015, and it’s estimated that 40 billion tons of the stuff will exist by 2050. People like plastics because they’re lightweight and degrade slowly. But those same qualities also make plastic a good geologic indicator. Sediment samples containing plastics nearly all caome from the last half century, according to Zalasiewicz. This abundance of plastic "was almost unknown before the mid-twentieth century,” he says. On Hawaii beaches, geologists are now finding rocks they call “plastiglomerate,” which is formed when campfires melt plastics into a massive glob containing pebbles and sand. In addition, microplastics, such as tiny microbeads from cosmetics and artificial fibers from clothing, are currently forming a sedimentary layer on the seafloor. The downside of using plastics as a marker is that they are not commonly found in glacial ice, so they are not a universal signal.

- Nearly all of the reactive **nitrogen** on Earth has been produced since 1913, when German chemists Fritz Haber and Carl Bosch figured out how to capture nitrogen gas from the air and turn it into fertilizer. Since then, the amount of reactive nitrogen on Earth has more than doubled, with a substantial increase around 1950 as the Green Revolution industrialized farming practices. And though it sounds like it would be a good Anthropocene marker, nitrogen doesn’t leave a strong signal in the sediments. “The processes are not quite as well understood,” says Zalasiewicz. In some remote lakes in northern Canada, far from local human influences, the dominant structures of nitrogen atoms (known as isotopes) shift around 1950, reflecting the addition of nitrogen fertilizers. But whether this shift is consistent enough across lakes throughout the world to make a good signal isn’t yet certain.
- Burning fossil fuels releases black “**fly ash**” particles into the atmosphere; with no natural source, they are clear signs of human activity. Those particles are now found in lake sediments throughout the world, starting as early as 1830 in the UK, and showing a dramatic, global increase beginning around 1950. “But they peaked already around the 1970s [through the] 1990s and are starting to decline,” says Waters. So similar to radioactive nucleotides, fly ash signals a geologic shift but doesn’t make a good permanent indicator.
- The increase in carbon emissions from burning fossil fuels is recorded in a shift in **carbon isotopes**, which is present in any materials that trap carbon including glacial ice, limestone, shells of marine animals (found in seafloor sediment) and corals. The signal shows up around the Industrial Revolution, with a sharp increase around 1965. It's a good signal, says Zalasiewicz, though not quite as sharp as either the fly ash or radioactivity.

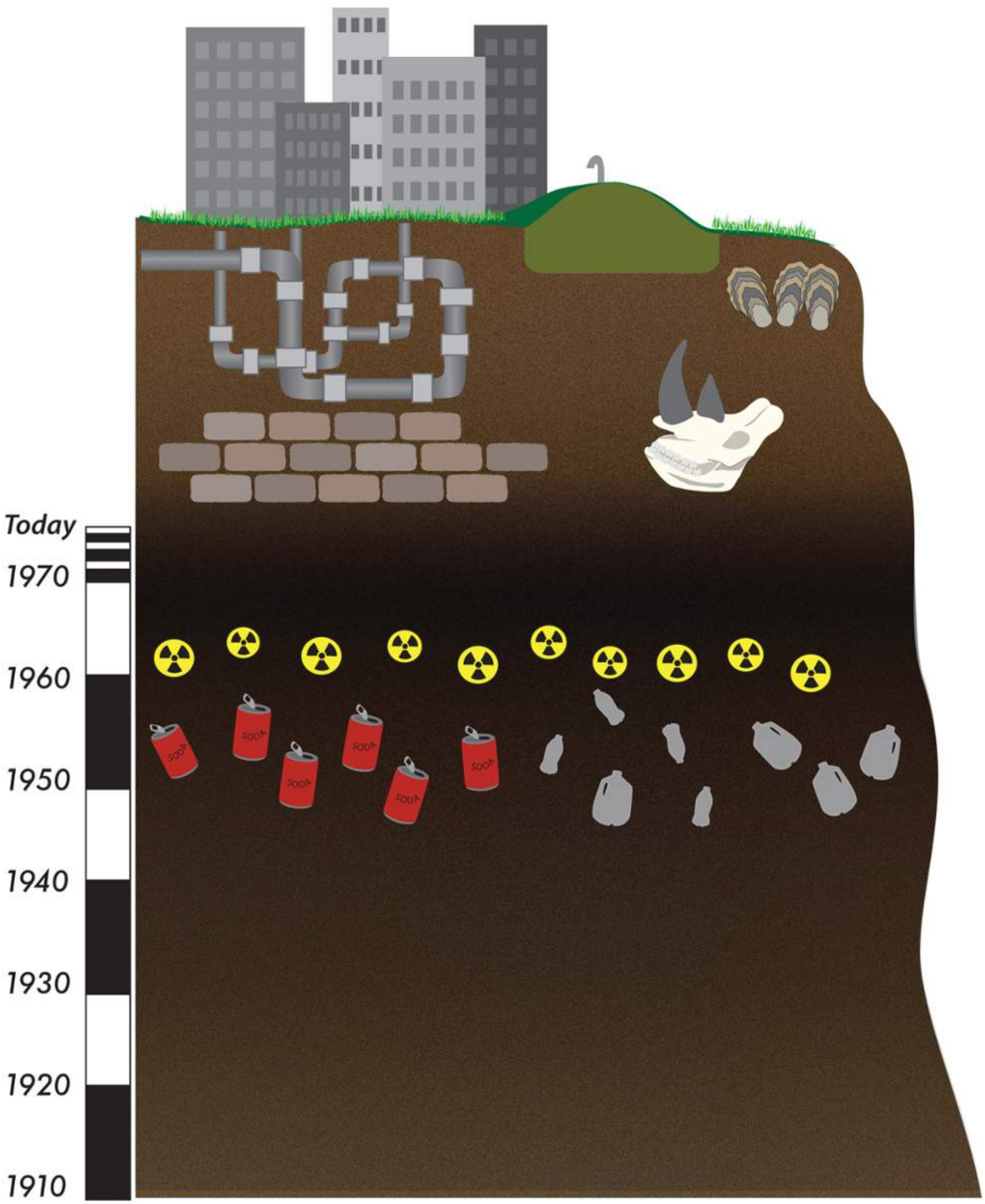
Some human impacts aren’t yet visible in sediments, but could plausibly leave signals in the far future. For instance, people have extensively transformed Earth itself. We dig mines, landfills and foundations for buildings; we build dams, docks and seawalls, which alter water flow and erosion; we quarry and transport rock around the world to construct towns and cities; we churn and move topsoil for farming. Future paleontologists could find these man-made materials compressed into an unusual rock layer that would be conspicuously Anthropocene.

Then there are the future fossils left behind by today’s plants and animals—and those that will vanish as species go extinct. Any hard-bodied animal that sports a shell or is held up by bones has a chance to leave a fossil upon its death.

If we are in the midst of a mass extinction, which some scientists believe we are, the disappearance of common fossils could be another indicator. But this would be a messy signal with different changes taking place at different times around the world. “It’s a more complicated signal simply because life is more complicated than the average radionucleide or carbon isotope,” says Zalasiewicz.

Interactive: What Will Mark the Anthropocene?

Illustration by Maya Wei-Haas; text by Hannah Waters and Maya Wei-Haas



Another option are the fossils from the species that dominate after extinctions, such as invasives, which might leave a cleaner signal. Zalasiewicz is currently leading a team that is studying the Pacific oyster, which was introduced from the Sea of Japan to coastlines around the world during the past century. It's both abundant and likely to fossilize, giving it strong potential as an Anthropocene indicator.

"Where [the Pacific oysters] appear they will be a new element of the biology and therefore future paleontology in those strata," he says. "But again because humans have transplanted different species at different times around the world, it's a complicated or messy signal."

These findings are all play into the AWG's presentation this week at the IGC. They originally hoped this presentation would coincide with their official submission on the Anthropocene to the International Commission on Stratigraphy. But after speaking with geologists on the commission, they decided to wait. "It's clear that the community would be more comfortable and feel rather more grounded with a traditional golden spike type definition," says Zalasiewicz. Collecting evidence of signals isn't enough; they need to identify a location to hammer in the Anthropocene golden spike.

The group isn't yet sure where they'll place it; they're eyeing sediment cores from the deep ocean or remote lakes where the layered signals are clear. But finding a good core comes with its own set of challenges because the layer of Anthropocene sediment is very thin. "If you went to the deep oceans, you might be talking about a millimeter or two of sediment," says Waters. "All you need is a bivalve to crawl across the seabed and it'll churn up the whole of the Anthropocene in one go." In many places, trash or fishing trawls have already obliterated any potential Anthropocene layers.

The work of identifying a golden spike location will likely take years. The researchers may need to go out into the field, drill for sediment cores, and do complicated analyses to prove that the signals are consistent and global. Up to this point, AWG members have been doing this work on their own time; now they'll need to find funding in order to devote themselves to the effort.

Zalasiewicz groans at the thought of it. "Writing grant applications is one of the world's great soul-destroying jobs," he says. But to stake a geologic claim to the Anthropocene and bring the world's overseers of the geologic time scale to a vote, a bit of soul destruction may be worth it.

"The current signals that are forming are quite striking to us already, even if humans died out tomorrow," he says, a mark will likely remain in the geologic record in the far future. "A case can be made that it can be separable as a geological time unit. We cannot go back to the Holocene."

GREEN 06/19/2014 09:23 am ET | **Updated** Jun 19, 2014

Plastiglomerate: The New And Horrible Way Humans Are Leaving Their Mark On The Planet

By Carla Herreria

Humans will now be forever inscribed into the Earth's geological history. Our everlasting signature? Plastic-infused stones.

The newly identified stone, according to a report from The Geological Society of America, has been officially named plastiglomerate. It is formed when plastic trash melts and fuses together with natural materials such as basaltic lava fragments, sand, shells, wood and coral, resulting in a plastic-rock hybrid.

Researchers say the new material is likely to last a very long time, possibly becoming a permanent marker in Earth's geologic record.

In the photo above: An example of clastic plastiglomerate found on Kamilo Beach. Clastic type is a combination of "basalt, coral, shells, and local woody debris" that are "cemented with grains of sand in a plastic matrix."

"In the future, when people see [plastiglomerate] in the rock record, they'll be able to know, 'Well, OK, people at this time were polluting the planet [with plastics]. What a travesty that these people were doing that,' " Patricia Corcoran, a geologist at the University of Western Ontario and study lead author, told The Huffington Post.

"Now that could be one side of the coin," she explained. "The other is that people continue to do this and it'll just become the norm to have this type of material preserved for all eternity."

This discovery, as the New York Times reports, might be another indication that Earth has “entered a new geological era“ referred to as the Anthropocene epoch — the period of time wherein humans began to leave significant and lasting impacts on the planet’s landscape and atmosphere. Earth is currently in the Holocene epoch, which began almost 12,000 years ago.

In the photo above: Fragment containing plastic pellets and “confetti” — small pieces of plastic from different sources — with woody debris.

Corcoran and her team traveled to Hawaii to observe the new substance after learning about it from sea captain and oceanographer Charles Moore, who discovered cases of plastiglomerate on Kamilo Beach on Hawaii’s Big Island in 2006.

Kamilo Beach, also considered one of the world’s dirtiest beaches, became the perfect spot to observe this new substance because of how the ocean’s currents push garbage, plastic debris and other ocean pollutants onto its shores, as it does in other beaches on the southeastern shores of the Hawaiian Islands.

Researchers first assumed that the melted plastic was a result from possible flowing lava from Hawaii’s active volcano, but discovered their samples were a result of beachside campfires that took place within their surveyed area. They point out in their report that while campfires were “responsible for the plastiglomerate on Kamilo Beach, it is conceivable that the global extent of plastic debris could lead to similar deposits where lava flows, forest fires, and extreme temperatures occur.”

While surveying Kamilo Beach, Corcoran and her team found plastic debris with markings that indicate they have traveled all the way from places like Asia and Russia. A lot of that debris, Corcoran said, is coming from the North Pacific Subtropical Gyre, also known as the Great Pacific Garbage Patch.

But plastiglomerate is likely to exist across the globe.

“We find plastic debris — and an abundance of it — on many shorelines in places like India, Africa, even on the shoreline of Iceland,” Corcoran said. “Plastic is everywhere,” and inevitably, it will become melded with beach sediment.

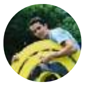
So, what can we do to permanently reverse the damage we’ve done with plastic pollution? Corcoran said every country on the planet would have to suddenly agree to never use plastics again, which, she notes, is extremely unlikely.

But “we can all pitch in and help through beach cleanups and not using as many plastic products,” she insisted. “Maybe by raising awareness [of how serious the problem is], people will start to say, ‘OK, that’s kind of disgusting so maybe … I should think twice before I buy a bunch of balloons or use a straw. Even small things make a difference.”

INTERVIEWS

HYPERALLERGIC

Plastiglomerate, the Anthropocene’s New Stone



Ben Valentine   November 25, 2015

Kelly Jazvac, “Plastiglomerate Samples” (2013), plastic and beach sediment, including sand, basalt rock, wood and coral. All of these found-object artworks are the results of a collaboration between Jazvac, geologist Patricia Corcoran, and oceanographer Charles Moore. (all photos by Jeff Elstone)

The idea of the Anthropocene, a proposed geologic epoch triggered by the effects of humans on the Earth, is increasingly gaining traction. People, myself included, are desperate for a framework in which to understand, discuss, and therefore confront our devastating impact on our planet. The Anthropocene is a large-scale admission of guilt — one that, if accepted worldwide, could hold the power to move us to action in a way that national and international bodies have been shockingly unable to.

The dates, the efficacy of the term “Anthropocene,” and even the existence of a new geologic age itself are, however, hotly contested. Scholars in the humanities have joined the discussion recently, debating the merits of differing terms such as “Capitalocene” (placing the blame on the overconsumption of capitalism) or “Plasticine” (pointing to the material that is choking our planet). Yet the determination and coining of a geologic epoch are ultimately scientific matters. The idea of the Anthropocene as distinct from the Holocene was first popularized in 2000 by atmospheric chemist and Nobel Prize winner Paul Crutzen. For it to hold, there must be hard scientific evidence that the geologic era we’re living in differs from the one that came before it. Increased CO_2 emissions and the acceleration of global warming are possible pieces of such evidence, as is the Plastiglomerate, a term for a new kind of stone proposed by geologist Patricia Corcoran , oceanographer *Charles Moore* , and artist *Kelly Jazvac*. The new stone is a fusion, through fire, of molten plastic and natural materials.

I spoke over email with Jazvac about the Plastiglomerate, which she has helped to document, exhibit, and understand. As an artist directly involved with research into the Anthropocene, Jazvac is uniquely equipped to bridge a discussion between the humanities and sciences. Jazvac’s positioning of Plastiglomerates as artworks, through found-object “sculptures” and photographs, captures the blurring of “nature” and “culture” embodied in these stones (if there ever truly was such a divergence). Some of the works can currently be seen in a group exhibition at the Justina M. Barnicke Gallery at the University of Toronto titled *Rocks, Stones, and Dust*.

Kelly Jazvac, “Plastiglomerate Samples” (2013) (click to enlarge)

Ben Valentine: *How did you come to investigate these rocks?*

Kelly Jazvac: I went to a lecture on plastic pollution at the university where I teach. The guest speaker was Charles Moore, an oceanographer and plastic pollution activist. He spoke about seeing an unknown substance on a beach in Hawaii that he thought was being formed by lava and plastic garbage mixing together. I was very interested in it, as it looked like both toxic waste and sculpture. After the talk I sought out the person who invited Charles Moore, geologist Patricia Corcoran. I suggested that if she ever wanted to collaborate I’d be interested. She wanted to go to Hawaii to check out this unknown substance presented by Moore, but needed a partner to do the field work with, and who would be willing to pay his or her own way. I happily volunteered. She has been a remarkable collaborator ever since — knowledgeable, focused, and open minded.

BV: *These Plastiglomerates are being used as evidence for our being in a new geologic period, the Anthropocene. Do you think that term is important or accurate?*

KJ: I’m glad you asked this question. I think it’s an important term but not a flawless one. It’s important because it’s clearly being used in many debates about human impact on the environment. For example, it's the word that the *International Commission on Stratigraphy* and the *International Union of Geological* Sciencesare currently debating whether to officially use or not to describe our current geologic epoch (I'm not a geologist, but I'm guessing that hasn't happened before). It's also useful to have a word for a very expansive, amorphous phenomenon. It's much easier to talk about (and therefore potentially change) when it has a widely used name.

However, at the same time, I think it's important to fully assess and debate the term, especially as it comes into prominence. I think everyone who is interested in this subject should read the essay "Indigenizing the Anthropocene" by Zoe Todd, from the book *Art in the Anthropocene*. Todd argues for complicating the term from an indigenous perspective. For example, the word "Anthropocene" implies that all humans are now a geological force irreparably altering the earth, when in fact not all humans have equally contributed to, nor profited from, actions that have resulted in climate change. She asks us to think about human life on Earth in terms of a network of complex relationships that include gender, race, colonization, geography, power, and capital.

Kelly Jazvac, “Plastiglomerate Samples” (2013)

BV: *Why are these stones important in this debate?*

KJ: Our 2013 paper on Plastiglomerate identifies its potential to act as a marker horizon in the future rock record. In other words, if a geologist takes a core sample a long time from now, there is the potential that she could see plastic in it. On Kamilo Beach in Hawaii, Patricia Corcoran and I saw large chunks of in situ Plastiglomerate buried in the sand. Once buried, the plastic will not be subject to erosion from wind and water, and thus has a greater potential to be preserved (unlike plastic floating around in the ocean that keeps breaking down into smaller pieces). Patricia is currently conducting experiments to determine the heat and pressure that Plastiglomerate can withstand. She's also working with graduate student Anika Ballent to determine the quantity of plastic at depth in Lake Ontario.

BV: *There's a material relationship between these rocks and much of your art practice, but how do you see them tying together conceptually?*

KJ: My art practice and Plastiglomerate both consider the permanence of the disposable. Both incorporate materials that seem temporary (like a single-use plastic item) and connect them to a longer scale of time. I sometimes get asked how long my artworks made from salvaged vinyl advertisements will last (say, compared to an oil painting). I put that question to a chemist who works for an adhesive vinyl company, and his answer was, "indefinitely."

My most recent solo show, *Site Words, Spoilers and Shoplifters*, was a more pointed look at how climate change, gender, politics, resource extraction, and the paranoia of ownership are entangled with culture. At this particular political moment in Canada, the specificity of this exhibition felt very urgent to me.

Kelly Jazvac, "Plastiglomerate Samples" (2013)

BV: *What role can art play in confronting climate change?*

KJ: In addition to the important and simple act of initiating discussion, art can help to visualize things that are very hard to visualize. Climate change is so large and all encompassing it's actually hard to "see" in its entirety. The visibility that artist Chris Jordan has given to the impact of plastic pollution on albatrosses comes to mind as an immediate example.

Furthermore, I think art can be adept at crossing disciplines, borders, and barriers in sophisticated and productive ways. It doesn't always play by the rules, and as such, it can be slippery and covert. Art can also make things uncomfortable, even if it's just for a moment, and ask us to confront our delusions and presumptions.

It's not a perfect system, of course, and there are lots of historical examples of really challenging art becoming nullified en route to the gift shop. However, I think there are truly remarkable instances of art's transgressive abilities in the pursuit of political and social change (because for me, climate change and political change go hand in hand). These instances include when artists have looked really closely at something in order to both analyze and mobilize. I'm thinking of projects like Forensic Architecture, Theaster Gates's work in Chicago, and Duane Linklater's sophisticated calling out of internet racism.

Rocks, Stones, and Dust continues at the Justina M. Barnicke Gallery (Hart House, University of Toronto, 7 Hart House Circle, Toronto) through December 18.

HUFFPOST

Plastiglomerate: The Rock of the Future Made Into Sculpture

By Rachel Mason

As scary as it is to think of what is going to happen to all the plastic waste that is filtering out into the ocean, one particular use seems to make a lot of sense — and its also really beautiful.

In 2013 the Canadian artist Kelly Jazvac and a geologist Patricia Corcoran discovered a new form of stone: they called it plastiglomerate, congealed masses of plastic waste merged with oceanic lava rock, coral, and sediment.

Jazvac has been making art out of the material ever since — and a new show opens next week in New York at Louis B. James gallery. I’m excited and a little scared to see the results.

Climates: Architecture and the Planetary Imaginary

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Views from the Plastisphere: A Preface to Post-Rock Architecture

MEREDITH MILLER

Plastiglomerate sample, 2013. This and the following plastiglomerates were collected through a collaboration between Kelly Jazvac, geologist Patricia Corcoran, and oceanographer Charles Moore. Photograph by Jeff Elstone, courtesy of Kelly Jazvac.

WHAT DOES ARCHITECTURE HAVE TO DO WITH GLOBAL CLIMATE CHANGE?

You might respond, "it has everything to do with global climate change" and then further articulate this sentiment with a list of the building industry's culpable features, such as the carbon footprint of steel production, or all the emissions from transporting construction materials, or the large share of energy consumption by buildings, or at an urban scale, wasteful mobility habits caused by the horizontal expansion of cities.

Okay. A fine response. But let me ask the same question again: "What does architecture have to do with global climate change?" As in, how does design as a cultural practice bear on the extensive processes of atmospheric modification and the social, scientific, and political circumstances through which we have come to know about, and have attempted to manage, this slow inevitability? To some, this version of the question might overreach or sound too theological coming from an architect. It's like asking, "Where does my design fit within the cosmic order of the universe?" But perhaps speculating on the tangible links

This text parallels a research and design project I am currently working on with Thom Moran, which speculates on plastiglomerates as a future building material. Called "Post Rock," this project is funded by the Research Through Making Program at Taubman College of Architecture + Urban Planning, University of Michigan, and was exhibited in March 2015.

between the immediate experience of architecture and its planetary milieu is exactly where we might look for design's significance right now. Escaping the nowhere of abstract metrics and summary figures that characterize climate's representation, and pursuing instead a cosmology of physical things, where might we end up?

It is in search of this cosmological perspective that I want to first offer a contemporary parable. On the surface, the parable involves land, water, and garbage moving about the earth's surface in biblical proportions. But beneath these large maelstroms of matter and energy, there is, I hope, a small lesson for architecture and about climate.

A CONTEMPORARY PARABLE FOR ARCHITECTURE AND ABOUT CLIMATE

Three travelers, having walked the greater part of the day, come upon a kind of monument made of what appears to be stone. The exterior surfaces of the open-air structure are very smooth and similarly colored, as if each large block had been cut from a much larger boulder or outcropping and then polished. The interior surfaces, on the other hand, are rough and uneven, with bulges and dimples of varying shapes and sizes. The travelers cannot determine whether this unevenness resulted from someone carving away purposefully at the stone or if these are the eroded edges of the original boulder or outcropping turned inward. From apertures in the ceiling, light falls upon these pockets and lumps to reveal the orange curve of a family-size detergent bottle here, a scattering of seashells and rubber oyster tubing there, and throughout, marbled stalagmites of misshapen ropes, plastic mesh, and minerals. Despite these fragmentary indications to the contrary, the overall effect of the space is entirely monolithic, as if the whole thing has been quarried directly from the earth. The travelers then wonder if the crenulations are too colorful, the crystalline specks too bright, and the cave-like forms too reminiscent of garbage for this material to be strictly geological…

On second thought, let me start again:

Three figures, two women and a man, are walking along a remote seashore. The beach is punctuated with black volcanic rock, but its most distinctive feature is a layer of colorful trash occupying a wide margin of sand. They look past the loose pieces of plastic and glass pushed about in the surf and inspect various nooks in the volcanic rock. Stooping over, one of them dislodges a softball-size object from a cluster of rocks, driftwood, and trash. Mostly smooth and granite-like in texture, the object is clearly geological in origin, except there is a bit of yellow nylon rope protruding from one end and a marbled neon-pink vein down the center.

These people happen to be an earth scientist, an artist, and a marine scientist. Defying categorization as either geological material or manufactured product, this rock-like object, and the many similar ones they collect along Hawaii's Kamilo Beach, prompts them to come up with a new system for classifying this hybrid material. In June 2014, the *Geological Society of America* published their report announcing a stone: "plastiglomerate." According to the article, a plastiglomerate is "an indurated, multi-composite material made hard by agglutination of rock and molten plastic."[1] This rock-like substance results from plastic waste of various sizes and types accumulating in the world's oceans and beaches. Much of this plastic breaks down into

1 Patricia L. Corcoran, Charles J. Moore, and Kelly Jazvac, "An Anthropogenic Marker Horizon in the Future Rock Record," *Geological Society of America Today*, vol. 24, no. 6 (June 2014): 4–8.

smaller bits called microplastics (less than 5 mm in diameter); some remains on the ocean surface; some of it drifts down and away from the ocean surface; some is ingested by marine life; and some, these researchers discovered, fuse with sand, shells, stone, glass, and other marine debris to form strange, heterogeneous rocks. In other words, a plastiglomerate is an emergent product of human and geological processes.

Given the inherent durability of both stone and thermoplastics, plastiglomerates are likely to last for a very long time. If geology is the study of the earth's history, plastiglomerates represent an unusual historiographical conundrum. Without a long record of existence (the mass production of synthetic thermoplastics began in the twentieth century), their geological classification relies instead on their likelihood of remaining in the earth's surface far into the future—probably well beyond the human race.[2] Thus, plastiglomerates are yet another indication that the Anthropocene has arrived.[3]

Within this pair of parables, the large stones (speculatively) encountered in an architectural structure and the rocks (actually) collected on the beach, are objects that mobilize concepts and territories outside their immediate moment of encounter. The rocks and stones, with visible remnants of fishing apparatus and seashells fused with smaller multicolored polymer fragments, tell a reverse history of the near and distant materials brought together by the heat of sunshine, the scattering of winds, the churn of ocean currents, the toss of a hand, the stamp of a thermoset mold, and the chemical daisy-chaining of synthetic polymers. While each is unique in its exact composition of parts, they all fall within a bracketed range of hardness, density, and hybrid materiality that places them

Plastiglomerate sample, 2013. Photograph by Jeff Elstone, courtesy of Kelly Jazvac.

2

By plastic I am referring to thermoplastics or synthetic polymers; there are of course other resins that occur in nature. Billie Faircloth's recent book thoroughly dissects the many types of polymers, identifies where they appear in construction products, and reflects on the conceptual limitations placed on plastic's presence in architecture. Billie Faircloth, *Plastics Now: On Architecture's Relationship to a Continuously Emerging Material* (New York: Routledge, 2015).

3

Corcoran, et al., "An Anthropogenic Marker," 4.

within this new geological series.[4] In this way, the qualities of each plastiglomerate sample, from its colors to its particular proportions of heterogeneous components, are inseparable from the dispersed geographies, energetic inputs, and consumer or commercial refuse that contributed to its making.

What do these physical qualities tell us that abstractions cannot? This essay will position such objects as points of access to broader knowledge formations, in particular the fraught epistemologies of global climate. By focusing on the literal qualities of a thing,[5] this essay looks at the potential of materials for creating new subjectivities in an era of climate anxiety and information overload. As an alternative to the abstracting tendencies of data-focused practices, this claim implies an approach to architecture. It acknowledges that architecture has a particular capacity to work on and through its physical, material specificity in order to make sensible and immediate those ideas that are more abstract and distant. The mediation of climate knowledge through the aesthetic qualities of things will be considered here as a kind of cosmology of subject, object, and environment: a means of apprehending the world by way of the here and now.

ABSTRACTION VS. EVIDENCE

At the turn of the millennium, architecture experienced a renewed interest in the informational, and diagrammatic techniques expanded into a broader descriptive field linking ecological processes with spatial form. Landscape became the envy of building designers; the allure was not in the dirty stuff of soils, plant matter, and hydrology but in the open-ended way in which designers could referee a complex set of circumstances toward an imagined future. The "agency of mapping" placed authorship at a remove from the matter meant to be authored. Notational systems of representation took precedence over measured drawings or experiential images to demonstrate the design's networks of relationships and their open range of possibilities.[6] This widespread shift to the paradigm of landscape was also significant for the scale and scope of architecture's purported capacities: programs, habitats, ecosystems, economies, were all seen as equal subjects for design's management. Anticipating effects and outcomes rather than specifying them, this architecture became more and more infrastructural and, thus, less and less material.

Today's design discourse has clearly benefited from this brand of systems thinking and a broader awareness of an ecological or even planetary context for design. These theories have been influenced by 1960s systems thinkers and environmental designers—figures like Ian McHarg, Buckminster Fuller, and John McHale, among others—evidenced in the representational techniques that support recent landscape-focused practices (network diagrams, energy budgets, data

4 The researchers distinguished two types of plastiglomerate found on Kamilo Beach: "an in situ type, in which plastic is adhered to rock outcrops, and a clastic type, in which combinations of basalt, coral, shells, and local woody debris are cemented with grains of sand in a plastic matrix." They cite the manner of plastic's adherence to rock ("molten plastic had infilled vesicles in volcanic rock, thereby forming plastic amygdales") and the density of the samples ("Bulk density of the clastic fragments ranged from 1.7 to 2.8 g/cm^3, with the highest values determined from fragments rich in basalt pebbles. The measured bulk densities show that plastiglomerate has greater potential to become buried and preserved in the rock record than plastic-only particles, which typically have densities in the range of 0.8–1.8 g/cm^3"). Corcoran, et al., "An Anthropogenic Marker," 4.

5 The aim here is not to reify the auratic object or speculate on its impenetrable ontology.

6 This is a reference to James Corner, "Agency of Mapping." Many other examples of the system's position in landscape are possible here, such as Corner and Stan Allen's entry to the Downsview Competition in 2000 and its influence captured in publications like *Large Parks*, ed. Julia Czerniak, George Hargreaves, and John Beardsley (New York: Princeton Architectural Press, 2007). In architecture, a significant example from this time period is the work of Jesse Reiser and Nanako Umemoto, who also describe their geometric surface modeling and its effects through an encompassing logic of landscape.

flowcharts). Yet it is instructive to note what representational practices did not carry over from that era of global consciousness. Collaging existing urban paradigms with visionary and formally distinct proposals (think Fuller and Shoji Sadeo's domes and pyramids) gave way to imaging emptiness (think James Corner's Fresh Kills) and demonstrating programmatic indeterminacy. This latter mode of representation is not without an aesthetic, of course, but the emphasis is on behaving like something and not looking like anything.

With some distance from the landscape paradigm's first appearance, it is time to recognize the presiding habits of mind that have developed from this influential chapter in our discipline's recent history. Of particular concern is the idea that the physical and aesthetic qualities of architecture take a backseat to the mutable circumstances that they frame, or that form simply serves to make visible the diagrammatic relations that are the real substance of the work. Either scenario easily argues for design as a passive instrument of information, which in turn implies an impossible neutrality. But we might instead see that architecture (framed here as a material practice) can be an active participant in the construction of, or challenge to, new knowledge formations. The physical and aesthetic qualities of architecture can create visceral cues, sensible reminders of the elsewheres and elsewhens that encompass and support that architecture's existence (and our own).

Moreover, systems practices that perpetuate a modernist concept of Nature's alterity often do so by privileging certain aesthetic categories over others. The scientism that is inherent to a modernist, managerial approach toward the earth's systems breeds a kind of false consciousness, disclaiming the considerable role that aesthetics play in shoring up certain ideological positions. Perhaps turning off that false consciousness would free us up to really "see" the aesthetic categories that often go ignored but that are intrinsic to the many "naturecultures" that constitute our planetary environment. (I am using Donna Haraway's term "naturecultures" here to refer to conditions that have fully dismantled any remaining possibility of a binary separation of culture from nature.) Design that enables us to "see" these "other" aesthetic categories is a step toward understanding the types of cultural and epistemological work they do. As designers we do not just document existing conditions—we can put things together in new ways, adding value through form, image, coloration, organization, and so on. However, this cannot happen from within autonomous bubbles of a "disciplinary" practice. It involves a more inclusive attention to the naturecultures that comprise architecture's contingencies and that condition architecture's reception.

In other words, the data-landscape project is not the only way for architecture to engage matters outside disciplinary boundaries. And conversely, the form-aesthetics project is not limited to discourses of autonomy. The geodesic dome was one techno-utopian image whose proliferation circulated a transforming set of political and social affiliations, while enduring as the aesthetic of technology's empowerment to individuals.[7] (It not only *behaved like* something, it also *looked like* something.) The ideas affiliated with that form evolved from the designer's original intentions; the dome is eminently recognizable and yet, it remains open to appropriation and discourse. Moving from abstraction toward evidence offers a model for architecture's capacity to mobilize ideas and associations outside its immediate material limits. One benefit of this model is the focus on architecture's primary domain of knowledge, which addresses the question of where form, material, and aesthetics can actually have effects in the world.

7 Felicity Scott, *Architecture or Techno-Utopia: Politics After Modernism* (Cambridge, MA: MIT Press, 2013).

Plastiglomerate sample, 2013. Photograph by Jeff Elstone, courtesy of Kelly Jazvac.

MATTERS OF FACT, MATTERS OF OPINION, MATTERS OF CONCERN

> It is not unanimous among scientists that [climate change] is disproportionately man-made. What I get a little tired of on the Left is this idea that somehow science has decided all this so you can't have a view.
> —Jeb Bush, interview with Fox News, 2011[8]

Climate change is not simply an atmospheric phenomenon. It is a multitude of competing narratives that shape what we know about climate change and what we are willing to put at risk in response to that knowing. Among these narratives is the perennial debate around the scientific evidence for climate change's anthropogenic causes. In the seven years between the Fourth and Fifth Assessments authored by the Intergovernmental Panel on Climate Change (IPCC), the consensus around the reliability of climate models as a source of data shifted. The Fifth Assessment Report from 2014 included risk scenarios and projected outcomes that were developed through data models. Still, public opinion on climate models remains uneven, as Paul N. Edwards discusses in his history of climate science, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*.[9]

Edwards begins his history with the 1968 portrait of Earth from Apollo 8. He emphasizes that the timing of this new vantage point corresponded with numerous scientific activities and cultural movements already in motion (the 1957–58 International Geophysical Year, the United Nations, Cold War

8 Suzanne Goldenberg, "Jeb Bush May Be 'The Smart Brother'—But He's as Much of a Climate Denier as Any Conservative," the *Guardian*, December 15, 2015, http://www.theguardian.com/commentisfree/2014/dec/16/jeb-bush-climate-denier-republican-presidential-candidate-2016.

9 Paul Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge, MA: MIT Press, 2013).

"closed world" discourses, the "One World" movement, and orbiting satellites with funny names dazzling Western and Soviet audiences). A planetary imaginary was in place, as were the international instruments for thinking and managing a global environment.[10] What is significant about this image, for Edwards, is how it exposes the tremendous gap between the simple immediacy of a single atmosphere as a concept and the intricate, layered, and multi-scaled composition of people, systems, and infrastructures involved in making that atmosphere "knowable" as climate. While computing, infrastructures, and measurement protocols are highly technical and essential components of this construction of climate knowledge, its effective aggregate is a socio-technical system, one that includes the scientists, their habits and errors of judgment, monitoring stations, organizations, and communication systems. It is a "vast machine."[11]

Asking "how did the world become a system?" Edwards frames a detailed account of how early, distributed forms of weather observation became incrementally consolidated into climate science. Localized practices, varying instruments, and uneven material conditions were absorbed into a coordinated network of data, through arduous institutional oversight and the labor-intensive task of reconstructing historical data sets. This system makes it possible to think of the Earth's climate as a "knowable entity" and its climate as something "conceivably managed by deliberate intervention." The incomprehensibly large and complex entity of global climate is rendered "knowable," but its key representation is unstable—and that merging of multiplicity into a single model has been at the heart of debates over the "truth" of climate change.[12] One objection is that science can only produce truths through empirical data or experimental evidence. The problem with this criticism, Edwards points out, is that it wrongly assumes that data has a greater degree of objectivity or autonomy than the sociotechnical system that generates it. Furthermore, the world's climate processes are clearly too complex and too many to reproduce experimentally. Edwards makes the case that the existence of climate models is what makes climate data possible. In other words, the model precedes the data it represents. Without this form of representation, much of climate history would remain in "shadow."

If matters of fact are inseparable from the sociotechnical apparatus that produces them, climate narratives that hang on science's objectivity are equally inseparable from those that appeal to public opinion. (The former Florida governor's insistence on having his own "view" is one of many examples of this popularized distrust in expertise.) Geographer Mike Hulme blames the slow public acceptance of climate change on a failure of communication. The deficit model of communication supposes that if the public is not convinced of a theory, it is due to a lack of information. Hulme argues that the problem is not an information deficit—advances in climate science and the unified front of the IPCC prove climate data's abundance and internal consistency. Instead, he claims, it is a problem of popularizing the information's *message*.[13] He proposes alternative models, including "deliberation," where communication between citizens and the scientific community would move two ways, exchanging the sentiments, beliefs, and histories of those who participate.[14]

The previous two examples expose the counterintuitive ways in which climate data becomes more meaningful when wrapped up with less objective modes of representation. Following these perspectives, it is clear that climate discourse needs a "powerful descriptive tool," as Bruno Latour articulated a

10 Edwards, *A Vast Machine*, 3.

11 Edwards, *A Vast Machine*, 3. The term "vast machine" is taken from a John Ruskin passage he quotes as the book's epigraph: "The meteorologist is impotent if alone; his observations are useless; for they are made upon a point, while the speculations to be derived from them must be on space… The Meteorological Society, therefore, has been formed not for a city, nor for a kingdom, but for the world. It wishes to be the central point, the moving power, of a vast machine, and it feels that unless it can be this, it must be powerless; if it cannot do all, it can do nothing. It desires to have at its command, at stated periods, perfect systems of methodical and simultaneous observations; it wishes its influence and its power to be omnipresent over the globe so that it may be able to know, at any given instant, the state of the atmosphere on every point on its surface. —John Ruskin (1839)." Edwards defines the vast machine of climate science as: "a sociotechnical system that collects data, models, physical processes, test theories, and ultimately generates a widely shared understanding of climate and climate change."

decade ago, in "Why Has Critique Run Out of Steam?" While Latour helped create a discipline out of investigating the conditions in which scientific knowledge is produced, this essay laments the use (or misuse) of similar constructivist tactics to debunk the science of climate change. Rather than a full reversal, Latour attempts to find another "powerful descriptive tool" that does away with "matters of fact" and allies instead with what he calls "matters of concern."[15] This approach takes root interrogating the materiality of science not as a series of "objects"—which are factual and undesigned—but rather to attend to them as "things," which he frames as a "gathering" of meaning and intents.

While climate is typically considered an atmospheric phenomenon or a representational problem of data, plastiglomerates are physical markers of climate's ongoing transformation. They are the sum of various inputs. Even if their existence cannot be ascribed human authorship, these things are crafted by a more complex composition of industrial and consumer activities, thalassic and riparian forces. Their physical qualities are signatures of this complex composition, or natureculture, that authored them. It would also be possible to say these objects are "post-natural," existing outside a modernist division of civil society from pure nature. They represent a possible avenue for thinking about a more

Plastiglomerate sample, 2013. Photograph by Jeff Elstone, courtesy of Kelly Jazvac.

12

In 1988, James Hansen testified before the assembly of the US House Energy Committee, with a graphic analysis of projected temperature ranges based on a model attesting to a 99 percent rate of reliability.

13

Mike Hulme, *Why We Disagree About Climate Change: Understanding Controversy, Inaction, and Opportunity* (Cambridge: Cambridge University Press, 2009), 217.

14

What this looks like is unclear, but it would require various media to convey evolving messages to different subjects. Hulme, *Why We Disagree About Climate Change*, 218–221.

15

"The mistake we made, the mistake I made, was to believe that there was no efficient way to criticize matters of fact except by moving away from them and directing one's attention toward the conditions that made them possible. But this meant accepting much too uncritically what matters of fact were. This was remaining too faithful to the unfortunate solution inherited from the philosophy of Immanuel Kant. Critique has not been critical enough in spite of all its sore-scratching. Reality is not defined by matters of fact. Matters of fact are not all that is given in experience. Matters of fact are only very partial and, I would argue, very polemical, very political renderings of matters of concern and only a subset of what could also be called states of affairs. It is this second empiricism, this return to the realist attitude, that I'd like to offer as the next task for the critically minded." Bruno Latour, "Why Has Critique Run Out of Steam? From Matters of Fact to Matters of Concern," *Critical Inquiry*, vol. 30, no. 2 (Winter 2004): 231–232.

literal version of architecture's connection to larger milieus. Architecture's capacity to link an aesthetic to a world of ideas, so clearly evidenced by plastiglomerate samples, starts with materiality.

Imagining the geocentric arrangement of a Ptolemaic cosmology, suppose that the physical encounters that make up an architectural experience correspond to the nested rings layered around the central subject. These nested encounters with physical things act like membranes through which subjects (individuals, collectives, publics) develop a new awareness of surrounding milieus at various scales. These are not conclusive encounters: the strange rocks and stones of my two-part parable leave much to the imagination while evoking some history outside that moment, a human and natural history. In this way, perhaps an architectural cosmology of things can re-enchant us with the nearby world or provide new perspectives on the "wicked problems" of contemporary life.

NAVIGATING THE PLASTISPHERE

The annual global production of plastics is currently estimated to be 245 million metric tons (270 US tons). According to one study, this amount "represents 35 kg of plastic produced annually for each of the 7 billion humans on the planet, approximating the total human biomass."[16] It is vivid and staggering to picture that each year, the earth's surface is populated with new plastic whose combined bulk is roughly equivalent to that of all the human bodies that also populate the earth's surface—and that year after year, another total-human-biomass's worth of plastic is added.

Of that 245 million metric tons, only 0.1 percent is believed to end up in one of the five subtropical gyres, the vast islands of floating debris that have now been well measured and documented.[17] Still, plastic has become the primary source of marine pollution in the sixty years of its manufacture. A new report by a group of marine chemists and biologists documents the microbial communities that are flourishing on fragments of floating plastic. This study found that a variety of "heterotrophs, autotrophs, predators, and symbionts" are concentrated on these plastic fragments at a density and diversity much greater than that of the surrounding ocean water. Plastic waste has become a substrate for "novel ecological habitats in the open ocean," and one that given plastic's long half-life, guarantees a stable alternative to indigenous substrates found at sea.[18]

16 "Plastic accumulates not only on beaches worldwide, but also in 'remote' open ocean ecosystems. Drifter buoys and physical oceanographic models have shown that surface particles such as PMD can passively migrate from Eastern Seaboard locations all the way to the interior of the North Atlantic Subtropical Gyre in less than 60 days, illustrating how quickly human-generated debris can impact the gyre interior that is more than 1,000 km from land. Plastic debris in the North Atlantic Subtropical Gyre and North Pacific Subtropical Gyre is well-documented and models and limited sampling confirm that accumulations of PMD have formed in all five of the world's subtropical gyres." Erik R. Zettler, Tracy J. Mincer, Linda A. Amaral-Zettler, "Life in the 'Plastisphere': Microbial Communities on Plastic Marine Debris," *Environmental Science and Technology* 47 (2013): 7,137–7,146.

17 Marcus Eriksen, Laurent C. M. Lebreton, Henry S. Carson, Martin Thiel, Charles J. Moore, Jose C. Borerro, Francois Galgani, Peter G. Ryan, Julia Reisser, "Plastic Pollution in the World's Oceans: More than 5 Trillion Plastic Pieces Weighing over 250,000 Tons Afloat at Sea," *PLoS ONE*, vol. 9, no. 4 (December 2014).

18 "Plastisphere communities are distinct from surrounding surface water, implying that plastic serves as a novel ecological habitat in the open ocean. Plastic has a longer half-life than most natural floating marine substrates, and a hydrophobic surface that promotes microbial colonization and biofilm formation, differing from autochthonous substrates in the upper layers of the ocean." Zettler et al., "Life in the "Plastisphere," 7,137.

WELCOME TO THE "PLASTISPHERE"

The "plastisphere" joins an assortment of other "-spheres" that encircle the planet with distinct but interrelated material conditions: atmo-, bio-, hydro-, litho- and so on. Each is defined by its particular components and by its vital function within the planetary system; and each outlines a distinct knowledge category comprised of the disciplines and institutions that attend to its study and management. By selecting the term "plastisphere" to describe the totality of garbage-surfing microbes and their nearly imperceptible ecosystem, these scientists underscore the phenomenon as a pervasive materiality and a global infrastructure of life. The proliferation of plastic waste represents the entropic flipside of the world's industrial system while revealing the adaptive capacities of life worlds outside our own. The balancing of ecological gains and losses according to a static idea of "nature" begins to feel like a futile motivation for environmentalist action. From this perspective, change—to the atmosphere, to the biosphere, to the lithosphere, to the financial sphere—becomes less an indicator of nature out of balance. Change appears instead as a consistent property of environment and a reminder of the conceptual limits to technocratic models of sustainability. This is not to argue that architecture has nothing to do with climate; rather, it is to modify Latour's and Hulme's call for descriptive tools or new mediums through which different perspectives, multiple views, and alternate sensibilities can be shared, in order to begin assessing which forms of change, what methods of adaptation, and whose burdens of responsibility are acceptable.

> The planet will be here for a long, long, LONG time after we're gone, and it will heal itself, it will cleanse itself, 'cause that's what it does. It's a self-correcting system. The air and the water will recover, the earth will be renewed. And if it's true that plastic is not degradable, well, the planet will simply incorporate plastic into a new paradigm: the earth plus plastic. The earth doesn't share our prejudice toward plastic. Plastic came out of the earth. The earth probably sees plastic as just another one of its children. Could be the only reason the earth allowed us to be spawned from it in the first place. It wanted plastic for itself. Didn't know how to make it. Needed us. Could be the answer to our age-old egocentric philosophical question, "Why are we here?"
>
> Plastic, asshole.
> —George Carlin

A PREFACE TO POST-ROCK ARCHITECTURE

Returning us to a cosmological perspective, George Carlin's punch line points out the absurdity of humanist logic in the context of geological and climatic transformations. What if "earth plus plastic" is a new paradigm of lithospheric materiality? What if plastic, or a plastic-rock hybrid, is the answer to the most basic existential questions? While this scenario may resonate with "post human" discourses circulating today, for me the humor is key here; as a speculative device, it offers a possible technique for reconfiguring persistent frameworks of environmental thinking and the subject-object relationships those frameworks support. It relieves the proprieties of a modernist idea of

Collection of identifiable plastic objects found by Noni Samford on Kamilo Beach and along the nearby coastline. Photograph courtesy of Kim De Wolff.

environmental design and its aesthetics. Learning from the qualities of plastiglomerates as material and medium, perhaps a post-rock architecture might be formulated:

Post rocks resist abstraction. They are neither symbolic nor instrumental. They embody the trajectories of materials and forces, rather than diagram them; they give physical presence to the entropic processes and cultural tendencies behind the plastic's production and eventual removal from a system of value. However, to describe this relation to process as indexical is not quite right either. Post rocks' physical appearance does not *index* their formation, a process that involves degrees of complexity and many agents acting at different scales. It's a process that is impossible to repeat precisely. As a "thing," post rock makes sensible those scattered inputs and distant geographies without *explaining* their contingencies. Carrying that external history, the aesthetics of post rocks both arrest with familiarity and resist easy categorization.

Now insert the word *architecture* after "post rock" in that last paragraph. Both literally and as a model for practice, what is envisioned here is a way of engaging architecture's milieus—atmo-, hydro-, bio-, plasti-, or other—not by emulating the abstract logic of the system but by authoring tangible things of the here and now.

Meredith Miller is an architect and an assistant professor of architecture at the University of Michigan's Taubman College of Architecture and Urban Planning. Through design research, writing, and collaborations, she explores the interactions of architecture and environmental thinking.

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Hard Science

Environmental alarm bell, artwork or both? With a team of scientists, artist Kelly Jazvac makes a newly discovered 'rock' art's latest Readymade.

by Matthew Ryan Smith

Kelly Jazvac: Plastiglomerate Samples (2013). Plastic and beach sediment, including sand, basalt rock, wood and coral. All of these found-object artworks are the result of a collaboration between Jazvac, geologist Patricia Corcoran and oceanographer Charles Moore. Photos: Jeff Elstone.

But if I see before me the nervature of past life in one image, I always think that this has something to do with truth. — W. G. Sebald, After Nature [1]

The seminal French artist Marcel Duchamp was, among other things, a trickster par excellence. Drawn into the Dada movement's embrace of absurdity, rejection of Nationalism, and assault on tradition, Duchamp culled from the world around him, making art from everyday found objects. From these he would create "readymades": already-made, mass-produced or manufactured stuff transformed into "art" simply because he, as an artist, said it so. While many people recognize Fountain (1917), a porcelain men's urinal flipped on its back, signed "R. MUTT," and placed in an art gallery, Duchamp's first readymade was created in 1913 under the title *Bicycle Wheel*. Here, Duchamp mounted a metal bicycle wheel onto a painted wooden stool; however, that one simple gesture changed everything. His statement on the marriage of materials was as much aesthetic as it was prophetic: "I had the happy idea to fasten a bicycle wheel to a kitchen stool and watch it *turn.*"[2] By combining common industrial materials to produce a sculptural object, Duchamp completely redefined just what art, design and craft really is.

Kelly Jazvac: Plastiglomerate Sample (2013). Plastic and beach sediment, including sand, basalt rock, wood and coral.

Exactly 100 years after Duchamp's radical innovation, a readymade of a more sinister variety, found on the quiet shores of Kamilo Beach, Hawaii, was studied and described. There, common mass-produced plastics melt into naturally occurring matter including sand, volcanic rock and coral to produce a substance known as "plastiglomerate."

London, Ontario-based visual artist and Western University Professor Kelly Jazvac has recently displayed plastiglomerate as readymade art objects at SECCA in North Carolina; Art Museum at the University of Toronto; Carleton University Gallery in Ottawa; Projekstrom Normanns in Norway; Louis B. James Gallery in New York; and Oakville Galleries' Gairloch Gardens. Jazvac has employed salvaged plastics, the readymade, and other mass-produced materials, including Plexiglas and cardstock, in her rich body of work since 2005. However, she first embarked on this new direction of research after Western University Earth Sciences Professor Dr. Patricia Corcoran invited noted oceanographer Charles J. Moore of the Algalita Marine Research Institute in Long Beach, California to speak publicly on plastics pollution at the university in 2012.

Moore presented a slide featuring a strange brew of plastics bound together with natural materials from Kamilo Beach. As of then, it did not yet have a name, nor was there a clear understanding of how it was formed. Moore's hypothesis was that lava from nearby volcanoes was in fact melting plastics washed ashore on the beach and, therefore, nature itself rather than the human population was remedying its own pollution problem.

Kelly Jazvac: Plastiglomerate Sample (2013). Plastic and beach sediment, including sand, basalt rock, wood and coral.

Soon after Moore's lecture, Corcoran and Jazvac traveled to Kamilo Beach to investigate the phenomenon for themselves. In exchange for paying her own way to the site, Jazvac was given the opportunity to pursue the research as a visual art project.[3] What they encountered was devastating: a new type of stone formed through an intermingling of melted plastic, beach sediment, basaltic lava fragments and other organic debris.[4] Further, plastiglomerate's making was clearly quite banal, and very human: people having bonfires on a beach littered with a remarkable amount of plastic debris is what created plastiglomerate – not lava. Although the lava version of the story is certainly more exciting, Corcoran and Jazvac began to discuss and consider the cultural implications of these findings; the result of which was a scientific manuscript that is drawn from their scientific data, but also contains a speculative component drawn from their dialogue.[5]

According to the findings of their research, published by the Geographical Society of America, plastics are essentially synthetic organic polymers used in mass-produced consumer goods that hold potential to break down mechanically, chemically or, to a lesser degree, biologically over hundreds or even thousands of years. It happens that Kamilo beach is enveloped with small plastics debris known as "plastic confetti," which litters the land, vegetation and sand in a rainbow of over-consumption, a metaphor for our times.

Corcoran, Moore and Jazvac suggest that the beach's proximity to trade winds makes it an ideal venue for waste pollution:

> Given the beach's constant exposure to the northeasterly trade winds, much of the small (<10 cm), lightweight plastic debris is blown to the back-shore environment, where it becomes trapped in vegetation. On a beach as dynamic as Kamilo, preservation of plastics in the sediment column could occur where trapped sediment is covered with sand or where a polymer is combined with a much denser material. We observed the results of this density increase on Kamilo Beach, where great quantities of melted plastic have mixed with the substrate to create new fragments of much greater density, herein referred to as "plastiglomerate."[6]

The mixing of plastics with substrate is a direct product of bonfires that occur, rather "naturally", on sites of the beach dirty with plastic confetti, as well as larger pieces of plastic debris. Not only does the fire melt the plastic into crevices of the substrate, but it also releases toxins directly into the air. That being said, Corcoran indicates that the presence of plastiglomerate is not confined to Kamilo Beach but occurs somewhat naturally in other beaches and shores throughout the world; though, these instances have yet to be reported or to be named as we are still in the early stages of its appearance.[7]

Kelly Jazvac: Plastiglomerate Sample (2013). Plastic and beach sediment, including sand, basalt rock, wood and coral.

What are the consequences of these findings? And, what cultural role does speculation play? In their 2013 manuscript, the most-viewed article in the history of the journal, Corcoran, Moore and Jazvac argue that plastiglomerate could potentially act as evidence of the Anthropocene era. Popularized by Nobel laureate and atmospheric chemist Paul Crutzen in 2000, the term Anthropocene suggests a profound epochal transformation whereby human beings and their destructive activities have altered Earth's geology. The term and its legitimacy as a productive concept are widely contested in academia, some researchers going so far as to say it is "more about pop culture than hard science."[8] However, in January 2016 the journal *Science* published a landmark paper by an international team of Anthropocene researchers, wherein they cite nuclear testing as a key Anthropocene marker, as well as a surge of specific man-made materials in the environment, including concrete, aluminum, and plastic.[9]

Artists like Jazvac and curators such as Jon Davies, formerly the associate curator of Oakville Galleries, have attempted to theorize the implication of the Anthropocene era in lieu of "hard science." Davies finds that plastiglomerate speaks to us as persuasive "evidence" of the destructive potential of plastics pollution. Jazvac approaches plastiglomerate under the rubric of the readymade; however, unlike Duchamp's readymade, which transformed mass-produced consumer products into art as a way to re-conceptualize the very meaning of art itself, Jazvac is interested in questioning the role of plastics pollution in relation to culture at large, it's the readymade redressed and made anew a century later, but this time it is waste, garbage and detritus that serves as the material. For Jazvac the object's role as a vehicle for contemplation is precisely where it draws its power:

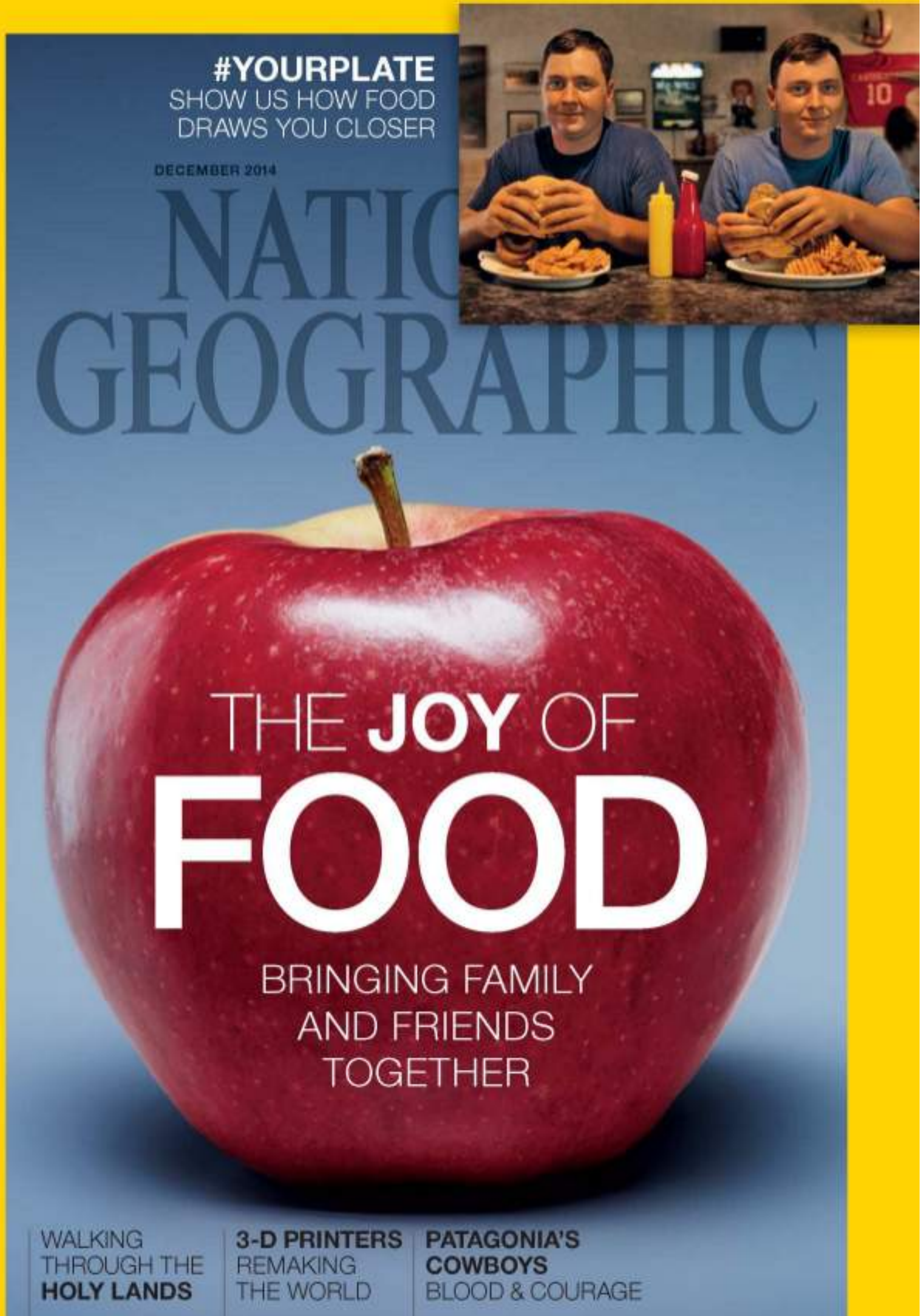
> I found these objects so aesthetic and haunting that I didn't want to do anything to them; this led to presenting them as found objects. In this role, I like how they use the simple framing device of calling something 'art', and all the institutional and historical infrastructure that is bound to that category, as a way to set up an opportunity for new knowledge and thought.[10]

These objects are unsettling reminders of our present biophysical condition. In Canada alone, detrimental amendments to the *Fisheries Act* has reduced protection of many fish species, *The Navigable Waters Protection Act* reduces crucial protection to most lakes and rivers, *The Environmental Assessment Act* was repealed, and perhaps most embarrassing is Canada's withdrawal from the Kyoto Agreement after signing the treaty.[11] Most recently, Canada has failed to meet its existing target of reducing emissions below 2005 levels while the United States continues to succeed.[12]

Kelly Jazvac: Plastiglomerate Sample (2013). Plastic and beach sediment, including sand, basalt rock, wood and coral.

In a different way, Jazvac's readymade plastiglomerate works are sinister prophesies of apocalyptic futures, and perhaps this is what she means by "haunting." They are spectres of over-consumption, waste and the accumulation of things. They prey upon the viewer as small metaphors of gluttony; they read as manifestos for irresponsibility. It's taken a century to see how far we've come. Here is the evidence: tangled webs of plastic and stone.

Kelly Jazvac's Plastiglomerate Samples *are currently featured in the exhibition* The Future We Remember *at the Southeastern Centre for Contemporary Art in North Carolina until June 5, 2016. In August, she sets sail on an expedition of Lake Huron with the largest-to-date, all-woman simultaneous sampling of plastics pollution in the Great Lakes. In October, she will be showing a new, large-scale installation of salvaged billboards at the former site of David Mirvish Books on Art*


#YOURPLATE
SHOW US HOW FOOD
DRAWS YOU CLOSER
DECEMBER 2014
NATIONAL GEOGRAPHIC
THE JOY OF
FOOD
BRINGING FAMILY
AND FRIENDS
TOGETHER
WALKING
THROUGH THE
HOLY LANDS
3-D PRINTERS
REMAKING
THE WORLD
PATAGONIA'S
COWBOYS
BLOOD & COURAGE

Riding on Rough Air

Some skies aren't so friendly, thanks to unpredictable bouts of turbulence. A United Airlines flight in February hit such rough air that a baby was thrown into the air (but wasn't harmed), one passenger's head made a dent in the ceiling, and five people later went to the hospital. Because of climate change, the extreme weather events that breed turbulence "are likely to become more frequent or more intense," says a U.S. Environmental Protection Agency report.

"Flight plans avoid known regions of severe turbulence, but these regions move, and it is difficult to predict exactly where the severe turbulence is going to be," says Sanjiva Lele of the Stanford-NASA Center for Turbulence Research. Help is on the way: Earlier this year one U.S. airline debuted new turbulence detectors that use special radar to predict the levels and location of turbulence in a flight path. —*Mark J. Miller*

CLEAR AIR TURBULENCE
The most common form of turbulence, this movement is often associated with the edges of the jet stream, a persistent atmospheric motion pattern in the Northern Hemisphere.

GRAVITY WAVES
Air that is forced upward, such as over mountains and above thunderstorms, causes gravity waves. Turbulence over mountains is common as two different, large air masses suddenly meet.

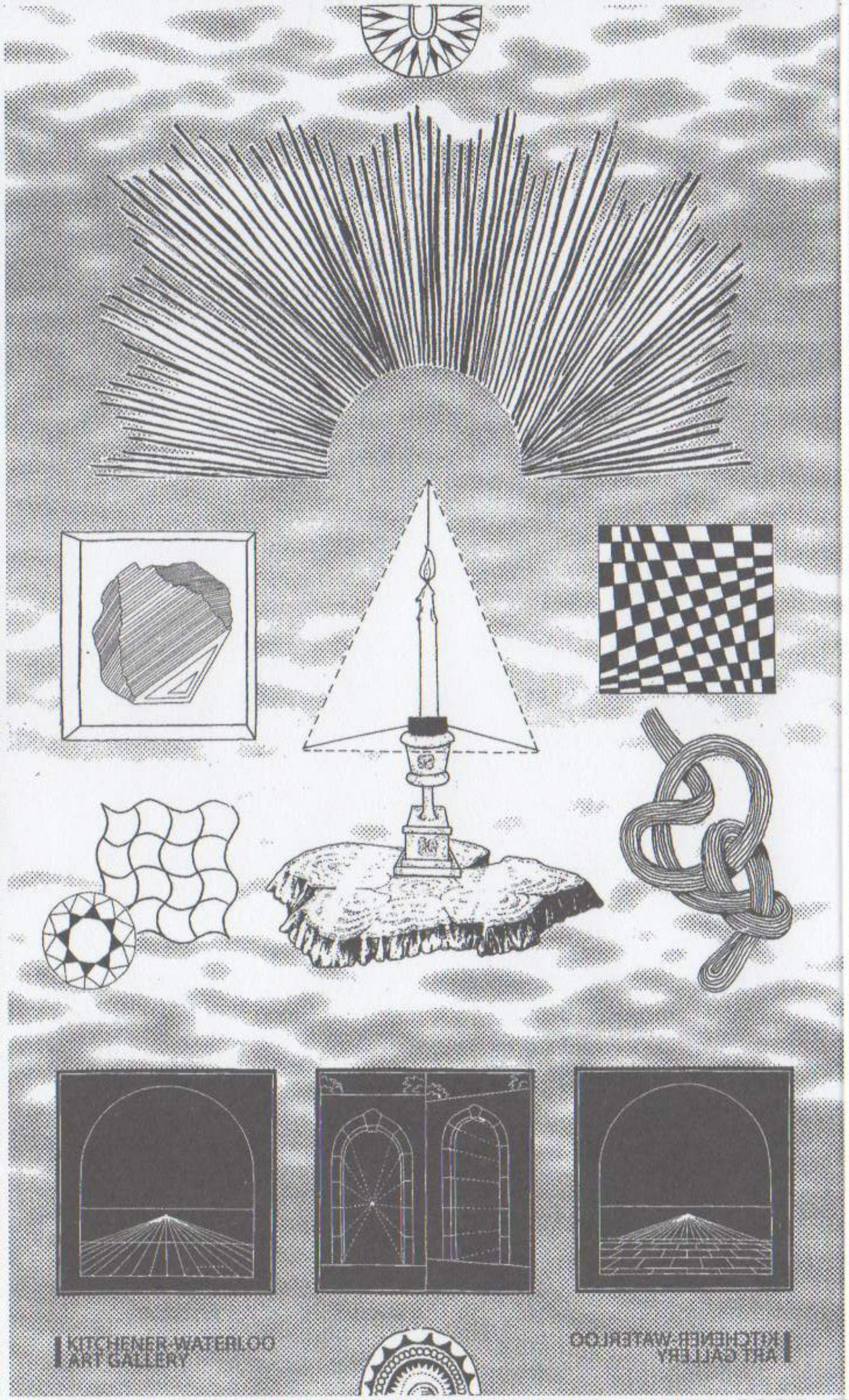
BAD WEATHER
Bumpy rides occur when planes fly through thunderstorms or after a rain, when warm air and cool air mix. Planes try to rise above such phenomena, but most can't fly higher than 45,000 feet.

WAKE FROM PLANES
Much as a boat's wake affects other craft, planes can suffer a major loss of control or altitude from wake turbulence. That's why air traffic control times takeoffs and landings to avoid it.

ALTERNATIVE ROCK

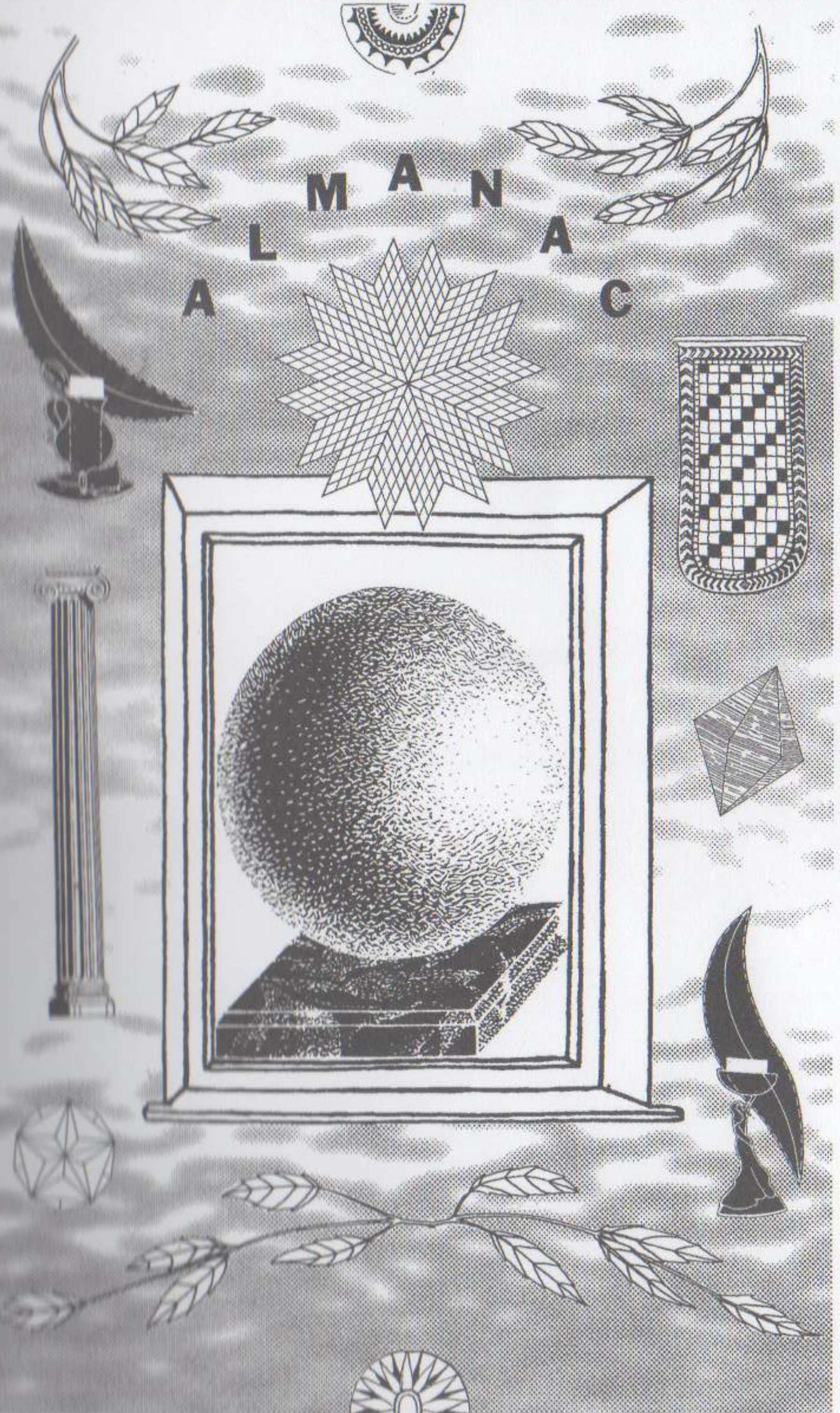
Some strange things are turning up on Hawaii's Kamilo Beach. They look like chunks of garbage but are actually pieces of a newly noted kind of stone. These "plastiglomerates" form when plastic litter melts in the heat of campfires and mixes with sand, basalt fragments, wood, and other debris. Sedimentologist Patricia Corcoran says that in Earth's future geologic record the stones could serve as markers of the point in civilization when humans started using (and discarding) plastics on a grand scale. —*Catherine Zuckerman*

PHOTO: REBECCA HALE, NGM STAFF. ART: SAMANTHA WELKER
SOURCE: SANJIVA LELE, STANFORD UNIVERSITY



BASIL ALZERI CRYSTAL MOWRY DIANE BORSATO DYLAN MINER

ALMANAC



FAITH LA ROCQUE FASTWÜRMS JASON DE HAAN JESSE HARRIS JIMMY LIMIT KARA UZELMAN KELLY JAZVAC MAGGIE GROAT OPEN STRUCTURES TANYA BOSSE

JOAR NANGO TANYA LUKIN LINKLATER WALTER SCOTT ALICIA NAUTA AMISH MORRELL ANNE RILEY

Plastiglomerate samples collected in 2013 by artist Kelly Jazvac with geologist Patricia Corcoran on Kamilo Beach, HI. These stones are comprised of molten plastic debris mixed with beach sediment, such as sand, wood, and rock.

NONI KNOWS

Written by Kelly Jazvac, but comes about through conversations with Patricia Corcoran, Noni and Ron Sanford, Odile Madden, Heather Davis, Max Liboiron, Kirsty Robertson, Kelly Wood, Patrick Howlett, and David Fierman

The fieldwork research discussed here took place on Kamilo Beach, Hawai'i, located within the traditional territory of the Hawaiian Kingdom, illegally annexed since 1838 by the United States of America.

If an artist has something to contribute to scientific knowledge, I think it is this: that there are different ways of knowing something. And different doesn't mean flaky. Different can be profound and impactful in ways science is not. Just as science can be impactful in ways that art is not.

In 2014, geologist Patricia Corcoran, oceanographer Charles Moore and myself, an artist, co-authored a scientific manuscript. It met standard scientific expectations: it contained data; it described our research methods and our research site. Yet the text also contained a speculative element. This is unusual for a scientific manuscript. This speculative element reflected on the future consequences of our findings. To an artist—or anyone who uses culture to think through ideas—this may seem like a perfectly normal thing to do. However, according to a materials scientist at the Smithsonian's Museum Conservation Institute, it was in fact a strange and curious thing.

Our paper described "plastiglomerate" and what it might mean in the future. Plastiglomerate is a stone made of sedimentary grains and natural debris (such as sand, wood, or basalt rock), held together by molten plastic debris. It forms when plastic garbage comes in contact with beach fires. In the case of our fieldwork, this happened via campfires on Kamilo Beach on the island of Hawai'i, but it has now been documented in many other places around the globe. Kamilo Beach suffers a remarkable amount of plastic pollution due to its proximity to the North Pacific Gyre and the direction of ocean currents. Plastiglomerate has the potential to enter the future geologic rock record, given the weight and density that accrue as molten plastic binds to beach sediment. Plastic strata for the future, so to speak.

As someone approaching this research from a cultural and humanities-based perspective, I am compelled to emphasize that our local guides, Noni and Ron Sanford, knew important components of what we published as scientific knowledge long before we published it. We traveled to Kamilo Beach with the hypothesis that plastiglomerate was created by lava melting plastic debris. Ron and Noni knew this was not the case—that plastiglomerate was created by people—and soon after talking with them, visiting the site, and learning about its history, so did Patricia and I. Most concerning to Noni was the possible and erroneous public perception that Earth, in the form of lava, was somehow taking care of humans' problems (extensive and choking marine plastics pollution). Ron and Noni, along with the Hawaiian Wildlife Fund, have personally removed tonnes of plastic from Hawaiian beaches, including mounds of plastiglomerate. The suggestion that volcanoes were "taking care of" plastic pollution didn't help their cleanup efforts. One might see the lava theory sending an easy and palatable message to consumers and industry: "Don't worry about this at the source of the problem because it is being taken care of on the other end." This is the same type of message that underlies the techno-utopianism[1] of certain ocean cleanup projects,[2] however well-meaning.[3] It's a mindset that doesn't ask us to take responsibility, change, rethink, or adapt.

Hawai'i has no petrochemical industry, and it was clear that most of this garbage came from elsewhere. I drew this conclusion based on the plurality of languages written on the wide range of plastic items washed up on the beach. Noni, a long-term collector and interpreter of international fishing tags and weather balloons, came to this conclusion based on her personal archive and database.[4]

There is also science that backs up this lived observation.[5] Ocean currents, like "capitalism, colonialism, and consumerism," are globalized.[6]

So, at this moment when multiple and contradictory versions of the truth can easily be found, how do we make space and give authority to local, lived knowledges? How can we do so effectively, in a way that works with the authoritative voice science can provide—especially at a time when science itself is under fire, as evidenced by the proliferation of lobbyists and climate change–denying think tanks (some of which now work for the US government)? How can artists be folded into this conversation from the get-go, in order to help science zoom out of the problem and look forward, while at the same time learning how to zoom in with precision, as science does so well?[7] And, crucially, how can science hear humans more acutely? We clearly need science more than ever, but now we must also contend with junk science and junk truth. As feminists, how can our work be taken seriously and authoritatively, yet still remain sentient and open to rewritings and self-criticisms, as any lived knowledge is?

Perhaps part of the answer lies in folding arts and humanities back into understandings of what knowledge can be. And I don't mean this in an academic sense, but in the sense of "culture" and "people." Because along with this type of knowledge comes a discussion of subjective biases, history, and power; a consideration of ethics; and a value and appreciation of speculation, listening, storytelling, feeling, and lived observation. An environmental crisis is also a human crisis. And humans are capable of learning through data, but they are more apt to learn through words, stories, emotions, images, and hands-on trial and error.

I will try to end these thoughts with possibilities instead of endgames, so I will quote an ongoing list from scientist and artist Max Liboiron's feminist marine science lab, the Civic Laboratory for Environmental Action Research (CLEAR) at Memorial University of Newfoundland. The list brainstorms what a feminist scientific paper might look like. I find it to be a fruitful and hopeful exercise that foregrounds both play and discussion as important components of progress. The list exists on a large piece of newsprint in a communal area in the lab, where it can be added to and rewritten. In keeping with this ethos, the text quoted on the following page has already been rewritten.

1 Heather Davis, "Life & Death in the Anthropocene: A Short History of Plastic," *Art in the Anthropocene: Encounters Among Aesthetics, Politics, Environments and Epistemologies*, eds. Heather Davis and Etienne Turpin (London, England: Open Humanities Press, 2015, 347–58).

2 The Ocean Clean Up Project involves building a massive floating boom in the ocean to sieve out marine plastics: theoceancleanup.com

3 Argued beautifully by Max Liboiron, "How the Ocean Cleanup Array Fundamentally Misunderstands Marine Plastics and Causes Harm," *Discard Studies* (5 June 2015): discardstudies.com/2015/06/05/how-the-ocean-clean-up-array-fundamentally-misunderstands-marine-plastics-and-causes-harm.

4 Interview with Noni Sanford, 8 June 2013.

5 A research study in Korea describes a similar phenomenon: Jang, Y.C.; Lee, J.; Hong, S.; Lee, J.S.; Shim, W.J.; Song, Y.K. "Sources of plastic marine debris on beaches of Korea: more from the ocean than the land," *Ocean Sciences Journal* 49, no. 2 (2014): 151–62.

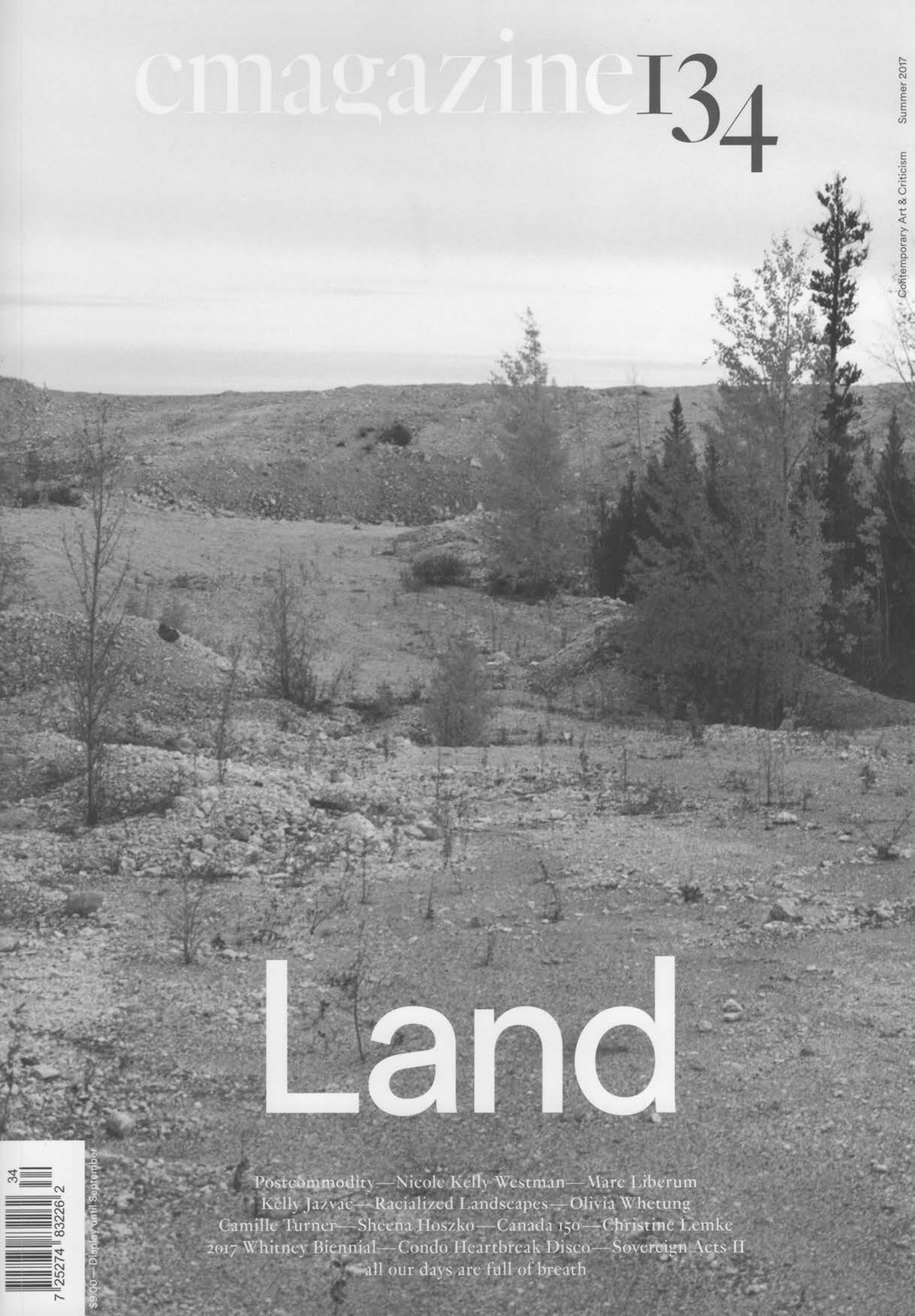
6 Kirsty Robertson, "Plastiglomerate," *e-flux journal* 78 (December 2016): e-flux.com/journal/78/82878/plastiglomerate.

7 Heather Davis clearly laid out the importance of artists and scientists working together from the get-go: "Working in interdisciplinary modes" (presentation at the Plastics Pollution Think Tank Workshop, Western University, London, ON, 28 June 2016).

The
MOST FEMINIST SCIENCE ARTICLE
in the WORLD *
would include:

- a Land acknowledgment
- a position statement
- a count of all the pretty things
- a map/graph/legend with 'no contamination' that wouldn't be used
- a discussion of justice
- hand-drawn graphs/maps
- local place names
- multiple languages, including local Indigenous languages
- sections on results of community peer review
- coloured ink
- elder review
- translation between traditional knowledge and scientific knowledge > how they work together or not
- what kind of day you're having and effects on results
- a 'layman's' term abstract > like an abstract but in less jargony terms
- dictionary-ish reference @ back of paper (like textbooks) for jargon terms
- a romantic novel
- zines/comics
- the social life of contaminants – follow the fish and log all its contaminants, not just in the ingestion of plastics
- sections on hands, brain, heart
- write it as a discussion or play so roles + carework are clear

* in progress



cmagazine 134

Contemporary Art & Criticism

Summer 2017

Land

Postcommodity—Nicole Kelly Westman—Mare Liberum
Kelly Jazvac—Racialized Landscapes—Olivia Whetung
Camille Turner—Sheena Hoszko—Canada 150—Christine Lemke
2017 Whitney Biennial—Condo Heartbreak Disco—Sovereign Acts II
all our days are full of breath

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Kelly Jazvac

Interviewed by Weiyi Chang

In February, my partner and I scoured the rocky beaches of Vancouver Island for a perfectly smooth stone. We sifted through countless contenders, debating the merits and demerits of each, gradually distilling the parameters of the prize. One tempting find was a smooth rock with a perfectly round hole neatly bored into the top, its deceptive lightness revealing a hollow interior. We briefly considered taking it home before returning it to the ocean to serve, we imagined, as a home to another inhabitant.

Beachcombing is a popular activity, evocative of summer vacations and communal gatherings. But artist Kelly Jazvac's beachcombing excursions in Hawaii have yielded another, more tragic, invocation in the form of the plastiglomerate. The name designates a type of aggregate in which plastic waste has bonded with a mixture of sand, shell, coral and other natural materials to produce a new type of stone. Exhibited as both readymade sculptural objects and as objects of scientific research, the stones were collected as part of a collaborative effort between Jazvac and geologist Patricia Corcoran, who was invited to research the stones at the behest of oceanographer Charles Moore. Plastiglomerates have captivated both art audiences and scientists, indexing the entanglements between petro-capitalist economies, oceanic currents and human activity, and animating the forces at play between globalizing forces and local reverberations.

WC: Can you describe your initial reactions when you arrived at Kamilo Beach, and how the stones have impacted your perception of the relationships between disparate locales? What has been your experience working with local communities, and what are their thoughts on the situation at Kamilo Beach?

KJ: I'll start by describing the nature of our fieldwork there. We didn't just show up with our cameras and notebooks looking for something shocking. This work was the result of a long activist relationship that oceanographer Charles Moore had with local individuals and environmental groups. Charles asked Patricia Corcoran to talk to members of the Hawaii Wildlife Fund, and locals Ron and Noni Sanford have led remarkable clean-up efforts on this beach. Through those conversations, this work began.

My initial reaction when arriving at Kamilo Beach was both sadness at the pollution, but also profound respect for the tremendous clean-up efforts of local organizations and individuals. A huge amount of plastic debris from the North Pacific Gyre washes up directly on this specific beach. Literally tonnes of plastic have been removed by volunteers. Hawaii has no petrochemical industry; a lot of the debris on this beach was clearly coming from elsewhere, as evidenced by the different languages written on it and more precise locators, such as plastic fishing tags that pinpoint the source of a piece of plastic to a specific region. There is an interesting 2014 study by Yong, Chang, Yang et al[1] that found that most of the plastic beach debris on six beaches in Korea came from the ocean, not the land. This has huge implications. And, like Kamilo, demonstrates how the people of one place can find themselves awash in other peoples' trash.

Ron and Noni were frustrated because they were constantly dealing with this. Noni is a second-generation beachcomber, and describes the extreme shift in what was washing up on the beach, starting in the 1960s, when plastics became a commonly used material. I learned a lot from her. As an outsider, I had trepidations with this fieldwork – this is not my land or country. And yet Noni showed me debris that she collected that *was* from my country – objects she found washed up on a beach near her home. I recently wrote a paper called "Noni Knows," for a publication edited by Maggie Groat published by Kitchener-Waterloo Art Gallery – it describes the extensive local knowledge that existed before the authority of science came in to study it, and how the two can possibly collaborate to productive ends.

WC: The stones seem to straddle a discontinuous territory, as both artistic objects and scientific artifacts, and as neither wholly industrial nor natural entities. Can you tell me how their reception has changed in different contexts? I also wonder about your thoughts on the liminal position the stones occupy, and how they intersect with current discussions about climate change and ecological crisis?

KJ: They have mostly been exhibited as objects in art contexts. Their life as scientific objects has revolved around the data that they generate. I think that art exhibition contexts can offer an important contribution – the opportunity to have a moment with an object, framed in a setting that suggests it has an extended and poetic meaning. Art contexts remind us that a physical, bodily experience of an object is also a site of knowledge. Natural history contexts can often set up a scenario where you see the thing, read the panel and then leave feeling like [you] "got" it. Art resists a simple reading.

In 2015, Patricia Corcoran and I had a display in the American Museum of Natural History at the Smithsonian in Washington D.C., in a section of the museum called "Q?rius." We had the samples on a table, along with other information, images and data about plastics pollution. Our audience was mostly kids and their parents. What struck me in that context was how ready the kids were to deal with something real. Often the parents were not, shuffling their kids along saying things like, "That's why we recycle!," which is a way of shutting down the conversation pretty quickly. Meanwhile, kids kept wandering back with more questions. I was at a plastics pollution youth summit in Long Beach in February and none of the youth there would tell you that recycling is a solution to plastics pollution. They were way more invested and informed: "Refuse and reuse and lobby government" was their call to action.

I hope the plastiglomerates' liminality acts as evidence that environmental harm doesn't stop at a geopolitical border. That a fishing tag from Canada could end up on a beach in Hawaii because of ocean currents; or, as I learned from artist Gautam Garoo, plastic motherboards sent from a company in Canada to a company in India to be separated from their salvageable metals doesn't absolve Canada when that melted plastic (and its toxins) ends up in the water. A scientist at [the] Smithsonian, Odile Madden, told us that she was often battling misconceptions from Americans about other countries' role in climate change. She found people were quick to blame countries like China and India for pollution without considering their own nation's driving role and complicity in the problem.

There's been so much useful writing about the dysfunction of nature/culture binaries and the power structures they reinforce – it's been very helpful to me in thinking through these objects.[2] The idea that nature exists outside of humans – that it is there to be controlled or used by humans – is an idea central to modernity that is deeply damaging and thus being challenged on many fronts.

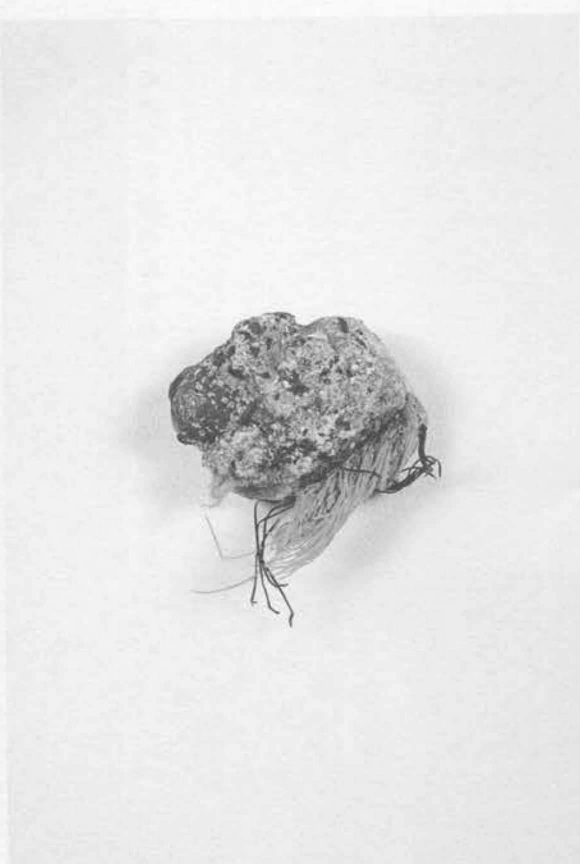
In terms of how liminality intersects with dialogues about climate change and ecological crisis, I think there is evidence everywhere for how climate change work requires us to think outside of established categories: Scott Pruitt as head of the EPA [Environmental Protection Agency]; Justin Trudeau's approval of more pipelines; government muzzling of scientists; Trump's grotesque glee in his own power to reinstate the Dakota Access Pipeline. These events clearly illustrate that this is a complex crisis that involves extreme and structurally biased imbalances of capital and power. Because of this, we need to start talking, in an accessible way, about the nature of knowledge, including ethics, borders, territories, science, economics, politics, education, ethics, race, gender and colonialism.

As an artist, I'm on the lookout for objects and materials that embody these entanglements.

WC: The aestheticization of anthropocentric interventions in the land, such as photos of melting sea ice and images of open pit mines, have been used to represent the actual, tangible realities of ecological crisis. What kind of social and political possibilities do you think the aestheticization of plastic pollution and climate change opens up?

KJ: This is a very important question for artists to be asking themselves. It's fraught, but also full of possibilities. I think artists need to be careful and specific about how they put objects out into the world. It's been very productive for me to learn the science behind the geology. The deeper I get into this research, the more I realize how much misinformed cultural production is out there, and how that can be unproductive or even damaging. I feel like the stakes have never been higher and it is my responsibility to inform myself as extensively as I can. As an artist, I'm not beholden to the facts in the same way a scientist is, which is a relief because straight-up illustrations of science rarely make good art. But I do think that I should *know* the facts in order to make my work.

I think aesthetics can play a very productive role here. I say that based directly on my experience of how people have had a sustained intellectual engagement with a plastiglomerate because they found it visually compelling. Everyone has seen plastic garbage before, but not this other object that stretches their understanding of "rock" and "trash." I think that that is an intellectually active place. There has been a lot of talk of "charisma" in relation to environmental issues, fully realizing that charismatic objects can buy more time from their audiences. I think this can be productive as long as the artist is informed about the potential risks and pitfalls of aestheticization. This includes being ready to adjust when new problems present themselves. ■



All images:
Kelly Jazvac, *Plastiglomerates*, 2013, molten plastic debris and beach sediment, including sand, wood and rock. These found object artworks resulted from a scientific collaboration between Jazvac, geologist Patricia Corcoran and oceanographer Charles Moore. PHOTO: JEFF ELSTONE.

Weiyi Chang is a curator and writer currently based in Vancouver.

Kelly Jazvac is an artist who also researches plastics pollution.

Endnotes

1 Y.C. Jang, J. Lee, S. Hong, J.S. Lee, W.J. Shim, and Y.K. Song, 2014. "Sources of plastic marine debris on beaches of Korea: more from the ocean than the land", *Ocean Science Journal* 49 (2), 151–162.

2 See, for example, Bruno Latour's *We Have Never Been Modern* (Cambridge: Harvard University Press, 1993).