***Belly of a Glacier*: Ohan Breiding's Media Ecologies**

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Several hundred miles from the Geographic South Pole in West Antarctica stands the terminus of the West Antarctic Ice Sheet, where it "calves" icebergs into the Amundsen Sea. In Swiss artist Ohan Breiding's 2023 film, *Belly of a Glacier*, the ice drill pulls out of the glacier like an umbilical cord from 11,171 feet deep, traversing this vast distance by way of flashlight.[1] This recorded trajectory of what the light discloses to us of the deep interior "belly" of the glacier is what French philosopher Félix Guattari might describe as "ecological praxes," which "runs counter to the 'normal' order of things, a counter repetition, an intensive given which invokes other intensities to form new existential configurations."[2] How do you determine the parameters of a glacier, its underside, a moving mass of frozen water and debris? Breiding's ecological praxes run against the grain, against the normalization of these metamorphosing landscapes of the planet's cryosphere. What can be made of this metaphor of flesh against the biting cold of polar ice and water? Of what does it speak?

There is something deeply metabolic about the fact that the temperature and amount of carbon dioxide (CO_2), as scientists discovered, decreased in sync over time.[3] CO_2 entraps the infrared

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[1] *West Antarctic Ice Sheet (WAIS) Divide Ice Core*, https://waisdivide.unh.edu/.

[2] Félix Guattari, *The Three Ecologies*, trans. Ian Pindar and Paul Sutton (London and New Brunswick, NJ: Athlone, 2000), 45.

[3] Jeremy Polk, *Antarctic Ice Sheet (WAIS) Divide: Modeling our Future Climate*, National Science Foundation, April 29, 2015, https://www.nsf.gov/news/mmg/mmg_disp.jsp?med_id=78444&from=. See also Roger Revelle

radiation from earth within its atmosphere, and CO_2 measurements are part of the larger dynamic climate models that scientists generate to understand how fast the world's atmospheres and oceans are changing. One such model is the Keeling Curve, which very clearly represents the fact that these carbon dioxide levels have increased over time. It is named after the scientist Charles David Keeling, who began taking meticulous readings of carbon dioxide in the earth's atmosphere in 1958. The principal Keeling Curve sites are at the South Pole and in the Pacific, from the side of one of the major volcanoes, Mauna Loa in Hawaii.[4] Paradoxically, climate modeling is not geared towards the past but the future, to understand how the energic frequency of atmospheric gases relates to solar and thermal energy.[5] It is difficult to convey these transformations—to visualize—those types of changes and their impacts on human and nonhuman actors.

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and Hans E. Suess, "Carbon Dioxide Exchange Between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO_2 during the Past Decades," *Tellus* 9, no. 1 (1957): 18–27; Charles D. Keeling, "The Concentration and Isotopic Abundances of Carbon Dioxide in the Atmosphere," *Tellus* 12, no. 2 (1960): 200–203; and Keeling, "Is Carbon Dioxide from Fossil Fuel Changing Man's Environment?," *Proceedings of the American Philosophical Society* 114, no. 1 (1970): 10–17.

[4] It is worth noting that in a 1989 interview, scientist Roger Revelle stated that Keeling had the desire "to measure CO_2 in his belly . . . to measure it with the greatest precision and the greatest accuracy he possibly can." Quoted in Spencer R. Weart, *The Discovery of Global Warming: Revised and Expanded Edition* (Cambridge, MA: Harvard University Press, 2008), 34. The Keeling Curve is maintained by the Scripps Institution of Oceanography at the University of California, San Diego: https://keelingcurve.ucsd.edu/.

[5] Polk, *Antarctic Ice Sheet (WAIS) Divide*.

Wavelengths—the movement of energy through space and time—are at the center of this story of corporeal exploration. In *Belly of a Glacier*, Breiding sequences a series of shots capturing the imaging of thin sheets of ice cut from ice cores. We see the apparatus. The technician cycles through a variety of illumination techniques, allowing the polarized light to reveal an array of wavelengths in the visible spectrum across the ice crystals. Each layer of ice is like a photogeochemical image. Within a single shot, the light moves as the slide is moved into position. Each shot encapsulates what is principally at play in scientific images of this kind, connecting optical effects to physical knowledge which is part of the larger arsenal of data collected on climate change. All of these elements speak to the ethical questions underlying knowledge production: Whose knowledge? How is it produced? How does this relate to visual form? While scientists might make graphs and charts, how do artists and filmmakers visualize that data from the field?

UK-based researcher and artist Susan Schuppli explores how media can capture these very fundamental qualitative and quantitative changes to the larger global environment. Schuppli has been investigating the Arctic in the Archipelago of Svalbard of Norway and Canada and thinking about the Arctic's environmental politics. Pursuing her own creative practice, thinking about the changing climate and how to capture it visually, is her multiyear research project *Learning from Ice*.[6] In *Ice Cores* (2019), she emphasizes the ethical role of the scientists who travel in the Indigenous territories in Upper Canada, for example, and the ways that they now attempt to be much more cognizant of existing cultural forms and communities in these various research

[6] Susan Schuppli, *Learning from Ice*, https://learning-from-ice.org.

fields.[7] Yet, in her subsequent video, entitled *NOT PLANET EARTH or How to Denaturalise the Image* (2021), she asserts, "Little about its politics is perceptible in the visual field."[8] In it, she opens questions that lie at the nexus of art and ecology since the late 1960s, ones that are critical for Ohan Breiding's project: How might artists and filmmakers render visible the devastation of climate change? What can we learn about ourselves and our relationship to the planet's ecology?

In her 2019 book, *Material Witness: Media, Forensics, Evidence*, Schuppli explores the legal and juridical implications of the types of information that nature tells and shows us about its own condition. She also examines who counts as a witness and what type of material becomes applicable in a court of law. When I speak to scientists who use imaging, they might rather wonder: What do the properties of light reveal about the nature of the crystallization of water? What can be revealed about the nature of a material by light that is transmitted through it, rather than reflected from it? In *NOT PLANET EARTH*, Schuppli discusses how the Arctic environment also has a material impact on the medium with which she shoots. One case in point is lens crystallization, as sea ice sprays into the air and onto her camera's lens. Dynamic range and sense of scale are constantly being put to the test in recording. Sensor failure is another important register. She discusses the difficulties of relying upon the camera's conventions like tracking shots, as they may or may not capture an actual shelf of ice breaking off into the ocean. Moreover, every time a photograph is shot and made, it is based on how we understand silver to

[7] According to the artist's website, the film "documents activities in the Canadian Ice Core Archive and the OSU Ice Core and Quaternary Geochemistry Lab in the US as well as glacial retreat at the Athabasca Glacier in the Columbia Icefields and ice core drilling at Mount Oxford, Nunavut." See https://susanschuppli.com/ICE-CORES-1.

[8] Susan Schuppli, *NOT PLANET EARTH*, https://vimeo.com/522262211.

respond to light and the different ways we can affect how the metal's photosensitivity ultimately appears in the image.

Scientific images become aesthetic from the sensual knowledge they impart—delivered to us in visual form. Modernist photographer Berenice Abbott, for example, collaborated with physicists of the Physical Science Study Committee at the Massachusetts Institute of Technology to set up model experiments demonstrating a range of different types of physical laws in a compelling way.[9] Charting principles of diffraction and refraction of light and reflection, the stunning portfolio emerging out of Abbott's artistic research opens questions like, how might one distill this physical idea down to its simplest components and make the most compelling image at the same time? These images show light as it moves across the surface of a table or workbench and moves through and across prisms. Because of the different densities of glass and air, light bends. Directing and attenuating it from its source generates all sorts of light effects. To shoot the photograph *Interferences of Water Patterns* (1958–61), for example, Abbott constructed a special apparatus not only for creating these effects but also for making them visible in a photograph, not unlike the photographic process of the photogram.[10] Working directly with light-sensitive

[9] For a research overview, see Colleen O'Reilly, "Pedagogical Interventions: The Physics Photographs of Berenice Abbott," *RACAR: revue d'art canadienne / Canadian Art Review* 41, no. 2 (2016): 77–90. See also Evans G. Valens and Berenice Abbott, *The Attractive Universe: Gravity and the Shape of Space* (Cleveland, OH: World Publishing Co., 1969); Physical Science Study Committee, *Physics* (D. C. Heath, 1960); and Valens and Abbott, *Magnet* (Cleveland, OH: World Publishing Co., 1964).

[10] O'Reilly, "Pedagogical Interventions," 85.

material, she allows different types of objects and materials to intervene between a light source and the photographic paper.

When historian of science Hans-Jörg Rheinberger speaks about the experimental system, he focuses on the apparatus around experimentation and its complexities.[11] I am interested to expand this idea into thinking about the way that artists work, the way that they are thinking in experimental terms. What happens when this system intervenes in the visual? In Abbott's case, very specific physical ideas stood at the center of her project, and she sought out the best way to illustrate them. Yet Abbott did not eliminate evidence of how this image came to be; as art historian Colleen O'Reilly writes, "The visibility—not the suppression—of image-making techniques facilitates knowledge."[12] The photograph is a highly communicative medium, capable of transporting knowledge. Rather than obscuring and effacing the photograph's coming into being, Abbott's inclusion of the means of light's transformation—by way of objects like prisms—lie at the foreground of these works.

Breiding's approach in the ice core archive captures these ideas. The entire architecture of the gallery space—which becomes experiential, thanks to Breiding's stipulation that the gallery's thermostat remain reduced for the duration of the exhibition, late winter to early spring in Massachusetts—opens a relation to the research activities at the West Antarctic Ice Sheet drilling site in Antarctica and the great repository of ice cores in Colorado. Measuring sea ice is one way that natural scientists observe and communicate changes in the overall climate. These practices

[11] Hans-Jörg Rheinberger, *Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube* (Stanford, CA: Stanford University Press, 1997).

[12] O'Reilly, "Pedagogical Interventions," 78.

are part of this arsenal of scientific and technological approaches used to measure the transformation worldwide. This amplifies the interconnectedness of natural scientific research and the processes of nature, particularly how we come to represent these transformations either through graphical means—as seen in the Keeling Curve, among a plethora of data visualizations—or by mediated means through the work of artists and filmmakers. In other words, as media theorist Jussi Parikka proposes, "it is the lens of media art practices and theoretical discourse that offers us a specific way to look at the recent years of climate change, the Anthropocene, and geophysics-embedded work: the ideas about deep time of the media, psychogeophysics, e-waste, the Anthropocene, chemistry, and the earthly as a media history that works in nonlinear ways."[13]

Breiding's *Belly of a Glacier* moves from the deep internal space of ice core tunneling into the earth just short of the glacier's lower boundary with the earth below; to the threshold of the facility's loading dock; to the refrigeration spaces with its corridors of segmented ice cores in metal cylinders; to the machines that crush the ice in sealed airless containers releasing "samples of ancient atmosphere"[14] containing CO_2 for measurement; and then to a series of dazzling, colorful thin sheets of ice viewed through polarized microscopes calibrated to reveal the morphological and chemical composition of the ice crystals. Four giclée prints, from a total of twelve, that capture the measuring techniques of the polarized microscope from two geographical locations (Antarctica and Greenland); a large, 1:1 scale photograph of a curated

[13] Jussi Parikka, *A Geology of Media* (Minneapolis: University of Minnesota Press, 2015), 6, 156n11.

[14] Polk, *Modeling Our Future Climate*.

selection of objects; and used shipping containers for the ice core samples, all populate the gallery.

For Abbott, one might imagine that a whole host of discursive information, annotated supplemental illustrations, and graphs would contextualize her photographs in textbooks on physical science. In Breiding's project, the entire "experimental system" of hydrological experimentation shifts from the regime of science into an exploratory space of interpretation. It effectively moves between two different poles: from the space of abstraction, where the horizontal photographs in the gallery capture the microscope's darkfield illumination to inculcate the crystals' kaleidoscopic nature, to a visual metonymic play between the eruption of Mount Okmok on the Umnak Island in Alaska's Aleutian Islands and Breiding's collection of human artifacts and volcanic ash in the *Atmosphere Codex*, a visual reproduction of objects and particulates. Speaking of a larger aggregation of matter emerging from human cultural and economic production, the implications here of empire—with the insertion of ancient Roman coins into the codex and Breiding's nod to the recent hypothesis connecting Okmok's eruption to the fall of Rome in the common era[15]—underscore the relationship between natural disasters and human folly, or even the futility of setting empire-building above and against nature on tectonic scales.

Part of the conceptual and perceptual understanding of the interconnectedness of the World Ocean is thinking about the geopolitics of the Global North and the Global South and historical

[15] Joseph R. McConnell et al., "Extreme Climate after Massive Eruption of Alaska's Okmok Volcano in 43 BCE and Effects on the Late Roman Republic and Ptolemaic Kingdom," *PNAS* 117, no. 27 (2020): 15443–49.

forms of hegemony and oppression. How does one invent new ways of articulating cultural, political, and ecological experience and perspectives towards and within the Arctic? For the Intergovernmental Panel on Climate Change (IPCC), and any activist, documenting the changing planet is intended to hopefully carry out consciousness raising and awareness in the larger public.[16] Driven by a desire to provide national economies with the data to justify changing their policies, the IPCC demonstrates in its analysis the way that climate change can impact the cryosphere in general, and specifically the local and Indigenous people, as they point out, who have lives and cultures strongly linked to the cryosphere.[17]

Does the archival impulse found in the fieldwork of natural scientists—who core the ice and maintain it in vast cold-storage repositories—represent a neocolonial gesture of paternalism and care(taking)? On the one hand, we have the remaining ice sheet in Greenland, which is undergoing change and decreasing in size and volume over time. On the other hand, we have the ice core extracted from Greenland, interned in a vast archive curated under the auspices of the

[16] The IPCC's ongoing published report on climate change underscores this interrelation, and interdependence is already flagged in the natural sciences. Founded in 1988 by the World Meteorological Organization and the UN environment program, the IPCC has become the space for governments and policymakers to gather information and be constantly informed of the up-to-date knowledge coming from the natural sciences on climate change. M. M. Meredith et al., "2019: Polar Regions," in *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*, eds. H.-O. Pörtner et al. (Cambridge and New York: Cambridge University Press), 203–320, https://doi.org/10.1017/9781009157964.005.

[17] Intergovernmental Panel on Climate Change, *2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*, https://doi.org/10.1017/9781009157964.

National Science Foundation. Thus, the existence of ice was and continues to be a defining aspect of this island and its (political) ecology. In Greenland, this colonial history started 1,000 years back, when the Vikings first arrived in Greenland and then the Danish arrived, and now there is this more formal relationship between Greenland and Denmark.[18] Although the people of Greenland are citizens of Denmark—and these two locations are quite different from one another—Greenland's lack of sovereignty is a continuation of Europe's paternalistic colonialist and imperialist history.

A member of one such empire, Sir David Brewster, first patented the kaleidoscope, in the United Kingdom in 1817.[19] By peering through a cylinder whose contents shone in brilliant colors due to a combination of mirrors and refraction, its viewer could marvel at the near magic of the application of the physical properties of light. What connects the genealogy of such a device to the wonderous transformative power of the ice sheets under observation? What is the relationship of artistic research to these scientific practices that contrast sharply with Indigenous forms of knowledge production? As Schuppli points out, the changing nature of Inuit perception in the Arctic in the wake of climate change speaks to the precarity of relation between the physiology of vision and physical law: "Light is bending and deceiving the eyes that have tracked the position of the sun for generation, using it as an index of place and a marker for direction. The crystalline structures of ice and snow are twisting and morphing, producing a new

[18] For an overview of the Nordic colonization of Greenland, see Søren Rud, *Colonialism in Greenland: Tradition, Governance and Legacy* (Cambridge: Palgrave MacMillan, 2017).

[19] David Brewster, *A Treatise on the Kaleidoscope* (Edinburgh: Archibald Constable & Co., 1819); Brewster, *The Kaleidoscope, Its History, Theory and Construction with Its Application to the Fine and Useful Arts*, 2nd ed. (London: J. Murray, 1858).

optical regime borne out of climate change and indigenous observations."[20] Even for scientists, those rays of light dissemble.

The cores of the West Antarctic Ice Sheet Divide include "dissolved chemicals, insoluble dust particles, and atmospheric gases that were present when the snow fell."[21] The less air they contain, the closer the ice crystals approach one another until they become a strong bluish hue, but they might even be pink, due to biological organisms and materials.[22] Breiding's photographs V–VII of the Greenland series of three images—titled *Diamond dust V–VIII: 123000-year-old atmosphere trapped in Greenland ice* (2023)—shuttles through a play of light and polarization settings that are both capricious and highly self-reflexive. The visual array of hues captured in the photographs, and at the end of Breiding's film, point to the fact that the colors of glaciers themselves can change in relation to the nature of the debris and the ground upon which they move, and according to their own composition.

And yet, the sharp contrast between the enormous scale of glaciers themselves and the fragments of the harvested ice seen under the lens of a petrographic microscope cannot be overstated. I vividly remember my first view of the Nisqually-Wilson glacier on the massive Mount Rainer, a volcano situated at the border of Washington and Oregon. From my location at the far end of

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[20] Susan Schuppli, "Can the Sun Lie?," in *Forensis: The Architecture of Public Truth*, ed. Forensic Architecture (Berlin: Sternberg Press, 2014), 60.

[21] *West Antarctic Ice Sheet (WAIS) Divide Ice Core*.

[22] Johanna Kerch, "Image of the Week—Why Is Ice Colourful?," *Blog of the Cryospheric Sciences Division of the European Geosciences Union*, May 4, 2018, https://blogs.egu.eu/divisions/cr/2018/05/04/image-of-the-week-why-is-ice-colourful/.

Paradise Valley, I could see across to the source of the Nisqually River. Fixed in place and simultaneously drawn, my first thought was, *Zeitverzögerung*. It was beyond sensory experience, a time delay. Glaciers move incredibly slowly, at a rate imperceptible to the human eye, yet the river along which my car raced while ascending the massive slope towards the recreation areas ran like wildfire, gravity pulling it fast and furious down and out of the mountains. The sheer amount of water rushing downstream seemed incomparable to the seemingly static mass of packed snow at Mount Rainer's peak. How could two timescales co-exist at one space in time? As I stood at this elevated vantage point from the descending glacier, the water was far enough in the distance that it, too, appeared immobile. The soundtrack of *Belly of a Glacier* uncannily sounds like dripping water, a clicking sound, like a solid object tapping against metal, a well of water. Listening. I imagine the glacier beckoning me into its belly.