



IMAGINING DEEP TIME

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DEEP TIME

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IMAGINING THE UNIMAGINABLE: DEEP TIME THROUGH THE LENS OF ART

“Geohistory is the immensely long and complex history of the earth, including the life on its surface (biohistory), as distinct from the extremely brief recent history that can be based on human records.”

Martin J.S. Rudwick, historian of science

“...the mind seemed to grow giddy by looking so far into the abyss of time.”

John Playfair, scientist and mathematician

From a human perspective, mountain ranges seem unchanging and permanent, but in the context of geological time, such landscapes are fleeting. Their change occurs on a scale outside of human experience. Whereas we measure time in terms of years, days, and minutes, geological change occurs within the scale of deep time, of long cycles framing the gradual movement of evolutionary change.

The history of scientific inquiry is marked by significant discoveries that have altered perceptions of our identity, the earth, and our position in it. Such discoveries cause a ripple effect in all areas of thinking because they change the basic premise of our existence. The discovery that the world is not flat and that the sun does not circle the earth toppled fundamental beliefs of our place, physically and hierarchically, within the universe. Similarly, the discovery of deep time revealed that the age of the earth is vastly greater than we could have imagined. The exhibition *Imagining Deep Time*, which contains 18 works by 15 artists, looks at the human implications of this significant geological discovery – perhaps one of the greatest contributions of geology – through the lens of artists where both rational and intuitive thinking come together to explore how we understand and relate to the vastness of deep time on a personal level. This exhibition explores the role of the artist in helping us imagine a concept outside the realm of human experience.

CONSTRUCTING DEEP TIME

Philosophy, religion, physics, mathematics, astronomy and other areas of human inquiry have attempted to crack the mysteries of time. As we see, for example, in *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution* by Martin J.S. Rudwick, the construction of the notion of deep time is attributed specifically to those who would now be called geologists.^[1] Through early observation of the signs of history preserved in the current form of geologic objects (strata, fossils, etc.), as well as through the broadening study of ongoing geological processes (volcanoes, tectonic shifts, etc.), geologists have been able to reconstruct a picture of the earth’s past. Thus, it was scientific research focused on the earth (as opposed to the universe) that most dramatically led to the shift in human perspective on time and the earth’s history.

The concept of deep time has evolved over time, and history has recognized a number of major contributors to its development. Notably, it was Scottish geologist James Hutton in the 18th century who, through his observations of farmlands and surrounding countryside, challenged the widely-held belief in a young earth. Hutton wrote his initial version of the *Theory of the Earth* in the 1780s. In the 1830s Charles Lyell wrote another influential treatise, *Principles of Geology*. But it wasn’t until the 1980s that John McPhee coined the term “deep time” in his publication *Basin and Range*. Introducing the concept, he wrote, “Numbers do not seem to work well with regard to deep time. Any number above a couple of thousand years—fifty thousand, fifty million—will with nearly equal effect awe the imagination to the point of paralysis.”^[2] McPhee offered a metaphor to help us consider our place in the earth time continuum: “Consider the earth’s history as the old measure of the English yard, the distance from

¹ Martin J. S. Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution* (Chicago: The University of Chicago Press, 2005), 2.

² John McPhee, *Basin and Range* (New York: Farrar, Straus and Giroux, 1981), 21.

the king’s nose to the tip of his outstretched hand. One stroke of a nail file on his middle finger erases human history.” When we confront the notion of deep time, we intuit that our limited time on earth isn’t significant either. Mark Twain put it in perspective when he wrote, “If the Eiffel Tower were now representing the world’s age, the skin of paint on the pinnacle-knob at its summit would represent man’s share of that age.”^[3] We can intellectually grasp the abstraction of deep time easily enough but as Stephen Jay Gould put it, “Getting it into the gut is quite another matter.”^[4] It is hard to grasp the concept of deep time on a personal level because our individual experience is typically less than a century long. Since the majority of deep time predates human existence, the concept lies not only beyond our individual experience but beyond the experience of the entire human race. Yet we yearn to find ways to comprehend it and this desire provides ground for artists to investigate. Understanding deep time lies, perhaps, in a combination of the rational and the intuitive.

METAPHORS OF DEEP TIME

“A person would have to take themselves out of the human context to begin to think in terms of geologic time. They would have to think like a rock.”

Terry Falke, photographer

“If one finds a rock boring, it’s not the rock’s fault.”

Zen proverb

In his book *Time’s Arrow, Time’s Cycle*, Stephen Jay Gould suggests we begin attempting to comprehend the concept of deep time and our place within the continuum

³ From the 1903 essay “Was the World Made for Man?” by Mark Twain written in response to Alfred Russell Wallace’s essay “Man’s Place in the Universe” of the same year.

⁴ Stephen Jay Gould, *Time’s Arrow, Time’s Cycle: Myth and Metaphor in the Discovery of Geological Time* (Cambridge: Harvard University Press, 1987), 3.

of its vastness through the use of metaphor.^[5] Analogies like McPhee’s fingernail of the king and Twain’s Eiffel Tower appear throughout literature in an attempt to convey meaning in terms of human experience. The practice of using metaphor is essential to the work of artists as well and it is worth considering how meaning is constructed through their work. The open-ended nature of metaphor – that is to say the possibility of multiple interpretations – is a key ingredient in the work of artists who wish to create layers of meaning. In contrast to art, science has a fraught relationship to metaphors. This is understandable, as metaphors are not exact and fall short of the specificity desired to communicate scientific concepts completely and accurately. Yet, they are embedded in our language and in our thinking. The works presented in this exhibition do not address the scientific construction or understanding of deep time, nor do they seek to illustrate, but rather, they are inspired by it. The artists’ use of common metaphors combined with newly constructed visual ones is an exploration of our connection with time on a personal and sometimes experiential level, and effectively combines the rational and the intuitive in an attempt to grasp the meaning of deep time.

Beholding the Big Bang, a kinetic sculpture by Arthur Ganson, functions in the space between rational and intuitive modes of developing meaning (Plate 1). The sculpture is comprised of a series of gears with a motor on one end turning the first gear. The gears are arranged in such a way that it would take 13.7 billion years (estimated age of the universe since the big bang) for the last gear to turn once – a fact that is poetically underscored by the artist’s decision to set the final gear in a block of concrete. Ruth Jarman and Joe Gerhardt who form the UK-based team known as Semiconductor have also attempted to convey the vastness of geological time. They primarily work with video and sound installations to explore our physical place in the world and our relationship to it. Semiconductor

⁵ Gould, *Time’s Arrow, Time’s Cycle*, 3.

ductor's *Subterranean (Seismic Blues)* is a sound work of seismic data made audible⁶ (Plate 2). It is composed of several types of seismic data: Earthquake, volcanic, and glacial, which form the three sections of the work. Each section has distinct characteristics which can be associated with processes involved in the seismic propagation; the earthquake data evokes images of rocks crunching and splintering under huge amounts of pressure, the volcanic data gives the impression of lava resonating underground while the glacial data crackles and snaps, evoking melting ice. By translating the seismic data into audible sound we are able to perceive subterranean movements which normally lie beyond our realm of experience. What we hear gives a sense of the earth in motion; what ordinarily appears static is in a constant state of flux, encouraging us to imagine the mechanisms producing these epic sounds. Through appropriating scientific data in this way, Semiconductor explores the role science plays in our experiences of the natural world and questions how it is mediated through technology. Such artistic investigations by Ganson, Semiconductor, and others provide a portal through which we can imagine deep time.

Gould suggests that we can comprehend the numbers but we rely on metaphor to truly grasp the concept. Within the title of his book, *Time's Arrow, Time's Cycle*, he offers two common metaphors that are often, sometimes unconsciously, invoked to suggest time. For example, a line or arrow is used in classrooms or textbooks to create a chronological chart of events. We mark time in our minds by events that occurred during a certain period and depict them on timelines and charts accordingly. Cycles are experiential and relatable in the form of phases of the moon and sun or the passing of the seasons. Take, for example, the two works by Sharon Harper both entitled *Sun/Moon (Trying to See through a Telescope)* (Plates 3 and 4). Photographic impressions of sun and moon cycles are arranged in a grid of vertical and horizontal lines. A Boston-based

⁶ Due to the impossibility of representing a sound sculpture in a printed catalogue, Plate 2 is a map showing the area where data was collected and the seismic stations.

artist, Harper works with photography and video to explore how technology mediates our relationship with the natural world and creates perceptual experiences.

Baltimore-based artist Chul Hyun Ahn also uses repetition to imagine infinite cycles. His piece *Void* (Plate 5) is constructed of simple everyday materials such as mirrors and lights. Ahn's work recalls that of minimalists such as Dan Flavin and Donald Judd who incorporated the use of ordinary everyday materials to create experiential spaces. In *Void*, viewers stand in front of the work which is over 7 feet tall by 6 feet wide. The reflection of light in the mirrors creates a repetition of reflections that makes viewers feel like they are confronting infinity with their own reflection in the center (Fig. 1). Ahn's art training was primarily Western, although he was born in South Korea. A broader interpretation of his work might include the Buddhist philosophy of "emptiness" which seeks the true nature of things and events, or as Buddhist writer and teacher Lewis Richmond puts it, emptiness means "that things do not exist the way our grasping self supposes they do." Such an interpretation of Ahn's work in the context of this exhibition opens up a comparison between cultural, religious, and scientific ideas that seem harmonious.

The exhibition also explores the imagery of geology and how it has become synonymous with the vastness of time in our collective imagination. Through fossils of fauna and flora, science has constructed a compelling image of what land and animals might have looked like before the human era. Such reconstructed images have formed an iconography that captivates our imagination – a fact that is suggested by the throngs of visitors who flock around the dinosaur exhibits at natural history museums (Fig. 2). We are fascinated by such visuals. The imagery enters the cultural imaginary through science exhibitions and textbooks as well as movies and literature and becomes fertile terrain for artistic exploration.

Alison Carey's photographs on glass are constructed dioramas inspired by the traditions of natural history muse-

ums (Plates 6, 7, and 8). *Organic Remains of a Former World*, is a series of photographs depicting ancient marine environments from each Paleozoic era. The artist built clay models of extinct vertebrates and invertebrates and then submerged them in the water of multiple 55-gallon aquariums. She then photographed these constructed tableaux with a 4x5 large-format camera. The printing technique is a contemporary form of ambrotype where silver gelatin emulsion is hand coated onto glass. The organic nature of this process adds to the rendition of these watery scenes by the serendipitous appearance of bubbles, streaks, and obliterated areas of darkness. In Carey's words, "In my search for a location that has not been photographed, I look to the Earth's ancient past, a world that existed millions of years ago. I am drawn to this space because it is absent from human recollection and experience. Through my photographs, I offer the viewer a glimpse into a primitive landscape that has since been eroded or erased. The photograph becomes a time machine that transports the observer onto the floor of a Paleozoic ocean. Photography is making the invisible past visible, giving the illusion that we are witnesses to a scene that vanished long before humans arrived on this planet." When creating images of these water worlds, Carey used scientific data and illustrations of fossils to inform her ideas, similar to the process of those who created dioramas for natural history museums.

The long history of the popularization of dinosaurs through dioramas and museum displays has embedded a certain imagery of deep time into our subconscious. This is a phenomenon that is reflected in the dream-like paintings entitled *The Age of Reptiles* (Plate 9) and *Flight in Deep Time* (Fig. 3, not in exhibition) by artist Alfredo Arreguin. Born in Mexico, Arreguin has lived and worked in Seattle since 1958. The hypnotic and meditative patterns found within his paintings are based on pre-Aztec images, Mexican tiles, and geometric and optical patterns. He writes of his childhood and early influences, "When I was a child growing up in Morelia, the beautiful colonial city of my birth, my grandfather, the late Carlos Mendoza, would

often climb a ladder and invite me to follow him to the flat roof of our house to watch the night sky: the moon and the stars. What an incredible spectacle that was! The vastness of space, the billions of galaxies and stars—things hard to comprehend for a young mind. During that time, I had the chance to experience yet another miracle: The eruption of the Paricutin volcano, not far from Morelia.



Fig. 3 Alfredo Arreguin, *Flight in Deep Time*, 2010, oil on canvas, 46 x 26 inches. Image courtesy of the artist.



Fig. 1 Installation of Chul Hyun Ahn's *Void*. Image courtesy of the artist and C. Grimaldis Gallery.



Fig. 2. Crowds surround the dinosaur installation at the entrance to the American Museum of Natural History, New York. Image courtesy of CPNAS.

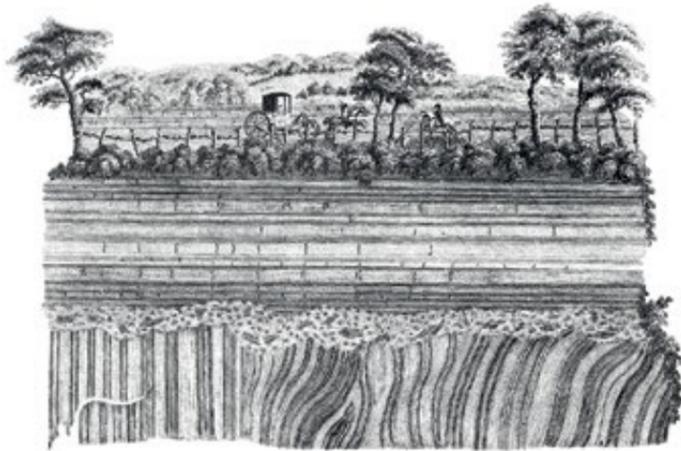


Fig. 4 John Clerk of Eldin's celebrated engraving of Hutton's unconformity at Jedburgh, Scotland. Reproduced with kind permission of Sir Robert Clerk of Penicuik.

The roofs became covered with volcanic ash, which my grandmother would collect and use later to polish her silverware."⁷ His intricate and brilliantly colored canvas combines his memories of Mexican culture and the natural landscape with imagery inspired by animals that are only known to have existed through scientific research. By doing so, Arreguín invites us to imagine the way our environment, both landscape and animal, has changed over time and how our imagination is influenced by cultural experience.

Adding to the imagery constructed by geology is that of strata often visualized as a layered cross section of the earth's depths. Geologic cross section views often reveal unconformities, that are vast gaps in time of up to hundreds of millions of years where no rock exists to represent that time period. Unconformities depicted in cross sections have long been considered compelling field evidence for the vastness of time.⁸ John Playfair elegantly articulated the idea of unconformity in his 1802 *Illustrations of the Huttonian Theory of the Earth*. Unconformity was depicted in John Clerk of Eldin's celebrated engraving *Hutton's Unconformity at Jedburgh, Scotland* (Fig. 4). The engraving is a slice of earth made visible, a perspective that reveals strata and unconformity as, in Gould's words, "...the complex

panorama of history that can be inferred from the simple geometry of horizontal above the vertical." This visualization of the earth is so powerful that it has become a metaphor for the vastness of time. Similar visual elements are incorporated in the work by geologist and photographer Jonathon Wells (Plate 10). His photograph, *Boston Basin*, depicts a 16-mile-wide by four-mile-deep view of Boston Basin looking west toward downtown as if the viewer were positioned in the harbor.⁹ The large city seems miniscule in comparison to what lies beneath.

The earth's strata are also seen in the work *Cyclists Inspecting Ancient Petroglyphs, Utah* (Plate 11), by Texas-based photographer Terry Falke, which depicts cyclists observing a rock's surface. Falke's images bridge the photographic traditions of landscape photography and social documentation, often with a wry sense of humor. In this image, a cyclist points upward across the strata to draw our attention to other marks left on the earth by humans – petroglyphs (whose head shape whimsically resembles the helmets worn by the cyclists) as well as bullet holes. The line of the road suggests an added human-made stratum reminding us that, although humans' presence in the continuum of deep time is small, we have left our mark. In the work by Falke and Wells, we see how John Clerk's method of visualization enters artists' vernacular.

⁹ The framework of Wells' image is from "Bedrock Geologic Map of Massachusetts" by E-an Zen et al., 1983. The portion depicted of crust began forming as a volcanic island chain far from North America. The lowest rock unit is Dedham Granite that crystallized around 610 million years ago. The island chain grew to form the microcontinent, Avalonia. Rifting of Avalonia caused the Boston Basin to open and fill with volcanic and sediment deposits between 600 and 545 million years ago. During a later rifting event 440 million years ago, volcanoes erupted in the area to the left in the image view forming the Blue Hills. The dark rock on the left edge cooled forming Quincy Granite. Tectonic plate movement caused Avalonia to eventually collide with the eastern edge of North America. Boston attached to North America around 400 million years ago. This collision caused the rock units in the basin to be uplifted, folded, and faulted as is seen in the image. In the hundreds of millions of years since, erosion has been at work to create most of the landscape and Boston Harbor as we see it today. Finally, in the last two million years, glaciers eroded the surface to a much less degree and left a mantle of till.

⁷ Alfredo Arreguín, e-mail message to the author, February 22, 2014.

⁸ Gould, *Time's Arrow, Time's Cycle*, 61.

ART AS A WAY OF KNOWING

"We ought to talk less and draw more. I personally should like to renounce speech altogether and, like organic nature, communicate everything I have to say in sketches."

Goethe, German writer

"If you can't draw it, it hasn't happened."

John F. Dewey, geologist, member of the National Academy of Sciences

Anyone who has ever resolved a mathematical equation on a chalkboard knows how powerful the act of mark-making is in organizing and resolving ideas. Nina Samuel, curator of the exhibit *My Brain is in My Inkstand: Drawing as Thinking and Process* (Cranbrook Museum of Art), eloquently described the role of drawing beyond documentation and note taking. She wrote, "The practice of drawing has conventionally been understood as a descriptive engine: A means of documenting a world observed by the artist. But a sketch on paper also can represent the materialization of a mental process, becoming an instrumental tool in shaping the meandering thought. The power of drawing and its ability to design an idea and affect our perception of the world derives directly from the agency of mark making."¹⁰

The importance of drawing to scientific understanding was acknowledged by the American Geophysical Union (AGU) at a session during a conference it held in December 2013. Entitled *Geology through the Lens of Art*, this session brought together representatives from a variety of disciplines including artists. The concept of art as knowledge production arises from the recognition that art creation – something as simple as making a mark on a piece of paper – is a cognitive act. A point made repeatedly at the AGU session was that students who study geology

¹⁰ Quoted from the wall text of the 2013 Cranbrook Art Museum exhibition *My Brain is in My Inkstand: Drawing as Thinking and Process* curated by Nina Samuel. For more information, see the catalogue: Gregory Wittkopp and Nina Samuel, eds., *My Brain is in My Inkstand: Drawing as Thinking and Process* (Bloomfield Hills, MI: Cranbrook Art Museum, 2014).

are encouraged to draw as part of their field research. The act of drawing a rock formation creates a connection and understanding that is more informative to the student than other forms of documentation and recording such as photography. One has to slow down and consider the forms more carefully in order to render them on paper resulting in a more intimate connection and awareness of the subject. During the session different methods were presented by which teaching drawing to geology students would improve their observation and cognitive skills.

Creativity is a critical characteristic for both artist and scientist. In a 2008 article in the *Journal of Psychology of Science and Technology*, Robert Root-Bernstein and others reported their findings from surveying the biographies of members of the National Academy of Sciences, the Royal Society, and Nobel Laureates.¹¹ In this survey, adult arts and crafts avocations were tabulated from autobiographies, biographies, and obituaries. Data was then compared with a 1936 avocation survey of Sigma Xi members and a 1982 survey of arts avocations among the U.S. public. Nobel Laureates were significantly more likely to engage in arts and crafts avocations than Royal Society and National Academy of Sciences members, who were in turn significantly more likely than Sigma Xi members and the U.S. public. The authors of the study point out that, "The utility of arts and crafts training for scientists may have important public policy and educational implications in light of the marginalization of these subjects in most curricula." It is difficult to draw definitive conclusions from the study but the evidence strongly suggests that, at the very least, thought leaders are not limited by departmentalized thinking and move fluidly between different epistemologies (Fig. 5). Art and science overlap in that both are cognitive processes involving acts of creativity and, in best cases, discovery.

¹¹ Robert Root-Bernstein, et al., "Arts foster scientific success: Avocations of Nobel, National Academy, Royal Society, and Sigma Xi members," *Journal of the Psychology of Science and Technology* 1 (2008): 51-63.



Fig. 5 Painting by geologist and National Academy of Sciences member John F. Dewey. A high percentage of accomplished scientists also engage in creative practices. Courtesy of John F. Dewey.

An example of this overlap applied to the advancement of scientific knowledge is the life work of geologist and cartographer Marie Tharp. Tharp, in partnership with Bruce Heezen, was the first to scientifically map the ocean floor in the 1950s. Prior to the work of Heezen and Tharp, little was understood about the ocean floor. Using data of ocean depths gathered by various methods (called “soundings”) along with informed intuition to fill in areas where little or no data existed, Tharp hand drew the maps which aided in the visualization and advancement of the then controversial continental shift theory.^[12] Tharp’s informed skills as artist and scientist aided in imagining what was invisible both beneath the water’s surface as well as across vast time spans (Figs. 6 & 7).

The way that art making involves a process of understanding – comprehending the observed – is illustrated in the artwork of California painter Rosalie Lang. Lang’s paintings draw inspiration from the aesthetic of rocks (Plates 12 and 13) photographed along the Pescadero, CA coastal areas. She has said, “I don’t know a rock until I paint it” underscoring the importance of mark making in understanding and focusing

¹² For more information, see: Hali Felt, *Soundings: The Story of the Remarkable Woman Who Mapped the Ocean Floor*, (New York: Henry Holt and Company, 2012).

observation. In the artist’s words, “In my opinion, the process of visually deciphering the unique qualities of rock formations and then painting them has given me a deeper understanding of their ‘essence’—where they came from and how they evolved over time...”^[13] The realism of Lang’s paintings of intricate rock surfaces, combined with the absence of horizon or other cues to scale, causes the viewer’s perception to oscillate between reality and abstraction. One of art’s great contributions is its ability to challenge our perceptions or to make us look differently at what we think we know.

How our perception is affected by the combination of various media (documentation, art, literature, etc.) is of interest to the collaborative team Mark Klett and Byron Wolfe. The foundation of the piece *Views from the Marble Canyon Platform* (Plate 14) by Klett and Wolfe is an appropriated 1882 lithograph by draftsman William Henry Holmes. Holmes was an explorer, artist, scientific illustrator, and geologist whose skills as a cartographer helped document the American West. Our historical perception of the land was partially formed by such documents. To express the passing of time visually, Klett and Wolfe overlaid the lithograph with round images taken through a military spotting scope of the same region. Lining the photographs up with the drawn landscape would not have been possible with any accuracy if Holmes’ original drawing had not been drawn with such precision. Klett and Wolfe’s work draws our attention to how perceptions of our environment are formed and mediated through a variety of imagery.

CULTURAL AND PERSONAL RELATIONSHIPS TO DEEP TIME

“Man cannot afford to conceive of nature and exclude himself.”
Emmet Gowin, photographer

Scientists have pieced together facts and data to calculate with astonishing accuracy the age of the earth. Once we

¹³ Rosalie Lang, email message to the author, June 18, 2014.

have an understanding of its vastness (and stand giddy at the abyss), what results will come of it? Despite our very short role in the history of the earth, no other species has had a greater impact on the planet. Can an understanding of our deep past lead us to consider our potential impact on our deep future? Can we design and implement strategic plans to meet grand challenges such as climate change and sustainable energy – issues that clearly require more than a quick fix? The decisions we make today will impact generations to come.

To create a symbol of long-term thinking and planning, the Long Now Foundation has implemented plans for a 10,000 year clock to be built on a monumental scale inside a mountain in West Texas. Conceptualized by Danny Hillis, the project brings together designers, engineers and other cross-disciplinary problem-solvers to create a clock that ticks once a year, where the century hand advances once every 100 years, and the cuckoo comes out on the millennium. The project itself embodies the idea of thinking beyond an individual time scale or even that of a generation. It requires thinking on the time scale of a civilization.^[14]

The 10,000 year clock illustrates the need for a paradigm shift in the way we think about long-term projects and their impact. Will facts and data alone be enough to alter behavior or impact policy? As logical as that might seem, one doesn’t have to read much public policy history to see that scientific evidence alone has not been enough to persuade. Artists most likely will not solve the grand challenges but they may contribute in the form of cultural consciousness and impact. However, what artists do well is deal with ideas within an emotional and/or personal framework. What impact might artwork, informed by scientific facts and research, have? This is still largely unexplored terrain.

Philadelphia-based artist Diane Burko’s paintings reflect on how time’s passing and the changing terrain are visu-

¹⁴ See <http://longnow.org/clock/>



Fig. 6 Physiographic Diagram of the South Atlantic, Bruce C. Heezen and Marie Tharp, 1961. Copyright by Marie Tharp 1961. Reproduced by permission of Marie Tharp Maps, LLC.

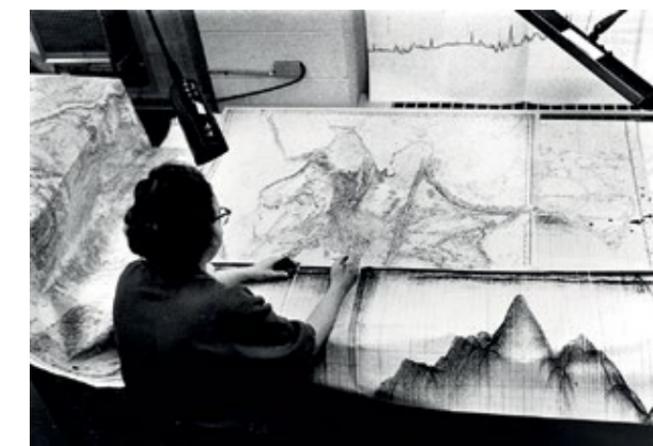


Fig. 7 Geologist and cartographer Marie Tharp produced the first global map of the seafloor in the 1970s with colleague Bruce Heezen. Image courtesy of Lamont-Doherty Earth Observatory.

ally represented in art and science. Recognizing that the exhibition of works of art creates a platform that promotes thought and discussion, the artist transforms visual and technical data in an attempt to raise awareness about climate change and the process by which we understand it – observation, documentation, interpretation, and communication – forming a comparison of artistic and scientific practices and methods of visualization. In her painting *Columbia Triptych II: Vertical Aerial 1981-1999, A, B, C after Austin Post and Tad Pfeffer* (Plate 15), Burko’s inspiration is a montage of five vertical aerial photographs of the lower reach of the Columbia Glacier, Alaska, taken on



Fig. 8 This photograph by Rachel Sussman entitled *Huon Pine #1211-4033 (10,500 years old; Mount Read, Tasmania)* depicts Lake Johnston in the background beyond the stand of Huon Pine. Image courtesy of the artist.

October 2, 1998.^[15] Superimposed on the montage in the publication are plots of selected terminus positions from 1981 to 1999. Also shown by symbol are three locations where the velocity of the glacier surface was determined. Burko's triptych combines the aesthetic of photography, scientific notations, and the tradition of landscape painting on the canvas, asking us to consider the role of art in communicating ideas related to climate change.

Evoking ideas of policy and social impact through art is certainly not new. By some accounts, Ansel Adams' black and white photographs of Kings Canyon have been credited with influencing individual lawmakers including President Roosevelt to pass legislation creating Kings Canyon National Park in 1940.^[16] Regardless of one's opinions about the National Parks system, a fundamental question is: To what extent can works of art persuade or impact public perception or the development of policy? Since

¹⁵ Published in B. F. Molnia, 2008, *Glaciers of North America -- Glaciers of Alaska*, in Williams, R.S., Jr., and Ferrigno, J.G., eds., *Satellite image atlas of glaciers of the world*: U.S. Geological Survey Professional Paper 1386-K

¹⁶ For more information, visit <http://www.nps.gov/yose/historyculture/ansel-adams.htm> and read the essay by Robert Turnage, "Ansel Adams: The Role of the Artist in the Environmental Movement," 1980, reprinted courtesy of the Wilderness Society from *The Living Wilderness* at <http://www.anseladams.com/ansel-adams-the-role-of-the-artist-in-the-environmental-movement/#>

Adams, new traditions have emerged in landscape photography (embodied by the New Topographics exhibit at the George Eastman House in 1975) that seek to be more socially conscious, focusing on the intersection of humans and land rather than representing a utopian untouched landscape. The work of many of the photographers and artists in this exhibit find their roots in that tradition including Falke, Klett, and Wolfe. Photographer David Maisel joins this rank as his early work focuses primarily on environmentally impacted sites. His images show the physical impact of industrial efforts such as mining, logging, water reclamation, and military testing on the land. Because these sites are often remote and inaccessible, Maisel frequently works from an aerial perspective that enables him to capture photographic evidence otherwise unattainable. The absence of easily recognizable points of reference within the image eliminates any sense of scale, causing the viewer's mind to oscillate between the damaged landscape and the beautiful abstract composition.

David Maisel worked on the series *Black Maps* from 1983 to 1988. This series, which eventually led to his larger *Mining Project*, comprised black-and-white aerial images of copper, gold, and silver mines in Arizona, Nevada, Utah, New Mexico, and Montana. These photographs depict the landscape of the American West as the site of human-induced trauma. According to the artist, the title *Black Maps*, which comes from a poem by Mark Strand, refers to the notion that although these images document the facts of these sites, they are essentially unreadable, much as a map that is black would be. As Strand writes, "Nothing will tell you where you are/Each moment is a place you've never been." Maisel considers these images not only as documents of blighted sites, but also as poetic renderings that might somehow reflect the human psyche that made them (Plates 16 and 17).

The lines between art, science, and activism are blurring due to better communication between practitioners in the various domains. Art informed by science carries authority across disciplines and ultimately has the potential

for greater impact on our perceptions and for generating dialogue. Case in point is the work of Rachel Sussman whose series *The Oldest Living Things in the World* is a result of ten years of work in collaboration with scientists to identify and photograph organisms that are at least 2,000 years old. Sussman's work reminds the viewer of the fragility and resilience of life by focusing on subjects whose longevity lie outside of human experience. Her photograph, *Dead Huon Pine adjacent to living population segment #1211-3609 (10,500 years old)*, depicts dead *Lagarostrobos franklinii* killed by fire (Plate 18). This species of conifer is native to the southwestern corner of Tasmania, Australia. As the title suggests, this scene is bordered by living trees (Fig. 8) with an extraordinary legacy. The age of the stand was determined by dating pollen collected from the bottom of Lake Johnston which matched the genetic makeup of the living stand and carbon-dates to 10,500 years old. Sussman states that this series of photographs are, "A record and celebration of our past, a call to action in the present, and a barometer of our future."^[17] Sussman's expression of purpose resonates with other contemporary artists who explore how art practices and exhibitions can impact our decisions regarding environmental issues.

CONCLUSION

The work of artists presented in this exhibition does not present evidence but rather raises the question of the possibilities of art's power to promote a deep awareness of the natural world that science reveals. In a 2010 interview with biologist E.O. Wilson for the online symposium *Visual Culture and Evolution*, Wilson presents a challenge for both artists and scientists. He states that scientists often fail at conveying the sense of awe and wonder of the natural world that is the driving force behind scientific inquiry. He also states that artists have the ability to inspire us but

¹⁷ TedTalk "Rachel Sussman: The World's Oldest Living Things" Accessed on July 17, 2014 http://www.ted.com/talks/rachel_sussman_the_world_s_oldest_living_things#t-787579

that they often get the science wrong. Informed artwork carries more authority and strengthens its ability to significantly enter into a larger cross-disciplinary dialogue.^[18] This exhibition focuses on the topic of *imagining* deep time, but Wilson's challenge still resonates throughout the artwork. As stated previously, comprehending deep time is a convergence of the rational and the intuitive. Mining scientific evidence alongside informed intuition makes the terrain between science and art a fruitful area for investigation. Art and science overlap in significant ways. The act of discovery and creativity is the same mental process in both despite the epistemological motivation or outcome. The difference manifests itself in the way work is actualized – either in the form of scientific research or artistic exploration. That current lines separating art and science are blurring suggests that perhaps new ways of networking knowledge to solve problems and inform one another are needed. For the artist, like the scientist, observation is fundamental in the act of discovery and art making is a cognitive tool for making sense of that discovery on a personal level. Working in the space between disciplines reaches its highest potential when the lines of thinking are blurred to form a new more deeply informed perspective. A new perspective may be a personal "eureka" moment. But it also has the potential to prompt a larger shift in societal thinking that acknowledges our collective impact on the trajectory of future time on a large scale. The vastness of the earth's age is an alien experience to us. But the perspective of science and art combined provides a portal through which our imagination can flourish as we consider the wonders of the past and contemplate the future.

JD TALASEK is the director of Cultural Programs of the National Academy of Sciences. He has curated a number of shows that explore the intersection between science and art.

¹⁸ J.D. Talasek et al., eds., *Visual Culture and Evolution: An Online Symposium*. Center for Art, Design and Visual Culture, (Baltimore: University of Maryland, Baltimore County, 2011), 45.

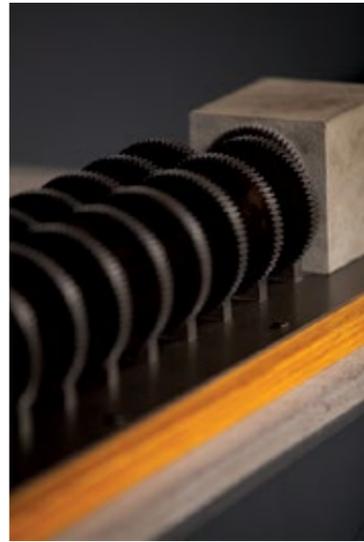


Plate I
Arthur Ganson
Beholding the Big Bang, 2009
Steel, motor, wood, concrete
5 x 34 x 8 inches
Photographed by Jonathan Williams



Plate 2

A Semiconductor work by

Ruth Jarman and Joe Gerhardt

Subterranean (Seismic Blues), 2012

Sound work / multi channel

Data courtesy of www/iris.edu, Professor Jonathan M. Lees, University of North Carolina, USA and Professor Gregory P. Waite, Michigan Technological University, USA. Audio Recording courtesy of Professor Willy Aspinall, Bristol University, UK.

Plates 3, 4

Sharon Harper

Sun/Moon (Trying to See through a Telescope) 2010

May 27 10:48:35 AM - 2010 May 27 11:08:34 AM 2010

Ultrachrome print on Canson Rag Photographique paper

58 1/8 x 17 inches

Sun/Moon (Trying to See through a Telescope) 2010

May 27 10:48:35 AM - 2010 May 27 11:08:34 AM 2010

Jun 19 8:16:30 PM - 2010 Jun 19 8:23:40 PM, No. 2 2010

Ultrachrome print on Canson Rag Photographique paper

58 1/8 x 17 inches

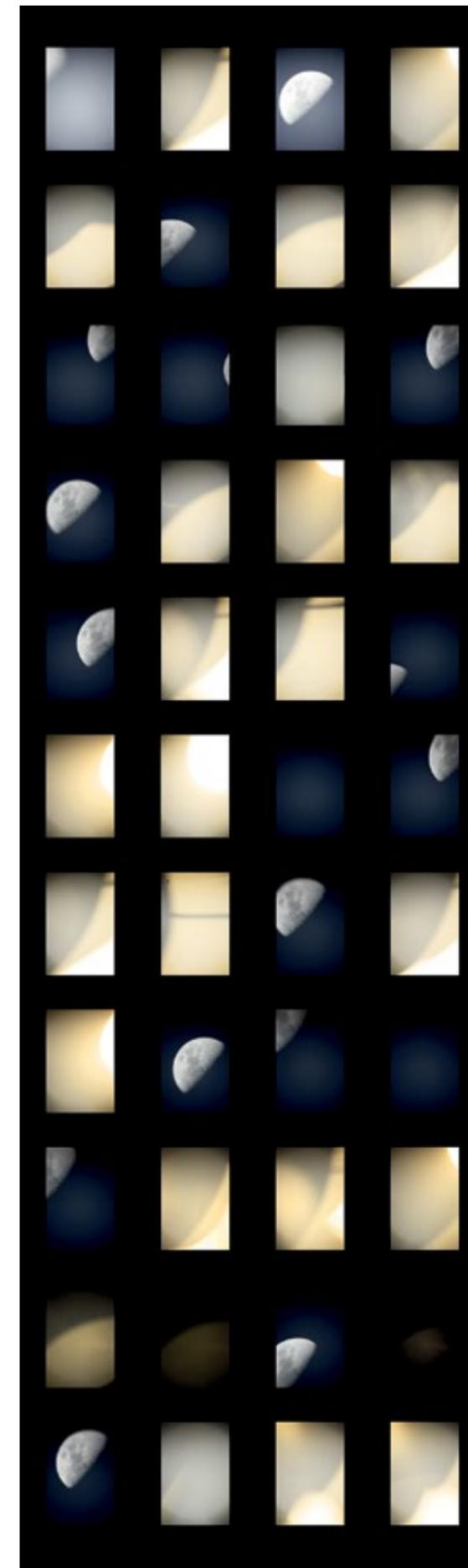
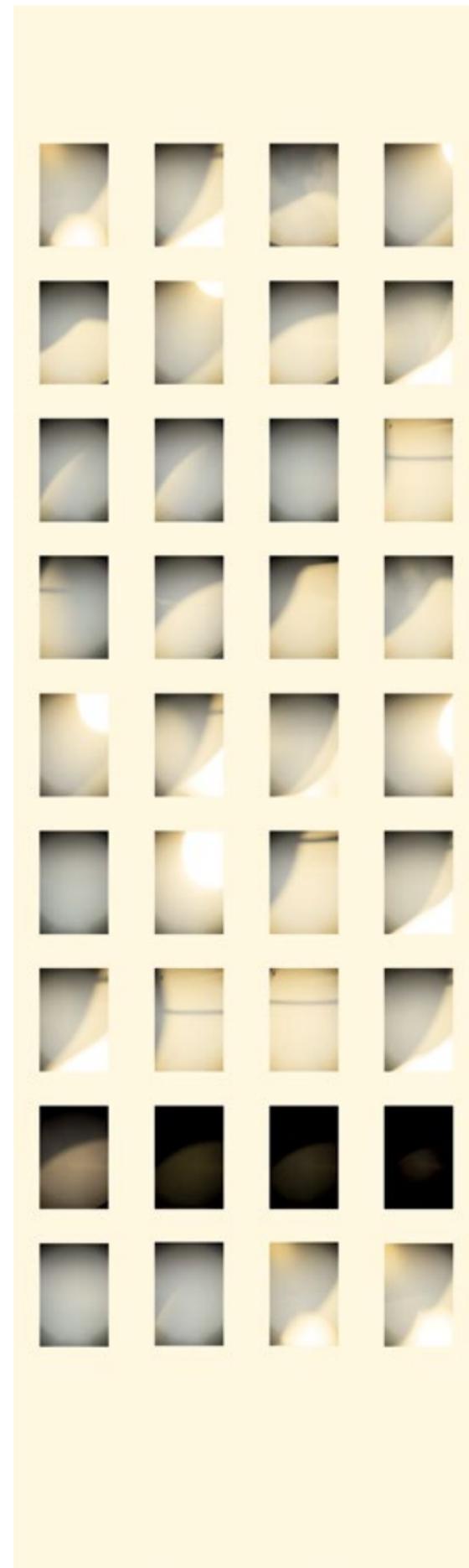
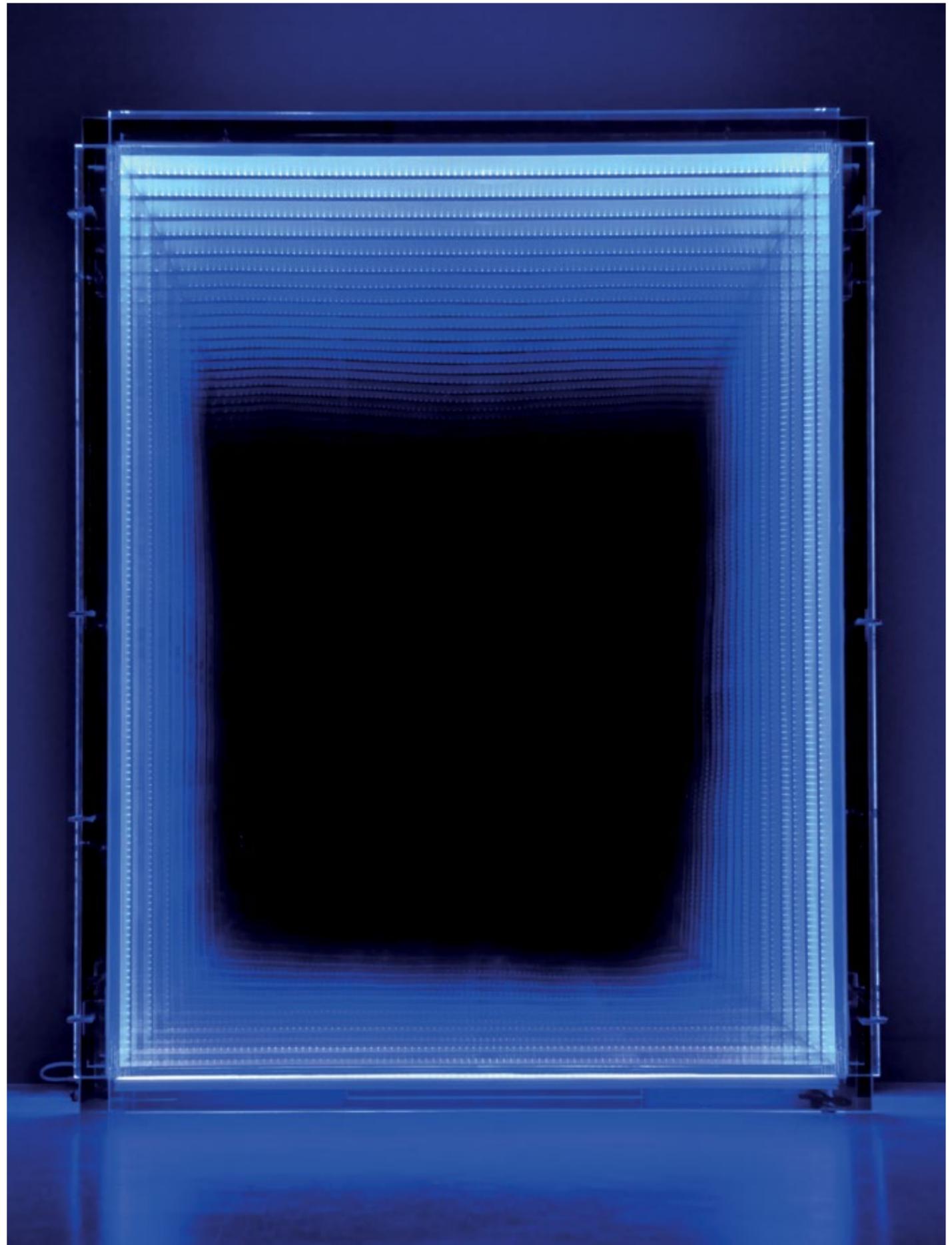


Plate 5
Chul Hyun Ahn
Void, 2011
Cast Acrylic, LED lights, hardware, mirrors
90 x 71 1/2 x 12 1/4 inches





Plates 6, 7, 8

Alison Carey

Stethacanthus, Pennsylvanian Period, 280 – 310 mya, 2005

Silver gelatin on black glass

9 x 23 inches

Criptolithus & *Eumorphocystis*, Ordovician Period, 440 – 500 mya, 2005

Silver gelatin on black glass

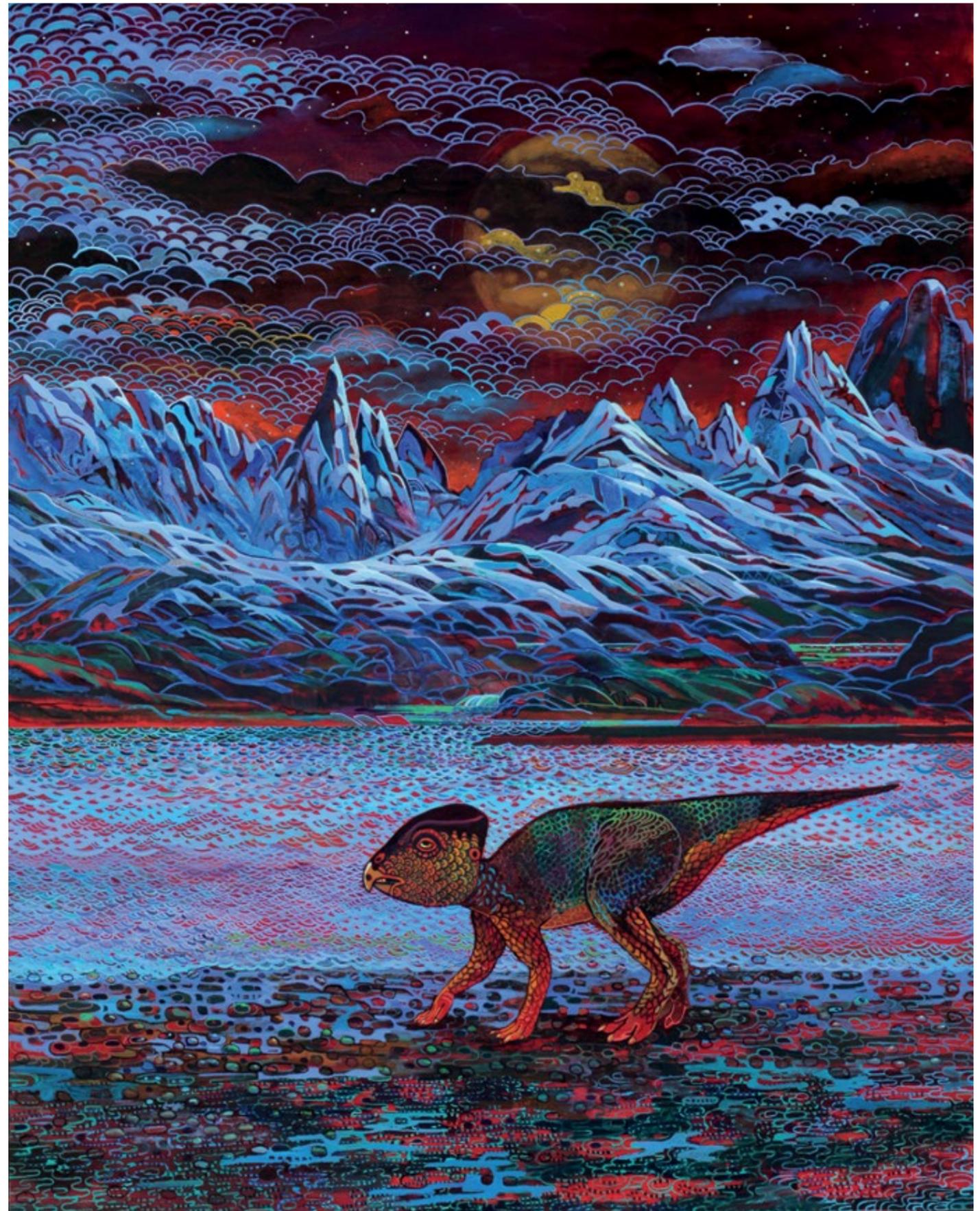
9 x 23 inches

Crinoids, Mississippian Period, 310 – 350 mya, 2005

Silver gelatin on black glass

9 x 23 inches

Plate 9
Alfredo Arreguín
The Age of Reptiles, 2012
Oil on canvas
60 x 48 inches



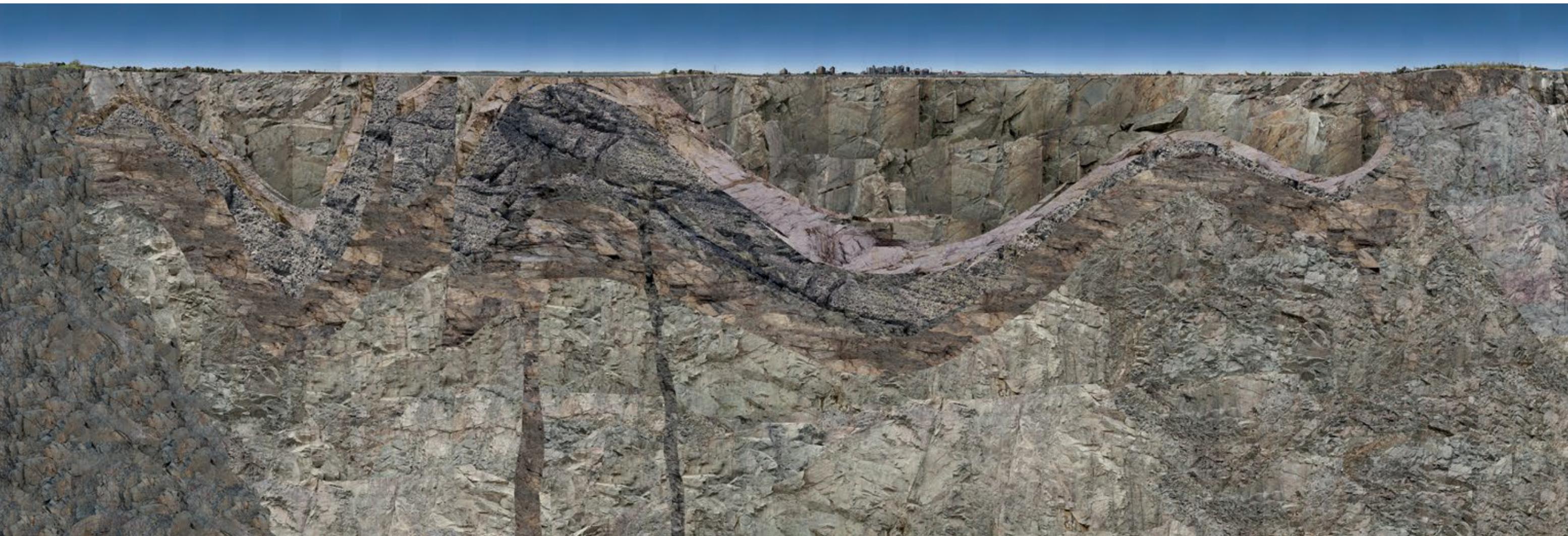


Plate 10
Jonathon Wells
Boston Basin
Photographed 2004, composited 2005
Digital inkjet print
28 1/2 x 78 inches



Plate 11
Terry Falke
Cyclists Inspecting Ancient Petroglyphs, Utah, 1998
Digital chromogenic print
30 x 40 inches



Plate 12
Rosalie Lang
Sandstone Crevice, 2009
Oil on canvas
20 x 22 inches



Plate 13
Rosalie Lang
Inner Life, 2009
Oil on canvas
20 x 22 inches

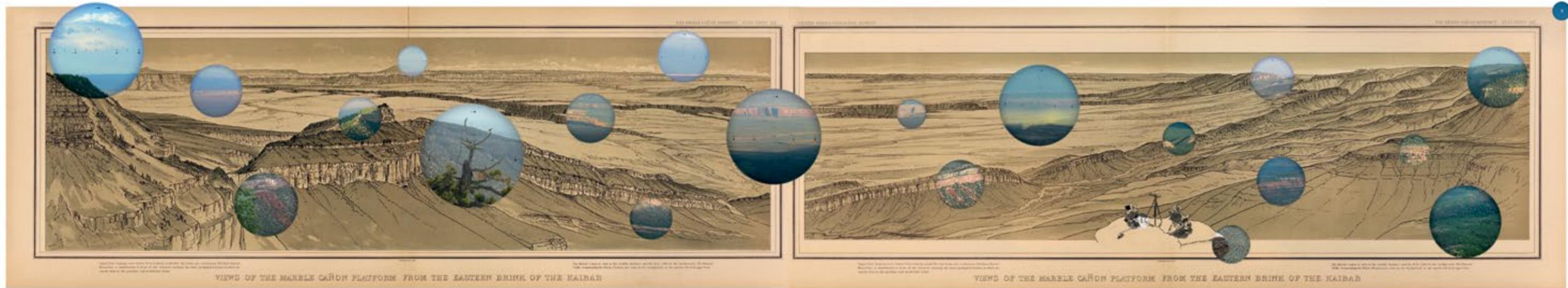


Plate 14

Mark Klett and Byron Wolfe

Views from the Marble Canyon Platform, 2008

Digital inkjet print

17 x 90 inches

Confirming the details of the moment across the geologic horizon of Marble Canyon. Views from a military spotting scope on the Platform where William Holmes drew the eastern edge of the Kaibab (1882).

Lithograph by William Henry Holmes, 1882. Sheet XIX, Views from the Marble Cañon Platform from the Eastern Brink of the Kaibab. From Clarence Dutton, *Atlas to Accompany the Monograph on the Tertiary History of the Grand Cañon District*. (Courtesy of the Library of Congress).

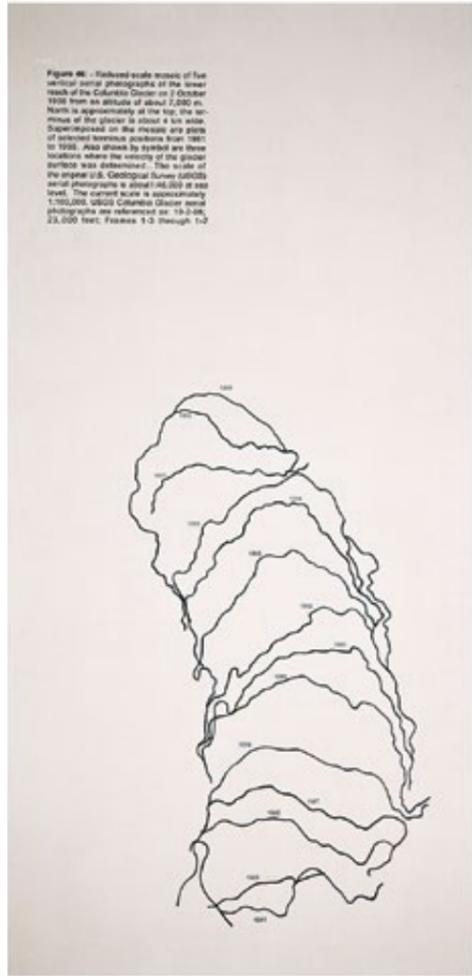


Plate 15
Diane Burko
Columbia Triptych II
 Vertical Aerial 1981-1999, A, B, C
 after Austin Post and Tad Pfeffer, 2010
 Oil on canvas
 76 x 36 inches, each canvas



Plate 16
David Maisel
Black Maps (Bingham Canyon, UT 5), 1988
Archival pigment print
29 x 29 inches



Plate 17
David Maisel
Black Maps (Bingham Canyon, UT 1), 1988
Archival pigment print
29 x 29 inches



Plate 18
Rachel Sussman
Dead Huon Pine adjacent to living population segment #1211-3509
(10,500 years old, Mount Read, Tasmania), 2011
Archival pigment print
44 x 54 inches

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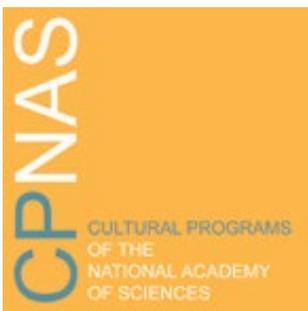
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