

DIANE BURKO
ENDANGERED:
FROM GLACIERS
TO REEFS

HAWAIIAN ARC



DIANE BURKO ENDANGERED: FROM GLACIERS TO REEFS

KMWstudio

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August 15, 2018 to January 31, 2019

National Academy of Sciences
2101 Constitution Avenue NW
Washington, D.C.



DIANE BURKO'S ART AND CLIMATE SCIENCE

Alana Quinn

Exhibition Curator
Cultural Programs of the National Academy of Sciences

Artist Diane Burko has a long history with the National Academy of Sciences (NAS), that began with her 1991 exhibition *Diane Burko: At Giverny*. I was introduced to her work in our 2014 exhibition *Imagining Deep Time*, with her painting, "Columbia Triptych II," which investigated the recession of Alaska's Columbia Glacier.

Landscapes have been Burko's primary subject for nearly 50 years, and for more than a decade, she has focused on communicating about climate change. Her work synthesizes information from her own on-site investigations with data gathered from scientists. From this research, Burko creates a range of media including paintings, photography, and video. One of the most compelling aspects of her work is the way she uses material as metaphor to evoke movement, the passage of time, and the fragility of endangered ecosystems. Her goal is to further the conversation about how climate change challenges our natural world by emotionally engaging viewers.

Since 2006, Burko has documented the dramatic disappearance of glaciers in large-scale paintings and photographs developed in close collaboration with glaciologists. She has made expeditions to study polar landscapes in Svalbard, Norway, Greenland, Argentina, New Zealand, and Antarctica. In the past year, she has turned her attention toward the impact of climate change on oceans and coral reefs, traveling to Hawaii, American Samoa, and Australia's Great Barrier Reef to learn how increasing temperatures, sea-level rise, and acidification affect the oceans' coral reef ecosystems. She visited marine labs and learned how to swim and snorkel in order to experience what is happening to coral reefs first-hand. Burko's exhibition, *Endangered: From Glaciers to Reefs*, brings these bodies of work together for the first time, encouraging viewers to draw connections between these two distant terrains.

The National Academies of Sciences, Engineering, and Medicine is an active leader in the discussion on climate change—a defining issue of our time. This year, the Academies launched the Climate Change Initiative in order to effectively share its extensive body of work on climate science, its impacts and response options. Endangered—an art exhibition about two ecosystems being impacted by climate change—reflects artists' growing interest in contributing to the conversation in a powerful and personal way. The exhibition appropriately coincides with the American Geophysical Union's (AGU) December 2018 meeting in Washington, D.C., where Burko, an active participant at AGU conferences, will speak about her work at the intersection of art and science. AGU's mission is to promote discovery in Earth and space science for the benefit of humanity—a mission that resonates with that of the Academies. Established as an NAS affiliate in 1919, AGU's offices were originally housed in the NAS' Constitution Avenue headquarters. The NAS is the right venue for this exhibition, providing a unique context where thoughtful inquiry from different disciplines can converge and inform one another.

For nearly 40 years, Cultural Programs of the NAS (CPNAS) has organized exhibitions and public programs exploring intersections of art, science, and culture, engaging society on critical issues through visual and performing arts. Through the synthesis of information, beauty, and metaphor, art offers visceral experiences of issues in ways that facts and charts alone cannot. I invite viewers of Burko's work to reconsider the wide-ranging impacts of climate change and their personal connections to it. While scientists predict that the global average temperature will increase 2 degrees Celsius by the end of this century, some of the direst consequences of climate change are not inevitable if people are both knowledgeable and compelled to act.

Pages 2-3
Hawaiian Archipelago,
detail, 2018
Acrylic on canvas
60 x 72 inches

Left
Diane Burko in her
Philadelphia studio
April 26, 2018
Photo: Anna Tas

GLACIAL IMAGERY: FROM SCIENCE TO ART

“...would you consider my reviewing and perhaps using some of your images in my project? Naturally, credit would be acknowledged. I so enjoyed seeing your photographs on the web. I especially was taken with your Columbia Glacier series. Also looking for images like Arapaho Glacier...”

Diane Burko wrote this to me in 2008. She was interested in the repeat photography of Arapaho Glacier and a series of photographs I and others had made of Alaska’s Columbia Glacier. Diane’s urge to artistically represent glaciers through scientific imagery brought up fascinating questions: Are Diane’s artistic motives similar to my scientific ones? How do scientific and artistic images differ?

There is a long tradition of photography within the sciences. Indeed, the distinction between scientist and artist was much less pronounced in the past. In the last years of the 19th century, photographers, such as Edward S. Curtis, cruised up the coast of Alaska during early scientific surveys of that region. In that era, photographs were a prime, descriptive tool for scientific disciplines. Yet a photograph is “scientific” only to the extent that information is extracted for some quantitative purpose. Any photograph can be considered “scientific” or “aesthetic,” depending on how it is used.

In truth, my own photographs of Columbia Glacier were a merging of scientific and aesthetic interests. Between 2005 and 2007, I photographed the glacier extensively from the air and on the ground, working to capture the state of the changing glacier and its surrounding landscape. My colleague Austin Post had also repeatedly photographed Columbia Glacier from the 1960s to the 1990s (he photographed virtually every glacier in Alaska during a career that spanned a half-century starting in the early 1950s). Throughout my 15 years of work there, I sought to understand the mechanisms of movement in one of the largest and, at the time, fastest-flowing glaciers in the northern hemisphere. Columbia Glacier had started retreating rapidly—flowing into the waters of Prince William Sound, calving icebergs, and thinning dramatically as it threw itself headlong into the ocean—starting in the mid-1980s. I was also interested in the changes taking place around the glacier, in the broader envi-

W. Tad Pfeffer

*Fellow of the Institute of Arctic and Alpine Research,
and Professor of Civil, Environmental and Architectural
Engineering at the University of Colorado at Boulder*



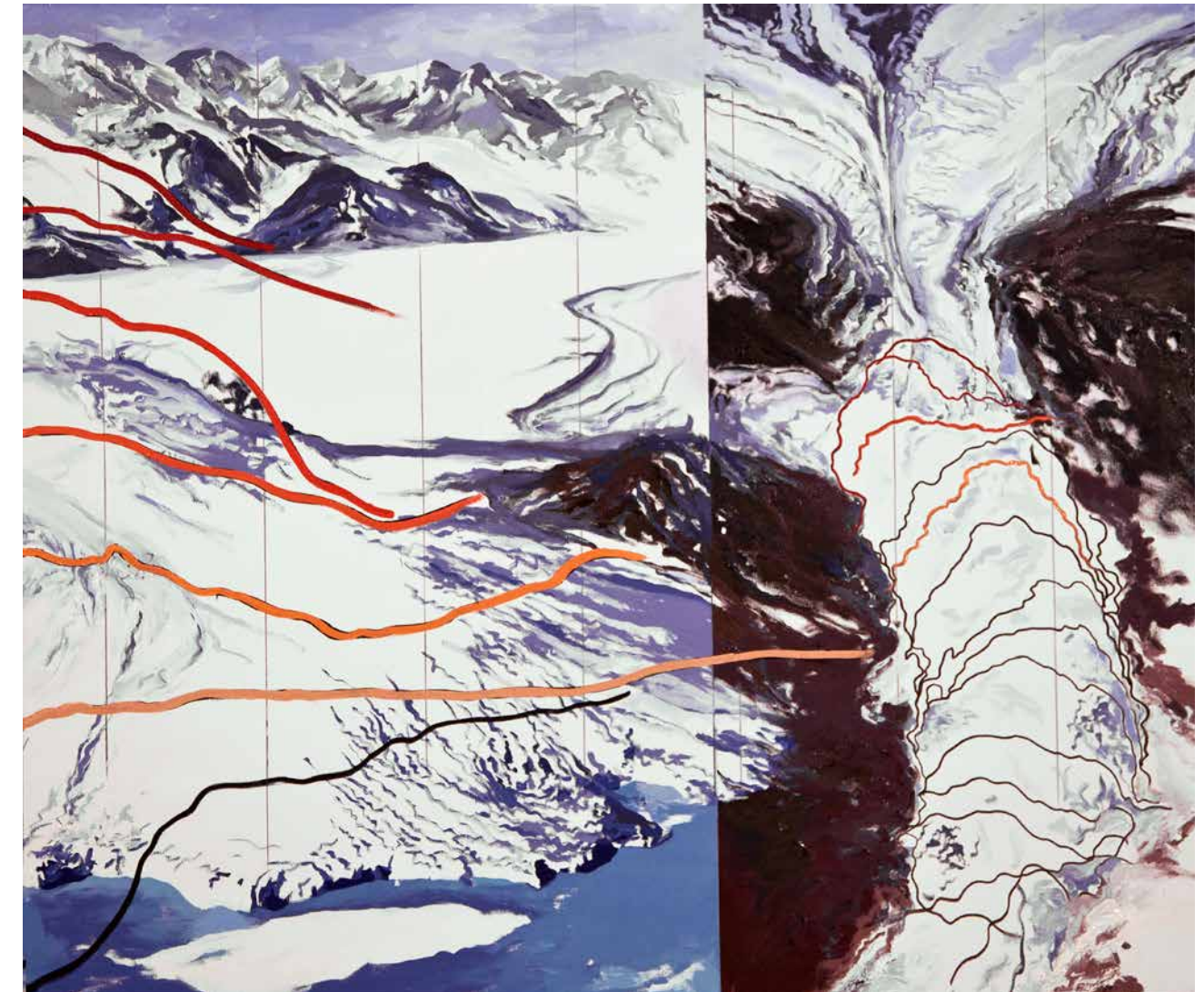
ronment of water, rock, soil, and life. This led me back to an earlier scientific tradition of description, in words and images, of complex environments whose basic character is imperfectly known.

Beyond the 20th century giants of landscape photography, there are others who sought meaning and structure in features of the world around them: scientist-explorers from G.K. Gilbert to Bradford Washburn, landscape theorists such as J.B. Jackson and Simon Schama, and the *New Topographics* photographers, including Robert Adams. These artists and writers impart the knowledge that photographs are complex objects. They represent the scene in front of the camera but also investigate it. The camera captures information beyond the photographer’s intention, and historical photographs are crucial to the scientist of today. A photograph made to show a geologist the shape and nature of a glacier’s terminus turns out a century later to be of great value to a botanist who recognizes in the photograph trees at the glacier’s margin.

This serendipity is lost in modern geoscience tools; well-developed and highly technical, they reveal only the precise information sought. Scientists of the past engaged a map of the world that still had a few holes in it; their tools were duller, but like artists, they investigated these mysteries with sharp wits and creativity. Photo-

Arapaho Glacier 1, 2, 2009
Oil on canvas
24 x 48 inches overall
Collection of Pamela and
Joseph Yohlin

*Columbia Glacier Lines
of Recession 1980–2005*
2011
Oil on canvas
51 x 60 inches



graphs have been largely shouldered out of the pages of scientific journals by younger, sharper-edged sources of evidence. We have lost something by no longer having the capacity to look behind the camera.

I found Diane’s choice of Columbia Glacier and repeat photography a novel and logical way to represent climate change. By painting from these photographs, Diane engages a long history of the relationship between science and art; the photograph, once a tool for

scientific discovery, can now be used to move the semiotic perspective of the artist towards a more objective, quantitative view—her nuanced abstraction based in factual prompts. Yet, simultaneously, Diane’s artwork reconnects these scientific images to their aesthetic roots, grounding them, once again, in the mystery of the image, which contains so much beyond the quantitative. From our initial correspondence, it seemed likely that our purposes would converge, and what we would find at that intersection would be fascinating, valuable, and beautiful. Ten years later, it is.



THE FUTURE OF CORAL REEF ECOSYSTEMS

Nancy Knowlton

Sant Chair for Marine Science, Smithsonian National Museum of Natural History

Coral reefs thrive in the warm waters of the tropics, but the warming of the seas is not working in their favor. Instead, it is causing them to bleach and die. As a result of climate change, living reefs are disappearing around the world, and in recent decades the scale of death has been staggering. Just in 2016, over 30% of the living coral on Australia's Great Barrier Reef disappeared in an unprecedented global ocean heatwave that continued to wreak devastation in 2017, threatening an iconic ecosystem whose scale is so grand that it can be seen from space.

Why is this happening? A coral colony is a collection of tiny interconnected polyps, a thin skin of tissue stretched over a stony skeleton. Although colonies can grow to be enormous in size and complexity, each polyp is a simple structure consisting of a cup-shaped body topped by a mouth and a surrounding ring of tentacles. The tentacles capture plankton which the polyps consume, but much of the energy that a coral uses to grow and reproduce comes from tiny algae that live inside the coral cells. Therein lies the problem: these algae are surprisingly sensitive to water that is too warm. Just one degree centigrade above the normal maximum temperature damages these algae, which are then expelled by their coral host.

The result is coral bleaching. Bereft of their algae, the corals lose their colors and the white skeleton below the living tissues is revealed, hence the term "bleaching." A bone white reef is visually startling, and to an untrained eye beautiful in its starkness. But the beauty is short lived as these corals, deprived of their food source, are starving, or even dying outright in extreme cases. While recovery is possible if temperatures return to normal quickly,

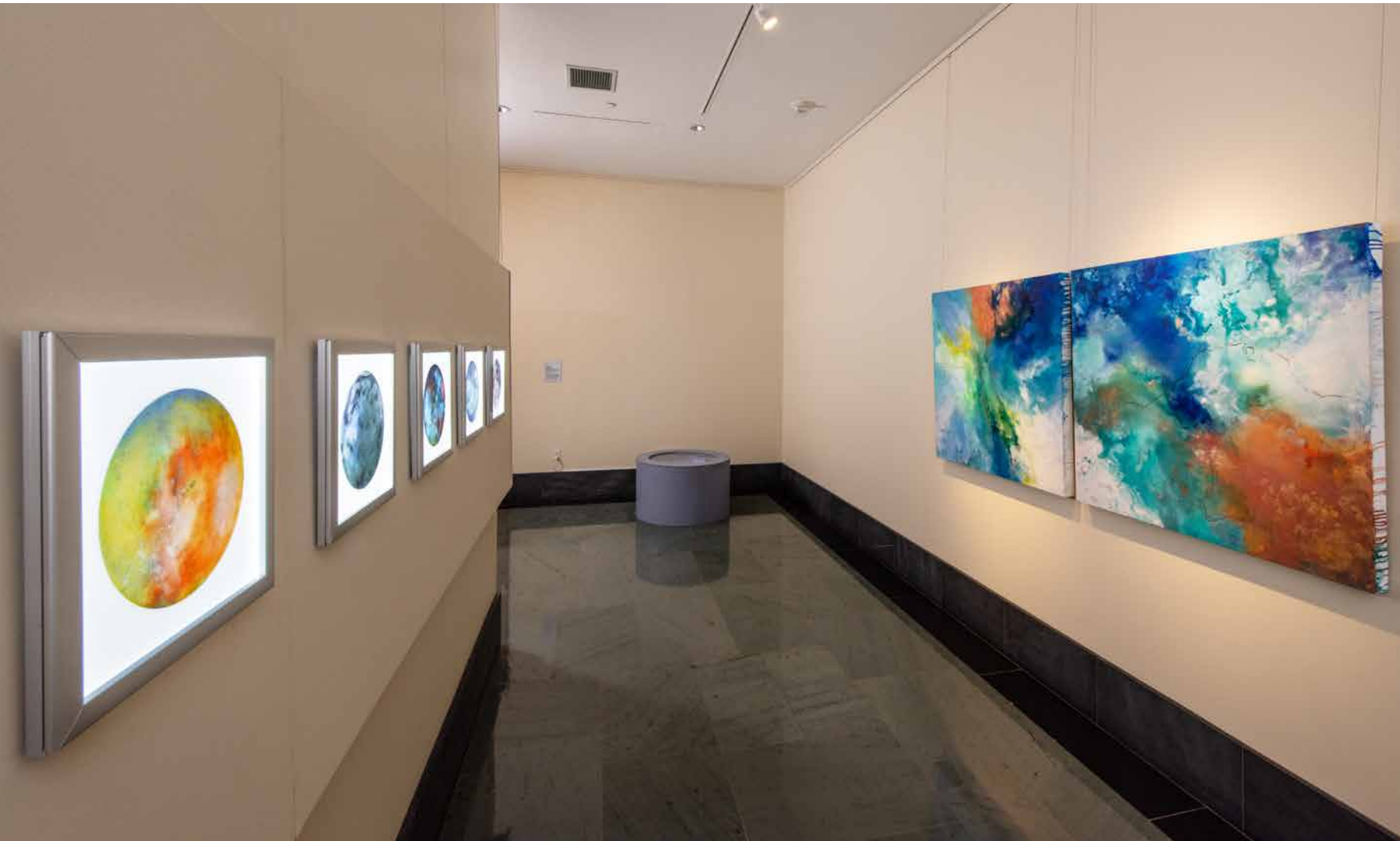
in many cases the corals do not survive. Once this happens, the skeleton, no longer protected by the living tissue, is colonized by seaweeds. Ultimately, the dead skeletons break down into sand and the majestic structures of the reef are lost. The result is tragic, not only for the corals and the millions of creatures that depend on them, but also for the people who depend on coral reefs to protect their coastlines from storms, attract tourists, and feed themselves and their families.

As a scientist, I have devoted my career to studying coral reefs. When I was a graduate student in the 1970s, diving off the north coast of Jamaica, no one talked about climate change and coral reefs. We did worry about overfishing, as these reefs were hardly pristine even then, but we took their existence for granted, something that we can no longer do. What I have seen in the last four decades has been heartbreaking.

You don't have to have spent your life diving in the tropics as I have to know that reefs are endangered. We've all read the statistics, seen the photos, and digested the gloomy projections about the end of coral reefs in the not so very distant future. And yet, as a society, we have mostly continued to fiddle while Rome burns. Change is hard, and for most of us it only occurs when we truly care, which requires an emotional connection.

For this, we need artists as well as scientists to tell the story of climate change, and even better, artists and scientists working together. The path to a healthier planet where reefs can thrive again will be challenging, but Diane Burko's work inspires us to make the journey and speeds us on our way.

American Samoa Corals
detail, 2018
Acrylic on canvas
42 x 42 inches



Page 10
Installation, Corridor
Gallery, August 2018
Photo: Kevin Allen

Right
Installation, Corridor
Gallery, August 2018
Photo: Kevin Allen

A CONVERSATION BETWEEN DIANE BURKO AND BEN ORLOVE

This transcript documents a conversation between the artist Diane Burko and the anthropologist Ben Orlove, the co-director of the Center for Research on Environmental Decisions (CRED) at Columbia University, who teaches in the School of International and Public Affairs, and is the co-director of the Master's Program in Climate and Society. He is also a Senior Research Scientist at the International Research Institute for Climate and Society.

*The conversation took place on the occasion of Diane Burko's exhibition, *Endangered: From Glaciers to Reefs* at the National Academy of Sciences in Washington, D.C.*

Ben Orlove: I'm struck by the way this show introduces your new project and includes some of the glacier work which first introduced me to you. Diane, what a change! This Glacier/Reef show is clearly about art and science—two ways of knowledge, two ways of communicating—and both ways are fully present in each of the works and in the show as a whole.

With the video and lenticulars, especially, you're thinking about how we experience the gallery space like a landscape, which is to say that we experience it in multiple ways. There are some things people see from afar, some they see from near, some that they see standing still, some that they see walking. These very basic qualities have been part of our heritage as mammals, the very complicated ways we infer our external world that enters our eyes, while our bodies are stationary or moving. You're exploring all of these inputs as an artist.

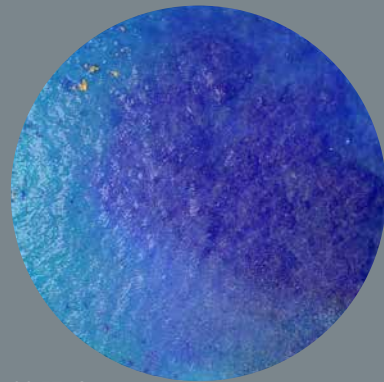
Diane Burko: Yes, I like that! My work comes directly from my experiences of these landscapes that I've placed specifically in this gallery space.

BO: And those experiences can be difficult; you're under the water, or in Antarctica. It's cold, it's wet, you're dealing with the realities of these places. So, your approach to painting isn't just to illustrate science, but to really embody your experience. You incorporate these maps and charts, these images that scientists use as tools for knowing, and you include what you learn from reading. Your

work is truly of this era, when the general public may not have visited glaciers or reefs, but they certainly have knowledge of them. They've traveled the world through images; scientific information is presented to them through news, YouTube, magazines, or a television special. And your work is part of that world, drawing on your viewers' knowledge.

DB: Absolutely. It's very important to me that viewers can relate and learn from the work. I draw from the physical experience of being there. I'm also a photographer, and a lot of my research comes out of making my own images of these places. When we went to the Pacific, we used a drone, and took underwater footage with our GoPro, and all of that is combined in my video piece. It's important to me that this work is legible, that it uses accessible images, yet can be ambiguous as well, inviting the imagination.





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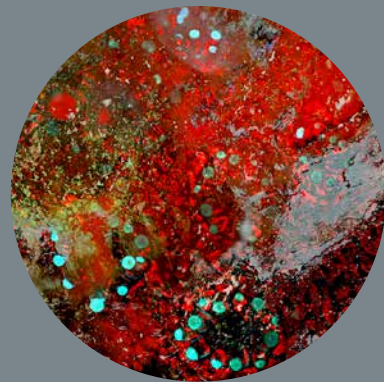
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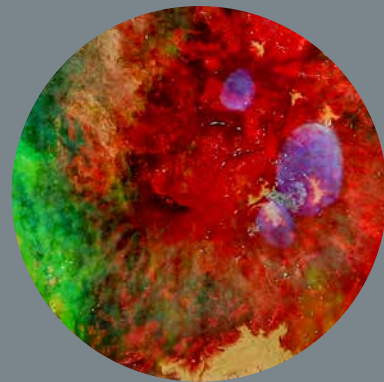
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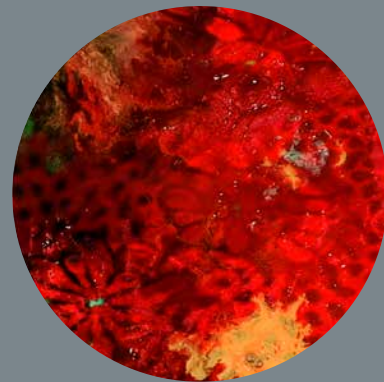
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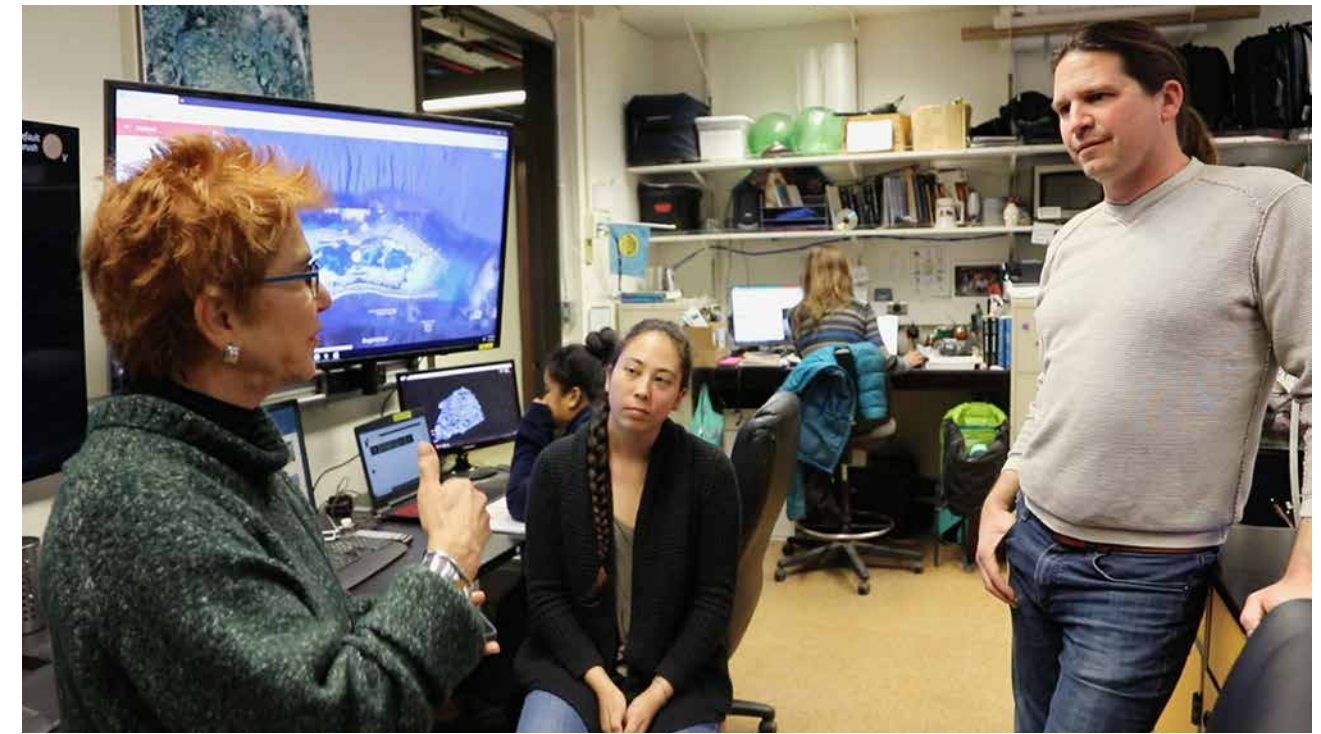


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Stills from single channel video projection, *Ocean/Reef/Paint* 12:46, 2018

Right
Diane Burko in conversation with Dr. Stuart Sandin at the Scripps Institution of Oceanography, March 1, 2018
Photo: Richard Ryan

Below
Diane Burko in conversation with Amy Eggers at the Hawai'i Institute of Marine Biology, December 28, 2017
Photo: Richard Ryan



BO: I love this footage of these microscopic organisms here that you were able to see at the Hawai'i Institute of Marine Biology.

DB: It just blew my mind that you could see this tiny polyp, and they're filming them. I mean they have dye, that's why they have those colors, but they're filming their movement in real time. So, with this video I've taken their scientific visual data and transitioned it into paint. This whole piece is only about 12 minutes but expresses multiple ways to experience nature.

BO: The paint is mesmerizing! Is this process called marbleizing? Boy, this piece is different. It's certainly hard not to read this part as waves, in the ocean.

DB: Yes, in a way—it's just paint, baby oil, dishwashing liquid, and I'm using air to move it. Different things are happening as it weaves in and out of the actual footage. This is all from the amazing confocal microscope at their Gates Lab. Then you've got more of the aerial, and we're just playing around with all of these shots and weaving and superimposing them with these



paint passages, which have air blowing through them simulating waves. And here's footage from Scripps 3D digital project...it's all very referential, kind of metaphorical. And I think that might even be the theme of this whole show.

BO: Isn't this the first time you're doing what they call "time-based media"? How did that happen?



The Blue Marble: Earth as seen from Apollo 17 in 1972

DB: Quite serendipitously. I first began working with Anna Tas, an artist friend who uses this “lenticular” photographic technique in her own practice. I wanted to evoke the movement of water, which we initially decided to do through animation. I mixed tints referencing my on-site coral experience and our visits with the researchers at HIMB and Scripps. We made paint move in small Petri dishes and on some of the 9x12 inch panels you see in the show, and Anna took lots of still photographs from which to choose the animation frames. But as we were doing this, I began making videos of the moving paint, which led me to this video idea—the “Ocean/Coral/Paint” experiment to present a montage of all the information I’ve gathered so far for this project. It includes Richard’s drone footage, our snorkel GoPro footage, as well as video clips from both labs. As you know, Richard, my husband—landscape architect, artist, and photographer—is my collaborator on all my projects. The Gates Lab confocal imagery at HIMB is incredible: seeing live symbionts, polyps in real time has more meaning when contrasted to the Sandin Lab’s 3D digital imagery from their ambitious 100 Island Challenge project. Having the chance to witness the microcosm and macrocosm in the space of a few months was so incredible—and something I wanted to share in my work. I love combining all this factual material with my painting.

BO: Viewers can certainly admire your work for its distinctiveness, originality, and beauty. I hope they recognize all of those qualities. But it’s important that they don’t see it as something unachievable; the work invites viewers to explore these ideas and relate them to their own world. You’re not just making art for the sake of aesthetic appreciation.

I think your work empowers people. If we think about art referring to nature, this work brings up fascinating commonalities between different liquid surfaces, and our ability to see them or comprehend them. We live in a world where there’s a lot of water surfaces, but these tropical oceans are remote. Your work bridges the surfaces of water that are part of our everyday lives, with these much vaster ocean surfaces.

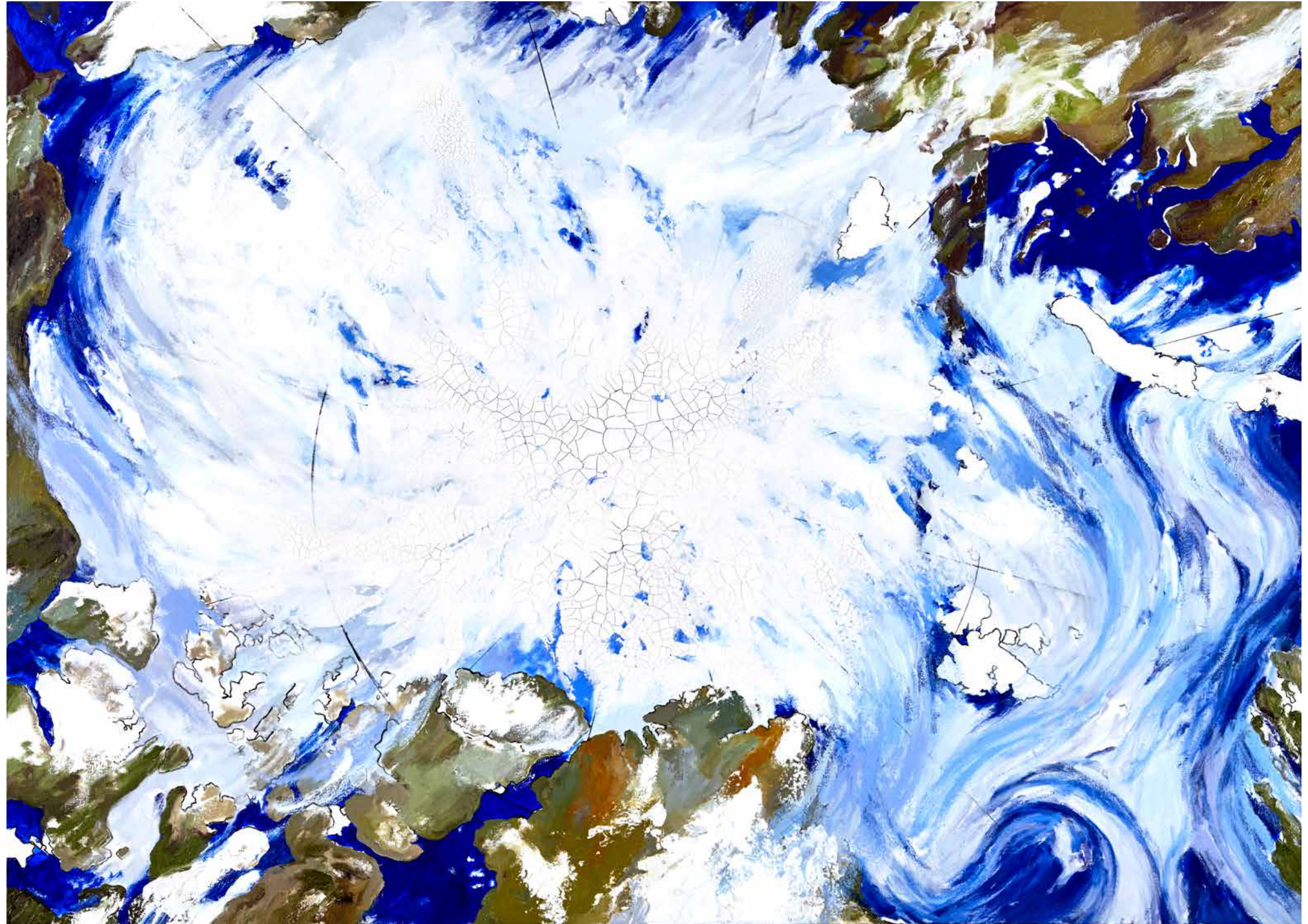
DB: I appreciate that. Public engagement is definitely part of my practice. I’m trying to do more than just make beautiful paintings. But I never thought about how they could make people respond through increased awareness of these feelings and multiple ways of seeing, that it can expand their point of view. I like that point.

BO: Don’t you sometimes think that, ultimately, we’re fortunate to have these opportunities like your exhibition at the National Academy of Sciences. There’s so much to do. Let’s just do what we can, do it well, and hope that others join us.

DB: Yes, that’s what I’m trying to do. That’s why I only agree to do university shows if they promise to include the community, other departments, for a panel on climate change, or a debate or a conversation between me and a scientist, something that goes beyond art talk....That’s the only way I’ll do it.

BO: And the image, painted or photographic, has such a huge effect on the public consciousness about the environment. Images have so much power. You could say one of multiple births of the Anthropocene was the arrival of the blue marble image of the Earth back in the early 1970s. It’s an image of tremendous hope, even as it recognizes the Earth’s fragility. Glaciers in the Himalayas and the Great Barrier Reef are both visible at that distance.

Arctic Melting, July 2016
(after NASA), 2016
Oil and mixed media on
canvas, 60 x 84 inches





Diane Burko in her Philadelphia studio March–April, 2018 Photos: Anna Tas

DB: Amazing that they are! Your introduction to my work, through GlacierHub, was a couple of years ago, when I was focusing on glacial melt. I'm so pleased that you can now see the new project on coral reefs through that chronological lens

BO: Well, for me the color is really a departure! But first I'm curious to hear you talk about your process. The last time I came to your studio, you were working with crackle paste, I think, to depict glaciers?

DB: Crackle—yeah. I discovered that special material in 2015. I'm glad there are two examples in the show.

BO: Cracks in glaciers are lasting, but they're not there forever. You're used to seeing cracks on really old paintings, and it's something to be avoided, so your paintings of glaciers really make me think about the passage of time and fragility, of lifespans. But just as your glacier paintings utilize this crackle paint that has a double identity, of both representing phenomena through image and embodying it as a material metaphor, so do the new reef paintings. It literally looks like you're working with water. And there's so much depth to the layers. How do you get the paint to do that on the canvas?

DB: Well, clearly, this ecosystem demanded a new painting method. I've never been a traditional easel painter because my paintings are usually large. I like situating them vertically on a flat wall. But when it came to investigating coral reefs, we were snorkeling, we were looking down all the time—and I love that point of view anyway—so it just seemed logical to approach the canvas that way, horizontally, spilling paint, letting it pool and flow.... Brushes just wouldn't do it. This way the material related more to the topic, the content, the experience. I think the fact that I was also concurrently working on the lenticulars, where you are moving paint around to make an animation, as you see in the video, this also contributed to this painting method. For me, it was logical to take the canvas off the wall and put it below me.

BO: How do you control the paint's movements?

DB: I'm pouring acrylic paint, and I do this in many different consistencies. There's been a lot of material experimentation working out the nuances of this system; that's what a lot of those small studies are showing in the 27-piece grid. I'm basically an oil painter, but these new works are entirely acrylic, some thin, some thick, along with mixing actual pigments into some mediums, along with other

granular mixtures. So, finally, when I started understanding all this, I could control the viscosity, wetting agents, etcetera. I first tried to move the paint around by tilting the canvas, but it looked obvious—too much about the paint itself—not enough about the reef.... That's when I realized I could use a compressor and have the air direct the paint across the surface, moving it wherever I wished.

BO: So, it's an air compressor?

DB: It's an air compressor, yes. While doing the lenticular series, I started using those little cans of air that you get if you're a photographer, and I realized that wouldn't work large scale, so I got an air compressor. You see how this section of Faga'alu spreads? All of this section is very thin, and the air is pushing it onto a wet surface. I mean, that's the magic—like how did this thing happen? It's a very fluid process about a fluid topic... .

BO: And how do you add details on the surface?

DB: Layering. Sanding. Working on it over time. Sometimes rags help to absorb pools of paint. You know, you adapt. It really is fun because it's totally new and brings discovery. I just figured out how to play with this stuff. I'm also wetting the canvas, so that allows some of it to be absorbed and move, and some paint is thicker. Depending on what I put in it, the paint does different things.

BO: And one of the paintings has some extra white lines, right?

DB: I drew that, and as you pointed out earlier, there's a lot of layering that goes on, which adds to the illusion of depth. So, lines come and go. These maritime maps start out very clear and precise, but I'm covering it and then letting it come out again in certain areas. It is implied, but not an illustration.

BO: Absolutely. Illustration only has one relationship to the thing it depicts. And your use of maps is interesting – and by the way, mariners use the word “charts,” not maps.

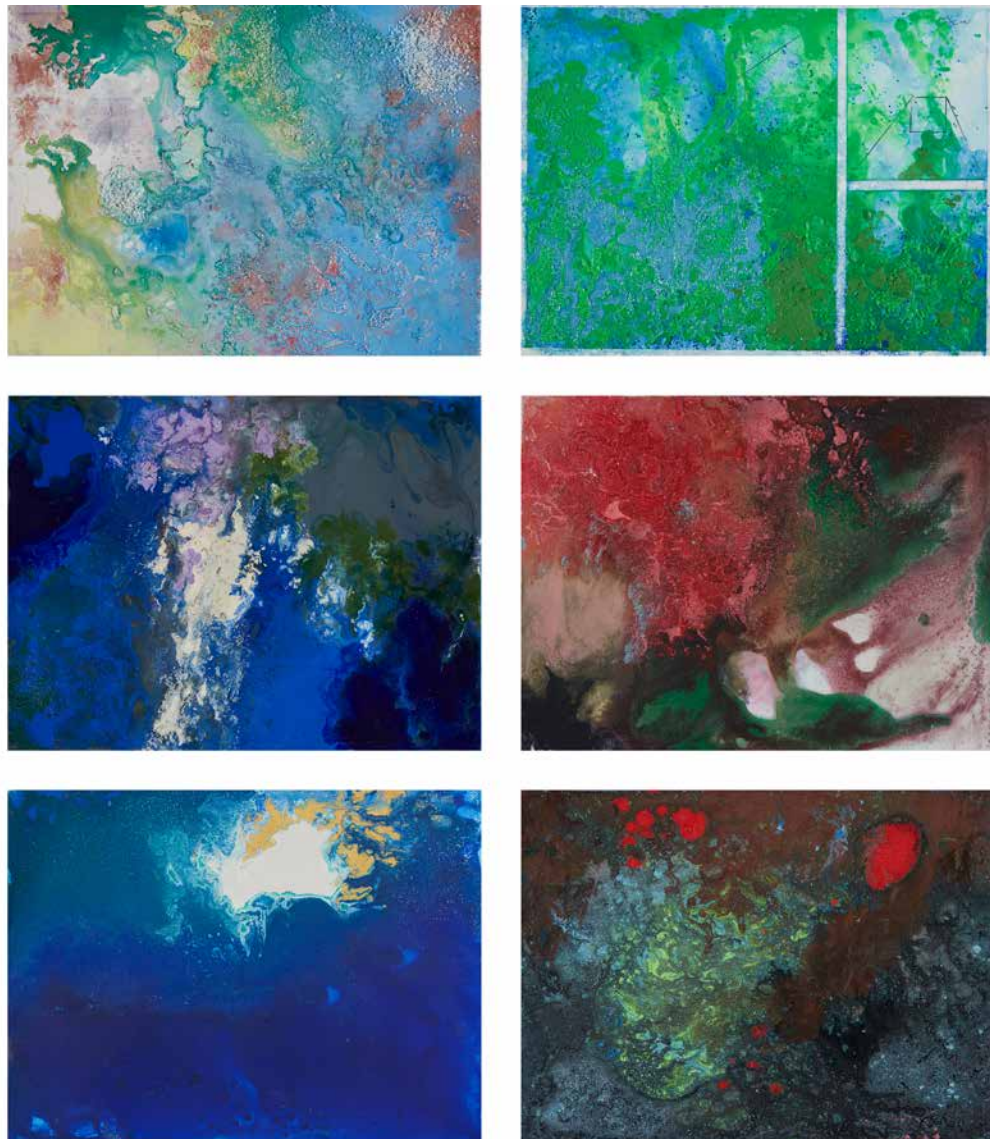
DB: I didn't know that.

BO: Ships have chart rooms—and you've heard of uncharted waters?

DB: Yes, I have! There you go! Thank you!



Reef Crid, 27 paintings, 2017–2018, mixed media on panel, 9 x 12 inches each



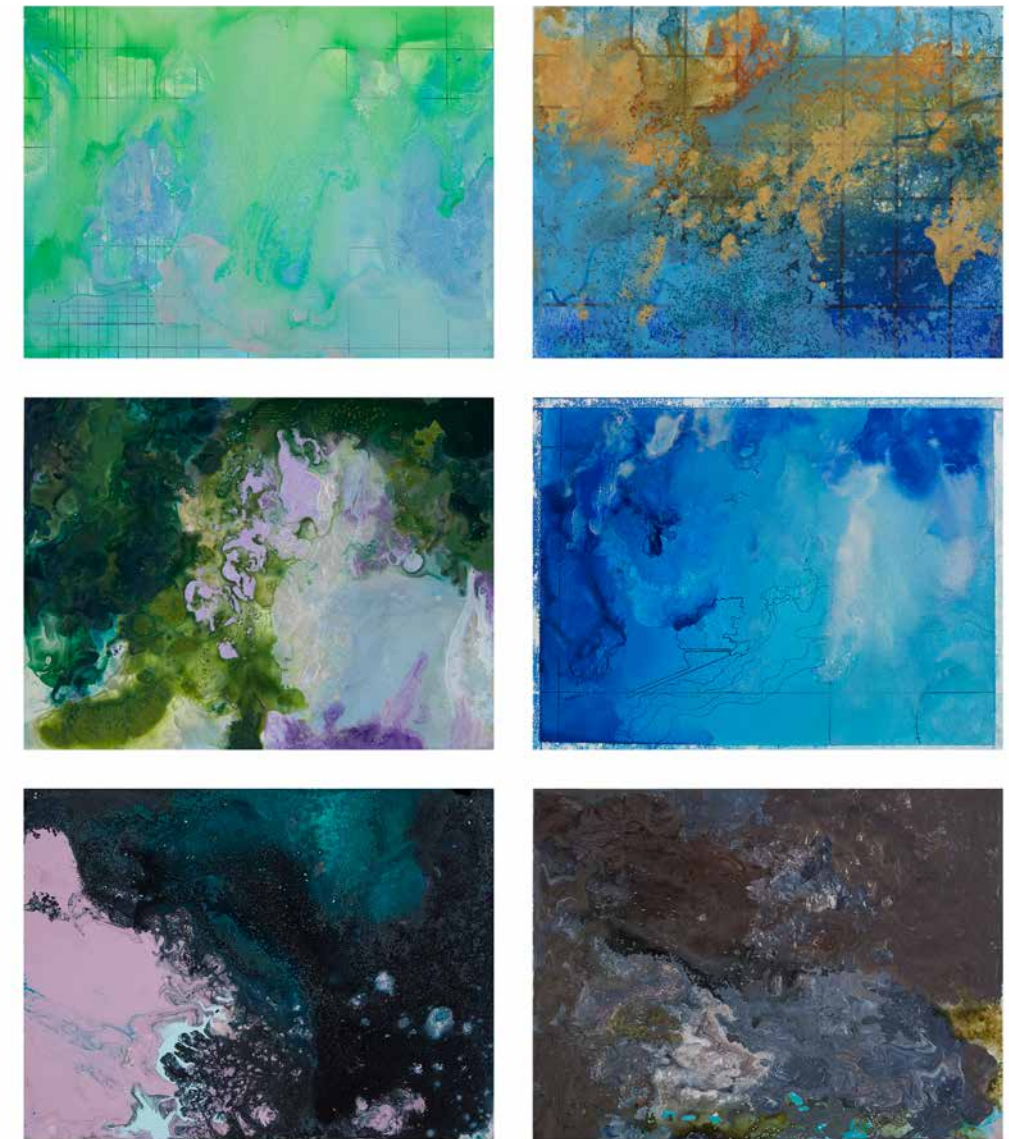
Study 02, 03, 11, 12, 20, 21, left to right



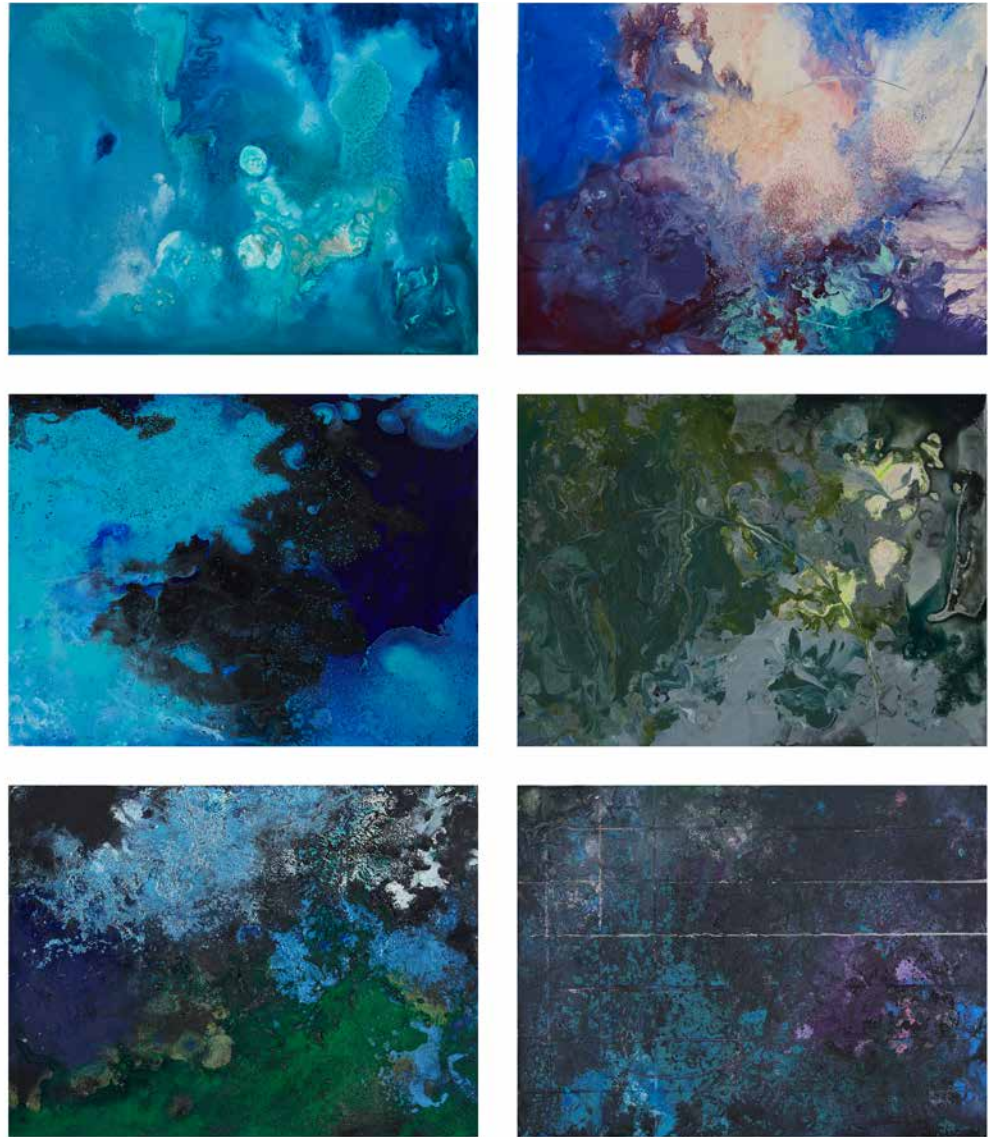
Study 21, 2018, mixed media on panel, 9 x 12 inches



Study 13, 2018, mixed media on panel, 9 x 12 inches



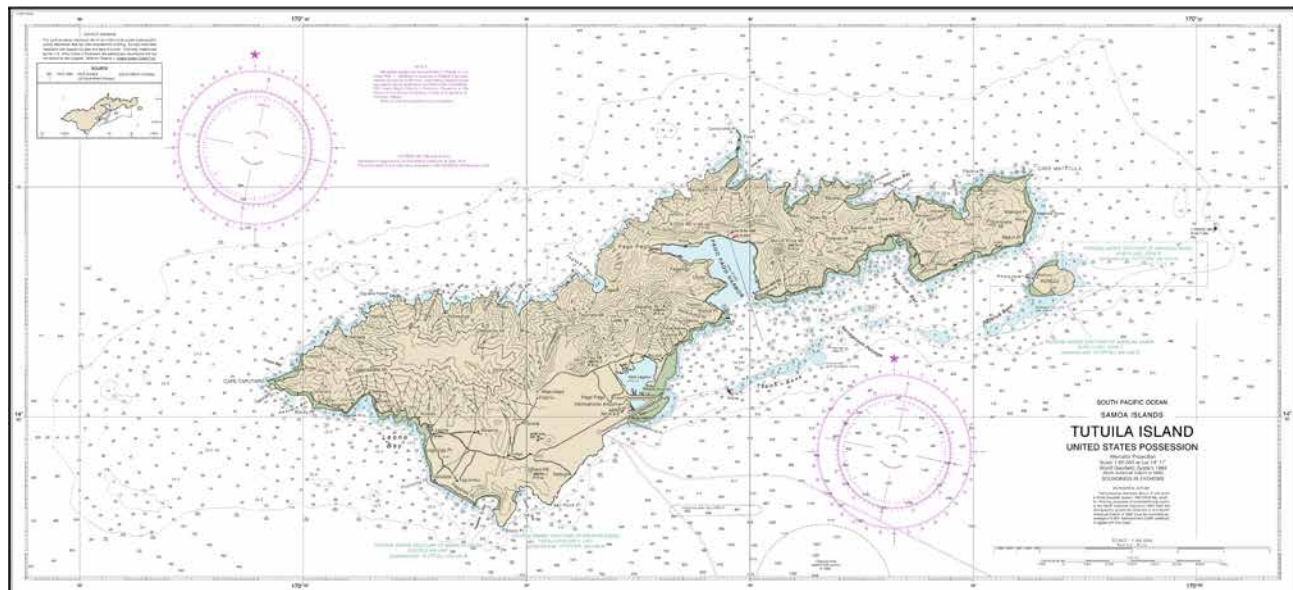
Study 04, 05, 13, 14, 22, 23, left to right



Study 08, 09, 17, 18, 26, 27, left to right



Study 09, 2018, mixed media on panel, 9 x 12 inches



Maritime map of American Samoa

Page 27
Faga'alu, detail, 2018
Acrylic on canvas
60 x 60 inches

BO: So anyway, maps are able to show us certain features in the ocean that correspond with reefs; they are actually able to show us where reefs are. The concentration of the reefs and the biodiversity of reefs in the Western Pacific are due partly to the geological substrate. That's an area where the plate tectonics have created these ridges. And it's also due to the prevailing winds blowing from South America to Asia at the equator.

DB: That we're losing. And that's what's so interesting about contrasting the glacier paintings and the reefs, too—their time scales are different. Glaciers will be here for much longer than reefs. Wherever you read, they talk about "Great Barrier Reef, might be gone in 20 years" or "This other reef, might be gone in 30." It's a much shorter life span and a much deeper threat for them.

DB: Reefs don't exist too much above or below 30 degrees of the equator.

BO: Yeah, glaciers are going to be here at least until 2200. People forget how high the tallest mountains in the world are.

BO: But you know not all reefs are around the equator. There are a few exceptions.

DB: And how deep the ice in the middle of Antarctica is.

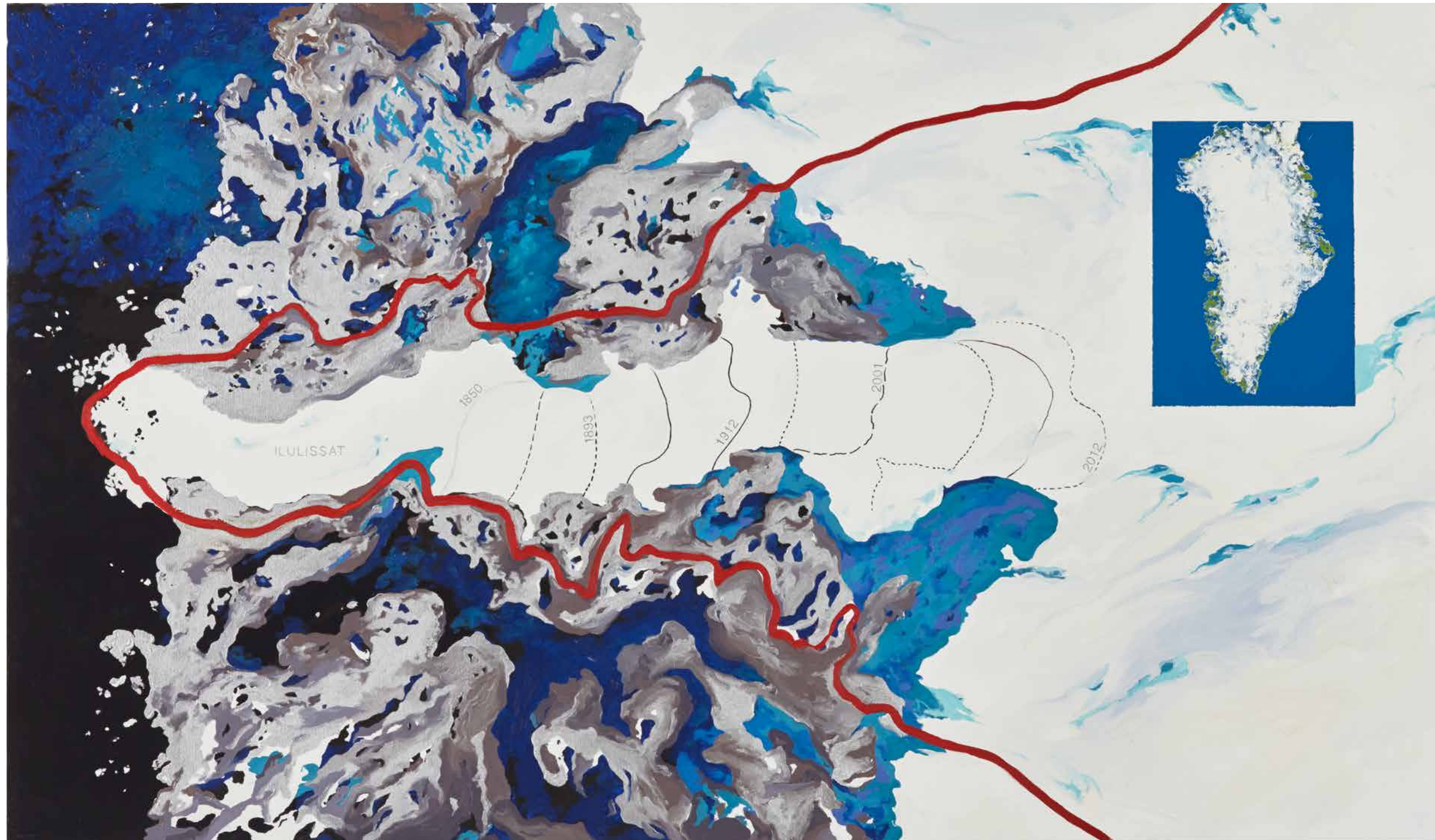
DB: There are, like the Red Sea, even some in the Arctic. I learned about this from a glaciologist at the Arctic Circle Conference in Reykjavik last October! She told me about rich coral assemblages identified in the Davis Strait, Baffin Island, and Labrador Sea, mainly black coral species likely associated with the meeting of the Arctic and Atlantic Oceans. They call them "cold water corals."

BO: For all the ice in the world to disappear is a very distant future... and it would be a very troubling future, because once Greenland goes, we have 20 feet of sea level rise, and once Antarctica goes, we get hundreds of feet. But for the next two centuries, there will still be ice. But yeah, there's a real risk that the reefs will basically be gone in this century, though they're so diverse and you might think that their diversity would promote their survival.

BO: But certainly, the majority are close to the equator. Water is moving across the Pacific, and its warming under the tropical sun leads to what's called the Pacific Warm Pool. Those are the warmest waters in the world, which support the biodiversity.

DB: Well some scientists do believe that there can be adaptation of the reefs, too. There's a lot of study about that. And there are many people who are growing reefs now in an effort to repopulate. But can they do it fast enough? They are truly the most diverse





UNESCO National Heritage II,
2015
Oil and Flashe paint on canvas
42 x 72 inches

of all marine ecosystems. Another connection: here I am with the glaciers, and here I am with the reefs. And they seem so different, but they have such synchronicity with each other, because one of the things threatening the reefs is sea-level rise caused by melting glaciers. With higher sea levels, there's less sunlight reaching the reefs, so there goes the photosynthesis. It's another contributing factor to their demise.

BO: There's another glacier-reef connection I just thought of. You know, glaciers are a major component of the weathering of mountains. As they scrape away at them, they expose rocks to natural weathering processes. Slowly and steadily, the rain that falls on the rock dissolves some of the minerals. The runoff contains calcium ions, which make their way, with the water, to the ocean...where microscopic coral organisms absorb them, depositing them as calcium carbonate, so they take solid form once again.

DB: Well that's a positive interactive process, but what I learned from some folks at NOAA and the National Park Service in American Samoa is that runoff can be damaging as well because of too much silt moving at once in a storm event, which seems to be happening more often. Instead of being nourished, they suffocate.

BO: It's one piece of it. In my view, to be honest, I see glaciers and reefs both threatened by the same cause.

DB: They are, in the end, the same. And it's clear that glaciers have contributed significantly to sea-level rise in the 20th century. And they're still a huge threat in the 21st, with Greenland and Antarctica.

BO: Your work on Greenland definitely talks about the same threat. Glad to see they've included paintings of yours about Jakobshavn in this show, by the way. But just to backtrack a second, it's so great that you use air when you're making your work. After all, atmosphere is so important to the ocean! It's immediately fascinating how your colors correspond with their subjects; glaciers are basically affected by just one driver, the warmth that's due to the increase in the concentration of greenhouse gases. With your focus on a limited range of colors, your glacier paintings aesthetically correspond with that simplicity, they memorialize it. Beyond our deep cultural history of the color of the tropics—Gauguin loved these colors—the use of color in your reef paintings is totally different and complex and makes me think about how complicated coral reefs are. They face multiple threats. With glaciers, typically snow falls in

mountains and gradually turns to ice, whereas reefs are comprised of a whole complex symbiosis.

DB: Yeah, the threats to glaciers are much simpler to wrap your mind around and also for me to visually portray. This was the biggest challenge of dealing with these reefs, because it's so complicated. They're plant, they're animal, and they're mineral; that's already difficult to understand.

BO: Yeah, reefs contain so many different processes, and threats range from warnings of sea-level rise, to ocean acidification, to so many other problems, like the people who collect the aquarium fish, destructive fishing practices....

DB: The overfishing.

BO: Yeah, and things like the changes in ecology that are bringing the crown of thorns starfish and lionfish. But when you show these reefs, you're not just showing them as fragile, you're not reducing them to a simple tragedy. The viewer's task is not to just look and feel bad.

DB: Absolutely, I don't want that. I don't want to frighten people away. I want to celebrate these places and ecosystems, and then through the celebration and through reminding people about ecological signs and warnings, communicate that there's an underlying issue: that we have to protect nature, and we're the ones who are directly involved in destroying it.

BO: In many ways. It's significant that your paintings also remind me of how powerful and vital these glaciers are, even though they're not alive.

DB: Well, they move, don't you think they're alive in that sense?

BO: They move, they make all kinds of sounds, and it's remarkable to hear the melting, the pieces of ice falling, the cracking, and certainly people around the world understand them as deserving respect.

DB: Yeah, and I think reefs are different. I don't think people are as aware of coral reefs.

BO: People know them in very specific ways—they get multiple messages of beautiful wildlife photography and their cousin having a wonderful snorkel vacation. We're taking for granted seeing the

reefs a certain way...and then when something sudden happens, it's a reminder that there could be an algae bloom, that these reefs are endangered. That it's not a distant thing.

DB: Right, so many people experience reefs as a beautiful place, but they don't understand how deeply reefs impact the coastlines, how the barrier reefs—emphasis on “barrier”—are there to protect!

BO: Yes, they certainly accomplish that. Many scientists think about both stable glaciers and barrier reefs as ecosystem services, though I'm not sure I like the word “services.”

DB: What does that mean?

BO: It's thinking of nature as having value for humans aside from what's intrinsic. For example, you can get lumber from a forest, but the forest also can also protect the watersheds and reduce the risk of floods and mudslides. Stable glaciers contribute to the diversity of our watersheds, so glaciers in that sense provide services. They keep the flowing rivers more even. If there's a year with snowfall, you're still getting something from the glacier.

DB: Yeah, you can depend on it. There are rhythms.

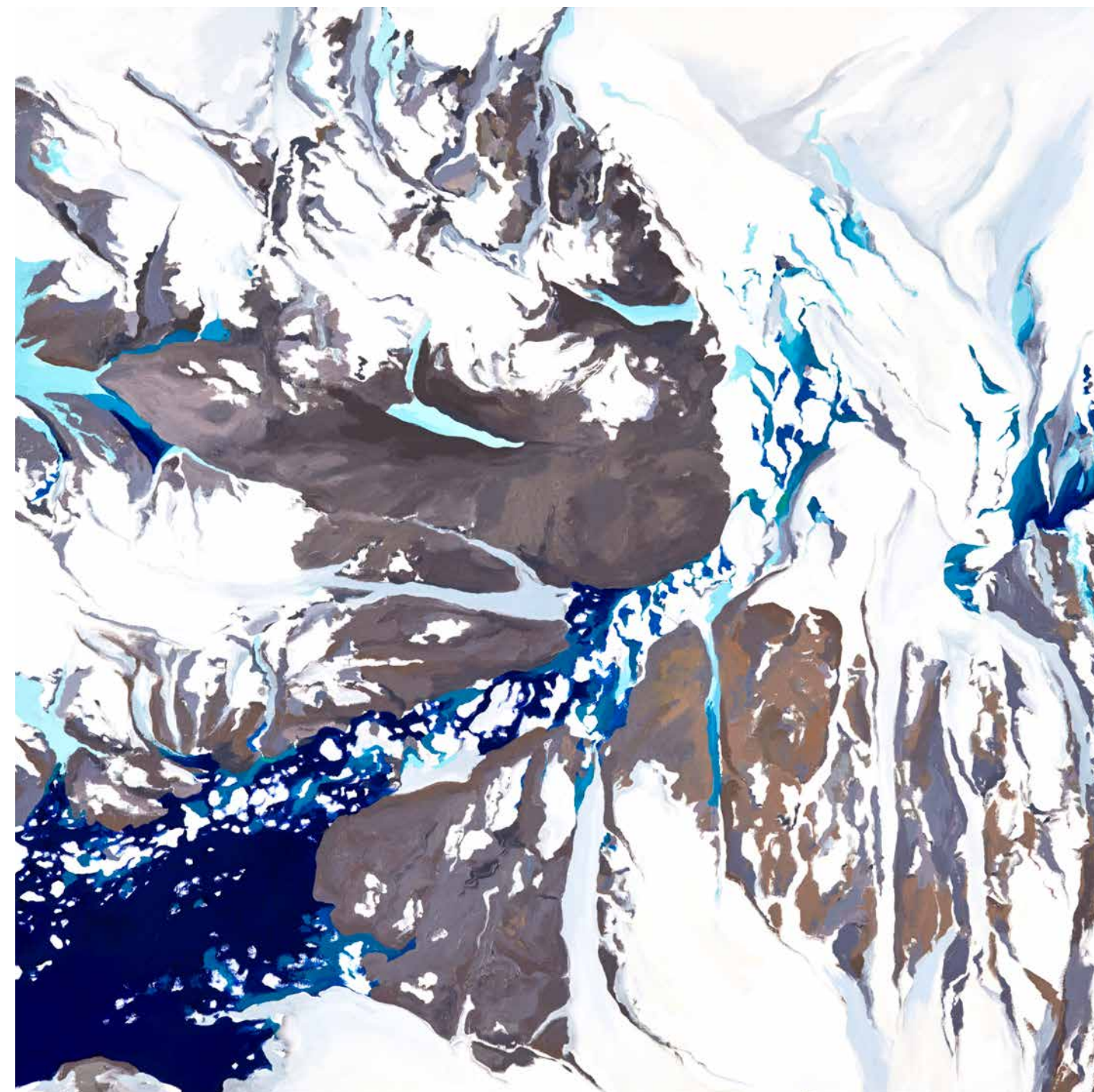
BO: And glaciers reach a wide area beyond themselves. So do the reefs! They have a huge impact, and so I like that so much of your new work uses the circle. In the lenticulars and the video, the circular format really functions like a globe, but it also feels like a submarine window. You get the sense that what you're seeing is a window, that there's vastness beyond the frame. You know you're not seeing the totality. And you're referencing the whole globe and the enormity of the ocean basin in paintings like Hawaiian Archipelago.

DB: Well, the ocean is 70 percent of the world. That's why we have a blue marble, because we have water.

BO: Yes, and the reefs are less than 1 percent of that ocean area, but they nonetheless support an enormous amount of biodiversity.

DB: And biodiversity is also something that's being threatened now. The extinction rate going on is amazing.

BO: Absolutely. Historically, people who study biodiversity of fish have seen that nearly all the most vulnerable species are freshwater



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Modis 2009 III, 2015
Oil and Flashe paint on
canvas, 42 x 42 inches



Hawaiian Archipelago, 2018, acrylic on canvas, 60 x 72 inches

fish that are inland, with very small ranges of habitable space.

DB: What are some examples of that?

BO: Lake Titicaca, high in the Andes, had a number of species found nowhere else in the world. Some of them are gone now, mostly due to the introduction of other fish species in a way that was not thought through. There are some fish found in ponds in deserts—there’s the desert pupfish from Southern California, found only in a small number of ponds. Some of the largest threatened fish species live in the Mekong River in Southeast Asia. They build dams the fish can’t navigate, and it’s over for these species.

DB: But now we’re seeing warnings of this extinction in oceans.

BO: That’s right. Ocean fishes historically have done much better because they can travel from one area to another, so if a species of fish in one area is wiped out, it can repopulate from somewhere else. It’s only now that we’re beginning to see these big threats to ocean fishes, and a lot of that is in the coral reefs. Reefs are so diverse and productive; there are a multitude of species that rely on them, and so reef bleaching is really a new kind of threat to biodiversity. Just like the freshwater fish found in small ponds, these species that live in reefs have nowhere else to go. This ties into what we were saying earlier, about complexity—how do you depict all of these systems?

DB: Indeed, it’s a real visual opportunity, a chance to expand my painting language. But I think it’s also the fact that the environment I’m dealing with, these reefs and the ocean, is very new to me. You know, I’m barely a swimmer. So, from the beginning, my exploration of reefs has been way different than putting on crampons and walking on a glacier. It’s a landscape that has demanded a new set of skills, an approach that has to do more with movement and time. To your earlier point about my work coming out of real experience—there are unique rhythms to these places and constraints that are totally changing how I think about painting and our planet.

BO: It’s also really interesting to see you pair glacier and reef work in this exhibition. Your approach is so different between the two bodies of work, but you take advantage of formal similarities like scale and contrast to draw connections. In Beaufort and Molokai, you’re taking advantage of the different depths of these two types of spaces, comparing the two. We stand on the surface of the glacier, and we stay near the surface of the ocean. You’re realizing

that both the glaciers and the oceans are vast surfaces, that there are parts of them that we can’t penetrate.

DB: Absolutely.

BO: I also like the Kona Diptych and how you actually changed the orientation of the second one—not matching the map in the logical way we would expect. Why?

DB: The “charts” are there to reference the facts of science, but for me, the aesthetics of painting have to prevail in the end. So, I liked the way the lines of the coast related when I flipped it 90 degrees to the right. Besides, as we know, the orientation of a map is arbitrary. It depends on where you stand or fly...

BO: In that vertical section when I look at Hawaiian Archipelago that lighter blue with darker blue just to the right really feels like you’re looking into deeper water, looking into the reef that’s on the edge.

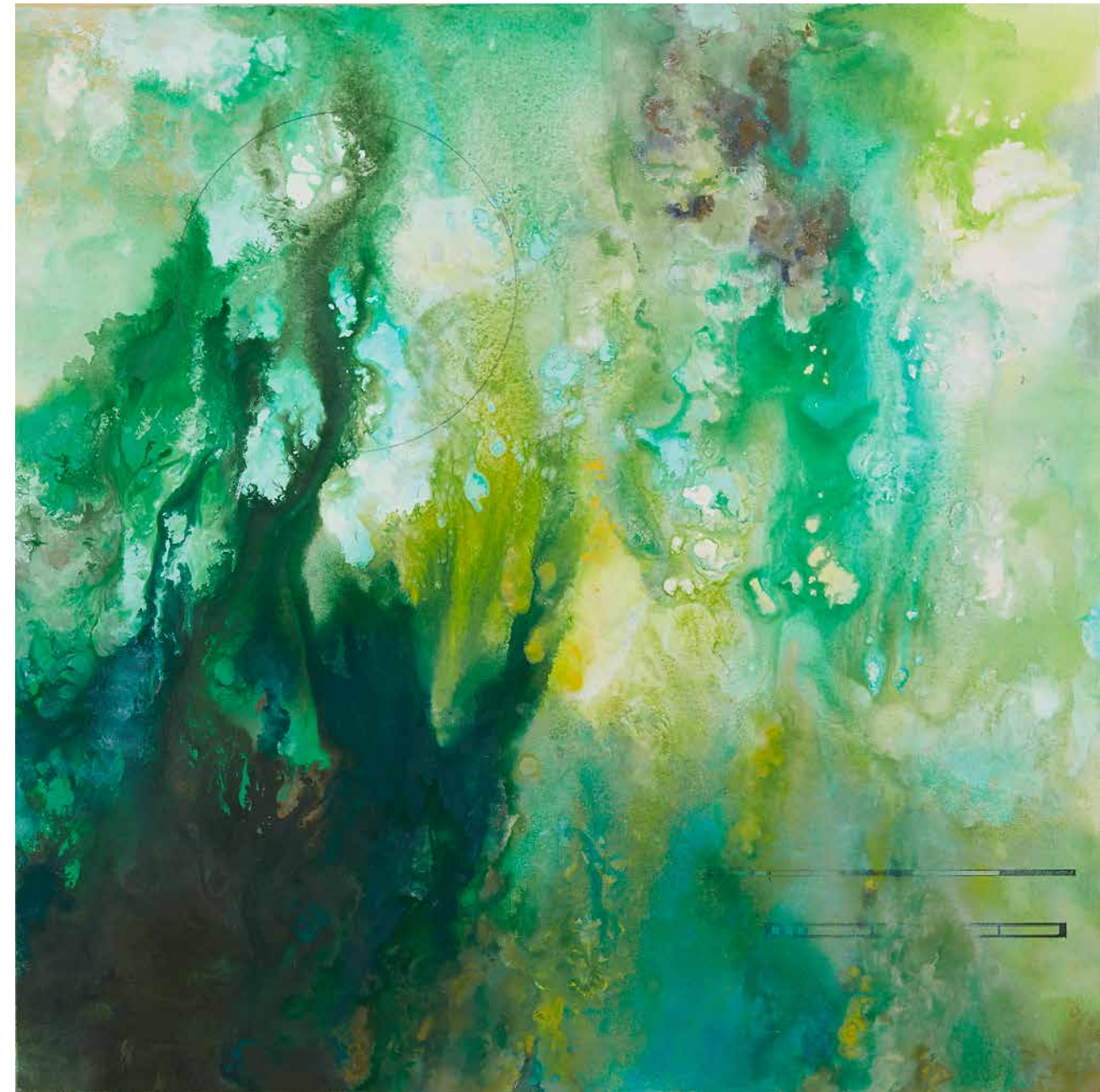
DB: Yeah, they do that. They go light and dark. I noticed that as we were flying over the Great Barrier Reef in 2017 and in Molokai earlier this year. There we did more air flight than anything. We flew between Molokai, Maui, and Lanai. There are reefs between all of them. The longest fringing reefs are in Molokai. We discovered that the culture of Molokai was the most sophisticated of the archipelago in terms of their 800-year-old traditional fish farming system. All along the southern shore, where we were staying, were preserved fish ponds from the 12th century with semicircular walls of the ponds made from lava boulders and coral that would allow the seawater to ebb in and out. And they are now restoring this ancient system!

That discovery made me think of all the many conservation and sustainability practices of indigenous civilizations which have been lost and ignored. We have bypassed their wisdom in the name of “progress.”

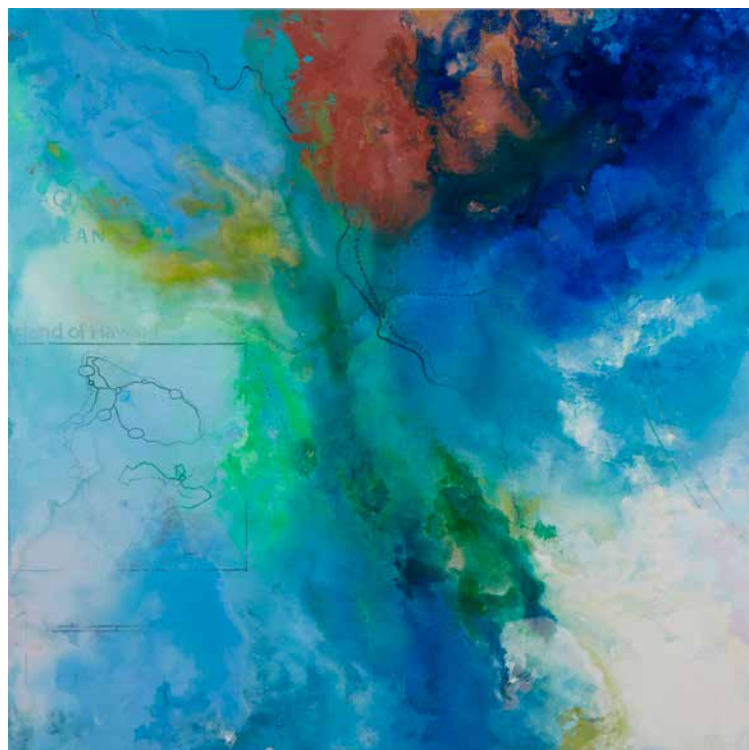
BO: Yes, indeed. And so far, we’ve really been talking globally. But let’s bring this back to the fact that this exhibition is taking place in the National Academy of the Sciences. It’s significant that you’re bringing attention to the ways that both glaciers and reefs are landscapes that exist in America. You’ve visited states and territories, and much as this is a global issue, let’s not forget that this is an American issue. That this is part of our heritage. This is an American question; we’re talking about Hawaii, we’re talking about



Visions of the Beaufort Sea, 2016, oil and mixed media on canvas, 42 x 42 inches



Molokai, 2018, acrylic on canvas, 42 x 42 inches



Kona Diptych, 2018
Acrylic on canvas
overall 42 x 84 inches

American Samoa, and the glaciers, which are principally in Alaska, though there are others. California has some, Oregon, Montana, Washington, Nevada, Colorado, Wyoming. Maybe Idaho, but I'm not sure. And I know you have painted many of them, Grinnell especially in Glacier National Park, Columbia Glacier....

DB: So at least eight states. That's quite a number.

BO: Ryan Zinke, our Secretary of the Interior, spoke very movingly about growing up in Whitefish, Montana, close to Glacier National Park.

DB: That is such a beautiful part of our country, I went there in 2014, as a guest speaker for a big climate change event called "Stories from the Mountain, Songs from the Soul," sponsored by a great group called Glacier Climate Action.

BO: Yes, so at his confirmation hearings, he was able to talk quite a bit about that. It's important to remember that many Americans have strong relationships to these places. Like the people living in Hawaii who have a close connection with the coral reefs, people in many western states live near glaciers. For many Americans, these are distant parts of our national territory, but we have to remember that for others, it's very close to home.

DB: Going back to your other point, what brings all of it full circle is that, yes, we can identify it as Americans, but as living in our world, we also can identify with it. Because we all know "what happens in the Arctic doesn't stay in the Arctic," as they say.... and what happens as the flow of arctic air warms impacts everything around the globe.

BO: Certainly, this is something everyone in the world is doing, contributing. Global warming is continuing through greenhouse gas emissions.

Fish pond along southern coast of Molokai
Photo: Richard Ryan



DB: We're all contributing, and we Americans are contributing a lot more, but here's the rub: we're contributing, but we're surviving, we're thriving. Then you have places like the Maldives, Tonga, or Fiji, all these island nations where they may not have an existence in the next 50 years; their cultures can literally disappear. Or maybe even sooner—maybe 20. But you're right, there's also Miami Beach, Florida, and the Gulf.

BO: That's true, and Alaska, the villages in Alaska like Shishmaref, that are facing coastal erosion from rising sea levels and loss of sea ice. One word that's come forward in climate policy is the word "habitability," the question of where people can live. And technology allows people to live in many places. Technology has allowed people to be on the moon, people to spend the winter at the South Pole, people to travel to the depths of the Mariana Trench in the Pacific. But places people can inhabit....

DB: That's different than just visiting or exploring. We're saying, where can they have a life and a culture and continuity.

BO: That's the question, precisely. Think about how the parameters of habitability are not defined because this never used to be a question. What about the people who live in vulnerable coastal areas who rebuild after one flood and after two floods. How long can that continue?

DB: After how many floods can you rebuild?

BO: Yes. For the people who face extreme heat, it's becoming a problem. There are places where people are used to saying, "with air conditioning you can live anywhere." But they're beginning to think there'll be some places like parts of West Africa or the Persian Gulf where it'll be so hot, the cost of air conditioning so high, it'll be too hot to go from your air-conditioned house to your air-conditioned car, that you can't cross that short distance. In any case, this idea of habitability comes forward.

DB: Another word that's becoming much more accepted in climate circles, or environmental circles, is adaptability, adaptation. That's where we are.

BO: And you can adapt to a certain extent, at a certain pace. We've been talking about human adaptability. Our designed, new ways to build our cities.

DB: New stilts, floating cities.

BO: Yeah, you can shift the crops you can grow. That can continue at a certain pace, but if the change is too extreme and too rapid, we can't adapt. The reefs really offer us a model of this.

DB: If they can't adapt, they're another canary in the coal mine, aren't they?

BO: Yes, they historically have adapted to predators, to fluctuations in sea level, to some shifts in ocean temperature.

DB: You're saying pre-Anthropocene?

BO: Yes. We're talking historically, tens of millions of years ago, if a huge asteroid hit the earth or if there's a massive volcanic eruption that lasts thousands of years, then we got mass extinctions. The things that wiped out the dinosaurs impacted the reefs as well.

But these smaller fluctuations of sea levels or arrival of predators would knock out some of the particular polyps or the particular symbionts, and it would take a while to adapt and regrow. The polyps reproduce and create a lot of these little larvae that swim around trying to find a surface where they can land and attach them-



Midway Atoll, 2018
Acrylic on canvas
60 x 84 inches

selves and grow. And if a gap forms in an existing reef, when a parrotfish comes or a tsunami, that's going to be a spot where the polyps can regrow. And then there are enough of the symbionts that are just floating around, and it'll say, "Well, here's a great polyp." And so, they put down the calcium carbonate.

DB: And they keep building their houses.

BO: Yep, and it keeps going. They have to actually do some evolution. So, it does mean that while they're dynamic and though they can deal with rising and falling sea levels and slow changes, they can't deal with very fast ones. And all the new things are hitting them so fast.

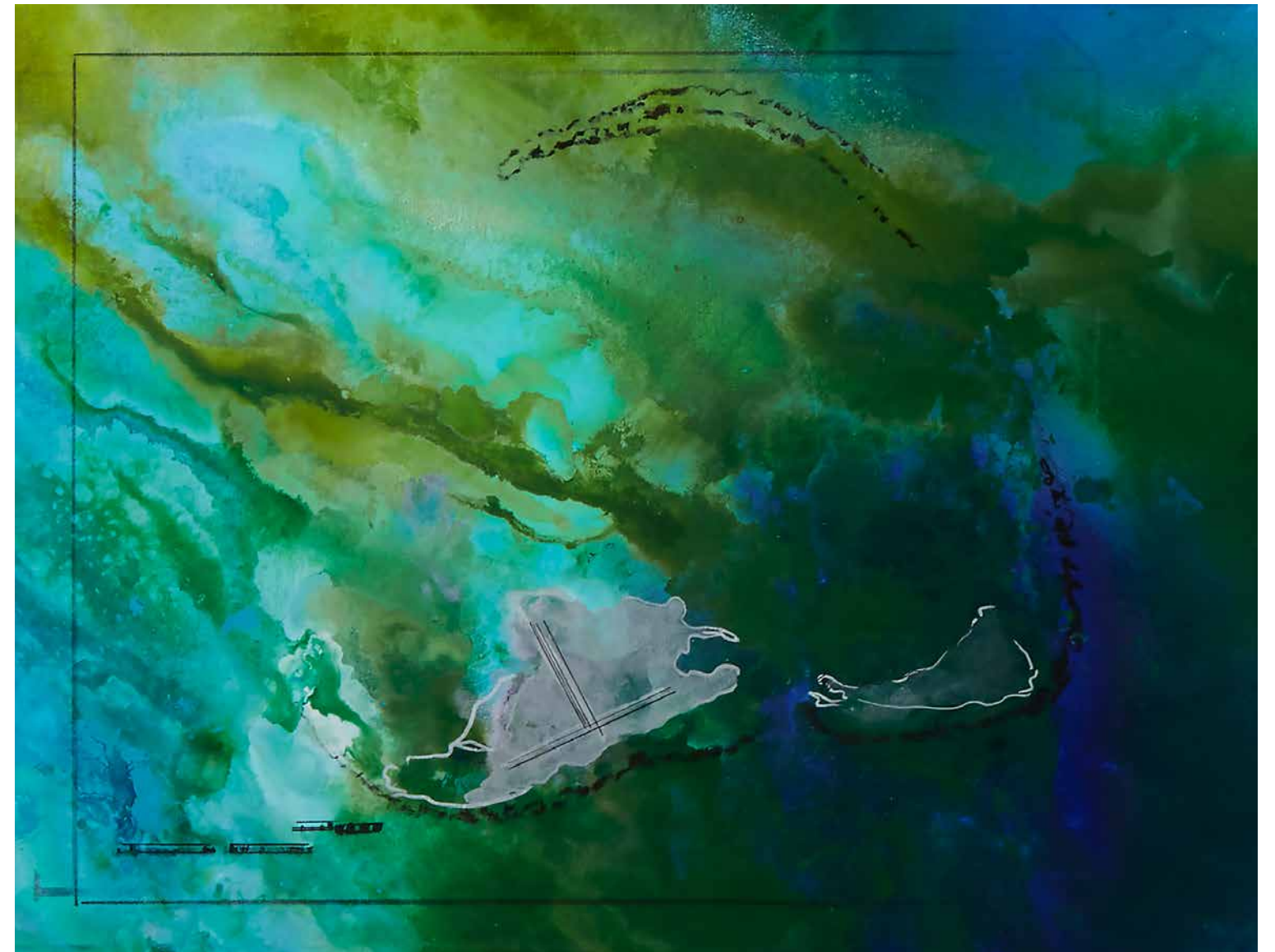
DB: Too fast! The heating up of the oceans, the acidification, yeah.

BO: Wow, we certainly have strayed from talking about your paintings, lenticulars, and that portal with your intriguing video, haven't we?

DB: No! This is exactly the kind of conversation I was hoping we would have.

BO: Well, how about one last question about your work. This show is so complete—is this the end of the project?

DB: Absolutely not, Ben! There's so much more I want to do, and this project has opened a lot of doors in terms of avenues

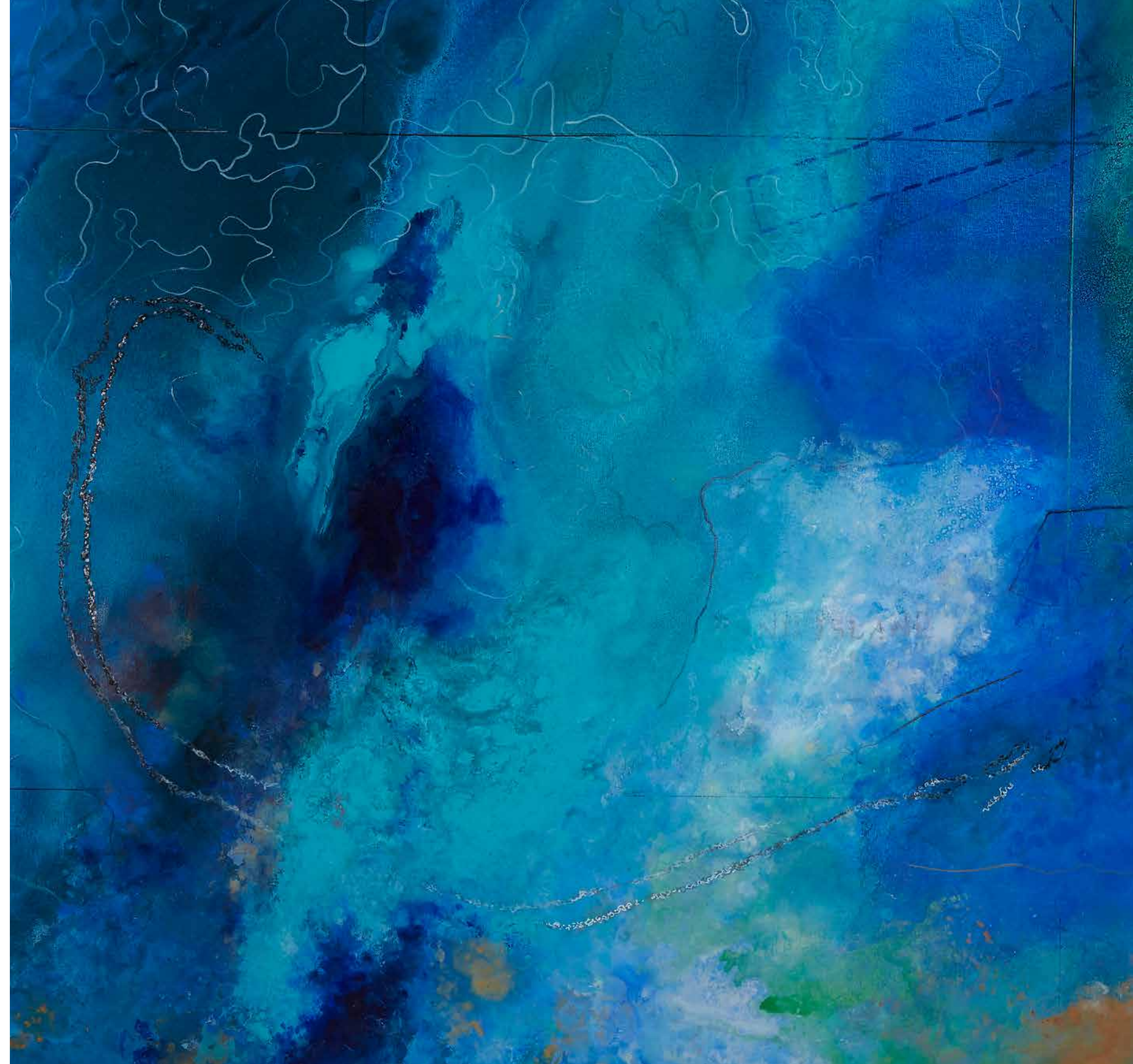


Hawaiian Archipelago, detail of Midway Atoll, 2018, acrylic on canvas, 60 x 72 inches



Palmyra Atoll, 2018
Acrylic on canvas,
42 x 72 inches

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Midway Atoll, detail, 2018
Acrylic on canvas
60 x 84 inches



of scientific research, along with the expansion of my studio practice. When I began my research for this exhibition, I didn't even know what an "atoll" was—like the detail of Midway Atoll in my Archipelago painting. I'm already beginning a new series on atolls. I've just finished a painting solely about Midway Atoll and another on Palmyra Atoll. I'm reading a copy of Darwin's first publication "The Structure and Distribution of Coral Reefs," where he wrote on the subject. An atoll is a series of coral islands forming a ring around a lagoon. They start as fringing reefs, which get converted into barrier reefs when encircling islands. The book has Darwin's fantastic map, which I'm excited to incorporate into my new work.

And bringing our conversation back to the idea about climate change as both a global problem and an American problem, I just got reminded about America's toxic legacy with atolls. Did you know that in 1946, our government sent a few hundred natives of the Bikini Atoll into exile while it set about destroying their island with 23 nuclear tests? Imagine. There was a necklace of 23

islands with sandy beaches, palms, all that tropical stuff, and our nuclear age devastated it. So, all of this is moving the trajectory of my practice forward.

The way this conversation has moved between talking about the art and really addressing the science—this is what I hope can happen with this exhibition. I no longer see myself as an artist just making work for exhibition. I'm creating work for a forum where the public can gather to converse, question, debate and not only think about the formal issues presented but what those images are about: our environment, our natural world, and our future destiny. Does that sound too corny?

BO: No, Diane, it sounds heartfelt! I think your art can definitely provoke thoughtfulness in the viewer. You are on the right path. I'm always inspired by your openness and your courage, exploring materials, possibilities, ideas... trusting that most of them will emerge. You bring your energy and enthusiasm to these issues—and hope!



Stressed Coral, 1/10, 2018
Still image of back lit Lenticular
13.5 x 13.5 inches

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Top: *Alega, American Samoa*,
1/10, 2018

Middle: *Hanauma Bay, HI*, 1/10
2018

Bottom: *HIMB, Confocal*, 1/10
2018



BIOGRAPHY

Born in Brooklyn, New York, in 1945, Burko received a BS in painting and art history from Skidmore College and an MFA from the Graduate School of Fine Arts of the University of Pennsylvania (1969). Burko is professor emeritus of the Community College of Philadelphia, where she taught (1969-2000). She has also been a visiting professor or lecturer at varied institutions, including Princeton University, Arizona State University, the Pennsylvania Academy of the Fine Arts, and the University of the Arts. She is an affiliate of The Institute of Arctic and Alpine Research (INSTAAR), having led a seminar at their headquarters and interacted with their research scientists in Boulder, Colorado, in 2014. Aside from numerous university lectures, she has been invited to speak at scientific conferences and seminars such as at the Geological Society of America, the American Geophysical Union, the Chemical Heritage Foundation, and in 2017, the Arctic Circle Assembly in Reykjavik, Iceland, and the International Cryosphere Conference in New Zealand. Burko has had more than 40 solo exhibitions of her work in galleries and museums throughout the country. Winner of two National Endowment for the Arts fellowships and two Pennsylvania Arts Council awards, Burko has had a six-month residency in Giverny, France, sponsored by the Lila Acheson Wallace Foundation, and a five-week residency at the Rockefeller Foundation Bellagio Study and Conference Center in Bellagio, Italy. She was awarded a \$200,000 public art commission by the Redevelopment Authority of Philadelphia and the Marriott Hotels (1996). In 2000, she received a \$50,000 Leeway Award to support her Volcano Project. In 2011, she was given the Women's Caucus for Art/College Art Association Lifetime Achievement Award. In 2013, she was selected to participate in The Arctic Circle, an annual expeditionary residency program that sails the Svalbard Archipelago and the Arctic Ocean. That expedition was supported with the Independence Foundation's "Fellowship in Art" award. Distinguished critics, scholars, and curators have written about Burko's work; they include Lawrence Alloway, Ian Berry, David Bourdon, Mark Cheetham, Robert Cozzolino, William Fox, Lenore Malen, John Perreault, Carter Ratcliff, Robert Rosenblum, and Judith Stein. Burko is represented in numerous collections, including the Delaware Art Museum, the Denver Art Museum, the Hood Museum of Art, the James A. Michener Art Museum, Pennsylvania Academy of the Fine Arts, the Philadelphia Museum of Art, the Tucson Museum of Art, the Woodmere Art Museum, and the Zimmerli Art Museum.

ACKNOWLEDGEMENTS

J.D. Talasek, the Director of Cultural Programs at the National Academy of Sciences (CPNAS), and I began a social media correspondence in the summer of 2010. That September, we finally met in my Philadelphia studio. Eight years later, his continued confidence in and support of my artistic journey have led to this exhibition. I owe him a special depth of gratitude.

I thank the curator, Alana Quinn, who so ably coordinated all the moving parts of a challenging installation. Without her organizational skills, astute suggestions, guidance, and enthusiasm, it would not have happened.

This is my first exhibit containing time-based media, which came to fruition thanks to my collaboration with artist Anna Tas, who introduced me to the world of the lenticular. My first video, "Ocean/Reef/Paint," combined material from that lenticular collaboration with Anna, along with drone and GoPro footage taken by my husband, Richard Ryan, as we traveled in the Pacific exploring coral reef ecosystems. It is further enhanced with footage from the Gates Lab at the Hawai'i Institute of Marine Biology, where we had the privilege to view their confocal microscope in action on December 28, 2017. In March 2018, we visited the Sandin Lab at the Scripps Institution of Oceanography, where they generously shared 3D digital imagery of their 100 Island Challenge project with us.

This work would not have been possible without the video-editing skill and determination of my intern Katie Supplee, from University of the Arts, who patiently met with me over the whole semester and into the summer, processing notes and the additional footage I continually added. I thank Scott Newman, another University of the

Arts student, for his ability to fabricate the portal structure for the installation.

While this publication documents the work in this NAS exhibit, it functions more like an informative book than a catalog. It contains additional images as well as commentary by two distinguished scientists: Nancy Knowlton, a pioneer in the world of marine science, and Tad Pfeffer, who is devoted to the study of glaciers. Additionally, my conversation with anthropologist Ben Orlove dives into my motivations and process, but also addresses larger environmental issues and public engagement. I am indebted to these three scholars for their contributions.

It is truly a blessing to collaborate again with the gifted designer Phil Unetic, whose wisdom brilliantly steered my vision into such a handsome publication—one that so gained from the attention of Brilliant Graphics as well as the support of my publishers, Mike Warlow and Kiersten Armstrong at KMW Studio.

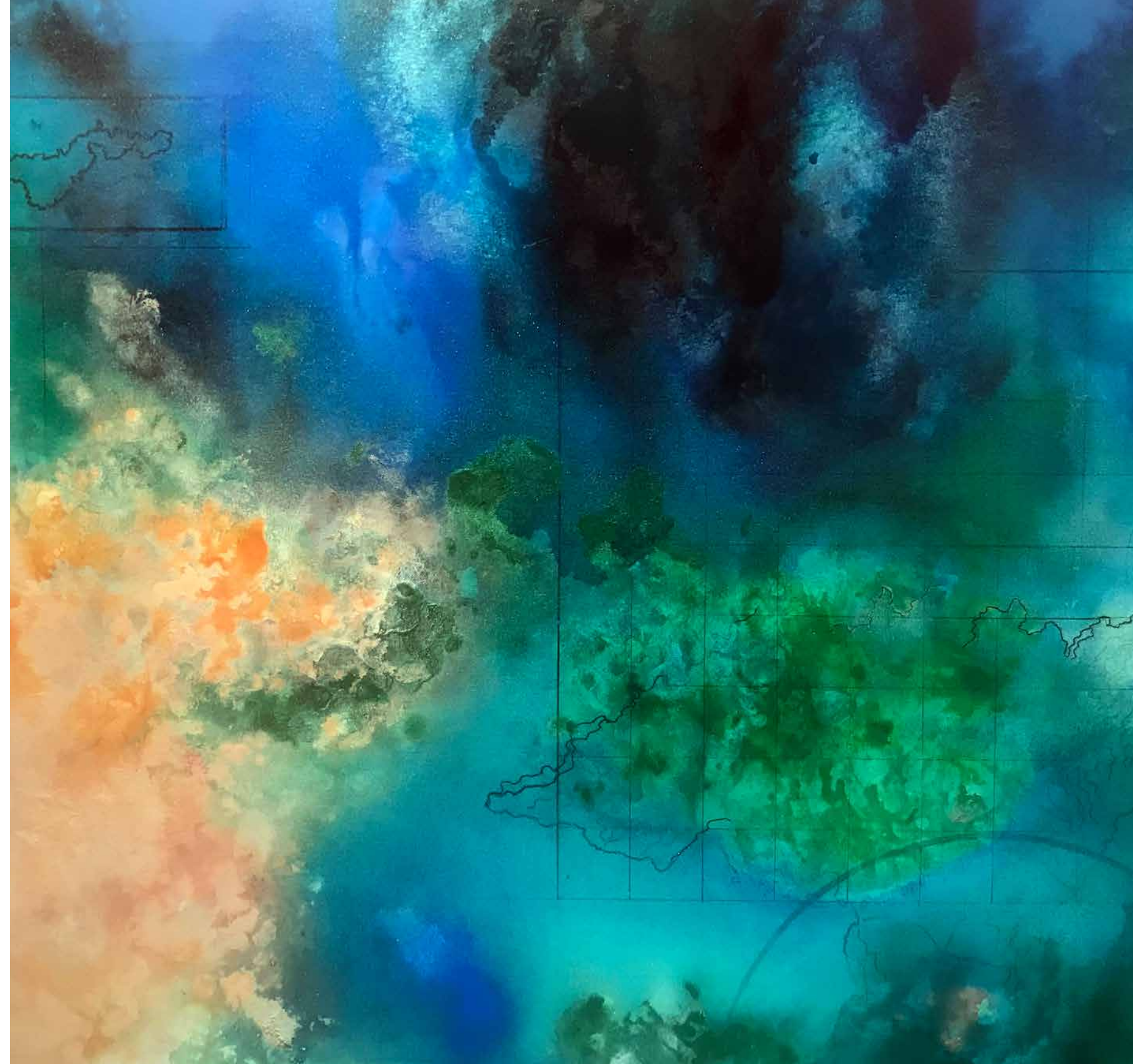
This exhibition and catalog also benefited from the many talents of my able assistant, Olivia Jia.

Ultimately, the sustained interest and generous support of Joseph and Pam Yohlin made this publication possible. I am forever grateful for their confidence and friendship.

Richard Ryan, my dear husband and partner in life, has supported me on all our expeditions—from ice to oceans—and in every other way. He has made all my work joyfully possible.

Diane Burko
Philadelphia, August 2018

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Pago Pago, detail, 2018
Acrylic on canvas
42 x 72 inches



Cover

Modis 2009 III, detail, 2015,
oil and Flashe paint on
canvas, 42 x 42 inches, and
Hawaiian Archipelago, detail, 2018,
acrylic on canvas, 42 x 72 inches

Back Cover

Molokai, detail, 2018, acrylic on canvas,
42 x 42 inches, and *Visions of the
Beaufort Sea III*, detail, 2016, oil and
Flashe paint on canvas, 42 x 42 inches

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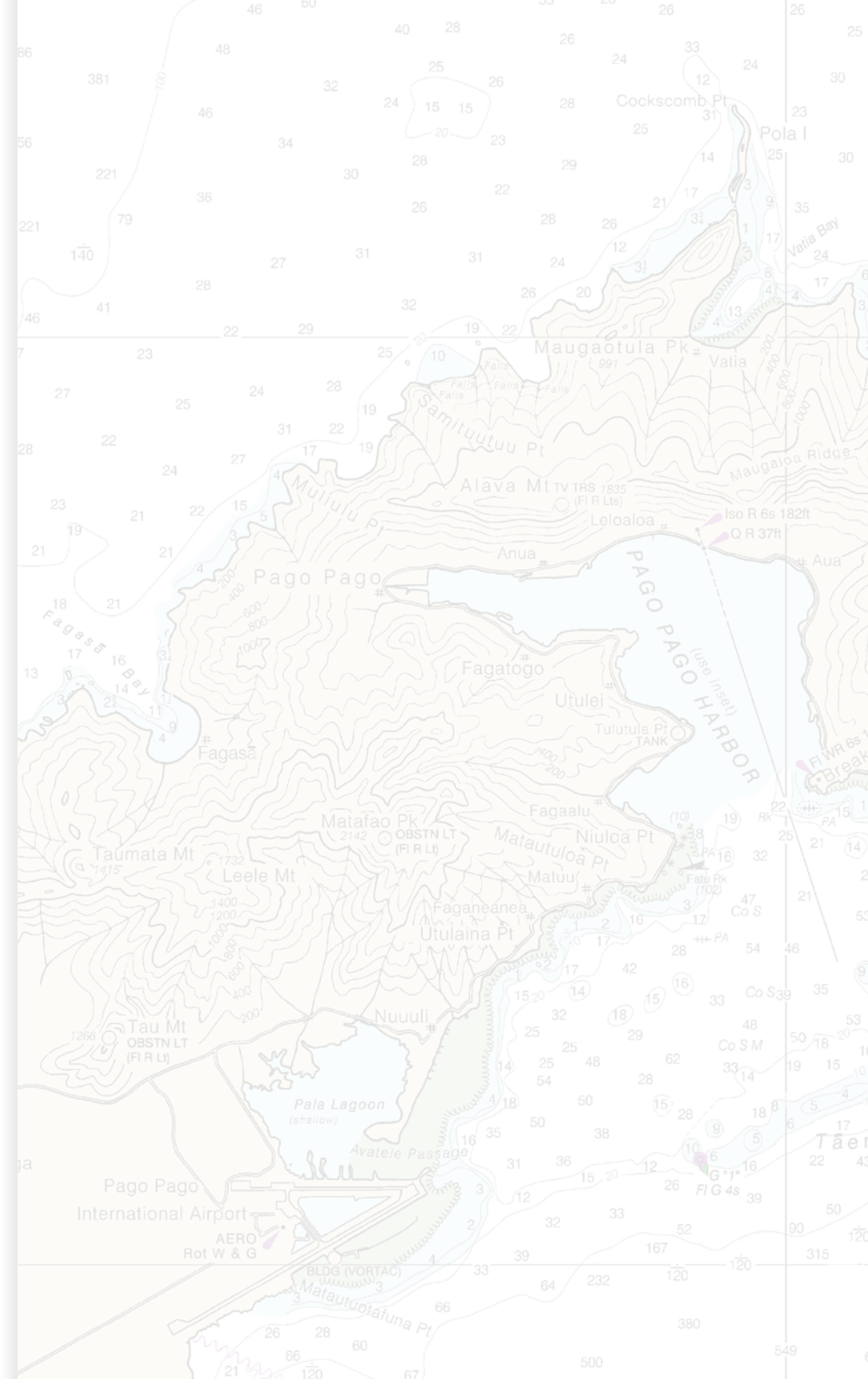
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Diane Burko on Kronebreen Glacier, Svalbard, 2013
Photo: Jack Kohler



