

How we Made “The Melting of Antarctica”

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FOR OVER 120 YEARS, *National Geographic* magazine has been mapping Antarctica, maintaining a commitment to visually illustrating the complex processes that occur on this remote continent. The National Geographic Society’s interest in Antarctica began in 1892, when it sent a small team of scientists to the southern continent to build on previous work by other explorers: Álvaro de Mendaña in 1567, Anthony de la Roché in 1672, and James Cook in 1772. Four steam whalers set off from Dundee in Scotland—an expedition that would result in *National Geographic*’s first map of Antarctica, by Dr. James Murray (Figure 1). This hand-drawn map was the first of over 50

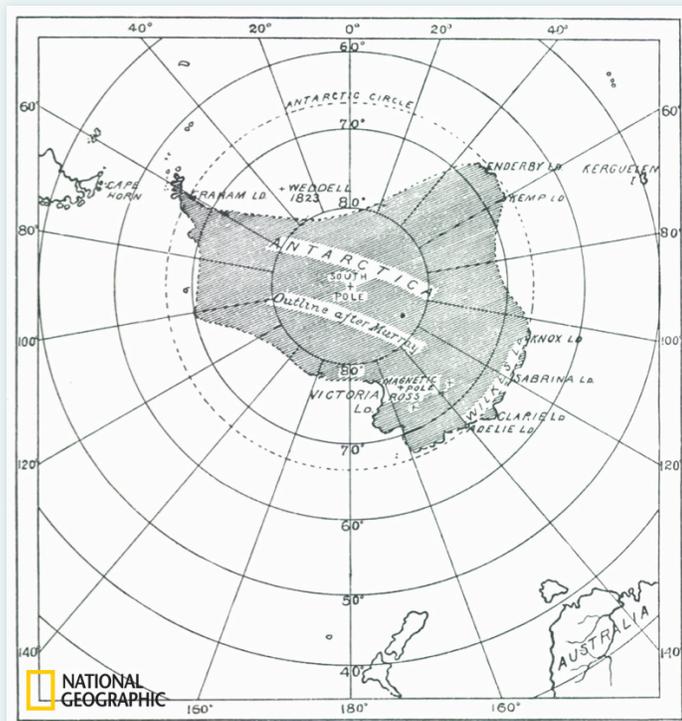


Figure 1. “The Antarctic Continent,” December 1894.

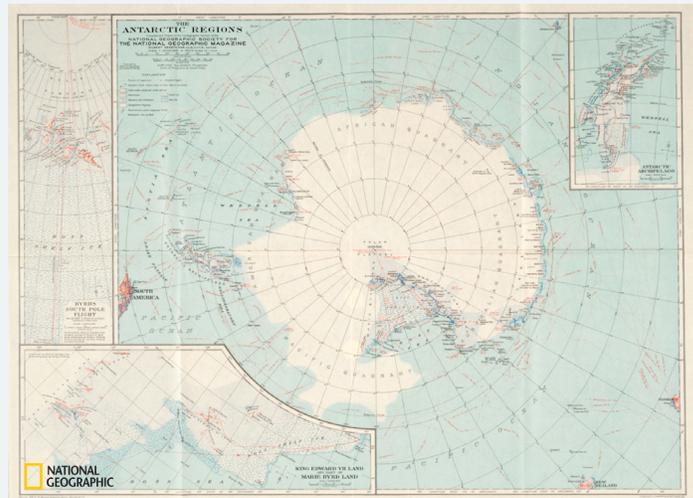


Figure 2. “The Antarctic Regions,” October 1932.

maps of Antarctica and the Arctic to be featured in the magazine—making the poles one of *National Geographic*’s most heavily mapped geographies.

National Geographic’s first supplement map of Antarctica was featured in the October 1932 issue (Figure 2), and shows the significant progress that had been made charting the coastline since Murray’s attempt 40 years prior. State of the art cameras brought unprecedented images of the great southern continent.

Among other excellent efforts in the following decades, in November 1971 the magazine published a single-page map with hand-drawn relief, with a perspective looking down the Antarctic Peninsula to the South Shetland Islands (Figure 3).

More recently, in September 2011, cartographers Ginny Mason and Stephen Tyson mapped Robert F. Scott and Roald Amundsen's expeditions to the South Pole in 1911–12 (Figure 4). The colors, texturing, and perspective truly place the reader in the frigid, harsh landscape alongside the explorers.

Today, the mapping tradition continues, with *National Geographic* actively pursuing its interest in Antarctica. In 2017, while at the magazine, I worked with senior graphics editor Jason Treat, and freelancer Stephen Tyson to create latest the installment of *National Geographic's* Antarctic maps, highlighting the impact of climate change on the continent (Figure 5).



Figure 3. "Antarctic Peninsula," November 1971.

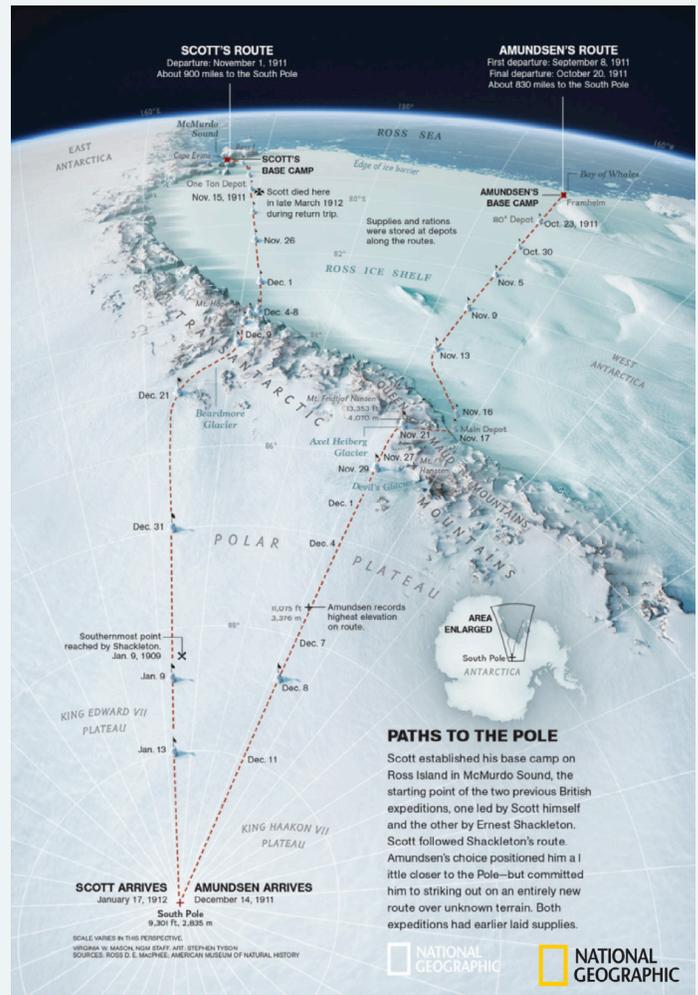


Figure 4. "Paths to the Pole," September 2011.

MAKING THE MAP

The creative process in the *National Geographic* magazine maps and graphics department involves an intensive process of multiple critiques, edits, adjustments, and tweaks over the course of weeks or months. And it all starts with a sketch. In January 2017, I drew up my first brainstorming sketch for our Antarctica map, to be published in the July issue of that same year. I remember making it during a meeting for another story I was working on (a map of the black-crested macaque's habitats on the island of Sulawesi in Indonesia—worlds away from Antarctica), with the sketch buried amongst the meeting notes. It's not the prettiest, but even the roughest sketch is critical to getting into the creative mindset needed to begin a project before getting locked down in the software.

I drafted several ideas, starting with a traditional top-down representation, then breaking apart the continent



Figure 5. "The Melting of Antarctica," July 2017.

into two separate maps to experiment with explaining the dynamics of western vs. eastern Antarctica, and then experimenting with this method in perspective view for both sides of the continent.

These early options (Figure 6) were drafted to fit a full spread (about 10 by 12.5 inches), until we tried our luck drafting a double-gatefold spread (Figure 7) to pitch to

our directors (for context, a double-gatefold is about 10 inches high and about 25 inches wide). This is not the sort of space that we frequently get for maps and graphics in the magazine. I began penciling a full-blown, perspective map of Antarctica that featured the full continent.

The directors loved the idea, and we got approval to move forward with the double-gatefold spread for the map.

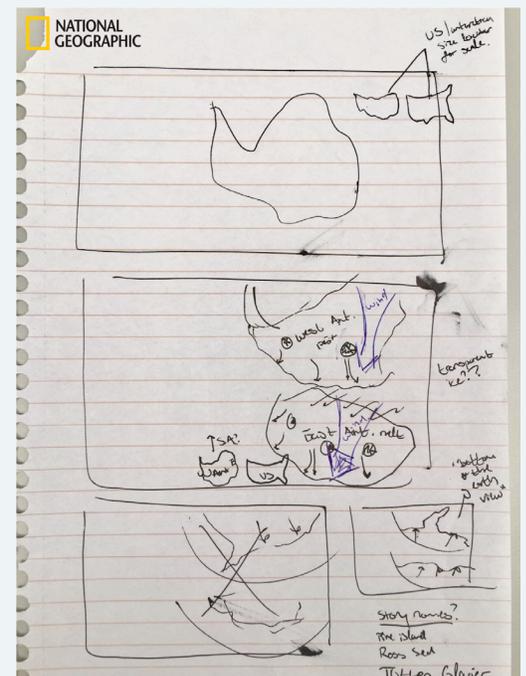
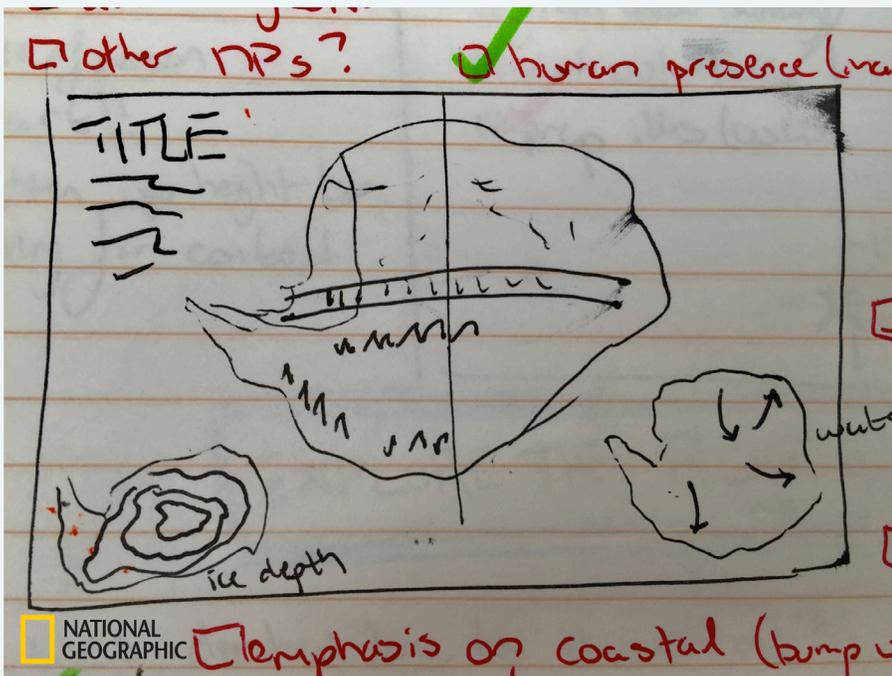


Figure 6. First (left) and second (right) rough sketches of "The Melting of Antarctica."

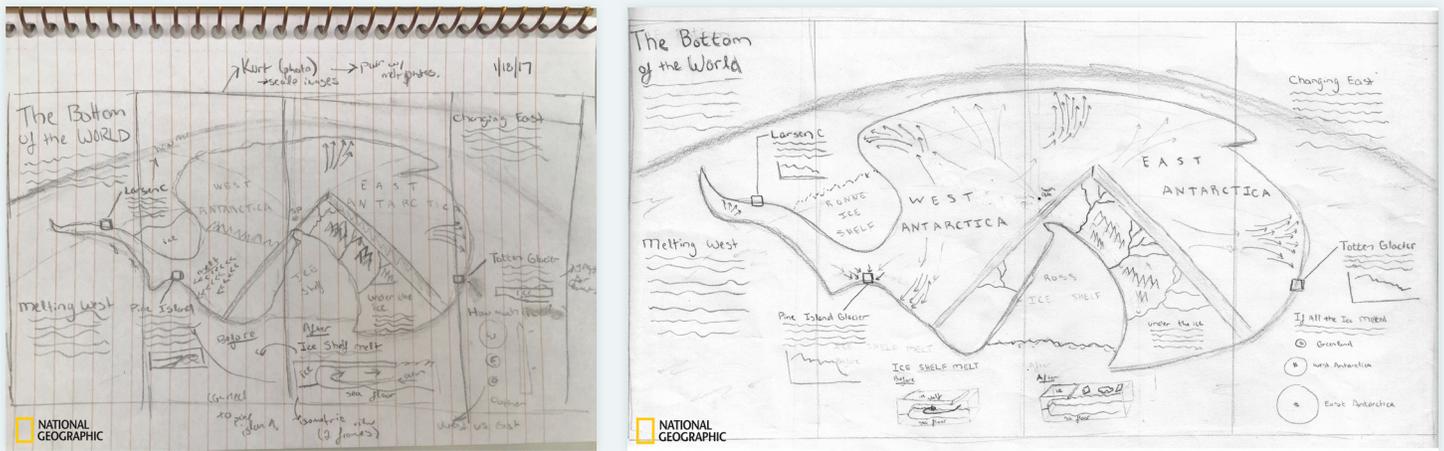


Figure 7. Initial sketches of a full double-fold layout.

Along with our layout, we also got approval for our main thematic elements. The four thematic goals of the map were to:

- compare the western and eastern sides of the continent, and how one is changing more rapidly than the other;
- demonstrate that ice is constantly on the move (referred to as “ice velocity”) on the continent, and how some places have been speeding up more than others due to climate change;
- illustrate what’s going on under the ice (subglacial rivers and lakes); and
- highlight how warming waters are changing the dynamics of the ice shelves that hold back the glacial ice on the continent.

With the layout and proposed thematic elements approved, we jumped into the software. I worked on the main map for the piece with Stephen, who used Maya to render the base map elements and Adobe Photoshop to fine-tune the 3D rendering. Our first step was to figure out which angle would communicate the vastness of the continent, and figure out the appropriate shape for the under-the-ice cutout. The early drafts, which were in greyscale, were commonly referred to by our creative director as “Death Star renderings” (Figure 8).

Once we got the angle of the perspective approved, we began to add color, draft the map notes, add small explainer graphics, and experiment with the locator map. My colleague Jason added graphics along the bottom of the spread, including a graphic of the Statue of Liberty to illustrate how much sea level would rise if all of the ice

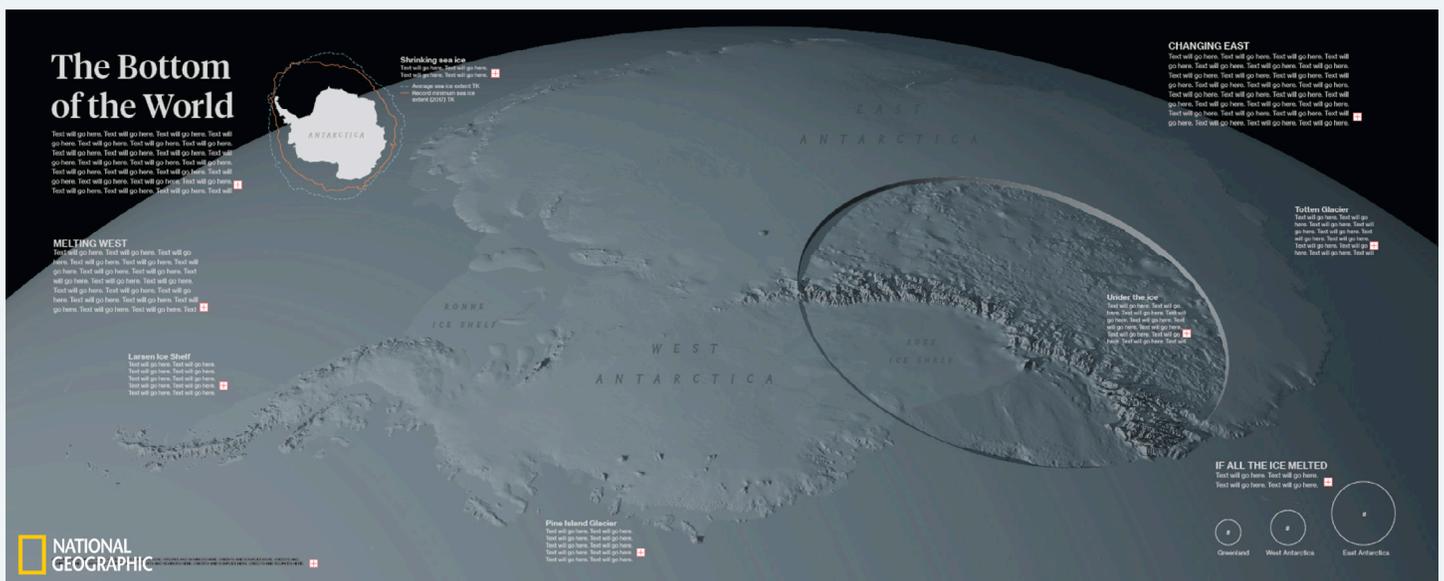


Figure 8. First render done in Maya.



Figure 9. Adjusting the thematic components of the map in Photoshop and Illustrator.

on Antarctica were to melt—this provided context for the sheer quantity of ice on the continent (Figure 9). I also began to experiment with how to visualize the ice flow velocity, trying my luck with some colored arrows (spoiler alert: it didn't pan out).

We experimented with rendering the sea ice surrounding the continent, which, while beautifully depicted, made the map very busy and crowded (Figure 10). We also reminded ourselves at this stage that the goal of the map was not to recreate the entire landscape of Antarctica. The goal was to give a window into the dynamics of climate change on the continent, and to do this we needed to stay more on

the “graphics” side of the spectrum, rather than the “rendering” side.

We opted for a line and slight tint boundary to give the extent of the sea ice. We expanded the locator map to show the average sea ice extent and the record low sea ice extent, which cleared space on the main map for the map notes and graphic elements and boosted the usefulness of the locator map.

To reach the final product we continued to fine-tune the map labels, graphics, and notes. The title went through three different versions, and we simplified the Statue of



Figure 10. The addition of sea ice caused the map to feel crowded.

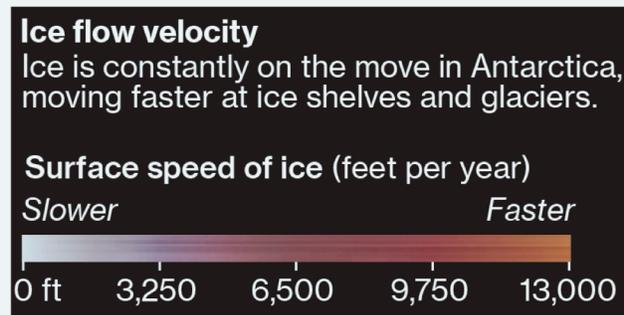
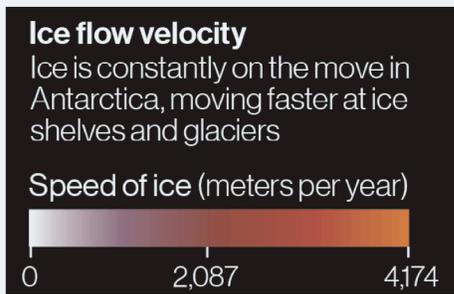
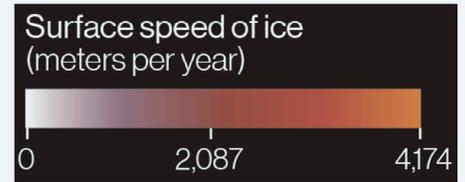
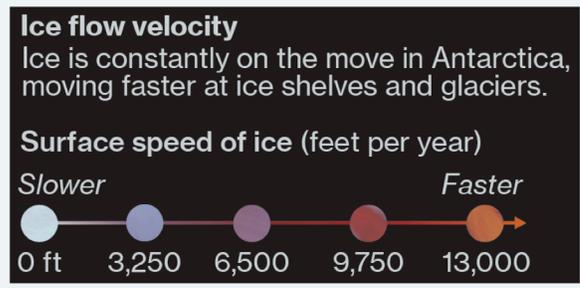


Figure 11. Examples of different iterations of the ice flow velocity key.

Liberty graphic to match the overall feel of the map. We blended the map labels in with the landscape, adjusted the lighting and shadows to emphasize volume of the ice, and adjusted the final purple-red-orange color ramp for the ice flow velocity.

ADJUSTING THE DETAILS

Each tweak, adjustment, and content change made a difference in creating the final piece. Some map elements went through many more iterations than others, including the map key and the arrows to emphasize ice flow velocity.

The key for the ice flow velocity went through many, many iterations (Figure 11; I estimate that we made 10 different versions). We began with a categorical version, and eventually evolved to a continuous ramp to emphasize the flowing nature of ice on Antarctica. As a final touch, we added the same streaking texture that appeared on the map to further drive home the connection between key and map.

For representing the ice flow velocity, we weren't fully confident that the streaking texture/effect alone would emphasize the movement of the ice, so we experimented with arrows on the edges of the ice shelves, where ice flows

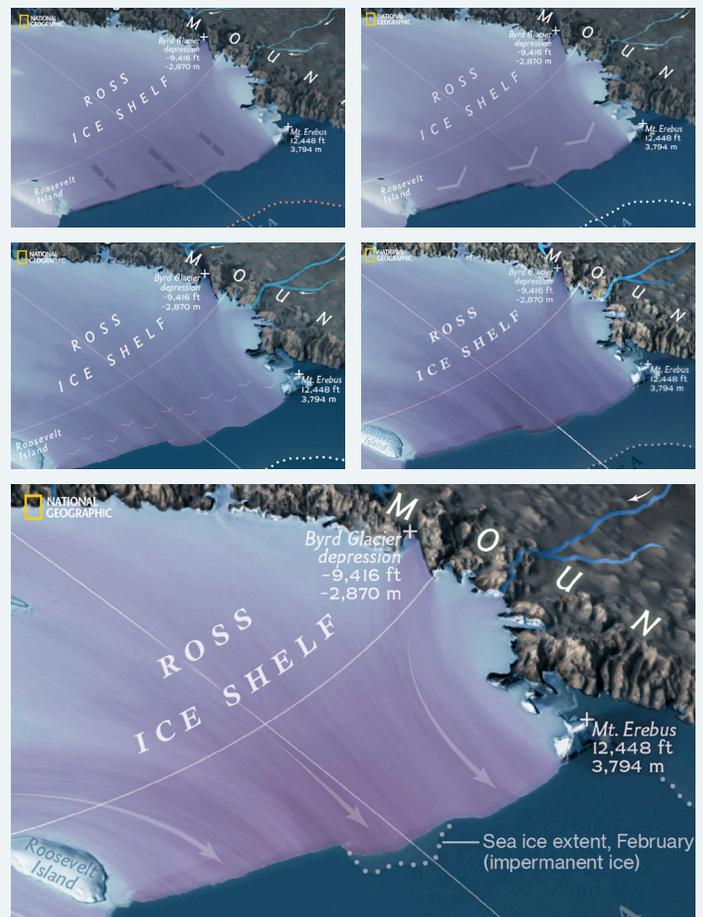


Figure 12. Examples of different arrows to indicate movement of ice along the shelves.

the fastest. We tried many varying versions: blocky arrows, blocky chevron arrows, big chevrons, lots of little chevrons, a brief period of no arrows, and then settled on a delicate, tapered arrow to subtly emphasize the flowing nature of the ice (Figure 12).

LOOKING TO THE PAST

We drew a lot of inspiration from historical *National Geographic* magazine maps of Antarctica and the Arctic. One of my favorite historical touches that made it into our map was the “golf flag” for the South Pole, inspired by an illustrated map of Greenland, published in the January 1956 edition of the magazine (Figure 13), and encouraged by the Director of Cartography at the time, Damien Saunder.

We also drew from the past for examples of cutaways at the poles, particularly a map of the route of the submarine USS *Skate* from the July 1959 issue (Figure 14), to explain

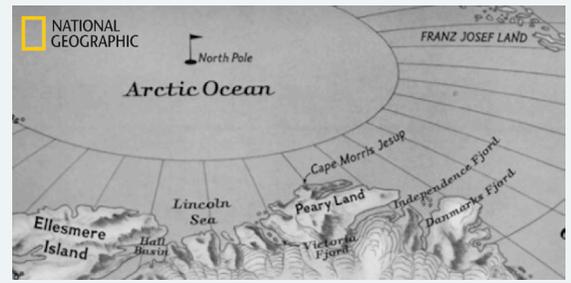


Figure 13. A map of Greenland from the January 1956 issue was inspiration for the golf flag symbol for the South Pole.

what lies beneath the ice. This proved pivotal for representing the flow of water below the ice on Antarctica.

Through the process of looking to the past for inspiration we also saw that some of our ideas that we believed to be original had actually already been done in the past. For

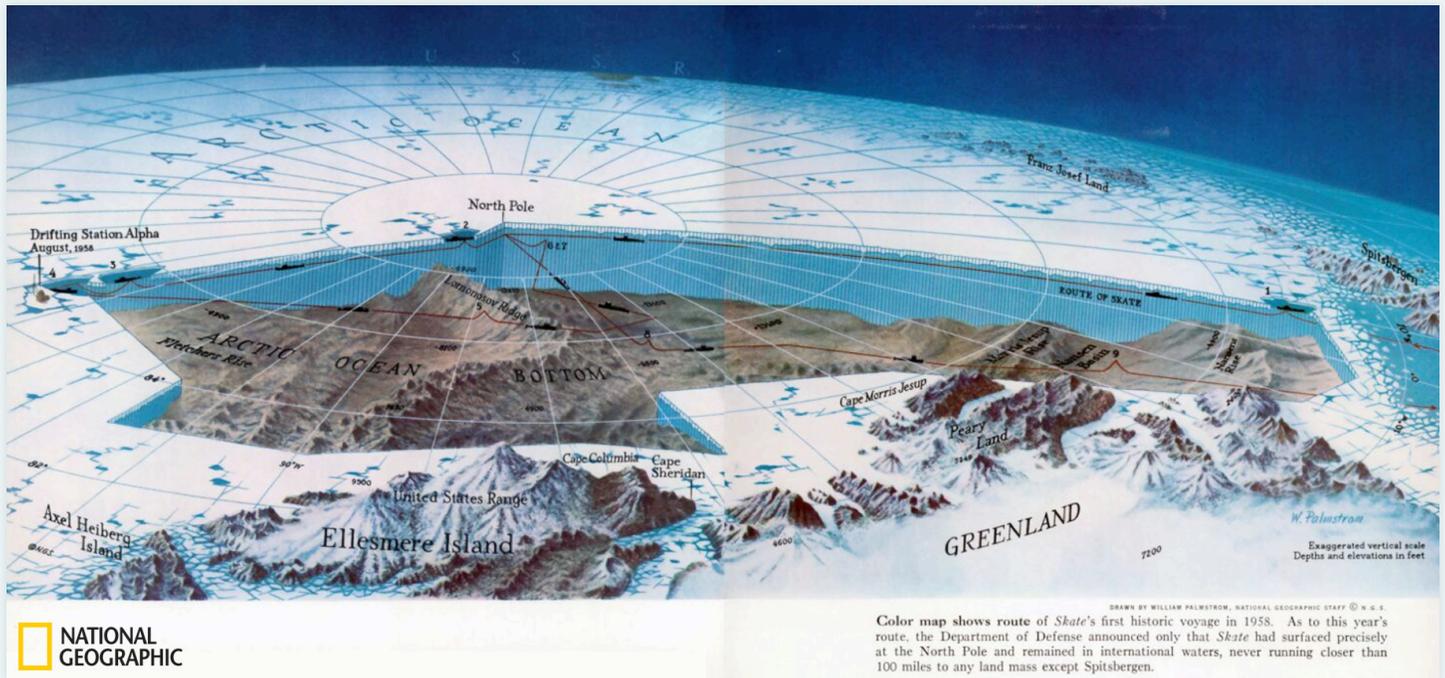


Figure 14. This “below the ice” map from the July 1959 issue was inspiration for the cutaway on “The Melting of Antarctica.”

example, our perspective view of Antarctica was not the first time the whole continent of Antarctica had been featured in perspective in the magazine (Figure 15).

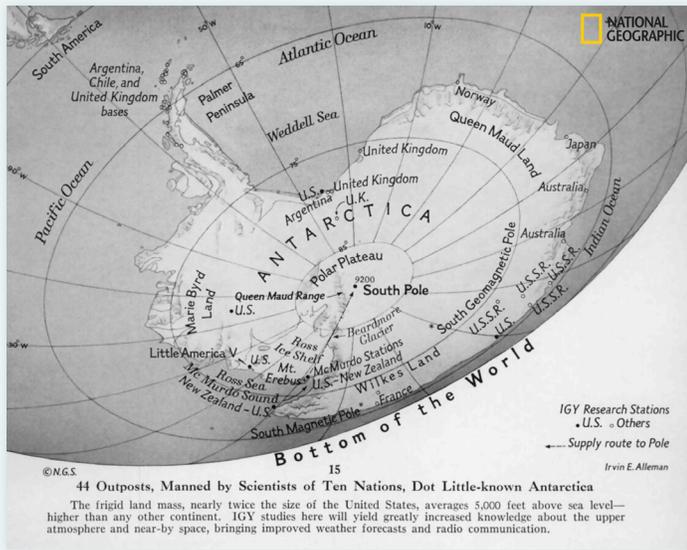


Figure 15. Another instance when Antarctica was portrayed in perspective view was in this July 1957 map of scientific outposts in *National Geographic*.

REACHING A DIGITAL AUDIENCE

After months of research, proof of concept tests, drafting, data wrangling, and designing, we sent the final version of the map to the printers, approximately two months before it would arrive at newsstands. We then turned our focus to the digital representation of “The Melting of Antarctica.”

Jason sketched out the first storyboard sketch for the digital component to be flexible as either an interactive digital rollout or a video (Figure 16). After much discussion, we decided to go with a video. We wanted to try something different from the more common interactive projects in order to effectively translate a 25-inch-wide print piece to mobile.

For the video Jason and I teamed up with filmmaker Hans Weise and animator Jennifer Smart. We used renderings done by Charles Preppernau for the title and closing scenes. One of the biggest challenges of the digital version was staying true to the look and feel of the original print piece. We created all new maps and I styled them to match Stephen’s texturing and lighting from the print

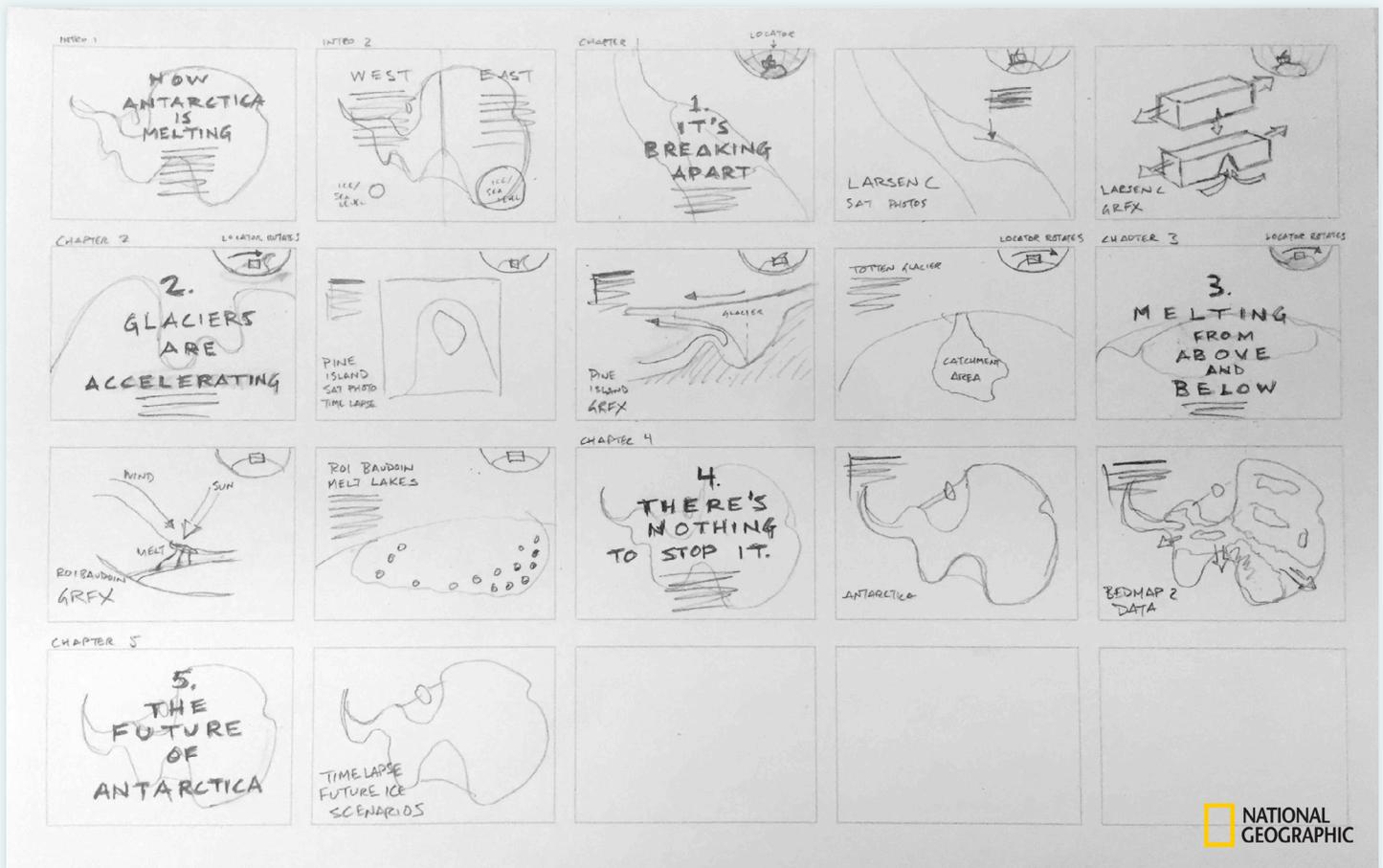


Figure 16. Initial storyboard sketch for the digital version of “The Melting of Antarctica.”

piece. These new maps were needed for the video so that they could be used multiple times to communicate the different thematic elements and place the viewer at particular locations at different times in the video.

To generate the hillshade for this new map, I used the open source program Pyramid Shader (terraincartography.com/PyramidShader). I exported several different hillshades with different levels of generalization and slightly different sun angles. This gave the ice on the top-down map a greater sense of volume.

I brought the hillshade layers into Photoshop and used some tricks from Tom Patterson’s illuminated shaded relief tutorial (shadedrelief.com/illumination) to build the

relief for the map. I overlaid this on top of a satellite image of the continent, and adjusted layer transparency settings to get a final product that matched the feel of the original print version (Figure 17).

The final design of “The Melting of Antarctica,” in both print and digital forms, required months of extensive fine-tuning of the map and graphic elements, as well as the incorporation of cartographic elements that drew from historic *National Geographic* maps of Antarctica, tying the map more closely with its predecessors. From initial concept to final design, it took over six months of planning, research, layout alteration, and cartographic fine-tuning to accurately communicate the effects of climate change at the bottom of the world.



Figure 17. Scenes from the final video version of “The Melting of Antarctica.”

“THE MELTING OF ANTARCTICA”

Click to watch the full video of “The Melting of Antarctica.”

WATCH LAUREN'S PRESENTATION

Click to watch Lauren's NACIS 2017 presentation on the making of “The Melting of Antarctica.”