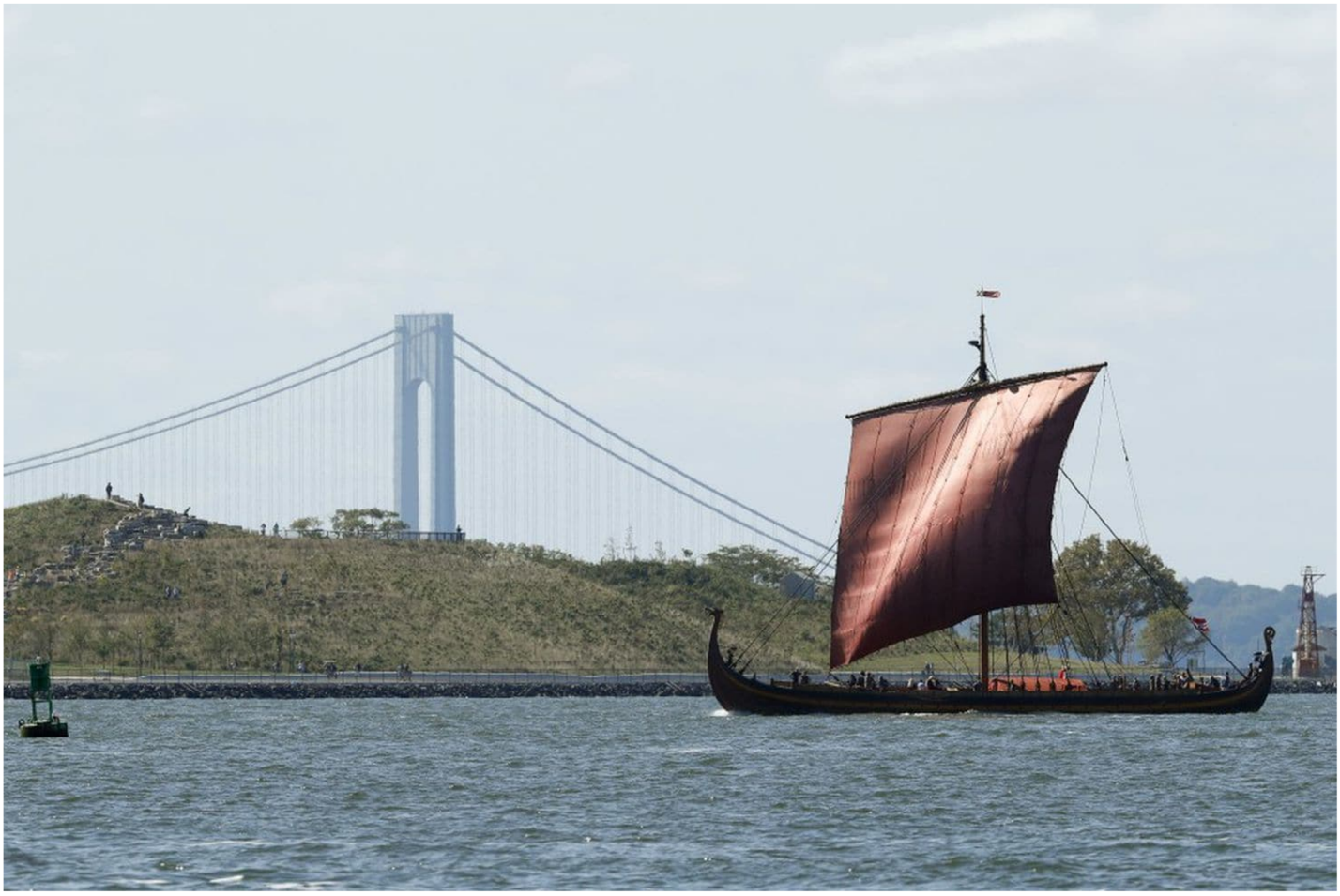
The Washington Post
Democracy Dies in Darkness

Speaking of Science

# Vikings may have used crystals to navigate across the Atlantic

By Ben Guarino Email the author
April 4 at 10:42 AM



A Norwegian Viking boat, Draken Harald Haarfagre, sails through the New York harbor in 2016. (Mary Altaffer/AP)

Before Google Maps and GPS, before knowledge of magnetic compasses traveled from China to Europe, Viking sailors journeyed across the North Atlantic. A thousand years ago, the trip between Norway and Greenland by longboat took about three weeks. Viking navigators used shadows cast by a sun compass, a ring with a central fin like a sun dial's, to identify geographic north.

But such compasses work only when the sun shines, not on foggy or cloudy days. In 1967, Danish archaeologist Thorkild Ramskou proposed that the Vikings had a backup tool for navigation. Perhaps, he suggested, they tracked the sun through the clouds using chunks of crystal called sunstones.

Sunstones sound wild, even mystical. But two optics researchers, Dénes Száz and Gábor Horváth at Budapest's Eotvos Lorand University, calculated that the Vikings could have used sunstones to orient their ships on the long voyage to Greenland.

The sunstone trick hinges on a property of sunlight called polarization. Polarization simply means that the light has a non-random orientation. When sunlight travels through the atmosphere, it forms polarized rings, with the sun at the center like a bull's eye.

Animals such as fish and migratory birds are able to detect the polarization of the sun's rays and use it to navigate. Human eyes, though, need help. Crystals like calcite, also called Iceland spar, can reveal the direction of polarization, a bit like a prism that reveals the rainbow within white light.

“Rotating such a crystal in front of our eyes to and fro, the intensity of skylight transmitted through the crystal changes periodically,” Horváth said. Put another way, the sunstone brightens as it aligns with polarized skylight, even on cloudy days. When the sunstone is brightest, the crystal points at the sun, allowing a theoretical Viking ship to get its bearings.

Archaeological evidence that Vikings actually used sunstones is scant. In 2013, a crystal of Iceland spar was found amid the wreckage of a British ship that sank in 1592. “This raised the possibility that the sky-polarimetric navigation method might have been used still, even in the 16th century,” Horváth said.

Much older Viking legends, like the “The Saga of King Olaf,” refer to navigation by sólarsteinn — a sunstone. And the theory holds up in experimental tests: A physicist named Guy Ropars, at France's University of Rennes 1, built a sunstone device and used it to find the location of the sun to within 1 percent of the sky, Science magazine reported in 2011.

The most recent work by Horváth and Száz gauged the success of a Viking ship navigating from Norway to Greenland by sunstone. They simulated a Viking boat that sailed beneath a sky with randomly changing meteorological conditions. The scientists modeled the properties of sunstone crystals based on laboratory tests and planetarium experiments, Horváth said.

After running the simulation 36,000 times, they concluded that a sunstone could guide Vikings through fog and clouds, as long as a navigator identified the sun once per three hours. Given that time frame, “the navigation success was very high,” Horváth said — between 80 and 100 percent, as the scientists reported Wednesday in the journal Royal Society Open Science. If the simulated Vikings used calcite sunstones once every four hours or more, they missed Greenland and sailed all the way to Canada.

A lot of uncertainty surrounds this model. “Nobody knows what the Vikings' navigation practices were,” Horváth said. He suspects they overestimated the success rate. The researchers assumed no strong winds or storms blew the ships off course and that the Viking ships didn't drift away at night. And other navigation techniques could have aided the Vikings, too, Horváth pointed out. Early sailors were keen observers, monitoring wave patterns, familiar islands and even the paths of migrating whales.

**Read more:**

Wonder Woman lived: Viking warrior skeleton identified as female, 128 years after its discovery

A hiker stumbled upon a millennium-old Viking sword

This tree might be the oldest living thing in Europe

Ben Guarino is a reporter for The Washington Post’s Speaking of Science section. Before joining The Post in 2016, he worked as a freelance science journalist, an associate editor at the Dodo and a medical reporter at the McMahon Group. He also has a background in bioengineering.
Follow @bbguari

**Most Read**

1 Twin sisters known for battle with debilitating OCD die in possible ‘suicide pact’

2 China fires back at Trump with the threat of tariffs on 106 U.S. products, including soybeans

3 YouTube shooting suspect was angry with the company, police say