A millennium ago, Viking navigators may have used crystals known as “sunstones” to navigate between Norway and settlements in Greenland.
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Viking seafarers may have navigated with legendary crystals

By **Sid Perkins** | Apr. 3, 2018 , 7:01 PM

For centuries, Viking seafarers ruled the North Atlantic, braving open seas peppered with icebergs to travel thousands of kilometers to their colonies in Iceland and Greenland—all without compasses. How they performed such a feat, especially given the region’s heavy clouds and fog, has long puzzled scientists. Now, one group of researchers has an answer, based on computer simulations—and legendary crystals.

For decades, researchers have suggested that enigmatic “sunstones” mentioned in Viking tales such as “The Saga of King Olaf” were the key to navigating under less-than-sunny skies. The sunstones of legend could identify the sun’s location even if it was occluded by clouds; however, no such stones have been found in the handful of Viking shipwrecks that exist. “This is all speculation, really,” says Stephen Harding, a biochemist at the University of Nottingham in the United Kingdom who wasn’t involved in the new study. But he notes that possible evidence of sunstones exists—including a rough, whitish crystal found near other navigational aids in a 16th century English shipwreck. It’s not unreasonable, he adds, that English sailors learned navigational tricks from the Vikings, who plied the same waters and raided the British Isles centuries earlier.

Navigating with crystals isn’t necessarily New Age hooey. Several types of minerals—especially ultrapure crystals of calcite, cordierite, and tourmaline—can split a beam of sunlight to form two images, with polarized light taking a slightly different path than the main beam. By looking at the sky through such a crystal and then rotating it so the two images are equally bright, it’s possible to spot **the rings of polarized light that surround the sun**, even under cloudy skies. Identifying the sun’s location would give mariners a sure point of reference during long sea journeys.

But could such a technique work in practice? Previous studies **suggest the answer is yes**, says Gábor Horváth, a biophysicist at Eötvös Loránd University in Budapest. Now, he and university colleague Dénes Száz have built on those studies by incorporating the data into computer simulations of voyages between Bergen, Norway, and the Viking settlement of Hvarf, on Greenland's southeastern coast. Such a voyage is a straight shot westward and would take about 3 weeks of daytime sailing at typical Viking ship speeds (which, for the uninformed, is about 11 kilometers per hour).

The team simulated 3600 voyages taken during the spring equinox, the presumed start of the open seas travel season, and the summer solstice, the longest day of the northern year. Otherwise, the simulations varied only by three factors: The amount of cloud coverage (which varied over the course of the day), the type of crystal used as the sunstone, and how often mariners consulted them. Each time a navigator made reference to a sunstone, the simulated ship adjusted its course if needed.

Crystals of calcite, like this one, may have been the "sunstones" of Viking legend that enabled these seafarers to successfully navigate lengthy voyages. ARNIEIN/WIKIMEDIA COMMONS (**CC BY-SA 3.0**)

When navigators took readings every 4 hours, their ships reached Greenland between 32% and 59% of the time. Readings every 5 or 6 hours meant the ship had a dramatically poorer chance of making landfall. But for voyages on which the seafarers took sunstone readings at intervals of 3 hours or less, **ships made landfall between 92% and 100% of the time**, the researchers report today in *Royal Society Open Science.* In addition to the frequency of readings, key to a successful journey was using the sunstone for an equal number of morning and afternoon readings, the researchers say. (That's because morning readings can

cause a ship to veer too far northward and afternoon readings can cause it to veer too far southward, sometimes missing Greenland altogether.)

All three types of crystals that the team studied—calcite, a form of calcium carbonate; cordierite, an iron- and magnesium-rich silicate; and tourmaline, a boron-rich silicate—worked well at intervals of 3 hours or less. Cordierite scored a perfect record of successful voyages. But when readings were taken at intervals of 5 and 6 hours, calcite, a mineral well-known to the Vikings as "Icelandic spar," performed slightly worse than the other two stones.

Nevertheless, in the dangerous seas of the North Atlantic, such a tool would have been invaluable. "The Vikings were fantastic boatbuilders," Harding says. "But if you got lost, you died." Ironically, some researchers have suggested that Viking explorers that ended up passing south of Greenland discovered America long before Columbus did.

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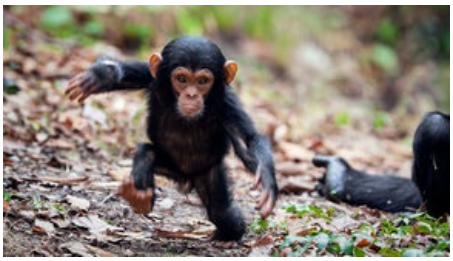

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