

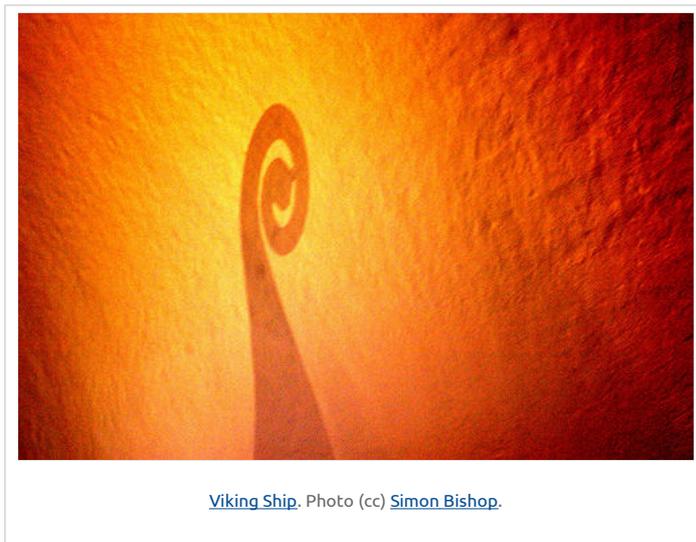
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HOW TO NAVIGATE A VIKING LONGBOAT WITH A KING, SOME BEES AND A DC-8

By ALUN | Published: 1ST OF FEBRUARY, 2011



[Viking Ship](#). Photo (cc) [Simon Bishop](#).

Jo Marchant has reported on a new paper, [On the trail of Vikings with polarized skylight: experimental study of the atmospheric optical prerequisites allowing polarimetric navigation by Viking seafarers](#), for [Nature news](#). She also [adds more on her own blog](#) including the link to the paper that you can access for free.

The research is part of an ongoing project by a collective of scientists to see if the Vikings could have navigated the Atlantic in cloudy weather using polarised light viewed through crystals. There is no doubt that the Vikings were master navigators, the difficulty is how did they navigate?

If the sun is visible then they could have used a [solar compass](#). This is a bit like a sundial. You make a wooden disc with a gnomon sticking up out of it. Then you scratch out a line showing where the edge of the gnomon shadow reaches during the day. Where it's shortest is south and the opposite direction is north. Now, when you go sailing the next day, you float it in a small tub of water – to make sure it's horizontal – and then look at the shadow, when you turn the disc so the shadow matches the line you can work out where north is. It does mean knowing morning from afternoon, so that's a problem round noon if you're not careful, but there error would not be huge. It wouldn't work for weeks on end, because the path of the Sun would move in the sky, but it would be good for a month around midsummer. At least if there's no cloud. That's not always the case in the North Atlantic. Storms and fog are common and if there's neither of those then there's often cloud.

Horváth *et al.* have been following the tale of the sunstone, that gets a brief mention in

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a saga I can't identify In the saga the Sun is obscured by cloud. Sigurd identifies the location of the sun by means unknown and Olaf, the king, uses a sunstone by an unknown method to confirm he's right. I cannot tell you why it was necessary to navigate immediately, nor what role the sunstone plays in the saga. If it's mentioned in a way similar to sails or rigging, we could say that it's probably standard equipment for sailing. On the other hand if the sunstones are gifts from islanders then maybe checking a sunstone is like recalibrating the sensor array in Star Trek, a meaningless action that allows the story to move on without really resolving anything. I don't even know, from the bit of the saga quoted, if the sunstone was used on a ship. There's no real discussion of historical context, which is a concern for anyone interested in Viking navigation for historical reasons.

The appearance of the stone in the saga is one of three justifications for their use. The authors have others. At this point I implore you to read the article yourself after this post, because this next bit must surely be over-simplifying their argument.

Horváth *et al.* say another reason for believing sunstones were used is that Scandinavian pilots in DC-8s in the mid-20th century used a sky compass developed for the US Air Force to track the polarisation of light. How convincing you find this as an argument depends on similar you link a Viking crystal and a piece of 1940s scientific equipment is. The third argument is simply too subtle for me to follow so I'll quote it in full.

The third argument for sky-polarimetric navigation by Vikings is related with the discovery of Frisch [4], that honeybees (Apis mellifera) are sensitive to polarized light and use the direction of skylight polarization for navigation, when the Sun is hidden by clouds, but some clear regions of the sky are still visible. A similar capacity to detect polarization patterns and orient by means of sky polarization was later found in many other arthropod species [5].

I can see how it shows polarised light is real, but I don't think that's disputed. To me saying *bees can see polarised light therefore Vikings used equipment to see polarised light* is like saying *bees can hover therefore Vikings could have used hover packs to rise above the ship and see further into the distance*. I must be missing something painfully simple and obvious, but I can't see what. Please feel free to tell me what it is in the comments below. It's baffling me.

What I liked about the paper was that beyond this, they also tackled some criticisms of the sunstone hypothesis. Roslund & Beckman (1994) have argued that sunstones aren't necessary in partly cloudfree skies and that people could have located the Sun by observation. The obvious thing to do is some sort of a test and they refer back to a test by Barta, Horváth & Meyer-Rochow in 2005 to see if people could do this. They showed people fish-eye photos on a monitor under various conditions and asked people to say where they thought the Sun was like a game of Spot the Ball.

Unsurprisingly they found it's easier to see where the Sun is in clear skies. In the cloudiest skies the range of guesses varied more, which you'd also expect. They report the maximum range of guesses varied between 8.1° and 162.9°.

That is unexpected.

That last result, 162.9°, bothers me a lot. I have no doubt it's real and what they measured. It's possible to do this on a monitor because you see all the sky at once, but the sky is immersive. If you go outside you're unlikely to see the whole sky. You'll see the direction you're facing, but some it will be behind you.

It's also temporally immersive. If you're sailing then you're under the sky from sunrise to sunset. You might see the sun in the morning and if you do, you won't be looking in

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WHAT I'M LOOKING AT

[Psychophysical study of the visual sun location in pictures of cloudy and twilight skies inspired by Viking navigation](#) 31st of January, 2011

Journal of the Optical Society of America A (2005). Volume: 22, Issue: 6. Pages: 1023. András Barta, Gábor Horváth, Victor Benno Meyer-Rochow et al. In the late 1960s it was hypothesized that Vikings had been able to navigate the open seas, even when the sun was occluded by clouds or below the sea horizon, by using the angle of polarization of skylight. To do [...]

[Disputing Viking navigation by polarized skylight](#) 31st of January, 2011

Applied Optics (1994). Volume: 33, Issue: 21. Pages: 4754-4755. Curt Roslund, Claes Beckman et al. The widely held notion that the Vikings utilized polarization of skylight on overcast days for navigational purposes is demonstrated to have no scientific basis. The use of polarized skylight for navigation under partly cloudfree skies should be treated with cau [...]

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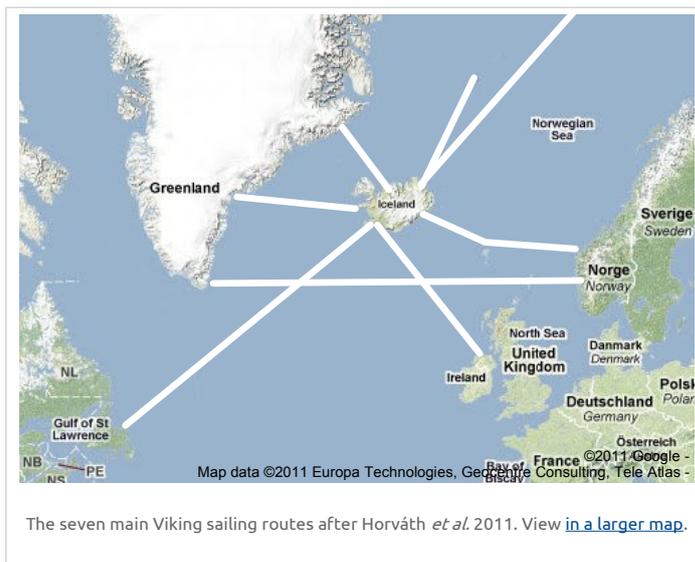
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that direction if you want to see the sun set in the evening. The photos given to the test subjects were snapshots, not sequences. This gives you more information if you want to see the direction of the Sun. If you've been out all day under the sky are you going to argue over whether the Sun is in the east or the west? That's what an error of 162.9° implies to me.

It's possible that it's a heavy cloud day in the morning, with the chance of rain in the afternoon. You won't see the Sun then, but your sunstone might also have a problem. The polarisation of light still happens in cloudy or foggy days, but the light reaching your eye is reduced. You don't just need polarisation to happen, you need enough polarised light to see it by. The paper reports this isn't likely in heavy overcast skies, but it could work in fog – if the fog is directly lit by the Sun.

Jo Marchant's blog post adds more to this [with Susanne Åkesson saying that actually the difference can be seen](#). To some extent there's an argument about how much light you need, but I'm willing to give Åkesson the benefit of the doubt on this. I don't know if I could see it, but using one of these stone is not going to be a trivial skill. Navigators would have much more experience and be much more sensitive to changes than someone picking it up for the first time. How much difference this would make I can't say because of lack of historical evidence.

It's this lack of historical evidence that bothers me. The paper is largely ahistorical, which is odd for a paper that really only has historical relevance. The purpose of the history seems to be to justify talking about light polarisation, and sometimes this simply doesn't work.



The map of major routes, shows the Iceland to Svalbard and Iceland to Newfoundland routes as 'main sailing routes'. It ignores the North Sea, which the Vikings regularly crossed and is prone to fog, perfect sunstone weather. There's reason to believe that Svalbard was visited by the Vikings, though some references might be confused with Jan Mayen but I'd be amazed if it was one of the seven main routes sailed by Vikings. I can't see what the source for this is or why it's there apart from to draw long lines over the sea.

Horváth *et al.* have a difficult task. There's no archaeological evidence for sunstone use and there might not be for many years. If you want to make a case that the stones were used in navigation you'll want to find one on a ship. The most likely place to find Viking ships is at the bottom of the sea. Prospecting for shipwrecks in the ocean is not going to be an easy in the foreseeable future.

Having read the paper I feel like I'm out of step with everyone else. While writing this [NewScientist have put up a story saying that there's more evidence in favour of the sunstone hypothesis](#). I think they could be used as a tool of last resort, like when a ship is fogbound. I liked that they made a serious effort to tackle criticisms, but I found their dismissal of Roslund & Beckman's argument against use under *partially cloudy* skies unconvincing, and it seems there's doubts if they can work in fully overcast conditions. Given how historically weak the idea is, I'm not sure how relevant the *possibility* they could have been used is. Impossibility would rule sunstones out, but there's plenty of possible things that could have happened that didn't.

Reading the paper actually made me less convinced about their use. I've gone from thinking that it's an interesting proposal to thinking that even if it was possible there's no reason to believe sunstones a regular part of the navigational equipment used on voyages. Maybe that's why Sigurd didn't think to use one. Perhaps they were royal trinkets.

UPDATE AT MIDDAY:

Thanks to tweets from Jo Marchant (@JoMarchant) and Rebekah Higgitt (@beckyfh) I'm now making a bit more sense of this paper. My biggest mistake has been to read this as if it's a history paper about what happened in the past. If you try reading it as using history as a starting point to think about what might be, then it makes a bit more sense. Think of it as "A paper about the possibility of using sunstones for navigation" with the Viking saga as the reason to be interested in the idea, and not the thing to be explained. In that light, "It's not just Vikings that might have used polarised light to navigate, DC-8s and bees do use it too." isn't quite so odd.

As a tightly focussed paper on *could the Vikings have used sunstones* it works to a large extent. However, *could the Vikings have used sunstones* is a different question to *did the Vikings use sunstones*, which is what Roslund, Beckman and most historians are interested in. I think it's the blurring of the *could* and *did* questions that derailed me. There simply isn't the data in this paper to discuss the *did* question. You can answer the *could* question with physics and biology, but *did* is going to require history and archaeology.

 Horvath, G., Barta, A., Pomozi, I., Suhai, B., Hegedus, R., Akesson, S., Meyer-Rochow, B., & Wehner, R. (2011). On the trail of Vikings with polarized skylight: experimental study of the atmospheric optical prerequisites allowing polarimetric navigation by Viking seafarers *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366(1565), 772-782 DOI: [10.1098/rstb.2010.0194](https://doi.org/10.1098/rstb.2010.0194)

See also:

Barta, A., Horváth, G., & Meyer-Rochow, V. B. (2005). Psychophysical study of the visual sun location in pictures of cloudy and twilight skies inspired by Viking navigation. *Journal of the Optical Society of America A*, 22(6), 1023. OSA. DOI: [10.1364/JOSAA.22.001023](https://doi.org/10.1364/JOSAA.22.001023)

Roslund, C. & Beckman, C., 1994. Disputing Viking navigation by polarized skylight. *Applied Optics*, 33(21), p.4754-4755. DOI: [10.1364/AO.33.004754](https://doi.org/10.1364/AO.33.004754)

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One Comment



Bastian

Posted 7th of February, 2011 at 11:00 am | [Permalink](#)

I think what contributes to your initial misunderstanding of the paper that the method, of using polarimetric light to navigate, is called "sky-polarimetric navigation by Vikings" by the authors... So what they tried was to make the point, that this method actually works. And it seems that there is no intent to prove that vikings actually used this method.

I was derailed in the same kind you were, especially while reading the point about the DC-8-Pilots: "Uh, scandinavian pilots used it. The vikings used to be scandinavians too, but where is the point?" 😊

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