

# NAVIGATION OF THE VIKINGS

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## 1 Introduction

Vikings are generally known as bellicose adventurers, yet they are more! Christopher Columbus discovered America or did he? The Vikings arrived there 400 years earlier. They must have been great navigators and probably possessed certain navigational aids, but which ones?

Vikings didn't know about a magnetic compass, nor did they use maps or nautical charts. Instead they had an unimaginable amount of experience passed on over generations and – according to an archeological find – the “sun compass”. However this aid could be of no use when the sky was overcast. Under such conditions Vikings are considered to have used a “sunstone”, a crystal with polarising properties. Holding it against the sky (skylight is polarised) and rotating it, you have to look for the darkest position or for a certain colour - depending on the crystal you use. The optical axes points at the sun now.

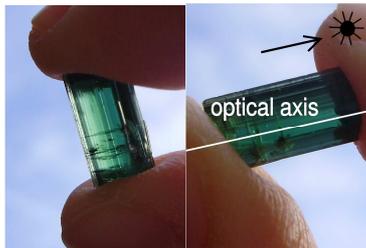


Fig.1 determining the location of the sun by rotating a sunstone (tourmaline) against the sky

## The purpose of the investigation

The validity of this hypothesis is controversial and has never been properly examined and that's what I wanted to begin with my investigations. Is it possible to find out the location of the sun with the help of a polarising crystal? What conditions are necessary for it? How accurate would this kind of navigation eventually be? Does it suffice as a possible explanation for the voyages of Vikings?

## 2 Experiments

For my experiments I decided to use a tourmaline as a sunstone, because it's one of the crystals where the optical axis coincides with the natural striae. Before I started with the proper experiments I had a setup to analyse my tourmaline (2x1x0.5cm), a dichroite changing intensity and colour (yellow-green to blue-green) while being rotated in

polarised light. Basically the same, I measured the degree of polarization of the sky, divided grid-like.

As the aim of my investigations was to examine the accuracy of my tourmaline as a navigational aid for the Vikings under several weather conditions, I didn't try to create a scientific setup for my experiments but matched the methods with theirs. Therefore I just scanned the sky with the crystal, noted date, time, the weather situation, the determined position of the sun (azimuth and altitude) by means of a compass and downloaded a weather chart which provided extra information about clouds and air humidity. In the end, the measured position of the sun was compared with the real one.

## 3 Results

The average of my azimuth deviation is approximately  $7.4^\circ$ , that of the altitude  $2.3^\circ$ . Examining the connection between weather and accuracy of my measurements, I could find several dependencies. The location determination of the sun is e.g. exacter if it's only partly cloudy or if there are at least tiny spots of sky visible through the cloud cover.

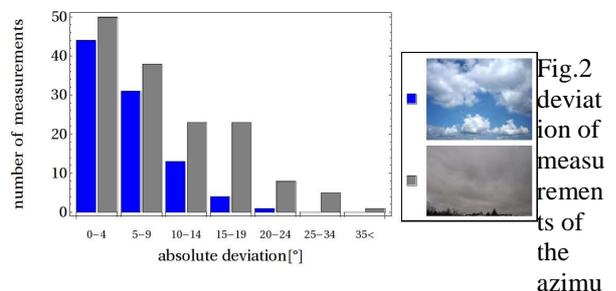


Fig.2 deviation of measurements of the azimuth depending on the weather (partly cloudy or absolutely overcast)

## 5 Conclusion

It is difficult to assess how helpful sunstones were to Vikings as we know so little about their way to navigate in general. Though this method is not really accurate for today's standard it can be seen as a real help to hold the course during overcast days and weeks at the time of the Vikings!

## References

- [1] <http://rspa.royalsocietypublishing.org/content/463/2080/1081.full.pdf>
- [2] Praxis der Naturwissenschaften, Physik in der Schule, Aulis Verlag Deubner, Köln/Leipzig, 2007, 56. Jahrgang, S.33-38