

The orientation of Vendel church

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In the course of excavations between 1995 and 2001 in the parish of Vendel in Uppland (Fig. 1), as part of the research project *Svealand in the Vendel and Viking periods*(SIV), we wondered a lot about the alignment of Vendel church. The long axis of the church deviates in a clockwise direction from the geographical W–E axis and is moreover not parallel with the cemetery wall.

In an article in *Kyrkohistorisk årsskrift* from 1982 Bertil Nilsson discusses the older directional concepts and the alignments of mediaeval churches (Nilsson 1982). There is confirmation from written sources as early as the fourth century that churches should be aligned east-west. Christ faced west on the cross and the congregation must therefore look to the east to be able to see Christ.

The question arises of how the orientation of the church was decided during construction. It has been argued that the church was aligned with sunrise at the summer solstice. Others have argued that the church was aligned with sunrise on the commemoration day for the saint to whom the church was dedicated. A third view was that it was aligned with sunrise on the day of the church's foundation.

Nilsson has investigated 209 mediaeval churches and has found no evidence for any single one of these three views but rather the existence of several parallel methods since the alignments of the churches vary.

One possibility that Nilsson does not discuss is that the alignment of the churches may have been decided with the aid of a compass. He refers to Ellergård, who alleges that Scandinavians did not have access to the compass then (Ellergård 1955), although he later informs us ambiguously in a note that the compass was only known about in Scandinavia in the fifteenth century and that Scandinavians were acquainted as early as the thirteenth century with the magnetic lodestone. He also mentions the compass referred to in Europe in the thirteenth century (Barfod 1981).

The earliest written information in Europe about the magnetic compass is contained in the two works by the English monk Alexander Neckham *De naturis rerum* from circa 1190–1200 and *De utensilibus* from the 1180s where a sea compass is described. The French crusade historian Jacques de Vitry mentions a compass in his *Historia hierosolimitana* from 1218 describing it as “valde necesseris – navigantibus in mari” (Abrahamsen 1992). Haukr mentions a lodestone in the Icelandic Hauksbók, which also contains Landnámabók, in about 1225. The magnetic compass was also a standard piece of equipment in China a long time before it started to be used in Europe. A Chinese document from 1117 states that large ships, which



Figure 1. Map of Sweden showing Vendel parish, Uppland (60.2°N, 17.5°E)

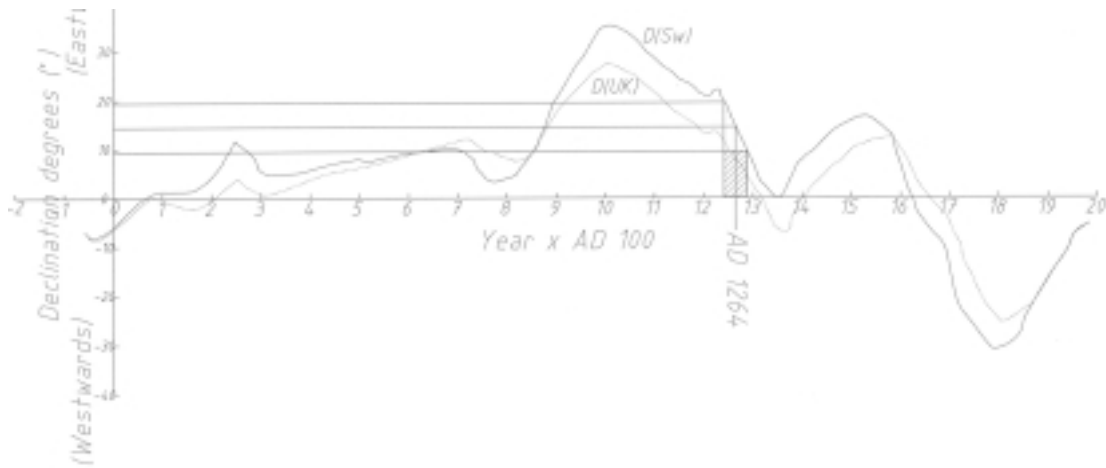


Figure 2. Archaeomagnetic dipole movement from England, (D (UK), dotted line) to Sweden (D (Sw), unbroken line). Based on Abrahamsen 2001.

could carry hundreds of passengers, were legally obliged to have a magnetic compass to be able to navigate in the event of bad weather.

It is possible to explain the deviations of church alignments if a compass was used when it was laid out. As early as 1581, the English compass maker Robert Norman mentions a declination in Öresund and in 1649, the Danish compass maker Herman Luchtemacher describes declinations in Denmark after measurements (Abrahamsen 1973). We now know that the magnetic north pole has moved over time and that a change of as much as 35° took place in Scandinavia between AD 1000 and 1350 in the position of north as indicated by the compass. Geophysicists have surveyed this movement and drawn up graphs showing the archaeomagnetic variations over time. When small magnetite granules settle in deep lakes, they orient towards the current terrestrial magnetic field. The magnetic alignments of the granules can be measured by taking a carefully oriented drill core in the bed sediment and taking samples from the top most recent sediment down to the lowest oldest sediment. The samples can then be ^{14}C -dated to obtain the varying positions of the pole for the time period.

A graph of this kind is available in England, the most recent layers of which have been correlated for the last 2000 years with the aid of a number of historically documented furnaces and it is accordingly more reliable than graphs only dated by ^{14}C . When the brick in a furnace is heated over the Curie point for iron (approximately 700°C), the magnetite becomes demag-

netised and when the brick subsequently cools, it will be remagnetised. The magnetite will then have the same magnetic alignment as the current terrestrial magnetic field. This magnetic alignment will then be retained until the next occasion on which it is heated above the Curie point. It is thus possible to determine the alignment of the terrestrial magnetic field on the last occasion that the furnace was heated up. By choosing furnaces that are well dated by written sources, it is possible to obtain the alignments of the field at that time.

On the basis of this English graph, the Danish geophysicist Niels Abrahamsen has calculated a new Danish graph for the movement of the magnetic pole and he has now assisted us to calculate a graph for Sweden (Vendel parish, Uppland, 60.2°N , 17.5°E).

The vertical axis shows the declination, the magnetic deviation from the geographical north alignment. Positive values are easterly and negative westerly deviations. The horizontal axis shows time (Fig. 2).

When we measured the alignment of the long axis for Vendel church on the map, we found that it deviated by 14.5° in a clockwise direction from the geographical West-East axis. We used a compass to measure in the field direction 101° for the church's long axis, accordingly a deviation by 11° clockwise from the West-East axis, which gives a difference of 3.5° towards the east from the north between the geographic north and the magnetic north today. We also obtained confirmation from the Geological Survey of Sweden, SGU, that the magnetic declination now for Vendel is



Figure 3. Vendel church with the declinations at present and at the end of the thirteenth century.

approximately 3.5° E. This means that when the compass shows north, it is in fact pointing 3.5° to the east. The graph can then be used to check when the magnetic compass would have showed 14.5° E as north.

According to our curve, this took place on four occasions, circa AD 880, 1260, 1470 and 1570 and only 1260 can have been a reasonable time for laying out the alignment of the church. We should calculate with a confidence interval of $\pm 5^\circ$ due to the uncertainty of recalculating the English result to central Sweden and the approximation of the terrestrial magnetic field to a simple dipole field. The method of dating medieval churches with the aid of the movement of the magnetic North Pole is a subject that is still discussed and called into question (Jason & Cunich 2001)

The conclusion is that if one stood in Vendel in about 1240–1280 with a compass and pointed out north and then pointed out 90° clockwise as east, the alignment would be obtained which Vendel church has according to this graph (Fig. 3).

Historians have previously dated Vendel church to 1310 on the basis of a text in Eric the Holy's collection of miracles. However, this is now considered to be a misinterpretation of the Latin text and Ann Catherine Bonnier considers that it is not possible to achieve a more exact dating than to the decades around the end of the thirteenth century (Bonnier 1987). Sigurd Rahmqvist wants to date the church to 1270–90 on the basis of a coin minted in the reign of Valdemar Birgersson 1265–75, which was found in a grave inside the church and the mention of Vendel church as

early as 1291 when a Mister Knut was named as the priest in Vendel (Rahmqvist 1996).

The last decade in our investigation 1270–80 when the position of the magnetic North Pole coincides with the orientation of Vendel church correlates particularly with Rahmqvist's dating.

This shows in our view that a magnetic compass was very probably used when the orientation of Vendel church was decided upon. This hypothesis could be statistically tested by measuring the alignments of other churches.

English translation by David Kendall.

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