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A high temporal resolution study of Holocene palaeomagnetic directions and intensity: assessing the reliability of a Swedish geomagnetic field reconstruction

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In order to better understand the temporal and spatial dynamics of the geomagnetic field, reliable, high-quality, empirical palaeomagnetic data must be generated (Stanton et al., 2011a). Records such as these allow us to: test models of geomagnetic behaviour; correlate spatially separate sequences; and look at the effect of the Earth's magnetic field on cosmogenic nuclide production. The field can be recorded by magnetic minerals that are present in geological archives, such as lavas, archaeomagnetic materials and sediments.

This abstract is concerned with the results from the main author's PhD studies (Stanton, 2011), which were primarily concerned with the palaeomagnetic signal recorded in four overlapping core sediment sequences from an annually-laminated Holocene lake in Sweden: Kälksjön. Annually-resolved archives allow the determination of high-resolution, temporal, palaeomagnetic reconstructions, with a resolution generally higher than those derived from lavas and archaeological archives, although the recorded values are relative and not absolute. The Kälksjön sediments have proved a good archive for recording geomagnetic field strength and direction, with an accurately dated, high-resolution chronology (Stanton et al., 2010). The resulting measurements showed a high level of correlation with other datasets in Fennoscandia (Stanton, 2011).

In another smaller study, an absolute palaeointensity curve was derived from a number of Holocene Icelandic lava samples (Stanton et al., 2011b). Comparison between this and the Kälksjön curve revealed similar long-term trends (Stanton, 2011).

Correlation between Kälksjön's palaeointensity data and various proxies, however, indicates that climatic conditions have affected the magnetic mineral assemblage in the sequence, which in turn has biased the recorded palaeointensity signal. In order to verify which of the palaeointensity features in the Kälksjön sequence could be deemed genuine, a comparison of the low-pass filtered Kälksjön relative palaeointensity curve with reconstructed ^{14}C and ^{10}Be geomagnetic field intensity data was made (Stanton et al., 2011a). The results indicated that – in particular – two main features could be considered real and reliable.

References:

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