Using the British archaeomagnetic database to determine palaeosecular variation 2-3ka ago

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This paper will present the results of an extensive re-evaluation and supplementing of the available British archaeomagnetic records for the period between 2000 and 3000 years ago. The aim of this PhD research was to use archaeological and geological material to characterise changes in the geomagnetic direction in the UK. This period of time was selected for two reasons: firstly it represents the end of prehistory on this archipelago, the British Iron Age and therefore represents a period of significant archaeological interest; secondly, results from previous work on lacustrine records and other fired materials suggest that during this period the geomagnetic field over Western Europe experienced a rapid change in direction. The archaeological period currently suffers from poor chronological resolution. This is due to a combination of factors but mainly results from high degree of regional variation in the archaeology of the British Iron Age, which means that dating based on cultural indicators (artefacts, building style etc) produces a spectrum of possible age ranges. This situation is further compounded by limitations with radiocarbon dating for this time period due to a plateau in the radiocarbon calibration curve. Therefore this period provides a promising target for improving the temporal resolution of palaeosecular variation curves and addressing a significant archaeological issue.

This research on palaeosecular variation (PSV) has two unique aspects: the refinement of the chronological precision of secular variation records from archaeological material and investigations into the potential for combining directional data from geo-archives with archaeological material. Primarily the focus has been on improving the precision of the chronological assignment associated with each magnetic directional measurement from archaeological materials. A total of 114 magnetic directions related to the period 2000 to 3000 years ago have been re-evaluated. This resulted in an improvement in 89% of cases due to the critical application of archaeological dating evidence within a Bayesian framework. Furthermore, 105 new data points have been added, doubling the amount of data for this time period. Together these approaches have resulted in a more evenly distributed dataset over the time span of interest. Secondly the deposition of British lake sediments was re-assessed using Bayesian modelling procedures to improve the age estimates for these data. This was followed up with the development of a statistical approach to quantify the differences between directional data recovered from sedimentary and baked clay archives with a view to combining them. This methodology, developed to refine the British archaeomagnetic dataset, has improved the precision of the British PSV curve and could be applied to other PSV curves to provide a detailed snapshot of secular variation in periods of archaeological interest. The potential benefits of this research impact the related fields of modelling and interpretation of the global geomagnetic field.