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New archaeomagnetic data from three roman kilns in northeast Spain: a contribution to the Iberian palaeosecular variation curve

E. Beamud (1), M. Gómez-Paccard (2), G. McIntosh (3), and J.C. Larrasoaña (4)

(1) Laboratori de Paleomagnetisme CCiT UB-CSIC - Universitat de Barcelona, Barcelona, Spain (betbeamud@ub.edu), (2) Institut de Ciències de la Terra "Jaume Almera", Barcelona, Spain (mgomezpaccard@ictja.csic.es), (3) Instituto de Geociencias (UCM-CSIC), Universidad Complutense, Madrid, Spain (gregc@fis.ucm.es), (4) Instituto Geológico y Minero de España, Zaragoza, Spain (jc.larra@igme.es)

New archaeomagnetic results from three kilns recovered from a roman age archaeological site in Badalona (northeast Spain) are reported. Archaeological evidences constrain the abandonment of kilns BC1 and BC2 between 0 and 50 yrs AD, whereas the abandonment of kiln BC3 is established between 50 and 150 yrs AD.
In order to perform the archaeomagnetic study 12 to 14 samples per kiln were collected using a portable electrical drill with a water-cooled diamond bit, following standard palaeomagnetic sampling methods. Samples were distributed all around the combustion chambers, being obtained in different orientations from the burnt walls and central pillars.
Rock magnetic measurements revealed a dominance of low titanium titanomagnetite or substituted magnetite as the main carrier of the magnetic signal and a minor contribution of maghemite. The presence of single domain material, along with the thermal stability of the samples, means that they are suitable candidates for archaeomagnetic studies, and in particular intensity determinations.
Archaeomagnetic experiments were attempted on 32 specimens characterised by NRM intensities between 0.5 and 8.3 A/m. Mean archaeomagnetic directions and archaeointensities have been obtained from the original Thellier method with regular partial thermoremanent magnetisation (pTRM) checks being used to estimate archaeointensities. Mean intensities of 68.3 $\pm$ 4.2 μT, 72.4 $\pm$ 5.0 μT and 72.9 $\pm$ 3.7 μT were obtained for kilns BC1, BC2 and BC3, respectively. A cooling rate correction factor of 5% has been applied to mean intensities and the values obtained have been relocated to Paris and Madrid through the virtual dipole moment VDM. The mean directions of the characteristic magnetization of each kiln and their associated statistical parameters were derived from principal component analysis and Fisher statistics. Very similar directions were obtained for BC1 and BC2 with the circle of confidence (α95) of the BC2 direction falling within that of BC1. This is in agreement with archaeological evidence that proposed the same age interval for the abandonment of kilns BC1 and BC2. On the contrary, there is only a small overlapping between the circles of confidence of BC1-BC2 and the BC3 circle of confidence. Moreover, the inclination obtained for the mean BC3 direction is lower than those obtained for kilns BC1-BC2, suggesting that kiln BC3 was abandoned latter than kilns BC1 and BC2. This is in agreement with archaeological evidence that proposed that kiln BC3 was abandoned about 60 years later than kilns BC1 and BC2. The new data are also consistent with previous archaeomagnetic data for the Iberian Peninsula. They add to and improve the description of palaeosecular variation during Roman times in Iberia.