COMPARING THELLIER-THELLIER PALAEOINTENSITY RESULTS WITH A TECHNIQUE BASED ON THE LINEAR FIELD DEPENDENCE OF PARTIAL THERMOREMANENCE

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Requirements for the Thellier & Thellier (1959) double heating palaeointensity determination technique are equality of blocking temperatures of partial natural remanent magnetisation (NRM) and thermoremanent magnetisation and linear field dependence of TRM. While the equality of blocking temperatures is tested during the experimental procedure by partial TRM checks and tail checks, the field dependence is in general not checked. However, two palaeointensity determination experiments can be derived from both aforementioned requirements: 1. the temperature is changed and the field is kept constant, *i.e.* the classical Thellier-Thellier technique and 2. the temperature is kept constant and the magnetising field is varied.

We applied both techniques to promising baked limestone samples from a Roman limestone kiln at Tournai (Belgium) and from a pottery kiln of the same period from Bruyelle (Belgium) in order to test if both independent methods yield the same results.

The studied limestone samples were taken inside the combustion chamber wall at two distances from the fire exposed surface, *i.e.* at 0 to 2.2 *cm* and at 4.8 to 7 *cm*. The alteration checks made during palaeointensity experiments fall generally inside the error envelope of the fitted slope. This indicates the absence of thermo-chemical alteration during the experiment and is apparently independent from the distance of the sample to the fire, although a colour gradient from white to black is observed at increasing distance from the fire. Somewhat different palaeointensities are systematically obtained with both palaeointensity determination methods. At 0 to 2.2 *cm* distance, the value is about 55 μT while at a 4.8 to 7 *cm* distance the value is about 72 μT. As the latter value is closer to known values for the same time period, the values obtained close to the fire are probably untrustworthy. Possibly, a low-temperature thermo-chemical disequilibrium, due to post-baking weathering, causes alteration below the first heating step (*i.e.* below 150°*C*) and being equalised by heating at 150°*C*. In this case, newly-formed magnetic grains would contribute only to the laboratory remanence. Consequently, TRM values are increased, implicating a flatter slope and eventually lower palaeointensity. The interior of the limestone slab, *i.e.* at 4.8 to 7 *cm* distance would not have been affected by weathering, and yields thus correct values.

Palaeointensity determinations from the baked clay sample taken from the combustion chamber of the Roman pottery kiln at Bruyelle were not successful at distances close to the fire due to thermo-chemical magnetic mineral alteration. However, in samples taken between 6.5 and 8 cm from the fire exposed surface, the alteration is negligible and both palaeointensity determination methods yield very similar results of 73 and 76 μT.

The good consistency of the results applying both techniques encourages us to use the variable field technique for further investigations, because the thermal stress during the experimental procedure is lower compared to the Thellier-Thellier technique, as one heats only to a constant temperature. However, preliminary alteration tests should be carried out in order to detect low temperature alteration and to choose the optimal heating temperature.