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Burnt clay magnetic properties and palaeointensity determination

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Burnt clay structures found in situ are the most valuable materials for archaeomagnetic studies. From these materials the full geomagnetic field vector described by inclination, declination and intensity can be retrieved. The reliability of the obtained directional results is related to the precision of samples orientation and the accuracy of characteristic remanence determination. Palaeointensity evaluations depend on much more complex factors – stability of carried remanent magnetization, grain-size distribution of magnetic particles and mineralogical transformations during heating. In the last decades many efforts have been made to shed light over the reasons for the bad success rate of palaeointensity experiments. Nevertheless, sometimes the explanation of the bad archaeointensity results with the magnetic properties of the studied materials is quite unsatisfactory.
In order to show how difficult is to apply a priory strict criteria for the suitability of a given collection of archaeomagnetic materials, artificial samples formed from four different baked clays are examined. Two of the examined clay types were taken from clay deposits from different parts of Bulgaria and two clays were taken from ancient archaeological baked clay structures from the Central part of Bulgaria and the Black sea coast, respectively. The samples formed from these clays were repeatedly heated in known magnetic field to 700oC. Different analyses were performed to obtain information about the mineralogical content and magnetic properties of the samples. The obtained results point that all clays reached stable magnetic mineralogy after the repeated heating to 700oC, the main magnetic mineral is of titano/magnetite type and the magnetic particles are predominantly with pseudo single domain grain sizes. In spite that, the magnetic properies of the studied clays seem to be very similar, reliable palaeointensity results were obtained only from the clays coming from clay deposits. The palaeointensity experiments for the samples formed from the ancient baked clays completely failed to give relibable results.