Geophysical Research Abstracts
Vol. 13, EGU2011-9748, 2011
EGU General Assembly 2011

Rock- and archeomagnetic characterizations of burnt sediments to investigate the geomagnetic field evolution during the mid-Holocene

Kathrin Lisa Kapper, Fabio Donadini, and Ann Hirt
ETH Zurich, Institut of Geophysics, Department of Earth Sciences, Zurich, Switzerland (klkapper@gmail.com)

Fire is a main mechanism to increase the magnetization of minerals in soils. During the burning process weakly magnetic oxides and hydroxides are converted to stronger magnetic phases. Burnt anthropogenic remains in shelters or caves record the directions and the intensities of the geomagnetic field at the time of combustion (Carrancho et al., 2009). In this study initial results that evaluate the suitability of burnt oriented sediment as geomagnetic field recorders from two distinct mid-Holocene stratigraphic sections (Neolithic and Mesolithic) from the Riparo Gaban, Trento, Italy, are presented. The sequences consist of burnt ash and rubefaction layers and unburnt soils. Anisotropy of magnetic susceptibility (AMS) was measured to assess the preferred alignment of the magnetic grains. The direction of the minimum AMS (k3) is perpendicular to the bedding plane for most of the units, whereas the directions of the maximum (k1) and intermediate (k2) AMS are distributed in the bedding plane. This behavior is typical of well-compacted units. The anisotropy degree, P = k1/k3, is small for each unit with values less than 4 %, with exception of one sample showing 7% anisotropy degree. For most of the specimens the anisotropy ellipsoid is oblate, but there are also some prolate shaped ellipsoids. After alternating field (AF) demagnetization the AMS measurements were repeated for selected specimens, but there was no significant change in the anisotropy values. The range of (mean) bulk susceptibilities of all samples is (72 - 2060) x 10-6 SI. In general, well-baked samples have the highest values of AMS.

To quantify the viscous part of the magnetization the natural remanent magnetization was measured repeatedly after representative samples from each unit were stored for several weeks in a shielded environment. After three weeks the measured viscous coefficients range from 2-12 %, whereas after six weeks they range from 7-18 %. For one unit, composed of white ash, the values remained unchanged. For each specimen the magnetization was removed using AF demagnetization to determine the inclinations and declinations of the geomagnetic field. Unstable and viscous magnetizations were removed in low fields, and the characteristic remanent magnetization was removed in higher fields.
In preliminary investigations declinations and inclinations of five units were compared to temporal variations of declinations and inclinations produced with the CALS7K.2 model (Korte and Constable, 2005). Three units fit to the model results. The two other units have much shallower inclinations than the model, however only a few samples were available at these sites. One of the lower units of the stratigraphy was dated with the C14-method to an age of around 4895 BC. This is only for the inclinations in satisfying agreement with the predicted model age. The model has large uncertainties especially for that period of time, because in this period it is mainly based on lake sediments. Nevertheless, the age dated with the C14-method is in good agreement with the age suggested by the archeologists investigating the Riparo Gaban excavation.