Geophysical Research Abstracts
Vol. 16, EGU2014-9823, 2014
EGU General Assembly 2014

Contributing to a precise and accurate chronostratigraphic time scale for climatic records: Absolute dating and paleomagnetism in lavas

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Understanding climatic mechanisms requires a robust and precise timescale allowing long-distance and multi-archives correlations. A unique tool to construct such time scales is provided by the Earth magnetic field (EMF), which is independent from climatic variations and the past evolution of which is recorded in most of the geological/climatic archives. Sedimentary sequences provide continuous records of relative intensities of the EMF on stratigraphic time scales, usually based on orbital tuning. They are transferred onto absolute intensity scale and chronological time scale using robust tie points available for the past ∼40 ka. However, for older periods this calibration remains poorly constrained. Our study reports on new tie points over the last 200 ka by combining paleomagnetic and geochronological (K/Ar and 40Ar-39Ar dating) studies on lavas.

Based on the K-Ar LSCE age database, a set of 18 lava flows corresponding to potential geomagnetic excursions and/or highs and lows in the paleomagnetic intensity as observed from sediments and occurring in the studied time-window were selected in the Canary Islands (Tenerife, La Palma and Gran Canaria).

A total of 205 oriented cores were taken from these 18 lava flows. Rock magnetic experiments include thermomagnetic analyses on each core, hysteresis loop and First Order Reversal Curves. Stepwise thermal demagnetizations in zero-field provided reliable mean-site paleomagnetic direction of the EMF for 15 of the flows. Paleointensity values were determined using the original Thellier and Thellier method. Based on previous experiments, 170 samples were analyzed, among which 51% provided reliable paleointensity values (determined using PICRIT-03 criteria).

The geochronological study focused on 40Ar-39Ar dating. Based on preliminary paleomagnetic results, 13 flows were analyzed and 11 provided ages consistent at the 2 sigma level with the already available K-Ar ages. This coupled K/Ar – 40Ar-39Ar results strongly constrain the chronological framework.

The new obtained paleomagnetic/age data will be compared to both sedimentary and volcanic data base.