

A paleomagnetic and paleointensity study of a Miocene polarity transition in La Gomera (Canary Islands, Spain)

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Abstract:

A paleomagnetic, rock-magnetic and paleointensity study has been carried out on a Miocene sequence of 39 lava flows recording a polarity transition in La Gomera (Canary Islands, Spain). In addition ⁴⁰Ar/³⁹Ar datings have been performed on two samples from two different flows of the sequence.

Rock magnetic experiments were carried out to find out the carriers of remanent magnetization, to determine their grain size and to obtain information about their thermal stability. Thermomagnetic curves allowed distinguishing three different types of behaviour. Type H samples show reversible curves with a single ferromagnetic phase with a high Curie temperature corresponding to low-Ti titanomagnetite. Type L samples mainly show a single low Curie temperature phase in the heating curve, which corresponds to titanomagnetite with a rather high titanium content ($x \approx 0.6-0.7$). In the cooling curve only magnetite can be recognized. Type-F samples are characterized by the presence of two ferromagnetic phases in the heating curve: A low and a high Curie temperature phase corresponding to low-Ti titanomagnetite. The cooling curve only shows this latter component. Analysis of hysteresis parameter ratios shows that all but one studied samples can be found in the PSD (pseudo-single-domain) area. This behavior might also be explained by a mixture of single-domain (SD) and multi-domain (MD) particles and if the data are compared with theoretical Day plot curves calculated for magnetite (Dunlop, 2002), the relative amount of MD particles in the mixture varies between approximately 20 and 80%.

Paleomagnetic results allowed determining a ChRM direction in all studied lava flows, and normal as well as apparently transitional directions were observed. The 25

lowermost flows of the sequence display normal polarity directions and above, a sequence of 14 flows recording a polarity transition can be observed. The twentyfive normal-polarity flows of the lower part of the sequence yield a mean direction $D=359.6^\circ$, $I = 42.4^\circ$ ($N = 25$; $\alpha_{95} = 5.1^\circ$; $k = 33$) which agrees well with the expected one. Virtual geomagnetic poles (VGP) during the transition show a complex behaviour and an analysis of the VGP path during the transition has been carried out.

Paleointensity determinations were carried out using a Thellier type double heating method as modified by Coe(1967). 27 of the 48 analysed samples measured present successful results. Mean paleointensity values of each flow range from 5.57 ± 2.39 to 41.10 ± 4.43 μT , and the corresponding VDMs mean values of each flow (calculated with the mean inclination of the flow), range from 1.11 ± 0.48 to $8.63\pm 0.96 \times 10^{22}$ Am^2 . Unsuccessful determinations were mostly related to a clearly concave up shape of Arai plots associated with multidomain (MD) behavior. No paleointensity results could be obtained directly from the transitional record, but flows near to the onset of the transitional direction show clearly lower than expected paleointensity values.

According to obtained ages and polarity directions, the observed results can be associated to the C4 Ar2n to C4Ar3r transition.

Keywords: Polarity transition, paleointensity, lava flow sequence, Canary Islands

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