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Holocene geomagnetic field variations from low latitude site: contribution from the Canary Islands

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Full geomagnetic vector information was retrieved from 37 lava flows (corresponding to 38 sites because one flow was sampled at two different localities) located in Tenerife and Gran Canaria (Canary Islands). Twenty-eight flows are dated between 1706 AD and about 13200 BC and one is historical. Eight other non-dated flows have stratigraphic links with the dated flows and at the end, our study allowed us to attribute to them archeomagnetic ages based on their paleomagnetic characteristics. Various mineralogical analyses were conducted, giving access to the nature and grain size of the magnetic minerals. Full stepwise (about 13 steps) thermal and AF demagnetizations were conducted on more than 400 samples to determine the paleomagnetic directions. The individual MAD values are on the average about 2° and the mean precision parameter at the flow scale (alpha95) is 4.2°. For paleointensities (PI), we performed the original Thellier and Thellier experiments with a success rate of about 65%, coupling it with the strict set of selection criteria PICRIT-03. The mean PIs at the flow level are based on 3 to 12 independent PI determinations except for one site in which only one reliable determination could be obtained.
The obtained data are unique in this area over the 1000-14000 BC period and they are complementary to the dataset obtained in the Canary Islands for the last 500 years. Over the last 3 kyr, they indicate some variability in the local field intensity with a prominent PI peak centered around 600 BC and reaching 80 μT (VADM 16 x 10 ˆ22 Am ˆ2), documented by four different flows and associated to significantly easterly deviated declinations. The directional data are rather consistent with the most recent models proposed for that area but the obtained PI indicate that models largely underestimate the paleointensities. Combined with published data obtained from western Africa, Spain, Portugal, Morocco and the Azores within a 2000 km-radius around the Canary Islands, our data allow to construct a curve illustrating the Earth magnetic field intensity fluctuations for Southwestern Europe/Western Africa. This curve shows three maximum broad intensity features which are also observed in the Middle East and in Central Asia indicating that they have a very large geographical extent. These maxima do not all appear clearly in the models of variations of the dipolar field intensity which have an insufficient resolution. Within the broad maxima characterizing the first millenium BC, regional variability is observed in particular with high PI around 1000 BC in the middle East and around 600 BC in southwestern Europe. This corresponds to a westward drift rate of 0.1° longitude/yr, consistent with the values generally accepted for the westward drift of the non-dipole field.