



Paleomagnetism and geochronology from the Lunayyir and Khaybar lava fields, Saudi Arabia

Luigi Vigliotti (1), Yue Cai (2), Najeeb M.A. Rasul (3), and Marco Ligi (1)

(1) ISMAR-CNR, Bologna, Italy (luigi.vigliotti@bo.ismar.cnr.it), (2) Lamont-Doherty Earth Observatory, Columbia University, USA, (3) Saudi Geological Survey, Jeddah, Saudi Arabia

The Arabian Peninsula was one of the first plates to be investigated using paleomagnetic data (Irving & Tarling, 1961). However, very few additional results appeared in the literature since then and the available information are far from sufficient to explain the tectonics of the Red Sea region.

In order to better constrain the tectonic history of the Arabian craton in the Tertiary, we carried out a combined paleomagnetic and Ar/Ar geochronological study on volcanic rocks from the Khaybar and Lunayyir Harrats (lava fields) plus a site of sediments deposited below the Miocene rocks in the former area. 86 hand-oriented samples were collected from 17 sites and progressive thermal or alternating field demagnetization isolated stable characteristic magnetizations (ChRM) that are consistent with a primary magnetization only in the Late Quaternary lava flows from the Lunayyir. Whole rock $^{39}\text{Ar}/^{40}\text{Ar}$ step-heating analyses yield whole-rock plateau ages of 12.8 to 16.3 Ma for four alkaline lava flows from Khaybar area, which is consistent with the estimated age range of the region-wide late Cenozoic alkaline volcanism in western Saudi Arabia. The paleomagnetic data from the rocks collected in this region appear to be affected by lightning and weathering and no significant tectonic/plate movement can be inferred from the obtained results. The direction of the high coercivity chemical remanent magnetization (CRM) isolated after thermal cleaning from the Pre-Miocene siltstones ($D=169.6^\circ$, $I=-44.8^\circ$; $\alpha_{95}=5.4^\circ$) is consistent with the existing paleomagnetic results. The associated VGP (314.4°E , 80.6°N , $A_{95}=6.8^\circ$) is close to the Pliocene VGP of the Arabian Plate and CCW rotated ($R=14.86^\circ \pm 6.38^\circ$) with respect to the Oligocene African VGP.

The Lunayyir paleomagnetic data set of 11 Quaternary lava flows ($D=0.31^\circ$, $I=36.9^\circ$, $\alpha_{95}=10.5$) is statistically indistinguishable from the present field and the virtual geomagnetic poles (VGP: 214.1°E , 85.1°N ; $A_{95}=12.3^\circ$) indicate a negligible rotation ($R=-1.98 \pm 10.49$) with respect to the coeval African pole position.

The paleomagnetic data indicate that the Arabian plate undertook a tertiary CCW rotation of about 10° with respect to the pole and about 15° with respect to Africa. This rotation appears to terminate in the Late Quaternary although the timing is still poorly constrained. More paleomagnetic data on rocks of different ages are necessary in order to clarify the relationships between the tectonic movements of the Arabian Plate and the Red Sea spreading.

Irving E. & Tarling D.H. 1961. The palaeomagnetism of the Aden volcanics, *J Geophys Res* 66: 549-555.