



The origin of Cenozoic magmatism of Libya

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Cenozoic volcanic provinces cover 66,000 km² of Libya. The main fields are aligned NNW-SSE where NE-SW trending structural features intersect the main regional uplift structures. They form some of the largest volcanic provinces in North Africa yet despite their size and relative accessibility they have been not studied in detail. We are engaged in a new study of the geochemistry (major-trace elements, REE, Sr-Nd-Pb isotopes) and geochronology (⁴⁰Ar/³⁹Ar and cosmogenic ³He) of basalts of the four main Cenozoic volcanic provinces (Garian, Jabal Al Hasawinah, Jabal As Sawda and Jabal Al Haruj) in order to elucidate the nature and origin of the volcanism. The volcanic fields are dominated by basaltic flows, with small volumes of phonolites present at Garian and Jabal Al Hasawinah. Basalt piles rarely exceed a few 10s metres thick and the presence of NW-SE trending dykes on the periphery of most fields implies that existing flows probably represent the latest phase of a protracted volcanic history in each region. The basalts tend to be alkali to mildly alkali. Compositional variation is dominated by fractional crystallisation with little indication of crustal contamination. Trace element and REE support an origin in 5 to 15 % melts of heterogeneous sub-lithosphere mantle. Nd and Sr isotopic composition of the Garian and Jabal Al Haruj basalts (0.5128-0.51294 and 0.703-0.704) overlap the Cenozoic volcanism of southern Italy characterized by Etna and Pantelleria. This is typical of the common European asthenosphere mantle reservoir, and lacks the influence of enriched mantle present in other North African Cenozoic basalt provinces. There has been no systematic change in the location of volcanism with time that is indicative of plate movement over a fixed mantle hotspot. The major pulse of basaltic volcanism in the northern (Garian) and southern (Jabal Al Haruj) provinces overlap in time (6-1 Ma,) while Jabal Al Hasawinah and Jabal As Sawda basalts were erupted significantly earlier (20-10 Ma). The Cenozoic basaltic volcanism in Libya appears to be related to reactivation of ancient structures during the passive rifting that has been produced in response to interaction of African and European plates since the late Mesozoic.