The CAMP Basalts in the Argana basin (Western High Atlas, Morocco). Physical Volcanology, Petrology and Geochemistry

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The Argana Basin volcanic pile is the westernmost witness of CAMP (Central Atlantic Magmatic Province) in Morocco. It comprises two volcanologically distinct lava flow fields. The lower lava field is a succession of 3 to 13 flows, 60 to 135 m thick, while the upper one, composed of 2 to 6 flows, is 60 m thick. A sediment layer or a paleosol (0.50-1m) separates the two formations. The lavas are compound pahoehoe flows and simple flows. The first type is almost exclusive of the Lower Formation (equivalent to the Lower Formation of the Central High Atlas), while the second type dominates the Upper Formation (correlative of the Intermediate Formation of the Central High Atlas). Most lava lobes in the compound flows present: (i) a thin (0.2 - 0.4 m) basal lava crust, less vesicular, sometimes with pipe vesicles; (ii) a dense lava core, corresponding to 40 to 60 % of the flow thickness (< 20 m), with vesicle cylinders and platy joints at the base and top; and (iii) an upper lava crust, 1 - 13.5 m thick, formed by alternating dense and vesicular levels, that presents tumuli and squeeze up structures. The lobes are S-type (spongy), vesicular, without pipe vesicles or, more frequently, P-type (pipe) with pipe vesicles, vesicular base and a less vesicular or dense core. Simple flows are 3.5 to 30 m thick. Each flow maintains a constant thickness over considerable distances. The simple flows appear as simple cooling units, without multiple lobes. Some flows present flow-top breccia. The compound pahoehoe flows of the Lower Formation show excellent and unambiguous evidence of endogenous growth by inflation, suggesting slow emplacement during sustained eruptive episodes.

The lava flows of the Argana basin display primary mineralogy typical of tholeiitic basalts: plagioclase, clinopyroxene, minor olivine (more common in the lowermost lava flow from the Lower Formation) and Fe-Ti oxides. Strong alteration is represented by chlorite, zeolite, amorphous silica and calcite often found filling vesicles or substituting for the mesostasis.

The basalts from the two formations, yield distinct geochemical compositions. Their major and trace element concentration and ratios match respectively the composition of the Lower and Intermediate Formation from the central High Atlas (Bertrand et al.,1982; Marzoli et al. 2004).

Bertrand H., J. Dostal, and C. Dupuy (1982). Geochemistry of Mesozoic tholeiites from Morocco. Earth and Planetary Science Letters, 58, 225-239.

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