Cenozoic Structure, Volcanism, and Evolution Of Relief In The Central and Eastern Anti-Atlas (Morocco)

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The Anti-Atlas mountainous region is located South of the High Atlas and its southern foreland basins (the Warzazat and Souss basins). A Proterozoic Pan-African basement is overlaid by post Pan-African Upper Proterozoic and Paleozoic rocks slightly deformed during the Variscan orogeny. Upper Cretaceous rocks (of continental and marine origin) are found in isolated outcrops South and West of the Warzazat basin and around the eastern termination of the Anti-Atlas relief. A poligenic erosional surface (the High Erosional Surface, HES) developed on top of older the rocks before the Miocene (Choubert, 1952). Mid Miocene to Pliocene (Pontian) Aït Kandoula Fm (of alluvial and lacustrine origin) lays on the older rocks in the northern part of the Anti-Atlas; in some places it is located within paleovalleys downcut in the HES, while in others it lays on top of the HES. A North-facing erosional escarpment truncates the HES in the northern slopes of the Jbel Saghro and marks the south boundary of the Aït Kandoula Fm in that area. Late Cenozoic phonolitic volcanism occurred in Jbel Saghro and most extensively in Jbel Sirwa, where the remains of the Sirwa volcano reaches 3304 m.

Reverse faults of decakilometric to kilometric-scale with vertical slips of 500 m to several tens of meters involve the Neogene rocks. The major structures related to the uplift of the Anti-Atlas, have been analysed by means of contour maps of the present attitude of several surfaces of reference (basal unconformity of Upper Cretaceous and Neogene sedimentary and volcanic rocks, and HES) and by generalised geological cross-sections. The present topographic elevation of the Anti- Atlas is over 1500 m in extensive areas of it, and exceeds 2000 m in several places. The structures causing this elevated topography can be summarised as fellows: 1) A broad NNWSSE- oriented anticline, 120 km in wavelength, which deforms the Upper Cretaceous and Neogene rocks of the Sirwa region. 2) This anticline is coeval with the Tertiary reactivation of the EW Anti-Atlas Major Fault –located South of the Sirwa– as a South-vergent reverse fault. 3) Another major gentle anticline, oriented WSW-ENE and more than 100 km long originated the relief of the Jbel Saghro; no thrust faults crop out in its limbs. The Proterozoic basement reaches 2500 m in the Jbel Saghro and Jbel Sirwa regions while it is at 1400 m in an intervening structural depression in the area where the Draa river crosses the Anti-Atlas massif.

A first stage (pre mid-late Miocene?) of growth of the Jbel Saghro anticline is evidenced by the erosional escarpment in the northern limb of the anticline. A second, main stage of growth, postdates the Aït Kandoula Fm and the Neogene volcanic rocks. The Sirwa anticline and the reverse remobilisation of the Major Anti-Atlas Fault also occurred during this stage. The resulting structural depression in between allowed the entrenchment of the Draa river gorge.

Choubert, G. (1952): Histoire Géologique du domaine de l'Anti-Atlas. Géologie du Maroc, fasc. I. Service géologique, Notes et Mémoires, no 100, pp. 75-195. Casablanca.