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Evidence for late Cenozoic surface uplift of the Atlas of Morocco

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The timing of the rise of mountains is important to understand the relationship between tectonics and erosion. It also has a critical role in determining the degree to which various mechanisms – crustal thickening, thinning of the mantle lithosphere – have contributed to the high elevation. One of the main difficulties in establishing the uplift history is in particular defining palaeoaltitudes. This is the reason why the occurrence at elevation of marine sediments or of deformed paleohorizontal markers can provide powerful geological tools to unravelling the poorly known uplifting history of mountainous regions such as the Atlas of Morocco.

Two such observations provide evidence for the history of surface uplift in the Atlas domain. First, late Miocene (Messinian: 5.3-7.1 Ma) undeformed marine sediments outcrop in the folded Middle Atlas at an elevation of 1100 m that is more than 1000 m of Plio-Quaternary uplift. Second, Early Pliocene-aged lake deposits in the Saharan region south of the High Atlas are tilted over 250 km implying almost 600 m of relative uplift of the High Atlas piedmont since then.

These sedimentologic evidences underscore a recent, long-wavelength surface uplift of the central Atlas domain of Morocco in post-Miocene times. The scarce compressional deformation of the aforementioned sedimentary formations and the wavelength of the doming indicate a mantle origin for the surface uplift. Consequently, the current mean elevation and rivers incisions of the Atlas system of mountains and plateaux is young in comparison with the Cenozoic crustal thickening that build the High and Middle Atlas deformed belts.