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Neogene Uplift and Exhumation of Plutonic Bodies in the Beni Bou Ifrour Massif (Nador, northeastern Morocco)

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In Neogene times, the whole Mediterranean Sea was the center of an intense magmatic activity. This post-collisional magmatism produced a large amount of volcanic edifices through the Alpine belts, together with some intrusives. These plutonic bodies can be associated with skarn-type mineralization, well-known in Elba Island or Serifos Island (Cyclades), where they are generally exhumed by detachment faults. In Morocco, the plutons hosted by the Beni Bou Ifrour massif are connected to the biggest skarn-type iron concentrations of the country (production > 60 Mt, reserves $\approx$ 25 Mt). The purpose of this work is to explain the late uplift of this massif and subsequent exhumation of the intrusives.

As a final product of the Africa-Eurasia plate convergence since ca. 70 Ma, the Rif Mountains constitute the westernmost segment of the Mediterranean Alpine belts. In the oriental part of this range, volcanic summits and Paleozoic to Mesozoic massifs outcrop in the surrounding Mio-Pliocene plains. The Beni Bou Ifrour massif, in the Nador province, consists in a dome-shaped folded Mesozoic series (Domerian to Barremian) affected by a slight epizonal regional metamorphism (ca. 14-12 Ma), dislocated by Neogene NE-SW faults and eventually sealed by upper Miocene transgressive sediments. The hosted intrusives (7.58 $\pm$ 0.03 Ma; Duggen et al., 2005) are the plutonic equivalents to the potassic calc-alkaline lavas (andesites mainly) from the surrounding "satellite" volcanic massifs. They turn out to stand in higher topographic position than the younger shoshonitic lavas of the neighboring Gourougou stratovolcano (6.12 $\pm$ 0.01 Ma; Duggen et al., 2005). Previous studies have attributed this uplift to the action of normal faults (pull-apart basins; Guillemin & Houzay, 1982), thrusting (Kerchaoui, 1985; 1995) or even of a caldeira resurgence (El Bakkali, 1995).

To discriminate against those exhumation mechanisms, field work has been performed, coming along with new cross-sections to illustrate the geometry of the Beni Bou Ifrour massif. A paleomagnetism campaign was conducted, to determine if the plutonic intrusions have been tilted since their emplacement. Apatite fission tracks and 40Ar-39Ar dating allow us to estimate the exhumation age of the igneous bodies, and therefore add chronological constraints to the tectonic model.

Geochemical study has also been performed on the magmatic rocks, and added to an extensive dataset (El Bakkali, 1995; Kerchaoui, 1995; Duggen et al., 2005). The existence of a magmatic chamber below the Beni Bou Ifrour dome will thus be discussed.

Once established, the tectonic model of the Beni Bou Ifrour massif will help to precise the emplacement of the mineralized bodies and to integrate the iron-skarn metallogenesis within the structural evolution of the Rif orogenic segment.