

# Reply to the comment on “Geochemistry, Rb-Sr whole rock age and Sr-Nd isotopic constraints on the Variscan A-type granite from Azegour area in the Marrakech High Atlas (Moroccan Meseta) and their geodynamic implications” by Hadani et al. (2024): **Geologos 30, 1 (2024): 1–16**

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We appreciate the comments made by Loudaoued et al. (2024, this issue). This discussion allows us to elucidate some of the key issues raised by these authors (Loudaoued et al. 2024, this issue):

Despite the strongly differentiated character of Azegour granitic rock samples, their multi-element patterns reveal many similarities to those of I-type granitoids, which fact has led us to postulate that the parental liquids of A1-type were derived from partial melting of mafic magmas. We have here included additional data related to I-type magmas, taken from Brown (1990), in a comparison of multi-element patterns for the Azegour granite samples (Fig. 1).

A clear understanding of the age and geochemical characteristics of the magmatic activity in the Marrakech High Atlas MHA is required to constrain the evolution of this region during the orogenic cy-

cle (i.e., rifting, tectonic inversion to post-collisional time), as follows:

- an early Cambrian age of the Medinet quartz diorite (Poulet et al., 2008; Ettachfani et al., 2018; Berrada et al., 2022), or even Neoproterozoic dates of arc volcanites (Ouazzani et al., 1998, 2001);
- a Namuro-Westphalian age: U-Pb radioisotopic ages on zircon that constrain the Adassil granite emplacement (Hadani, 2009; Fekkak et al., 2017);
- Permian intrusions in the Azegour region: basic, intermediate and felsic rocks with calc-alkaline affinity (Loudaoued et al., 2023).

The dating of 275–268 Ma reflects the effects of late Variscan hydrothermal activity, because K/Ar and Rb-Sr isotopic systems are both extremely sensitive to temperature. Several mineralisations from the Marrakech High Atlas have yielded <sup>40</sup>Ar/<sup>39</sup>Ar muscovite ages bracketed between 270 and 275 Ma

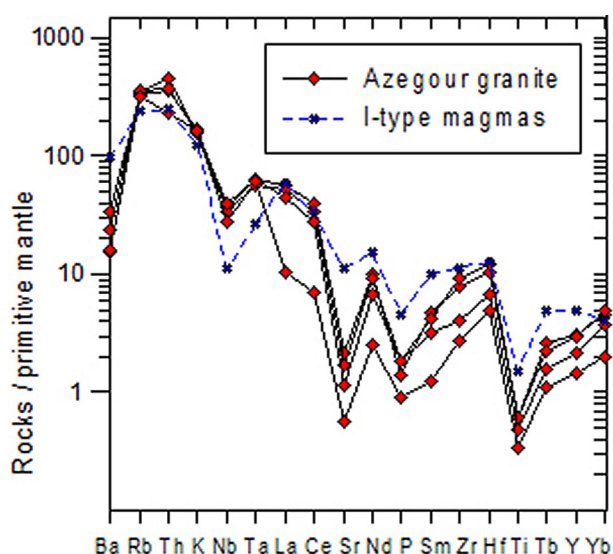


Fig. 1. Primitive mantle-normalised, multi-element patterns for the Azegour granite samples (Sun & McDonough, 1989). For comparison, I-type magmas patterns taken from Brown (1991), are included.

(Chauvet et al., 2002). It is therefore highly likely that the  $^{40}\text{Ar}/^{39}\text{Ar}$  low temperature plateau age does not provide a date for the emplacement of the Medinet intrusion (Hadani et al., 2007). Consequently, it is not possible to exclude the presence of a hidden pluton (evolved melt/mush) of the same composition as that of Azegour in the region (Boukerrou et al., 2018; Taib et al., 2020; El Khalile et al., 2023; Jinari et al., 2023; Loudaoued et al., 2023).

Two granitic samples (leucogranites) from the Tichka complex show geochemical similarities to the Azegour granite. These leucogranites are geologically younger than the other intrusions (Gasquet, 1991).

We propose further studies using further analytical techniques and procedures that have been developed in order to evaluate mixing or unmixing (fractional crystallisation) in geological systems (e.g., Vogel et al., 2008).

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