
Pressure-Temperature-time path of the micaschists of the Sidi Bou Othmane (Variscan Jebilet massif, Morocco) constrained by zoned garnet and thermodynamic modelling

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Résumé

The Variscan Jebilet massif of the Moroccan Meseta was affected by a low-grade greenschist regional metamorphism, even absent in the Eastern and Western units of the massif, increasing near intrusions where contact metamorphism reached the pyroxene hornfels-facies conditions. However, the Sidi Bou Othmane unit (SBO), located at the boundary between Central and Eastern Jebilet, is dominated by a low-pressure-high-temperature (LP-HT) metamorphism, and intruded by numerous syntectonic pegmatitic dykes.

A microstructural and petrological study of micaschists of the SBO unit reveals the presence of a major syntectonic metamorphic event characterized by the crystallization of biotite-cordierite-andalusite-garnet with peak P/T conditions reaching the amphibolite facies.

Using chemical zoning of garnet and calculated P-T pseudosections, the prograde metamorphic evolution is characterized by a LP-MT amphibolite assemblage composed of garnet + andalusite + biotite + muscovite + plagioclase + quartz + ilmenite. The calculated peak P-T conditions (3.6-3.9 kbar, 565-578°C) indicate a burial depth of 14-15 km and correspond to a geothermal gradient of 38-39°C/Km. Such burial results from crustal thickening related to Variscan transpression. The retrograde metamorphic evolution is characterized by the crystallization of cordierite in equilibrium with the previous metamorphic assemblage. The calculated P-T conditions (0.6-1.3 kbar, 530-550°C) indicate a hot geothermal gradient of > 100°C/km and a decompression following peak P-T conditions. The high geothermal gradient has been accompanied by crustal anatexis at depth and emplacement of a leucogranite intrusion and associated pegmatite dykes. The decompression was nearly isothermal allowing the preservation of syn-kinematic assemblages developed at the end of garnet growth. Exhumation of the SBO metapelites has taken place in the garnet-biotite-andalusite-cordierite-muscovite stability field, defining a clockwise pressure-temperature (P-T) path. The decompression was relatively rapid and was followed by isobaric cooling. ⁴⁰Ar/³⁹Ar dating on muscovite obtained on pegmatite and micaschist samples from the SBO unit shows that metamorphism, shearing deformation and pegmatite magmatism occurred almost simultaneously around 320 Ma.

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Mots-Clés: P–T path, $^{40}\text{Ar}/^{39}\text{Ar}$ dating, metamorphism, metapelite, pseudosection, Variscan Jebilet massif from Morocco.