

New Geochronological Dating of Zircon, Monazite and Thorite from the Granulite of the Beni Bousera Massif (Internal Rif).

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Within the last years, the age of metamorphism in the Sebides (internal Rif) is mostly considered to be Alpine, 19-23 m.y. This is in contradiction with Hercynian mineral ages derived earlier. In order to assess the geodynamic evolution, it is necessary to understand the relation between Hercynian and Alpine metamorphic events. For this purpose, we measured monazite, zircon, and thorite from granulite of the Beni Bousera.

P-T evolution is characterized by a high P/high T episode (M1) followed by medium P/high T partial melting and crystallization (M2).

Monazite

Chemical U-Th-Pb dating (electron microprobe) was applied. The derived ages depend on the position of the monazite relative to garnet. Monazites in the matrix as well as in multi-phase inclusions in garnet invariably result in young < 50 m.y. ages that can not be further resolved with this method. In contrast, single-phase monazite inclusions in garnet are distinctly older. The measured data result in ages between 173-266 m.y. An intermediate position is taken by monazite appearing in the rim of garnet: the resulting ages vary from young Alpine to 220 m.y. Obviously, early in the metamorphic history (Variscan times?), monazite was formed. Later, it is overgrown by garnet that subsequently shielded the enclosed monazite. Monazite formed during high T equilibration of the matrix including partial melting, in contrast, is probably newly formed in young Alpine times.

Zircon

Results of SHRIMP dating are concordant ages of 21 m.y in the rim of grains. Highly discordant data points yield a lower intercept of again 21 m.y., whereas the upper intercept of 2011 m.y. may reflect formation of zircon in the source region. In addition, there is a significant amount of weakly discordant data with apparent ages of 150-450 m.y. No clearly defined Variscan event is discernable, and the latter data may be related to the contribution of a low/medium grade metamorphic precursor and/or of a heterogeneous sedimentary source region.

Thorite

Inclusion in garnet was chemically dated (U Th Pb) with the electron microprobe. The resulting ages range between 56-78 m.y. This age may also be assessed, as in the case of monazite, to a partial rejuvenation of an old mineral during Alpine time. According to the data, only the alpine event 21 m.y. is clearly discernable. Older data are scattered and do not seem to define a single major event. Therefore, it is tentatively assumed that the major rock-forming episode spanning M1 at high P and M2 at medium P is young Alpine. This includes the formation of most of garnet, partial melting and growth of matrix monazite.

Keywords: monazite/zircon/ thorite, granulite, metamorphism, Internal Rif.