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Inheritance, Variscan tectonometamorphic evolution and Permian to Mesozoic rejuvenations in the metamorphic basement complexes of the Romanian Carpathians revealed by monazite microprobe geochronology

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Monazite U-Th-Pb chemical dating reaches an acceptable compromise between precision and accuracy on one side, and spatial resolution and textural constraints on the other side. Thus it has a powerful potential in testing the coherence of individual metamorphic basement units, and enabling correlations among them. Yet, sensitivity and specificity issues in monazite response to thermotectonic events, especially in the case of superposed effects, remain still unclear.
Monazite dating at informative to detailed scale in the main metamorphic basement units of the Carpathians resulted in complex age spectra. In the main, the spectra are dominated by the most pervasive thermal and structural overprint, as checked against independent geochronological data. Post-peak age resetting is mostly present, but statistically subordinate. Resetting in case of superposed events is correlated with the degree of textural and paragenetic overprinting, inheritances being always indicated by more or less well-defined age clusters. The lack of relict ages correlating with prograde structural and porphyroblast zonation patterns is indicative for juvenile formations. Age data distribution in the Carpathians allowed distinction of pre-Variscan events, syn-metamorphic Variscan tectonic stacking of juvenile and reworked basement, post-Variscan differential tectonic uplift, as well as prograde metamorphic units ranging down to Upper Cretaceous ages.
In the South Carpathians, the Alpine Danubian domain consists of several Variscan and Alpine thrust sheets containing a metamorphic complex dominated by Upper Proterozoic to Lower Cambrian metamorphic and magmatic ages (Lainici-Păiuș), and several complexes with metamorphic overprints ranging from Carboniferous to Lower Permian. Any correlation among these units, as well as geotectonic models placing a Lower Paleozoic oceanic domain between pre-existing Lainici-Păiuș and Drăgșan terranes are precluded by the age data.
Other basement of the South Carpathians contain lower Paleozoic or older units intruded by Ordovician granitoids, imbricated with juvenile Variscan slivers, the structural sequence differing in individual basement complexes. So, in the Leaota Massif the lowermost term of the sequence is prograde Variscan, tectonically overlain by reworked lower Paleozoic gneisses, supporting thrust sheets with very low- to low-grade Variscan schists. In the Făgăraș Massif a lower Paleozoic (Cumpăna) complex bearing a strong Variscan overprint, straddles Variscan juvenile rocks, and the lowermost visible structural level is assumed by upper Carboniferous to Permian juvenile medium-grade metamorphic schists. In the Lotru Metamorphic Suite of the Alpine Getic Nappe, the Variscan stacking is overprinted by post-orogenic differential uplift, documented by the correlation among younging ages, structural and metamorphic low-pressure overprints, recording often higher metamorphic temperatures. The most spectacular structure is Upper Jurassic in age, contains high-grade metamorphic rocks and peraluminous anatectic granitoids, is outlined by a deformed boundary evolving from ductile to brittle regime during cooling, and induces a thermal overprint in the neighbouring rocks.
In the basement units thrust over the Getic Nappe, the Sibișel unit yielded Permian prograde peak metamorphic ages and Triassic post-peak overprints, while an adjacent gneissic unit (Laz) delivered an exclusively Cretaceous age pattern.
Unexpectedly young metamorphic ages resulted also for the East Carpathians and the Apuseni Mountains. While most of the ages obtained so far correspond to Variscan retrogression of older basement units, the lowermost structural unit of the infra-Bucovinian nappe system in the East Carpathians yielded Upper Cretaceous metamorphic ages in apparently monometamorphic medium-grade schists. In the Apuseni Mountains, schists of the Baia de Arieș Unit display an Upper Jurassic age spectrum, corresponding to a clearly prograde medium-grade event.
The ages recorded not only question some of the currently accepted correlations among basement units, but urge to reconsideration of the way in which the basement-cover relationships are interpreted and extrapolated.