Isotopic disequilibrium between migmatites and granites in an anatectic complex

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We present isotopic data for a variscan (ca. 320 Ma) migmatite/granite complex from the Central Iberian Zone. These data allow to demonstrate the existence of isotopic disequilibrium between metatexites, diatexites and granites, at odds with what would be expectable for rocks linked by partial melting.

In an $\varepsilon Hf_{320\ vs.}\ \varepsilon Nd_{320}$ diagram, the studied samples form two tight clusters each of them comprising metatexites, diatexites and granites. However, each of these groups display a significant $^{87}Sr/^{86}Sr$ range, but almost constant εNd. The increase of Sr isotopic ratios from metatexites to granites, through diatexites, suggests that $^{87}Rb/^{86}Sr$ of the progressively generated melts increased with the advance melting of micas (moscovite and, later, biotite). Moreover, the range in Sr isotopes is observed even when considered the initial values $(^{87}Sr/^{86}Sr)_{320}$, indicating that isotopic disequilibrium occurred during melting. This is here considered as a consequence of the contribution to the melt of minerals which, being characterized by high $^{87}Rb/^{86}Sr$ relatively to the whole host rock, had developed higher $^{87}Sr/^{86}Sr$. This process involving, essentialy micas, with wich Sm and Nd are highly incompatible, did not produce distinct $^{143}Nd/^{144}Nd$. The more radiogenic Nd signatures of the anatectic rocks as compared with the putative metasedimentary protholith can be considered the result of apatite melting. Granites tend to present εNd similar to those characterizing the assotiated metatexites, but lower εHf ("zircon effect") indicating the decoupling of Hf and Nd isotope systems.

According to these evidences suggesting the existence of isotopic disequilibrium during crustal melting, caution must be taken when assessing the source of granitic rocks through the use of isotopic ratios (see also [1]).

[1] Wolf & Romer, 2017, Goldschidt Abstract

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