Crustal sources of peraluminous granites: the Montes de Toledo batholith, Iberian Hercynian Belt

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The Montes de Toledo batholith (MTB) is a composite Hercynian plutonic array (~ 200 km long) located within the Central Iberian Zone (CIZ). The MTB magmatism lasted from 316 to 297 Ma with prevailing monzogranitic to leucogranitic compositions and a marked S-type character. Two contrasted segments are distinguished according to their geochemical and isotopical signatures: the eastern (E-MTB) and the western (W-MTB; Villaseca *et al.* [1]). Restitic and metamorphic enclaves are commonly found, though in the E-MTB are also frequent mafic microgranular enclaves. The E-MTB granites are enriched in Ca, Fe, Na, Sr and Y-HREE, whereas the W-MTB granitoids display higher ACNK ratios and higher P, K, Rb and LREE contents. The wide whole-rock $(^{87}Sr/^{86}Sr)_{300}$ isotopic variation (0.706 – 0.723) and the abundance of inherited Neoproterozoic zircons in the granitoids imply the involvement of a heterogeneous crustal source. εHf values of the Neoproterozoic zircons from the W-MTB granites overlap those from the Schist-Greywacke Complex (εHf up to +10 and +11, respectively), suggesting a major contribution of these metasediments to the granite source. This is also supported by the similar range of their εNd whole-rock isotopic composition (from -3 to -6) and Nd model ages (1.3 – 1.4 Ga). In contrast, the Neoproterozoic zircons of the E-MTB granites show lower εHf values (< +5) suggesting a different protolith. A meta-igneous source is consistent with the common presence of inherited zircons in those granites with the same Ordovician age range as in the outcropping CIZ peraluminous augen orthogneisses (i.e., from 460 to 480 Ma).

[1] Villaseca *et al.* (2008). J Geosci **53**, 263-280

Rates of Natural silica precipitation through time

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Significant deposits of amorphous and cryptocrystalline silica (opal) in the Northern Yilgarn Craton are closely associated with the formation of calcrete. Precipitation of this calcrete occurs in the areas of summer rainfall, where rapid water infiltration and high evaporation rates limit prolonged periods of dampness and plant respiration. The high U concentration accompanied by low initial Pb and Th concentrations shown by some common varieties of opal facilitates the application of the U-Pb and U-series techniques for high precision age determination of opaline silica.

We used SHRIMP (sensitive high resolution ion microprobe) U-series dating of two common opal samples found in calcretes from the weathering profile in the Yilgarn Craton (Western Australia) to determine the timing of one of the latest silicification events in the area and to investigate variations of silica precipitation rates during the late Pleistocene. All analyses indicate that ^{238}U, ^{234}U and ^{230}Th are not in secular equilibrium, allowing the calculation of $^{230}Th/^{238}U$-$^{234}U/^{238}U$ ages.

An apparent symmetrical decrease of ages from centre of the opal veins towards their contacts with the calcrete suggests that the precipitation of silica did not take place in an open space fissures, but rather as replacement of carbonate. The opal growth rate was not constant during the entire time interval between 150 and 40 kyr recorded by the two samples and the age patterns can be interpreted to represent several episodes of very fast growth of opal interrupted by periods of absence or relatively slow silica precipitation. The estimated precipitation rate variation obtained from both opal samples shows three maxima with one near 90 kyr that is visible in both samples. In addition, we found increased precipitation rates at about 135 kyr and 117 kyr in one sample, whereas in the other samples the highest precipitation rates occurred at about 70 and 45 kyr.

These rates appear to exhibit systematic variations through time that can be linked to the major orbital cycles of the Earth, suggesting that silica precipitation rates in the Yilgarn craton and perhaps in whole Australia are controlled by climate variations.

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