Strontium and oxygen isotope compositions from Redondo and Reguengos de Monsaraz plutons, southern Portugal

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The granitoid plutons of Redondo and Reguengos de Monsaraz are located in southern Portugal. The Redondo pluton is syntectonic relatively to D2 hercynian deformation phase and crops in the core of a thermal dome of regional metamorphism, which attained the sillimanite zone. The Reguengos de Monsaraz pluton is late to- post-tectonic relatively to the same deformation phase. Both plutons are very heterogeneous and are formed mainly by tonalites/granodiorites with associated coeval diorites and microgranular enclaves. The granitoids are metaluminous to slightly peraluminous, calc-alkaline rocks, while the diorites and enclaves are metaluminous and tholeiitic. In each pluton, some variation diagrams suggest a mixing process between granitoid and dioritic magma.

The granitoid magma from Redondo pluton was derived from a source more enriched in LREE than that of the associated diorite and enclaves (Silva, 2004). $\delta^{18}O$ varies from 8.53 to 9.15 in the granitoid, from 7.60 to 7.74 in the associated diorite and from 7.77 to 7.86 in the enclaves. The initial $^{87}Sr/^{86}Sr$ ratio in the granitoid varies from 0.70612 to 0.70811, while it varies from 0.70582 to 0.70606 in the diorite and from 0.70623 to 0.70659 in the enclaves.

In the Reguengos de Monsaraz pluton $\delta^{18}O$ varies from 8.64 to 8.71 in the granitoid, it is 8.11 in the diorite and varies from 8.62 to 8.81 in the enclaves. The initial $^{87}Sr/^{86}Sr$ ratios are slightly higher in the granitoid (0.70826-0.71031) than in the diorite 0.70665 and in the enclaves (0.70997 to 0.70912).

In both plutons there is an increase in the initial $^{87}Sr/^{86}Sr$ ratios and $\delta^{18}O$ from the diorites to the granitoid. The enclaves, in both plutons, have strontium and oxygen isotopic compositions which are intermediate between those of the diorites and of the granitoids.

References

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Recycling of juvenile crust in Neoproterozoic granodiorite from South Anhui of China: Zircon U-Pb age, element and O isotope evidence

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Zircon U-Pb dating, whole-rock elements and Sr-Nd isotopes, and mineral O isotope analyses were carried out for three plutons of Neoproterozoic granodiorite in South Anhui. LA-ICPMS zircon U-Pb dating indicates two age phases of magmatic zircons, formed respectively at 821±7 Ma and 881±9 Ma. From CL images no apparent distinction is found between the two groups of zircon, but most spots of the old age occur in cores. The granodiorite has high Al_2O_3 contents and high whole-rock $\delta^{18}O$ value of 11.1 to 13.6‰, pointing to a supracrustal origin characteristic of S-type granite. On the other hand, it has neutral ε_{Nd} (t) values of −2.04 to 0.04 and low initial $^{87}Sr/^{86}Sr$ ratios of 0.7033 to 0.7087, indicating a magmatic source with significant proportions of juvenile crust in affinity to I-type granite. Refractory minerals like zircon, garnet and quartz retain the magmatic O isotope ratios; the other minerals such as K-feldspar, plagioclase and biotite are obviously at isotopic disequilibrium when paired with quartz, and thus suffered different degrees of post-magmatic alteration at medium to low temperatures.

On the basis of element and isotope results, we interpret the zircons of 881±9 Ma as the inherited one, and those of 821±7 Ma as the coeval magmatic genesis. It is inferred that an extensive mantle-derived magmatic activity took place at ca. 900 to 880 Ma in South Anhui. After the rapid weathering and depositing of juvenile crust, the low-mature sedimentary rocks were formed in the southeastern margin of the Yangtze craton. It is assumed that due to anomalously thermal pulse by a mantle superplume event at ca. 820 Ma that heated the overlying lithosphere, the S-type granodiorite was generated by remelting of the water-rich sedimentary rocks in the thickened orogenic crust. During emplacement and cooling of granitoid magma, only medium to low temperature hydrothermal alteration occurred without supersoildus water-rock reaction, indicating that the granodiorite was formed in the pre-rift phase of continental margin rather than at the peak of rift magmatism. Although no coeval mantle-derived magma was added to the granodiorite, the heat is appealed to cause the remelting of juvenile crust that experienced weathering and sedimentation. As a result, the granodiorite has the characteristic features of both S- and I-type granites and thus witnesses the short-term recycling of juvenile crust.