Recycled crust as a cause of large magmatic events in the convecting mantle

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Recycling of subducted oceanic crust is widely used to explain much of the chemical and isotopic heterogeneity of Earth's present-day mantle [1]. In addition, recycled (oceanic) crust fundamentally differs in mineralogy and melting behavior from common peridotite and thus may cause significant melting anomalies in the convecting mantle. Specifically, melting and reaction of basaltic crust (as silica oversaturated eclogite) with peridotite produces olivine-free pyroxenitic lithologies which are able to generate more than 30% of melt at solidus of normal dry peridotite [2]. This means that recycled crust may serve as an efficient source for large amounts of magma at high pressures when typical peridotite does not generate any significant amounts of melt.

Sobolev *et al.* [2, 3] have recently proposed a method for quantitative estimating the amount of recycled crust in the sources of basalts based on the abundances of Mn and Ni in early-formed olivine crystals. This method estimates the proportions of peridotite and pyroxenite derived melts for particular olivine-bearing igneous rock by quantifying Mn deficiency or Ni excess in its olivine phenocrysts relatively to olivine from purely peridotite –derived melt.

Here I will show that estimated proportions of pyroxenitic and peridotitic components usually significantly correlate with Nd and Os isotope compositions and trace elements ratios of bulk rocks, which strongly confirm method and allow constraining compositions and model ages of peridotite and pyroxenite end-members.

Using mentioned approach I will show that initial stages of mantle–derived Large Igneous Provinces commonly associate with almost pure pyroxenite melting. Shortly then the amount of peridotite component drastically rises up to more than 50%. This may suggest that melting of reacted recycled material act as a trigger for break up of continental lithosphere.

[1] Hofmann & White (1982) *EPSL* **57**, 421-436. [2] Sobolev *et al.* (2007) *Science* **316**, 412-417. [3] Sobolev *et al.* (2005) *Nature* **434**, 590-597.

Zircon dating and inheritance of a pre-Variscan granite (SW Iberia)

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The Portalegre pluton is an aligned series of Pre-Variscan granitoids located along the boundary of the Central Iberian/ Ossa Morena Zones (SW Iberian Massif, Portugal). Single-zircon geochronology (U-Pb SHRIMP and Pb/Pb stepwise evaporation) yield an Upper Cambrian/Lower Ordovician age (492.7 ± 3.5 Ma) interpreted as the magmatic crystallization age. The inherited zircon cores indicate the involvement of sources with a wide range age-components: an important Late Neoproterozoic (548 ± 7 Ma and c. 611-681 Ma) population and a Mesoproterozoic (c. 0.95-1.1 Ga) and older (c. 2.6 Ga) components. Younger zircon ages of 358 ± 36 and 387 ± 7 Ma were also found and interpreted as the record of a Variscan metamorphic event. The presence of Grenvillian zircon-forming events in the protoliths of Portalegre granites is significant in the regional geodynamic context of the Iberian Massif (Central Iberian affinity?). At present, the Grenvillian ages are not noticeable in the Late Neoproterozoic/Early Cambrian record of the Ossa-Morena Zone, that has been correlated with West African Craton [1]. These data suggests that the Central Iberian Zone and Ossa-Morena Zone were independent peri-gondwana terrains with diferent paleogeographic affinities before the Ordovician times. The overall chemistry for the Portalegre granites shows they are very differentiated (SiO_2=74-76 wt %), peraluminous (A/CNK=1.1–1.4); have low Zr=36-125ppm, Th/Ta=2-10, $\sum$REE= 22-134 and 1000Ga/Al >3. Their isotopic signatures $(^{87}Sr/^{86}Sr)_{493}$=0.7050-0.7065, εNd_{493}(-2.88 to -0.85) and $\delta^{18}O$=10.5-10.8‰, are compatible with partial melting of relatively young recycled metaigneous ± enriched mantle sources. The age pattern from the inherited zircon cores in the Portalegre granites shows that the late Neoproterozoic age (Cadomian) basement was actively involved in their magma generation. The Grenvillian and Archaean zircons can be accounted for by that source component but they do not imply the presence of an older pre-Neoproterozoic basement rocks beneath SW Iberia.

Thanks are due to I. S.Williams, P. Montero, F. Bea, T. Zinger, F. L. Longstaffe, M. Chichorro and F. Pereira.

[1] Fernández-Suárez *et al.* (2002) *Earth & Planetary Science Letters* **204,** 75–88.