U-Pb and Lu-Hf isotopic constraints on the genesis of a Variscan two-mica granite from Carrazeda de Ansiães

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The Carrazeda de Ansiães area is located in the Portuguese sector of the Central Iberian Zone and is characterized by abundant S-type granites. LAM-ICPMS U-Pb geochronology confirms that one of those granites (Cabeça Boa granite) has been emplaced during the last ductile deformation phase (D_3) of the Variscan orogeny, showing an age of 327 ± 3 Ma. LAM-ICPMS Hf isotope data of the magmatic zircons show a wide range of negative εHf_t values (from -8 to -4), indicating that they could have been derived from heterogeneous crustal anatectic melts. Detrital zircons from a host chlorite phyllite yield a major group of Neoproterozoic ages (561 – 574 Ma), but there are also Mesoproterozoic, Paleoproterozoic and Neoarchean ages. The inherited zircon cores from the granite superficially match the age pattern of the host metasediment. Furthermore, a significant number of inherited zircon cores from the granite has εHf_t values similar to those of the detrital zircons of the chlorite phyllite, suggesting that this metasediment could have been one of the sources involved in the genesis of the granite. However, the average εHf_{320} for the detrital zircons is ca. -19 and is much more evolved than the magmatic zircons with average εHf_{320} (ca. -6), supporting that the melt was not exclusively controlled by the detrital zircons. Therefore, a more juvenile melt source, possibly indicated by the tonalite enclaves in the granite, must also have been involved in its genesis. So, the detrital zircons are interpreted as a contaminant during ascent and emplacement and not a source for the melt. The U-Pb isotope data of detrital zircons of the chlorite phyllite indicate that its maximum depositional age is ca. 578 Ma. The presence of Mesoproterozoic zircons (ca. 1.1 – 1.2 Ga) in the chlorite phyllite argues in favour of a peri-Amazonian location of its Neoproterozoic/Early Paleozoic depositional basin, close to West Avalonia. A West African Craton provenance could also be admitted, if a long distance river transportation of Mesoproterozoic zircons, from the southwest Baltica or Arabian–Nubian Shield, is considered.

PGE perspective on Early Cretaceous oceanic anoxic event: Pacific vs. Tethyan domains

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Mapping of the Os isotope composition of organic-rich sediments formed in Early Cretaceous oceans, Tethys (Gorgo a Cerbara, Italy) and Pacific (DSDP Site 463 and ODP Site 1207B), supports the global occurrence of oceanic anoxic event OAE 1a. In this study, PGE abundances of the same sedimentary sections, together with their Os isotope composition are used to investigate whether or not a meteorite impact had caused the changes in marine conditions that led to oceanic acidification and oxygen depletion at that time. Alternatively, was it the massive volcanism of the Ontong Java Plateau, in southwest Pacific Ocean that solely led to the early Cretaceous global marine anoxia?

In both oceans, based on results from the Selli Level horizon at Gorgo a Cerbara and its equivalent at Site 463, a negative excursion of the seawater Os isotope composition coincides with the OAE1a interval. These results suggest input of unradiogenic Os into the oceans, attributable to both mantle and meteoritic materials. However, no meteoritic signature is evident from the abundances and the inter-element ratios of the PGEs for both sections. The Ir abundance at Site 463 section is 24-285 ppt and fall within the range for that of Gorgo a Cerbara, which are lower than the values for other known large impact horizons. Selli Level-equivalent horizon including the interval that yielded the highest concentration of Re and other PGEs at Site 463 have non-chondritic Os/Ir and Pt/Ir values of 1.5-41 and 14-76, (vs. chondritic values of 1.03 and 2.0). At both sites, PGE abundances and interelement ratios point to a massive volcanic eruption, during the emplacement of the Ontong Java Plateau (+Manihiki and Hikurangi plateaus), as the most likely explanation for the seawater Os isotope excursions coinciding with the anoxia event in both Tethyan and Pacific oceans 120 m. y. ago.