Zircon as a magma mixing proxy: Textural, chemical and isotopic evidence from a young plutonic system

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Ion microprobe U-Pb zircon analyses of the Miocene Monte Capanne Plutonic System (MCPS, Tuscan Magmatic Province, Italy) reveal a range of ages (ca. 7-10 Ma) pointing out to a protracted magmatic history (2-3 Ma; Daly *et al*., 2007) where magma mixing is believed to have played a significant role. As a companion study, we have investigated the textural, chemical and Hf isotopic response of zircon to various magmatic processes, with particular emphasis on magma mixing. For this purpose, we are using CL, BSE imaging as well as electron microprobe chemical data on a variety of magma products, including mafic microgranular enclaves, host monzogranites, mafic (Orano) dykes and granite porphyries. Importantly, zircon ages for these components partially overlap, suggesting that zircon was transferred and/or recycled throughout the lifetime of the whole plutonic system. A variety of textures have been encountered (inclusion-rich cores, patchy-zoning, small and large scale oscillatory zoning, pristine cores) as well as an extremely large range of trace to minor elements compositions (e.g., Hf: 7159-21284 ppm, Y: 39-8661 ppm, U: 67-65319 ppm and Th: 0-46225 ppm). While partitioning of Hf is largely temperature-dependent, intra-grain variations (zoning) in other elements (P, Th, U, Y and HREE) are interpreted to reflect changes in melt chemistry due to mixing between mafic and felsic magmas, where growth/resorption of zircon was also associated with reactions between other accessory minerals (particularly apatite and monazite; Dini *et al*., 2004). The chemical signature of the dominant oscillatory zoning texture suggests growth from melts relatively depleted in trace elements, emphasising the important role of crystal fractionation in the evolution of the MCPS. These interpretations are in perfect agreement with models involving other phases, namely plagioclase (Gagnevin *et al*., 2004) and K-feldspar (Gagnevin *et al*., 2005a, b).

References

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Sr/Ca as a proxy for temperature in the deep-sea coral *Desmophyllum dianthus*

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We test Sr/Ca as a proxy for temperature in the cosmopolitan deep-sea coral species *Desmophyllum dianthus*. Several individuals of recent coral from regions of the deep-ocean typified by near constant temperate were selected from existing collections. Sub-samples were removed from the most recent portions of each skeleton and subjected to a full trace-metal cleaning protocol. Skeletal Sr/Ca was determined using isotope-dilution on a Neptune (ThermoFinnigan) multi-collector magnetic-sector ICP-MS. Intra-run reproducibility of a deep-sea coral consistency standard was better than 1 ‰ (2s), an improvement over most existing ICP-MS and optical spectroscopic methods. Across 8 individuals of *D. dianthus* spanning a 12°C range of growth temperatures, skeletal Sr/Ca decreases linearly as a function of temperature (R^2 = 0.82) with a shallower slope than most surface coral calibrations. Applied to the new archive of deep-sea coral, the Sr/Ca temperature proxy has the potential to generate high-resolution records of past deep-sea temperature.