Zircon from continental and oceanic diorites: why are they different?

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Dioritic magmas are a link between mafic and felsic magma evolution. In oceanic crust and in mafic intrusions they are the most evolved rocks, whereas in upper crustal granitic batholiths they constitute the primitive end members. As such they have the potential to record detailed processes of continental crust evolution from basaltic to overall andesitic composition.

Here, we compare trace element and isotope compositions of zircon from (1) oceanic crust (IODP Hole 735B), (2) monzodioritic intrusions within a late-collisional setting (Niemcza Zone, ca. 340 Ma Variscan orogeny) and (3) quartz dioritic intrusions within a post-colllisional setting (Gęsiniec Intrusion, ca. 300 Ma episode of post-collisional extension in Europe).

The nature of the mantle source is depleted and not variable in oceanic ridges as shown by zircon with εHf of ~15 units. εHf in continental zircon ranges from -5 to 0, consistent with enriched mantle source or crustal contamination. $\delta^{18}O$ mostly overlaps between oceanic and continental zircon, suggesting that contamination by upper crustal weathered material is limited. In terms of trace elements, continental diorites have higher U, Th contents, Th/U ratios, and Eu anomaly while having lower Yb/Gd ratios. Such difference suggestss that continental diorites could likely be the first melts derived from lower crustal cumulates, whileoceanic zircon crystallized in second stage melts formed after MORBs were already extracted from oceanic cumulates.

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