Hf-O isotope signature for zircons in the Taitao Granite: geochemical constraints on slab-melting

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Slab-melting is one of the most important processes for formation of granite, however, its detailed mechanism has not been revealed; for example relative contributions of sediments, basalts, and lower oceanic crust in subducted slab to granite magma genesis. Hf and O isotopes can provide key information because the components in oceanic crust could have different Hf-O isotope compositions.

The Taitao granite in Chile is ideal to obtain the initial isotopic signature of slab-melts, because the granites were generated by modern (ca. 4-5 Ma [1]) slab-melting beneath relatively thin crust (<30 km) without an overlying mantle wedge [2]. We analyzed 132 spots for O and Hf isotope ratios in zircons from 5 granitic plutons using an IMS-1280 SIMS and a LA-ICP-MS, respectively. The zircon $\delta^{18}O$ value in the Seno Hoppner pluton (5.4 ± 0.5‰) is consistent with mantle-equilibrated zircons (5.3 ± 0.6‰ [3]), while those in the other plutons are relatively high (5.6 to 7.2‰). Furthermore, the zircon in the Seno Hoppner pluton shows higher εHf values (6.1 to 9.2) than those in the other plutons (0.9 to 7.6). The zircon Hf isotopic composition is negatively correlated with the zircon $\delta^{18}O$ value. Compared with the analyzed whole rock Hf-O isotope data of 11 rocks around the granites, the variation can be explained by mixing of the sedimentary rocks with high $\delta^{18}O$ (7.9 to 11.3‰) and low εHf (-7.1 to 1.3) values, and the gabbroic-doleritic rocks in the Taitao ophiolite with low $\delta^{18}O$ (4.4 to 6.1 ‰) and high εHf (13.7 to 15.2) values. Our results imply that (1) the sedimentary rocks contaminated to the Taitao granitic magma; (2) the magma without the sedimentary contamination had Hf-O isotope ratios similar to those of the gabbro and the dolerite, which may have composed subducted middle to lower oceanic crust.

[1] Anma et al. (2009), Lithos, **113**, 246-258. [2] Kon et al. (2013), Geochemical Journal, 47, 167-183. [3] Valley et al. (1998), Contrib. Mineral. Petrol, **133**, 1-11.