Zn-Mg isotope evidence for carbonate reactivation during Himalayan anatexis

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Continental crust is a long-term, vast reservoir of sedimentary carbonates and melting of continental crust may reactivate the carbonates and release the stored carbon into the atmosphere, which is crucial for the climate change [1, 2]. Himalayan leucogranites are recognized as typical products of crustal anatexis related to the continental collision between India and Asia. Their peraluminous and extremely radiogenic $^{87}Sr/^{86}Sr$ suggest an origin of metapelite melting. The Mg and Zn isotopes have shown great potential to trace the signals of carbonates in magma sources [3, 4]. In order to test whether sedimentary carbonates are involved during Himalayan anatexis, we investigate the isotopic compositions of Zn ($\delta^{66}Zn$) and Mg ($\delta^{26}Mg$) on a variety of Eocene-Miocene leucogranites.

Our data show that samples except garnet-bearing leucogranites have $\delta^{26}Mg$ and $\delta^{66}Zn$ values that overlap the granitoids reported so far. The heavy $\delta^{26}Mg$ is consistent with a metapelite source whose precursor is a residue of aluminosilicates weathering. In comparison, garnet-bearing leucogranites display extremely light $\delta^{26}Mg$ and heavy $\delta^{66}Zn$ values compared with the mantle. After carefully excluding the effects of fractional crystallization, fluid exsolution and preferential melting of garnets, we propose that partial melting of carbonated pelite or assimilation of carbonates is able to account for the distinct isotopic compositions observed in garnet-bearing leucogranites. This demonstrates that CO_2 was released from the deep crust associated with the emplacement of Himalayan leucogranites.

[1] Lee & Lackey. (2015) *Elements* **11**, 125-130. [2] McKenzie *et al*. Science **352**, 444-447. [3] Li *et al*. (2017) *Natl. Sci. Rev.* **4**, 111-120. [4] Liu *et al*. (2016) *Earth. Planet. Sci. Lett.* **444**, 169-178.