Magnesium and iron isotope fractionation during subduction: perspectives from jadeitites

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Jadeitite is a relatively rare high-pressure/low-temperature rock associated with blueschist and eclogite in serpentinite-matrix melánges. It is commonly interpreted either as the direct aqueous fluid precipitate from subduction channel devolatilization into the overlying mantle wedge or as metasomatic replacement by such fluids of oceanic plagiogranite, graywacke, or metabasite along the slab-mantle interface. Therefore, jadeitite represents direct sample recording fluid transport in the subduction channel and provides a window into this important geochemical process. Previous studies of jadeitites mainly focused on the remarkable transport of large ion lithophile elements; however, the stable isotope fractionation during this process remain enigmatic.

Here we firstly present Mg and Fe isotope compositions of jadeitites, as well as the country amphibolites and serpentinites from Myanmar jade mine. The Atg-serpentinites have undergone subduction-related prograde metamorphism and preserve devolatilization texture which is chareacterized by a secodary Mg-rich olivine (Fo_{96}) directly in contact with the primary olivine (Fo_{92}). Both jadeitites and amphibolites have lower $\delta^{56}Fe$ (-0.05~-0.47‰) and $\delta^{26}Mg$ (-0.80~-1.33‰) values than Atg-serpentinites. Furthermore, Fe isotopes are negatively correlated with bulk Cl contents, suggesting that serpentinite devilatilization would release Cl-rich and low-$\delta^{56}Fe$ fluid into jadeitites. Mg isotopes have no correlation with Cs, Ba, Sr, Ca, Eu and CO_2, respectively, implying that the isotopically light Mg in jadeitites and amphibolites is not caused by sediment dehydration or cabonatitic metasomatism. Therefore, we regard serpentinite devilatilization during subcution results in the release of isotopically light Fe and Mg from serpentinites, with the Fe and Mg isotopically heavy residue returning to the deep mantle. Such low-$\delta^{56}Fe$ and $\delta^{26}Mg$ fluids are expected to currently affect the overlying mantle wedge and arc magmas.