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A sulfur isotope perspective of fluid transport across subduction zones

Nobumichi Shimizu[1*]

[1]Woods Hole Oceanographic Institution, [2]Charles Mandeville

There is a broad consensus that mantle melting in subduction zones occurs as a result of transport of H2O (or H2O-rich components) from subducting slab to the mantle wedge. However, how and where this transport occurs is still one of the outstanding questions. We report here recent SIMS-based sulfur isotope data of pyrites in eclogites from the Western Gneiss Region (Norway: 700 - 850degreesC, 2 - 2.5 GPa; -3.4 - +2.8permil) and of olivine-hosted primitive undegassed melt inclusions from Galunggung (Indonesia: -3 - +5permil, 1000 - 2000ppm S), Krakatau (Indonesia: +1.6 - +8.7permil, 1200 ? 2400 ppm S), and Augustine (Alaska: +1 - +14permil, 2500 - 4700 ppm S). We argue that the observed sulfur isotopic compositions and mass balance considerations do not support the prevailing view of fluid transport at depths around 2.5 - 3 GPa, because the fluid released from eclogites (at 700degreesC; +2 - +8permil, 4000 ppm S) seems incapable of modifying the perceived sulfur isotopic composition of the mantle wedge (0permil, 250 ppm S) to the range observed in the primitive melt inclusions, if amounts of fluid transported to the wedge are constrained by trace element abundances of arc magmas. Our data suggests instead that fluid transport must occur at lower pressure and temperature conditions than previously thought; one possibility being subduction of the hydrated mantle wedge as a source of H2O-rich component for magma generation.

Keywords: subduction zones, magma genesis, fluid transport, sulfur isotopes