

Recycled Archean sulfur in the mantle wedge of the Mariana Forearc

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Non-mass dependent (NMD) sulfur isotopes in rock record is found in the Archean (>2.5 Ga) period, probably owing to the low oxygen concentration in atmosphere at that time (e.g., Farquhar et al., 2000). Recent studies reported NMD sulfur isotopes in sulfide inclusions in olivine within OIB, suggesting recycling of Archean materials in the mantle (Cabral et al., 2013; Delavault et al., 2016). However, sulfur isotopes in the mantle wedge is poorly constrained. In order to evaluate sulfur cycle in the mantle and incorporation of surface materials through subduction, we analyzed quadruple sulfur isotopes of dissolved sulfate in upwelling seepage fluids collected as deep as 202 mbsf (meters below the seafloor) in a cased hole near the summit of the South Chamorro serpentinite seamount in the Mariana Forearc. Sulfate in the upwelling fluids show NMD ($D^{33}S$ ranging from -0.2% to -0.3% with analytical errors of $\pm 0.01\%$). These are unlikely to originate in typical sulfur components in the subducting plate, which is a mixture of sulfide in the MORB ($D^{33}S \approx 0\%$; Labidi et al., 2013) and sulfide produced by reduction of seawater sulfate ($D^{33}S > +0.05\%$). Instead, it is comparable if Archean materials or the plume-related OIB is present in the mantle wedge beneath Mariana Forearc. Because NMD sulfur primarily originates in Archean sulfur, our results may extend the potential presence of recycled Archean materials in the upper mantle due to subduction of oceanic crusts in the Archean period or ongoing subduction of OIB seamounts abundantly exist in the Pacific Plate.

References

Farquhar, J., Bao, H.M., Thiemens, M., 2000. Atmospheric influence of Earth's earliest sulfur cycle. *Science* 289, 756-758.

Cabral, R.A., Jackson, M.G., Rose-Koga, E.F., Koga, K.T., Whitehouse, M.J., Antonelli, M.A., Farquhar, J., Day, J.M.D., Hauri, E.H., 2013. Anomalous sulphur isotopes in plume lavas reveal deep mantle storage of Archaean crust. *Nature* 496, 490-+.

Delavault, H., Chauvel, C., Thomassot, E., Devey, C.W., Dazas, B., 2016. Sulfur and lead isotopic evidence of relic Archean sediments in the Pitcairn mantle plume. *Proceedings of the National Academy of Sciences of the United States of America* 113, 12952-12956.

Labidi, J., Cartigny, P., Moreira, M., 2013. Non-chondritic sulphur isotope composition of the terrestrial mantle. *Nature* 501, 208-+.

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