

## A possible mantle plume source in the lower mantle; Evidence from Polynesian HIMU

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One of the major issues of mantle geochemistry is to decipher heterogeneous nature of the mantle through the studies of ocean island basalts (OIBs) related with mantle plumes. In this study, we focus on OIBs from Polynesia, with unique geochemical characteristics referred to as HIMU. Combined Pb-Sr-Nd-Hf-Os-He isotope analyses using mineral separates provide reliable isotopic information of the basalt source. Coherent isotopic systematics in multi-isotope spaces defined by the HIMU basalts are best explained by recent mixing of melts derived from the HIMU reservoir and the local shallow mantle. The HIMU reservoir has high Pb isotope ratios ( $^{206}\text{Pb}/^{204}\text{Pb} \geq 21.5$ ), low Nd isotope ratios ( $\epsilon_{\text{Nd}} \leq +4$ ), low Hf isotope ratios ( $\epsilon_{\text{Hf}} \leq +3$ ), low He isotope ratios ( $^3\text{He}/^4\text{He} \leq 6 \text{ Ra}$ ), and moderately high Os isotope ratios ( $^{187}\text{Os}/^{188}\text{Os} = 0.14\text{--}0.15$ ). Low  $^3\text{He}/^4\text{He}$  is consistent with involving recycled materials, most probably, the oceanic crust in the source. However, moderately high Os isotope ratios suggest that the HIMU reservoir is not a recycled oceanic crust itself, but a metasomatized mantle by subducted oceanic crust-derived melt. Such the metasomatism can occur at various settings in the recycling process. These would include (a) wedge mantle metasomatism beneath subduction zones by melting of subducted slab, (b) metasomatism of the upper mantle by melting of stagnant slab, and (c) metasomatism of the lower mantle by melting of deep slab near core-mantle boundary. The parent-daughter element fractionation in Sm/Nd, Lu/Hf and U/Pb deduced from the present day Nd, Hf and Pb isotopes of the HIMU reservoir, respectively, should constrain when and where the subducted oceanic crust melted and subsequent metasomatism occurred. We demonstrate a possibility that melting of the oceanic crust in the lower mantle at 2-3 Ga leaving Mg-perovskite as the residual phase adequately fractionates these parent-daughter element ratios. If this is the case, the oceanic crust was subducted and melted to metasomatize the lower mantle to generate the HIMU reservoir.

## Sorption mechanism of dilute fluorine in wastewater using aluminium hydroxide coprecipitation method

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Hydroxide coprecipitation method is widely used in a treatment of wastewater containing dilute toxic anions. But now detail mechanism or quantitative characteristic is not well understood and also demanded. This study discussed a sorption mechanism of fluorine (F(-I)) in wastewater using aluminum hydroxide coprecipitation method by analyzing filtrates and precipitates using artificial wastewater.

Sorption mechanism of F(-I) coprecipitation with aluminium hydroxide was investigated using 4 kinds of experimental methods: (i) sorption isotherm, (ii) zeta potential measurement, (iii) XRD analysis, and (iv) FT-IR analysis. We compared between coprecipitation experimental results and simple adsorption ones in which F(-I) was just adsorbed on the synthesized aluminum hydroxide.

Sorption isotherms of F(-I) on aluminum hydroxide exhibited a BET type isotherms and sorption densities abruptly increased when the initial F/Al molar ratio was more than 3. And zeta potential hardly changed even if sorption densities increased when the initial F/Al was more than 3. But results of XRD and FT-IR suggested that precipitates between F(-I) and Al (i.e.,  $\text{AlF}_3$  and  $\text{AlF}(\text{OH})_2$ ) were not formed in all cases [1]. In other words, sorption of F(-I) to aluminum hydroxide was always achieved by simple adsorption. In particular, FT-IR spectra indicated the amount of F(-I) adsorbed to Al-O bonding increased when initial F/Al was more than 3. Therefore, these results exhibited that F(-I) was adsorbed as complex ions between F(-I) and Al (i.e.,  $\text{AlF}_3^0$  and  $\text{AlF}_4^-$ ) and sorption densities of F(-I) abruptly increased when initial F/Al molar ratio was more than 3. There was little to distinguish coprecipitation experimental results from simple adsorption ones in all kinds of experiments.

For summary, All of experimental results showed that F(-I) was adsorbed as  $\text{F}^-$  when the initial F/Al molar ratio was less than 3 whereas F(-I) was adsorbed as complex ions between F(-I) and Al (i.e.,  $\text{AlF}_3^0$  and  $\text{AlF}_4^-$ ) when the initial F/Al molar ratio was more than 3.

[1] C. Stosiek, G. Scholz, S. L. M. Schroeder and E Kemnitz. (2010) *Chem. Mater.*, **22**, 2347–2356.