# Fluorapatite as a fluid tracer in the hydrothermal Olserum-Djupedal REE mineralisation, SE Sweden

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In order to characterise the fluids for REE mineralisation in the Olserum-Djupedal area, the Cl isotope, halogen and trace element compositions of fluorapatite were determined by SIMS and LA-ICP-MS. Textural relations demonstrate that fluorapatite precipitated concurrently with primary monazite-(Ce) and xenotime-(Y). Later dissolution-reprecipitation processes formed monazite and xenotime inclusions in fluorapatite, and subsequently remobilised the REE into fractures in fluorapatite and into the surrounding mineral matrix. Locally in Djupedal, paragenetically later allanite-(Ce) formed, and alteration of primary monazite took place, resulting in the formation of secondary fluorapatite ± allanite ± xenotime.

All fluorapatites are low in REE content (<0.5 wt% ∑REE) and exhibit concave REE patterns. The REE are strongly correlated with Na, and indicates that REE were primarily incorporated via the substitution $Na^{+} + (Y+REE)^{3+} = 2Ca^{2+}$. The strong correlation between Na and REE suggest a Na-rich character of the original ore-forming fluid. Formation of later REE minerals resulted from an increase in Ca in the fluid, as shown by the appearance of allanite and other Ca-bearing minerals.

The halogen compositions reflect local differences in fluid chemistry, where primary and secondary fluorapatite in Djupedal exhibit higher Cl and Br/I (>10), and lower F compared to primary fluorapatites in Olserum, which typically show the reverse trend. The $\delta^{37}Cl$ compositions of primary fluorapatite range from −0.7 to +1.6‰, and are heaviest in granite-hosted veins. Secondary fluorapatite vary from −0.7 to +0.3‰. The combined halogen and isotopic evidence are in line with a crustal reservoir as the source of the fluids. A possible magmatic input from the adjacent granite will be evaluated.