Ca-REE fluorcarbonates from Cuasso al Monte (Western Southern Alps): a new (Nd)-fluorcarbonate and evidence of Ce mobility

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Ca-REE fluorcarbonate minerals are the main ore for Rare Earth Elements (REE). As well established, REE are critical raw materials and their role is crucial for the industrial progress, the development of modern and environmental-friendly green technologies. However, despite their importance, a lot of open questions exist about the mechanism that governs their transport and deposition. Nevertheless, the understanding of the partitioning of REE is of paramount importance for mineral beneficiation and recycling. Furthermore, Ca-REE fluorcarbonates belonging to the bastnäsite-synchysite series are important for a mineralogical and crystallographic perspective, since they form a polysomatic series (Capitani, 2019).
We studied Ca-REE fluorcarbonates from Cuasso al Monte (Western Southern Alps) found within miarolitic cavities of the granophyre. Ca-REE fluorcarbonates occur in two different morphologies: hexagonal prism and flower-like aggregates of hexagonal lamellae, both micrometer in size. This report focuses on the latter. By means of SEM-EDS and Micro-Raman spectroscopy (Conconi et al., 2023), we identified two different phases: synchysite-(Ce) and a possible new (Nd)-fluorcarbonate. In the latter, the dominant REE is Nd, followed by La and Ce, and has a Ca/(Ca+REE) ratio of 0.09-0.15, which is close to the ratio of the B_5S (0.14) and B_6S (0.12) unnamed polysomes. Moreover, the new phase is associated with botryoidal phyllosilicates covered by a thin Ce-oxide layer. The morphology of synchysite and the new phase is very similar, but whereas in synchysite the hexagonal lamellae are compact, with a Ca and Ce depleted rim, in the new phase they show a complex microstructure: the lamellae are highly porous and, as evidenced by TEM, they consist of an intergrowth of fluorcarbonate nanocrystals and minor hematite, chamosite and kaolinite.
Overall, these observations suggest a mechanism in which Ce is leached from synchysite-(Ce) and precipitates as Ce-oxide, leading to a remnant Nd-fluorcarbonate phase.

References

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