

CRMs in Central Italy's LREE-F-Rich Belt: A Potential REE resource?

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Advances in green and sustainable technologies, particularly those aimed at decarbonisation and energy transition, have significantly increased the demand for critical raw materials (CRMs) in recent years. In this perspective, the European Commission is pushing for continuous research into economically viable deposits.

The LREE-F-rich belt of the Roman Comagmatic Province (RCP, [1]) has already been identified as a promising source of CRMs [e.g., 2]. Key sites include the Pianciano deposit (RM), which contains a fluorite – F-Ca carbonatite orebody, representing the largest underdeveloped fluorite deposit in Western Europe, and Santa Maria di Sala (VT), characterised by the F-Ca carbonatite facies. The significant presence of LREEs and critical minerals, such as barite, means that these areas could offer significant potential for recovering CRMs.

The first results of a new geological, hyperspectral and geochemical evaluation of these two areas are presented, including an industrial perspective focusing on the development of efficient and environmentally sustainable CRM beneficiation processes.

XRPD and SEM analyses show that the main minerals are fluorite, calcite and barite, accompanied by apatite, clays, Pb and Mn carbonates, and rare pyroxenes, garnets and feldspars. XRF analyses indicate LREE contents of approximately 5000 ppm in the fluorite and 1000 ppm in the F-Ca carbonatites. SWIR hyperspectral surveys were carried out both in the field and in the laboratory. Spectral bands were detected at 1400 and 1900 nm (OH and H-O-H bonds), 2206 nm (Al-OH bonds), 2330 nm (CO₃²⁻ overtones). An unidentified band at 1775 nm is tentatively ascribed to fluorite.

In preliminary extraction tests, fluorite-rich samples were treated with HCl and H₂O₂ at different concentrations, volumes and reaction times. The HCl treatment resulted in the recovery of 42% of the LREEs, whereas the H₂O₂ treatments were less effective. Further tests are being carried out to design tailored protocols for CRM extraction, which could be transferred to other similar deposits at a global scale.

[1] Washington (1906). The Roman comagmatic region. *Carnegie Institute of Washington* 57.

[2] Stoppa, Pirajno, Schiazza & Vladykin (2016). State of the art: Italian carbonatites and their potential for critical-metal deposits. *Gondwana Research* 37, 152– 171.