

PhD project - Sustainable carbon sequestration using mineral waste

We are looking for a motivated PhD student with a background in geology, chemistry, environmental science, applied physics, or a related field to develop a research project within a National Science Agency-funded initiative (Agencia Estatal de Investigación, AEI). The student will be supervised by C. Pimentel (Facultad de Ciencias Geológicas, Universidad Complutense de Madrid <https://scholar.google.com/citations?user=HeJeUDYAAAAJ&hl=es>) and A.E.S. Van Driessche (Instituto Andaluz de Ciencias de la Tierra, Granada <https://scholar.google.es/citations?user=dFdudz4AAAAAJ&hl=en>).

Project summary

The escalating global climate crisis, primarily driven by anthropogenic CO₂ emissions, demands innovative solutions for carbon sequestration. While technological advancements in carbon capture and storage have emerged, their widespread implementation is hindered by economic and technical challenges. This project explores a promising alternative: the transformation of abundant gypsum waste into valuable carbon-based materials. By harnessing the potential of mineral carbonation, we aim to develop a sustainable and economically viable strategy to mitigate climate change.

Elucidating the underlying mechanisms governing the carbonation process is crucial for optimizing this approach. By investigating the complex interplay of factors influencing the formation of carbonate minerals from gypsum waste, we seek to unlock the full potential of this resource. Through experimentation and advanced characterization techniques, this PhD project aims to optimize scalable carbon sequestration technologies, contributing to a more sustainable future with reduced carbon emissions.

Training program planned in the context of the PhD project

The doctoral candidate will be enrolled in a suitable PhD program tailored to their academic background. Under the guidance of both supervisors and several external collaborators, the candidate will immerse themselves in a research environment focused on aqueous-mediated crystallization and mineral carbonation reactions. A strong emphasis will be placed on in-situ observation techniques, including the comprehensive training in advanced characterization tools such as vibrational spectroscopy (Raman and Infrared), atomic force microscopy, synchrotron-based X-ray scattering, electron microscopy, and potentiometric titrations.

To broaden the candidate's skill set beyond technical expertise, a robust training program in soft skills will be implemented, encompassing effective communication, project management, and interpersonal abilities. Furthermore, two research stays are planned: a collaboration with BAM (Germany) for hands-on X-ray scattering training and a partnership with BASF (Germany) to gain industrial insights into crystallization additive characterization. These experiences will foster scientific exchange and prepare the candidate for a successful career in academia or industry.

Through active participation in conferences, training schools, and collaborations, the doctoral candidate will develop a strong professional network and acquire a unique skill set at the intersection of mineral chemistry and advanced analytics. This comprehensive training program is designed to equip the candidate with the knowledge and expertise necessary to excel in a competitive job market.