

Enhanced Rock Weathering Using Serpentine from Naślawice, Śląska Massif (Poland, Europe)

Remus Weekes¹

¹University Of Warsaw, Warsaw, Poland

The urgent need for active atmospheric carbon dioxide (CO₂) removal stimulates the development of innovative geochemical technologies, fundamentally shifting the economic paradigm of silicate mineral deposits. Enhanced Rock Weathering (ERW) is a highly promising, low-infrastructure method. By spreading crushed magnesium- and calcium-rich rocks on agricultural lands, ERW facilitates the chemical conversion of atmospheric CO₂ into stable carbonates, ensuring secure carbon storage for up to 10,000 years according to current research.

Despite theoretical efficacy and significant advantages over Carbon Capture and Storage (CCS) – including eliminated leakage risks and no specialized infrastructure requirements – empirical field data remains critically limited. This research addresses this gap by applying ERW technology using serpentinite from the historical Naślawice deposit in Poland. This work presents the conceptual framework of a newly initiated field experiment simulating the application of serpentinite-based mineral fertilizers across various treatment variants to investigate their sequestration potential.

Beyond evaluating the in-situ CO₂ drawdown capacity of serpentinite from the Naślawice mine (Śląska Massif), this study assesses secondary agricultural benefits. The fertilizer's effectiveness in soil deacidification – a major issue in Poland and across Europe – is analyzed, and its ability to improve soil water retention is evaluated. The microporous structure and sorption properties of the Naślawice serpentinite are hypothesized to drive these improvements, offering vital adaptation mechanisms during drought periods.

By integrating carbon sequestration with soil enhancement, this research demonstrates how historically mined ultramafic deposits can be revitalized, creating entirely new applications for existing resources. Utilizing serpentinite as an ERW catalyst provides a scalable, economically viable emission reduction method requiring no land-use changes.