

EGU21-8412, updated on 25 Jun 2022

<https://doi.org/10.5194/egusphere-egu21-8412>

EGU General Assembly 2021

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Major element geochemistry of European agricultural soil: weathering processes of silicate parent materials

Philippe Negrel¹, Anna Ladenberger², Clemens Reimann³, Alecos Demetriades⁴, Manfred Birke⁵, and Martiya Sadeghi²

¹BRGM, Orleans, France

²Geological Survey of Sweden, Uppsala, Sweden

³Geological Survey of Norway, Trondheim, Norway

⁴Institute of Geology and Mineral Exploration, Athens, Hellas

⁵BGR, Hannover, Germany

Collection of agricultural soil samples in Europe (0–20 cm, 33 countries, 5.6 million km²) during the GEMAS (GEOchemical Mapping of Agricultural and grazing land Soil) continental-scale project allowed the study of geochemical behaviour of major elements during weathering (SiO₂, TiO₂, Al₂O₃, Fe₂O₃, MgO, CaO, Na₂O, K₂O, P₂O₅) using their total concentrations (XRF data). The chemical composition of soil represents to a large extent the primary mineralogy of the source bedrock, the effects of pre- and post-depositional weathering and element mobility, either by leaching or mineral sorting with the addition of formation of secondary products such as clays.

Bulk geochemistry is used to calculate a set of weathering indices such as chemical index of alteration CIA, reductive and oxidative mafic index of alteration MIA, the change in mass balance t (calculation relative to immobile Nb) for soil derived from silicate parent materials defined as granite, gneiss and schist at the European continental-scale. Silicate minerals of soil parent materials can be either very resistant to weathering or very soluble and export of elements in dissolved form and precipitation of secondary phases can occur at a large scale. Either way, they leave a strong chemical signature in derived soil, which can be quantified and classified with help of geochemical indices that are useful tools to evaluate chemical weathering trends. Weathering indices and gain-loss mass transfer coefficients were applied to agricultural soil to provide an insight into the weathering processes affecting three silicate parent rocks and their impact on soil development at the European scale. Distinct chemical composition and weathering patterns has been evidenced in silicate derived soil. The interpretation of geographical distribution of soil types with silicate substrate allows better understanding of soil nutritional status, metal enrichments, degradation mechanisms under various climate conditions.