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Aeolian inputs as parent materials for Podzols and terra-rossa soils in a dolomitic landscape in the Italian Alps (Salmezza, BG, Italy)

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On an unglaciated karst landscape in the Lombard Pre-Alps (Salmezza, Bergamo, Italy), an extremely high pedodiversity occurs across a few hectares on Norian dolostone. The rock is locally enriched in well crystallized sand-grained quartz. The climate of the area is suboceanic, with >1500 mm of annual rainfall, and an average temperature around 6-8°C. Rendzic Leptosols and Phaeozems are developed on the steepest slopes, Podzols, Cambisols and Luvisols on flatter areas, while Rhodic Luvisols/Alisols (Terra-Rossa soils) are found in doline cracks and crevices. The sand-grained quartz content of the parent rock seems to be the main soil differentiating factor: where it is abundant (ca. 10-20% in volume), it is responsible for the genesis of Podzols.

We sampled and analyzed 9 soil profiles from the Salmezza area, thus characterizing all pedogenic processes active in the area. In particular, we analyzed standard soil chemical properties (pH, organic carbon, base status and Cation Exchange Capacity, dithionite and oxalate-extractable Fe and Al); we performed a total elemental analysis on most samples and on substrate samples, in order to calculate mass balance and element loss and enrichment; we observed thin sections and performed XRD analysis in powder samples and on the clay fraction of most pedogenic horizons as well.

The parent material is a rather pure dolostone, composed of dolomite, locally enriched in quartz. No other minerals have been observed. Very little amounts of Fe, Al and other elements are thus included in the parent rock (almost completely composed of Ca, Mg and Si), often very close to the analytical detection limit. Ca and Mg were almost completely lost during most soil forming processes in this temperate humid climate, while the enrichment in Si, Fe, Al varies broadly amidst the different soils, thanks to different pedogenic processes. Fe and Al, in particular, were up to 120 times more concentrated in Bt and Bhs horizons than in the parent rock. The ratios between stable elements in rocks and soils verifies important inputs of aeolian materials. The values are, however, different also amidst different soils, so an univocal origin of aeolian materials cannot be hypothesized. The mineralogy of the clay fraction is also strongly modified by pedogenesis, so that each soil type is characterized by a different mineralogical assemblage, making it difficult to detect signatures of specific aeolian origins as well.