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The contribution of dust to volcanic soils in a semi-arid to sub-humid setting, a case study from the Golan Heights.

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From the Pacific islands to the Mediterranean, the importance of dust addition to soils has long been recognized. In this study, we examine the influence of felsic dust input on volcanic soils developing under semi-arid to sub-humid conditions, on the Golan Heights Plateau, northern Israel. Mean annual precipitation in the study area ranges between ~450-900 mm/yr. and typical of the Eastern Mediterranean, the climate is strongly seasonal. Precipitation is restricted to the short winter months, and the soils are dry most of the year.

While topographic position and field evidence indicate that nearly all soils formed in situ from bedrock weathering, the contribution of allochthonous aeolian sediments to the soils has long been recognized through the presence of quartz grains, typical to the regional dust. The distinct mineralogical and chemical compositional differences between the felsic dust and the basaltic bedrock allows us to trace the dust in the soils and examine its contribution and effect on the soils.

Soil samples were collected along a south-north transect following the precipitation gradient, for grain size distribution, mineralogical, chemical and Sr isotope analyses. Few grain size modes were identified: at the fine silt fraction (~10 μm) indicative of “regional” Sharan dust and coarse slit (~100 μm) that suggest an additional proximal dust source. While dust-derived quartz grains are a significant component of the soil, a detailed examination of the chemical composition of soils (<2 mm), in comparison to the basalt bedrock, and dust, exhibits a complex picture. In both bulk and different grain size modes, different elements or elemental ratios exhibit stronger/weaker autochthonous basaltic and allochthonous felsic (dust) signatures, indicating a large variation in residence times for different dust constituents/elements in the soils.

Combining the results from all these different analyses exhibits the complexity of measuring, describing, and quantifying the contribution of dust to the soil, and the importance of a multi-parameter approach when addressing these types of questions.