

Complex rock varnish from the Dry Valleys (Antarctica) suggests the interaction of biochemical weathering and dust accretion in a frontier critical zone

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Rock varnish is a glossy, yellowish to dark brown coating that in arid lands covers geomorphically stable, aerially exposed rock surfaces and landforms. It represents the initial stage of pedogenesis in the critical zone. In warm deserts, rock varnish consists of clay minerals and Mn-Fe oxides/hydroxides, occasionally containing sulphates, phosphates and organics. In Antarctica, rock varnish has been described being mostly formed of Si, Al, Fe, sulphates, whereas Mn/Fe rich coatings are rare.

We investigated rock coatings developed on sandstones outcropping at different localities of the Dry Valleys of Antarctica. In the most of our samples, rock varnish is extremely complex and multi-layered. Optical microscope evidenced the occurrence of highly birefringent material, occasionally thinly laminated (corresponding to Si and Al) interlayered by few micron-thick dark lenses and layers. The latter are well evident under the SEM and chemical analysis confirmed that they consists of different kinds of sulphates, which mostly belong to the jarosite-alunite series, but gypsum crystals were also found. Fe-rich crusts and coatings were also detected, sometimes preserving the shape of the hyphae they have replaced. Samples collected from small weathering pits are rather different and rarely display a very thin Si/Al-bearing rock varnish. These samples show a yellowish brown rind around the external quartz grains, which are often coated by an amorphous, dark Mn/Fe-rich rock varnish. Preliminary data suggest that the formation of rock varnish in the Dry Valleys is a complex process, which required the accretion of airborne dust of variable composition and subsequent recrystallization of some constituent, possibly promoted by microorganisms. On the contrary, the formation of Mn-rich varnish should be in relation with the occurrence of higher environmental humidity within weathering pits. Rock varnish in the Dry Valleys represents a potential tool to reconstruct past water availability and changes in the aeolian fallout.