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Bioweathering of a basalt from Etna (Sicily) by the moss Grimmia pulvinata (Hedw.) Sm.

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Lichens and mosses, as pioneer plants, firstly colonize rocky surfaces enhancing biogeophysical and biogeochemical degradation of their substrates. Indeed, the contact area between the lithological substrates and the cryptogams is considered a simplified environment for studying the mechanisms of bioweathering, which, in many cases, characterize the initial stages of pedogenesis. In this paper we report the results of a study conducted for the recognition and characterization of the bioweathering processes of a basaltic lava present on the slopes of Mt Etna (western Sicily) at an altitude of 1550 m above sea level, associated with the growth of the moss Grimmia pulvinata (Hedw.) Sm. The Etnean rock, characterised by a porphiric structure, is mainly made by a microcrystalline groundmass in which are immersed abundant phenocrysts of plagioclase, augite and rare olivine crystals. The groundmass shows the same mineral assemblage.
With the use of X-ray fluorescence spectroscopy, we determined the chemical composition of the fresh rock, of the materials collected at the rock-moss interface and of the plant tissues. The X-ray diffraction has allowed to have detailed information on the mineralogy of the bioaltered rocky and interface materials. Scanning electron microscope observations and microanalytical investigations carried out on fragments of rock colonized by moss showed a significant disintegration of the rock and the presence of crystals with tabular habit, containing Cu and Fe, aligned tangentially to the surface of Grimmia pulvinata rhizoids.
The weathered material covered by the moss cushion has the chemical and physical characteristics of low pedogenized soils. The high value of the C/N ratio has to be referred to the presence of plant residues with high resistance to mineralize. The significant amount of plant available phosphorus, as assessed by Olsen extraction, confirmed the possibility that the bryophytes constitute important reserves of phosphorus, playing, in particular environments, a significant role in defining the biogeochemical cycle of the nutrient.
With the use of FT-IR spectroscopy the humic acids separated from the organic material present in the "protosoil" and from the moss have been characterized. Limited differences were detected compared to humic acids commonly found in soils. In particular, different is the quantitative contribution of the functional groups that characterize the molecular organization of carbohydrates, organic acids and nitrogen constituents.