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# Lichen-rock interaction in volcanic environments: evidences of soil-precursor formation

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The weathering action of the lichens Lecidea fuscoatra (L.) Ach. and Stereocaulon vesuvianum Pers. on basaltic rock collected on the slopes of Mt. Etna (Sicily) at 1550 m a.s.l. has been studied using optical (OM) and electron (SEM) microscopy equipped with microanalytical device (EDS).
Biological factors associated with lichen growth play a major role in the weathering of minerals on bare rocks and contribute to the preliminary phases of soil formation. The present work investigates the biogeophysical and biogeochemical weathering associated to the growth of epilithic lichens on lava flows from Mt. Etna (Sicily) and Mt. Vesuvius (Campania). The chosen lichen species were the crustose Lecidea fuscoatra (L.) Ach., the foliose Xanthoparmelia conspersa and the fructicose Stereocaulon vesuvianum Pers. An integrated approach based on the study of both disturbed and undisturbed samples of lichenized rock was applied in order to appreciate the complexity of the rock-lichen interface environment in terms of micromorphological, mineralogical and chemical properties. XRD and XRF analyses coupled to microscopical (OM), submicroscopical (SEM) and microanalitical (EDS) observations were the used techniques. In both study environments, the chemical, mineralogical and micromorphological properties of the uncoherent materials found at the lichen-rock interface suggest they consist of rock fragments eroded from the surroundings and accumulated in cavities and fissures of the rough lava flows. According to the thallus morphology, the lichens colonizing the lava preserve the interface materials from further aeolic and water erosion, provide these materials of organic matter and moisture, entrap allochtonous quartz and clay minerals. The calcium oxalate production by L. fuscoatra and X. conspersa, the Al enrichment around S. vesuvianum hyphae and the occurrence of Fe-oxide phases at the rock-lichen interface are evidences of lichens interaction with the underlying sediments. Indeed, according to the young age of the basaltic lava the recent lichen colonization results in a physical reorganization and chemical modification of the interface materials, which are not necessarily produced by the lichen action on the rock substrate. In volcanic environment, the ability of lichens to retain considerable amount of unconsolidated material, which becomes mixed with organic matter, produced by decomposition of the thallus, and trap atmospheric dust may contribute to the andosolization process. Accumulation of Al and Fe, found at the rock-lichen interface likely as organo-metal complexes, can be considered initial stage of Al and Fe active phases formation, distinguishing features of Andosols development. The simple chelating oxalic acid, produced by the lichens, may be involved in the formation of organo-metal complexes.