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The micromorphological approach to rock-lichen interactions

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Biological factors associated with lichen growth play a major role in the weathering of minerals on bare rocks. Research on this topic over the last decades has demonstrated that a variety of interactions exist between these organisms and substrates and that further progresses in the study of the rock-lichen relationships rely on modern instrumental and analytical techniques application.
In this investigation a micromorphological methodology has been produced in order to study the weathering phenomena resulting from the growth of six crustose (Lecidea fuscoatra, Lecanora sulfurea, Rinodina beccariana, Lepraria sp., Rhizocarpon geographicum and Diploscistes actinostomus) and three foliose (Xanthoria calcicola, Xanthoria ectaneoides and Parmelia conspersa) lichen species growing on volcanic and metamorphic rocks. Lecidea fuscoatra was collected on phonolitic tefrite from Mt. Etna (Sicily), Parmelia conspersa on tefritic leucitite from Mt. Vesuvius (Campania), Lepraria sp. and Rhizocarpon geographicum on granite from Alghero (Sardinia), Xanthoria ectaneoides on massive serpentinite from Impruneta (Toscana), Lecanora sulfurea, Rinodina beccariana and Diploscistes actinostomus on metal-bearing schist from Argentiera (Sardinia).
The methodology implies a multi-resolution analysis of rock-lichen undisturbed samples ranging from direct (OM) to electron microscopic (SEM/EDS) observations.
Different litologies covered by lichens were sampled in the field in selected locations (1st level of resolution). Samples were analysed by both direct observation and stereomicroscopy in order to spot the most relevant zones for further study (2nd level of resolution). Such parts were impregnated with polyester resin to obtain a series of thin sections (30 micrometer thick). The thin sections were analysed by optical microscopy using point counting procedures (3rd level of resolution). Bulk and undisturbed microsamples, separated from the most representative weathering sites by microdrilling technique, were analysed by X ray diffraction (XRD), IR spectroscopy (FT-IR), electron microscopy (SEM, TEM) and energy dispersive X ray spectrometry (EDS) (4th level of resolution). Rock-lichen weathering microsites, identified by the results of these analysis, were further subjected to ultrathin sectioning (60 nm thick) for the TEM analysis (5th level of resolution).
Multi-resolution analysis has proved to be an effective and powerful method in order to address the complexity of the rock-lichen environment; more specifically the selection and the analysis of the most relevant microsites for each type of resolution has provided a very interesting tool in order to obtain very detailed spatial study of specific weathering features.