

Microanalytical investigations of rock varnish from different regions

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During the last 200 years there has been a variety of studies debating the origin of the black or brown, up to 250 μm thick manganese-rich coatings on rocks, which are referred to as rock varnish. Varnish grows in almost every type of terrestrial weathering environment, and literature rarely distinguishes between varnish from arid to semi-arid climates, cold climates or even river splash zones.

We used a combination of 200 nm-femtosecond laser ablation-inductively coupled plasma-mass spectrometry (fs LA-ICP-MS), focused ion beam (FIB) slicing and scanning transmission X-ray microscopy (STXM) for high-spatial-resolution analysis of rock varnish. Even though fs laser measurements are almost matrix independent, appropriate reference materials are rare, due to their low Fe and Mn amounts. Therefore, manganese nodule reference material powders (JMn-1 (GSJ), FeMn-1 (IAG), NOD A-1 and NOD P-1 (USGS)) were investigated for their suitability as future reference materials for LA-ICP-MS analyses of these Mn rich coatings.

Rock varnish samples from different arid (Negev, Israel; Death Valley and Mojave Desert, California; An Nafud, Saudi Arabia) and semi-arid (Knersvlakte, South Africa) locations, river splash zones (New York state, USA)², and an urban area (Smithsonian Castle, Washington D.C., USA)³ were investigated for internal morphologies and element distributions at the nm scale, as well as for their element composition and Pb isotope ratios. Based on these features, we present our results displaying differences and similarities between the rock varnish samples from different regions.

¹Samples (dated to ~110 years) obtained by B. DiGregorio

²Samples were obtained by R. Livingston and C. Grissom