Black Crusts on Urban Sandstone: Natural or Anthropogenic?

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Patches of a thin black crust has been observed on sandstone buildings in the US and in the United Kingdom. This has been attributed to sulfur dioxide air pollution attack similar to the black gypsum crusts that have been observed on limestone and marble.

A nondestructive investigation of the dark crust was made using portable XRF on two areas of the Seneca sandstone of the Smithsonian Castle. For comparison, measurements were also made on two adjacent areas without the crust. For each area 5 points along a horizontal traverse were measured at spacings of 2.54 cm. The Mn Kα peak at 5.88 keV was normalized by the Fe Kα at 6.40 keV to compensate for geometrical effects. The resulting Mn/Fe ratios versus traverse distance are plotted in Fig. 1. The ratio typically fell in the range of 0.58 to 1.4 for the encrusted areas, while it was less than 0.05 for the bare areas. This high degree of Mn enrichment is typical of desert varnish on sandstone, which is microbial in origin [1].

Examination of cross-sections of the crust using SEM EDS revealed a thin layer of LC, but no sulfur. XRD analysis did not show any crystalline structure.

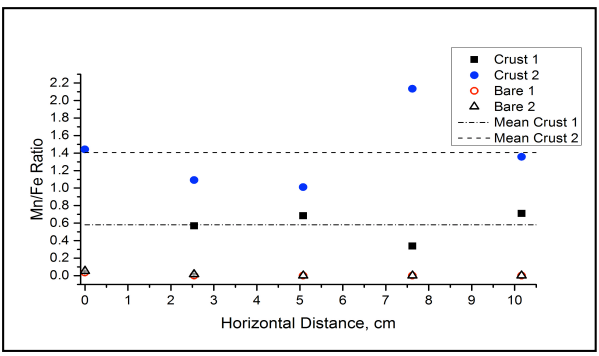

Figure 1: Plot of MN/Fe ratio XRF data as a function of traverse distance

The prelininary conclusion is that the Mn-enriched crusts on the sandstone are not anthropogenic, but rather microbial.

[1] Dorn & Oberlander, (1981). *Science* **213**, 1245-1246