

Manganese and Sulfur in abundance on Mars



Pancam image of the rock "Stuart Island" taken by MER Opportunity.

Rocks from Murray Ridge at the edge of Endeavour crater, where the Mars Exploration Rover Opportunity spent its sixth winter on Mars, were found to have the highest concentrations of Manganese (Mn) and Sulfur (S) measured to date.

- The rock surfaces of "Pinnacle Island" and "Stuart Island" were serendipitously exposed by rover wheel action and extensive measurement campaigns were undertaken for two rocks. The unique phases occur as a relatively bright sulfate-rich coating on basaltic rock, capped by a thin deposit of Mn oxide phases mixed with sulfate minerals.
- We infer subsurface precipitation of sulfate-dominated coatings, followed by partial dissolution and reaction with one or more strong oxidants to produce Mn oxides intermixed with sulfate-rich salts.
- These mineral features indicate that after the large impact that formed Endeavour crater, there was significant movement of fluids through the subsurface and a strong redox gradient in near-surface environments – continuing to improve our understanding of local conditions across Mars.

Arvidson et al., *American Mineralogist*, 2016.

Murray Ridge, Endeavour Crater, Mars