

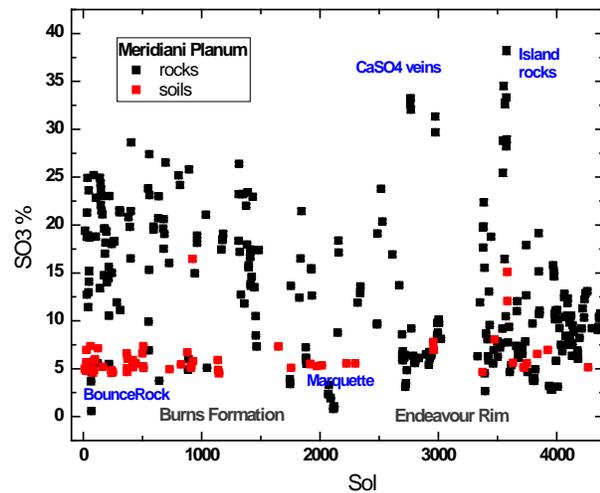
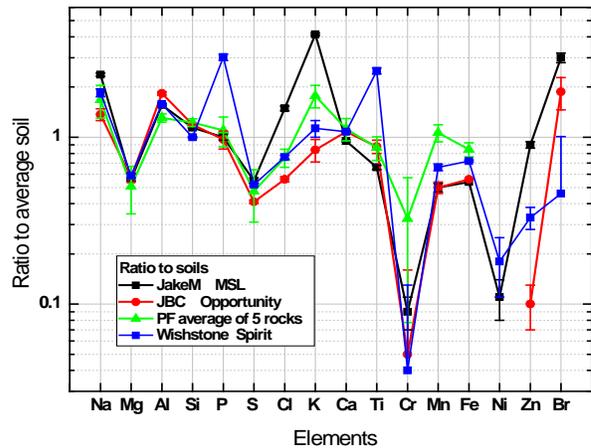
Igneous and sedimentary compositions from four landing sites on Mars from the Alpha Particle X-ray Spectrometer (APXS)

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The APXS – supported and promoted strongly by Heinrich Wänke - on all four Mars Rovers has returned compositional data from about 1000 rocks and soil targets along the combined traverses of over 60 kilometers. Providing precise and accurate bulk chemistry with typically 16 quantified elements, the APXS is a powerful and versatile tool that when combined with the ability to traverse to key rocks and soils has provided critical information needed to understand the geologic evolution of Mars. APXS data allow comparisons among landing sites, provide ground truth for orbiters and connections back to SNC meteorites.

The soils and dust are basaltic in character and represent the average Mars composition similar to Adirondack basalts from Gusev crater but with unambiguous elevated and correlated S, Cl and Zn contents.

At all four landing sites the APXS found several rocks with a felsic composition. The similarity is best assessed in a logarithmic ratio plot of rock normalized to the average soil composition (Fig.1). High alkaline, Al, and low Mg, Fe, low S, Cl and Ni, Zn as well as an Fe/Mn ratio of approximately 50 indicate a likely unaltered and igneous origin.



Sediments, e.g. the Burns formation, with ~25 wt% SO₃ at Meridiani Planum have been documented over 10s of kilometers (Fig. 2). This formation is compositionally homogeneous, but showing the removal of MgSO₄ and a threefold increase in Cl downhill in 2 craters. The degraded rim of the Noachian crater Endeavour resembles average Mars crust, with local Ca, Mg and Fe sulfate alteration and elevated Mn, some felsic rocks, and high Al, Si and low Fe rocks, possibly indicating clays. Unusual soils at Gusev crater in the area surrounding Home Plate include some very rich in ferric sulfate salts (up to 35 wt% SO₃) and some with 90% wt% SiO₂, possibly indicating fumarolic activities. Rocks in the Columbia Hills show significant signs of alteration including elevated S, Cl and Br in the abraded interior. At Gale Crater, mudstones with ~20% clay, <1% SO₃ and overall average Mars composition indicate a former habitable environment with low acidity. A remarkable diversity of compositions was found during Curiosity's traverses, which likely stems from material influx from the northern Gale rim. At Pahrump, the base of Mount Sharp, a homogeneous mudstone with lower Mg and Ca was encountered. The composition of this Murray unit can be traced over several kilometers with smooth trends of higher Fe/Mn and lower soluble trace elements Ni and Zn at higher elevation. The likely aeolian Stimson formation with average Mars crustal composition intersects in several places in sharp contact with the Murray formation. Both units show local alteration halos with highly elevated SiO₂ of up to 75%, usually correlated with increase in Ti and often P.

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