A STONY METEORITE DISCOVERED BY THE MARS EXPLORATION ROVER OPPORTUNITY ON MERIDIANI PLANUM, MARS.

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Introduction: The Mars Exploration Rover Opportunity is exploring the Meridiani Planum terrain of Mars. The area is characterized by a sulfate-rich bedrock largely covered by wind-blown basaltic sand and a hematite lag [1,2]. Only two large rocks (Bounce Rock and Heat Shield Rock) have been observed; they are interpreted as ejecta from a distant crater and an iron meteorite, respectively. Numerous cobbles (here, rock fragments > 1 cm), however, are scattered across the surface of Meridiani Planum [3]. Here we make the case for the possible meteoritic origin of one of these cobbles.

Results and Discussion: On sol 121 of its mission, Opportunity investigated a ~ 3 cm-sized cobble at the rim of Endurance crater. The cobble named FigTree_Barberton was analysed in situ by the Microscopic Imager (MI), the Alpha Particle X-ray Spectrometer (APXS), and the Mössbauer (MB) spectrometer. Barberton was too small to be brushed or abraded. Hence, the APXS spectra and, to a lesser degree, the MB spectra are contaminated by a thin dust covering. Owing to mission constraints, integration times for both spectrometers were limited. After subtraction of a dust component, APXS reveals a composition rich in Mg and Ni and poor in Al and Ca unlike any other material analysed by Opportunity. The Fe-bearing mineralogy revealed in MB spectra is dominated by the mineral olivine and contains metallic Fe in the form of kamacite. Nanophase ferric oxide may be attributed to dust contamination or alteration after deposition of the rock on the surface of Mars. The presence of kamacite suggests crystallization below the IW buffer. This makes a martian origin of Barberton unlikely, since SNC meteorites crystallized at or slightly below the QFM buffer and lack metallic Fe [e.g., 4]. Compared to a range of meteorites [5], Barberton is similar in Mg/Si, Ca/Si and Al/Si ratios to howardites and diogenites, but enriched in S/Si, Fe/Si and Ni and depleted in O. Mesosiderites provide a good match because they have a howardite-like silicate composition with additional metal and sulfide. Mesosiderites typically do not contain abundant olivine, although olivine diogenites are known. Imperfections in the dust correction may allow for other possibilities. In any case, it appears likely that Barberton is the first stony meteorite discovered on the surface of Mars.

References: [1] Squyres S.W. et al. 2004. *Science* 306:1698–1703. [2] Klingelhöfer G. et al. 2004. *Science* 306:1740-1745. [3] Jolliff B.L. et al. 2006. Abstract #2401. 37th Lunar & Planetary Science Conference. [4] Herd C.D.K. et al. 2001. *American Mineralogist* 86 :1015-1024. [5] Nittler L.R. et al. 2004. *Antarctic Meteorite Research* 17:231-251.