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SEDIMENTATION IN MERIDIANI TERRAE, MARS, OWING TO MAGMA-ICE INTERACTION WHEN THARSIS AROSE?

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Introduction: Cold temperatures on Mars [1] and a thin atmosphere prevent the occurrence of water in liquid form on the planet. However, sedimentary rocks at Meridiani Terrae show aqueous sedimentation. Catastrophic outgassing due to the Tharsis rise would result in increasing temperature and pressure, enabling water to exist on the surface for short periods of time. Magma-ice interactions during intrusive events that correspond to peak periods of Tharsis volcanic activity have been proposed as possible origins of surface materials in Xanthe, Margaritifer, and Meridiani Terrae [2]. New images from the Opportunity landing site show what appear characteristic of sedimentary sequences including gradation and cross-bedding. Turbulent flow of sediment-laden water deposits grains in a graded sequence, such as is common in turbidites. Jokulhlaup deposits (sediments from subglacial outburst floods resulting from volcanic activity) in Iceland also show graded deposition [3], superposed by cross bedding structures, reflecting deposition during both the rising and falling limbs of the flood hydrograph.

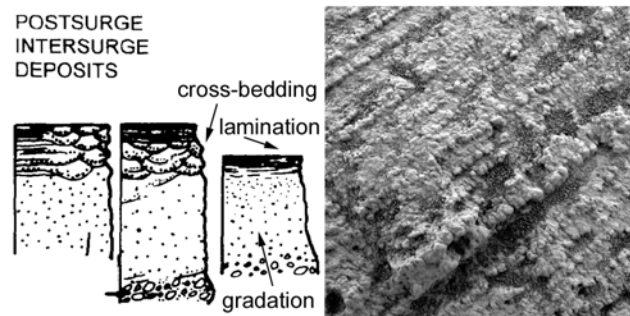


Fig. 1: Graded and cross-bedded sedimentary structures (adapted from Maizels 1997), and microscopic image of graded rocks from the Opportunity landing site, both are sequences thought to have been deposited by a waning, low density turbidity current in shallow lacustrine environment (image courtesy NASA/JPL/Cornell).

Conclusions and future work: Widespread changes in volcanic activity, atmospheric density, and water vapour triggered by Tharsis volcanoes should leave their footprints in martian rocks. At present, the only samples of the martian surface that we have in our collections are martian meteorites. Although they are all igneous rocks, they do contain pockets of melts produced by aqueous alteration [4]. We intend to investigate potential correlations in the timing and extent of activity by means of laboratory measurements, especially IR-spectroscopy.

References: [1] Gaidos, E., and G. Marion, 2003, *J.Geophys.Res.*, 108 (E6). [2] Chapman M. and Tanaka K., 2001, *Icarus* 155, 324-339 [3] Maizels, J., 1997, *Quaternary Science Reviews*, Vol. 16, pp. 793-819. [4] Bridges, J. et al., 2001, *Space Sci. Rev.*, 365-392.