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On the geochemical interpretation of the compositional maps obtained by GRS of Mars Odyssey Mission.

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The Gamma-Ray Spectrometer (GRS) of the 2001 Mars Odyssey Mission [1] yielded global maps of the Martian surface chemical composition. In the following, we will discuss three observations.

1: The abundance of Si in the Tharsis regions turns out to be very low. It is not easy to understand why the area around the Tharsis Montes volcanoes should be so low in Si. The simple explanation of less Si due to a higher proportion of olivine does not work because we should than see an increase in Fe. In fact, Fe is low there, too. That is why we believe that the depression of Si as well as of Fe is a dilution effect. Rieder et al. [2] observed with Opportunity in the outcrops at Meridiani Planum a mean content of 9.2 weight % S coupled with a Si depletion of down to 17 weight %.

The observed Si depression at the Tharsis region amounts to about 20 %. It could be speculated that this might also be due to high abundance of sulfates.

The most recent GRS regional data of Tharsis Montes do not show S concentrations sufficiently high to account for Si depression. However, dilution seems to be the major reason for the Si depression as it is paralleled by low Fe.

It is interesting to note that rover Spirit just found with the APXS an so far unknown type of volcanic rock, which is high in Na (4.5 wt. %), Al (8.0 %), P (2.3 %), and Ti (1.5 %) [3]. Hence, several elements might add up for the dilution effect.

It is conceivable that large amounts of sulfur ended up in sulfuric acid, which formed lakes and oceans covering most of the Martian surface. On reaction with olivine, Mg

and Fe and other sulfates were formed, which now are found on the Martian surface in large quantities.

2: Iron is generally low in the southern martian highland for yet unknown reasons.

3: On Earth, K, U, and Th follow each other except in special cases. The GRS maps for Mars for K and Th show a similar trend but there are deviations. Potassium shows enlarged abundances in several areas in the northern hemisphere of Mars. Thorium is also enriched in these areas, but the Th enrichment covers larger areas. We believe that during magmatic fractionations Th follows K also on Mars. However, Th resides, contrary to K, mainly in phosphates that are easy soluble. They can be distributed over larger areas with running water and even more so in the presence of sulfuric acid.

References: [1] Boynton, W.V. et al. (2004), *Space Science Rev., 110*, 37-83. [2] Rieder, R. et al. (2004) *Science, 306,* 1746–1749.[3] Gellert, R. et al. (2005) LPSC XXXVI, LPI Houston (CD-ROM).