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WEATHERED METEORITES ON MARS: EVIDENCE FOR A GLOBAL DUST UNIT AND IMPLICATIONS FOR OXIDATION STATES OF THE MARTIAN SURFACE

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Due to the cessation of consumptive plate tectonics several billion years ago, the Martian sedimentary record represents a long-term archive of exogenic processes. Anticipated low soil formation rates on the order of meters per billion years as well as the closeness of Mars to the asteroid belt (2.6 times the impact rate of bolides in comparison to Earth) should cause relatively large amounts of meteoritic accumulates in the Martian soil. We estimated the mixing relationships in the Martian soil by means of least squares calculation on chemical data from APXS-Pathfinder and XRFS-Viking measurements. In our model the soil composition is considered as a mixture of the Pathfinder Soil Free Rock (SFR), physical weathering products of Pathfinder andesites (PWP) and primitive meteoritic material consisting of CI-chondrite. Based on our model, the existence and composition of a Global Dust Unit (GDU) was established and compared with previously published Rock Free Soil and global dust compositions. GDU material appears to be intimately admixed to Pathfinder surface soils and, to a smaller extent, to Viking deep soil samples. Some GDU material also appears to adhere to Pathfinder rock samples. APXS spots were targets of VNIR reflectance analysis during the Pathfinder mission. Combination of terrestrial analogue calibration and chemical diversity among the principal component space can give clues to oxidation states of Martian surface materials. Three dimensional regression analysis of oxidation states as taken from Pathfinder VNIR reflectance analysis suggests that the meteoritic fraction is the main sink for oxygen in the course of oxidative weathering on Mars. We show VNIR reflectance spectra of weathered meteoritic finds and compare them with spectra of Martian surface materials. Finally, from the correlation between oxidation states and the primary component composition of Martian surface materials the potential of different source materials to sequester atmospheric oxygen during weathering is discussed.