FE-BEARING PHASES IDENTIFIED BY THE MÖSSBAUER SPECTROMETERS ON THE MARS EXPLORATION ROVERS: AN OVERVIEW. R. V. Morris¹, G. Klingelhöfer², D. W. Ming³, C. Schröder³, D. Rodionov⁴, A. Yen⁵, R. Gellert⁶, and the Athena Science Team. ¹ARES, NASA Johnson Space Center, Houston, TX 77058 (richard.v.morris@nasa.gov). ²Institut für Anorganische Chemie und Analytische Chemie, Johannes Gutenberg-Universität, Staudinger Weg 9, 55128 Mainz, Germany. ³Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109. ⁴Depart. Physics, University of Guelph, Guelph, Canada.

Introduction: The twin Mars Exploration Rovers Spirit and Opportunity have explored the martian surface at Gusev Crater (GC) and Meridiani Planum (MP), respectively, for about two Earth years. The Mössbauer (MB) spectrometers on both rovers have analyzed an aggregate of ~200 surface targets and have returned to Earth information on the oxidation state of iron, the mineralogical composition of Fe-bearing phases, and the distribution of Fe among oxidation states and phases at the two landing sites [1-7]. To date, 15 component subspectra (10 doublets and 5 sextets) have been identified and most have been assigned to mineralogical compositions. Two subspectra are assigned to phases (jarosite and goethite) that are marker minerals for aqueous processes because they contain hydroxide anion in their structures. In this paper, we give an overview of the Fe-bearing phases identified and their distributions at Gusev crater and Meridiani Planum.

Martian Fe-bearing phases, according to Mössbauer spectroscopy: In the following paragraphs, we identify the Fe-bearing phases in two ways. One is a generic name that refers to its oxidation state and whether the phase is characterized by a doublet or sextet subspectrum. For example, Fe2D1 and Fe3S1 refer to Fe2⁺ doublet subspectrum #1 and Fe3⁺ sextet subspectrum #1, respectively. The second identification is the mineralogical assignment for the subspectrum. Why two names? The generic name is not subject to interpretation and therefore not subject to revision. In contrast, the mineralogical assignment can be contentious and subject to possible revision as our understanding of Mössbauer data sets improves and Mössbauer results are integrated with information from other MER instruments. Except for newly detected subspectra, details concerning the values MB parameters are reported in [1-3].

Fe2D1 (oct-Fe2⁺, olivine). Olivine occurs in basaltic soils at both landing sites and in float rocks on the Gusev plains (Adirondack class basalts) and in the Columbia Hills. It is less common in outcrop rocks at West Spur and in the summit region of Husband Hill. There is an extensive, olivine-rich outcrop along Haskin ridge (rocks LarrysBench through ComancheSpur). A nearby basaltic soil (ElDorado) is anomalously enriched in olivine.

Fe2D2 (oct-Fe2⁺, pyroxene). Like olivine, pyroxene occurs in basaltic soils at both landing sites. Pyroxene is the major Fe-bearing silicate component in many West Spur and Cumberland ridge rocks. BounceRock at MP is nearly all pyroxene with respect to its Fe-bearing phase.

Fe2D3 (oct-Fe2⁺, ilmenite). Ilmenite occurs in rocks located in the summit region of Husband Hill.

Fe2D4 (oct-Fe2⁺, probable chromite). Chromite is found in only two rocks near the Husband Hill summit (Independence and Assemblee).