CRYSTAL FIELD SPECTRA OF Fe(II), Fe(III), AND Cr(III) IN SINGLE CRYSTALS FROM ROCKS 66095, 14063, AND DEEP-DRILL CORE 70002: IMPLICATIONS OF OXIDATION/REDUCTION PROCESSES IN THE LUNAR REGOLITH, P. M. Bell & H. K. Mao, Geophysical Laboratory, Washington, D. C. 20008

A wider range of oxidation/reduction conditions has been identified in the lunar regolith than was previously observed. Data on the crystal field spectra of iron and chromium in single crystals from Apollo 14, 16, and 17 samples suggest that the partial pressure of oxygen was significantly higher than the value $10^{-13.5}$ determined in Mare basalts. Spinel: Single spinel crystals from 14063 and 70002 ranging in composition to a limiting value of FeO 5.66, MnO 0.10, MgO 24.23, Al_2O_3 64.52, Cr_2O_3 4.31, SiO_2 0.09, TiO_2 0.06, wt. %, contain tet. and oct. coordinated Fe(II) and Cr(III). In contrast, synthetic and terrestrial spinels of analogous composition additionally contain Cr(II) after treatment in an atmosphere of $10^{-11.5}$ partial pressure of oxygen at 1400°C. Fe-Cl-Ni oxyhydrate phase: Single crystals of approximately 50 μm diameter selected from rock 66095 are "göethite-like" in appearance and contain abundant ferric iron. Ferrous iron was not detected.

The present determinations imply that whereas the chemical environment of the lunar regolith is typically reduced, oxidation conditions corresponding to partial pressures of oxygen of more than approximately 10^{-10} exist in lunar rocks. The most oxidized rocks appear to have been altered as a late-stage event because they contain unoxidized metallic phases. However, the spinels studied from 14063 and 70002 appear to better represent the surface conditions, as do the Mare basalts. It will be necessary to assess the oxidation/reduction data in order to formulate a model of the chemical atmosphere of the moon as a function of depth. It may be possible to determine: A. The degree and variation of oxidation/reduction conditions of the lunar interior; B. Oxidation/reduction processes at the lunar surface and the influence of implanted solar wind gas; C. Nature of the gas phase; D. The extent of meteoritic contamination in the lunar regolith.