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SURFACE MAGNETOMETER EXPERIMENTS: INTERNAL LUNAR PROPERTIES AND SOLAR WIND-LUNAR FIELD INTERACTIONS. Palmer Dyal and Curtis W. Parkin,* NASA-Ames Research Center, Moffett Field, CA 94035.

The Apollo 12, 14 and 15 magnetometer network has yielded unique information about the history and present physical state of the Moon. The measured remanent magnetic fields vary considerably from site to site: 38 ± 3 gammas at Apollo 12, 103 ± 5 and 43 ± 6 gammas at two Apollo 14 sites separated by 1.1 km, and 6 ± 4 gammas at Apollo 15. The strengths and variety of these field magnitudes imply that the field sources are local rather than global in extent. Sample analyses by other investigators indicate that a magnetizing field $> 10^3$ gammas existed when the source material at the sites cooled below the Curie temperature. The large field and sample remanence measurements indicate that material located below the randomly oriented regolith was uniformly magnetized over large areas. The Apollo 15 site lies near the edge of the mare Imbrium mascon basin; the fact that little or no remanent field exists at that site leads us to draw the preliminary conclusion that mascons are not highly magnetic.

The global magnetic response of the moon to solar and terrestrial fields varies considerably with the lunar orbital position. During times when the Moon is immersed in the steady geomagnetic tail field, the bulk relative lunar magnetic permeability is calculated to be $\mu/\mu_0 = 1.03 \pm 0.13$.

When the Moon is located in the free-streaming solar wind, measurements from a magnetometer on the nighttime side of the Moon can be analyzed to determine the lunar electrical conductivity profile. A three-layered model has been used to analyze Apollo 12 magnetometer data for solar wind magnetic field step-transient events. The results yield a thin non-conducting outer layer; an intermediate layer of conductivity $\sigma_1 \sim 10^{-4}$ mhos/meter for a shell of radial thickness $\Delta R = R_1 - R_2$, where $0.95\ R_{moon} \leq R_1 < {}_{moon}$ and $R_2 \sim 0.6 R_{moon}$; and conductivity $\sigma_2 \sim 10^{-2}$ mhos/meter for the core bounded by $R_2$. The temperature of the lunar interior can be calculated for assumed material compositions; for an olivine Moon, temperatures are calculated to be $< 440°K$ for the crust, $\sim 810°K$ for the intermediate shell, and $\sim 1240°K$ for the core. Subsequently a continuous model of the lunar interior has been developed which determines more detailed radial profiles of internal conductivity and temperature.

Comparison of preliminary Apollo 15 data with the Apollo 12 data indicates that the lunar response to solar wind transients is similar at

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the two sites and that Apollo 15 data, when fully processed and analyzed, will allow calculation of both horizontal and radial conductivity profiles.

Correlation with solar plasma measurements yields information concerning the plasma interaction with lunar remanent and induced fields. The 38-gamma remanent field at Apollo 12 is found to be compressed by the solar wind during times of high solar plasma density. Since the Apollo 15 remanent field is much lower than 38 gammas, detailed analysis of Apollo 15 data should allow investigation of the plasma interaction with induced lunar fields alone.