ORIENTALE AND SOUTH POLE-AITKEN BASINS: PRELIMINARY GALILEO IMAGING RESULTS. J. W. Head[1], M. Belton[2], M. Carr[3], C. Chapman[4], M. Davies[5], F. Fanale[6], E. Fischer[1], R. Greeley[7], R. Greenberg[8], R. Kolvoord[8], L. Doose[8], P. Helfenstein [9], H. Hoffmann[10], R. Jaumann[10], T. Johnson[11], K. Klaasen[11], A. McEwen[12], T. Becker[12], S. Murchie[1], G. Neukum[10] , J. Oberst[10], C. Pieters[1], C. Pilcher[13], J. Plutchak[1], M. Robinson [6], R. Sullivan[7], J. Sunshine[1], J. Veverka[9]. [1]Brown University, Providence RI; [2]Kitt Peak National Observatory, Tucson AZ; [3]USGS, Menlo Park CA; [4]Planetary Science Inst., Tucson AZ; [5]RAND, Santa Monica CA; [6]Univ. Hawaii, Honolulu HI; [7]Ariz. State Univ., Tempe AZ; [8]Univ. Arizona, Tucson AZ; [9]Cornell Univ, Ithaca NY; [10]DLR, Oberpfaffenhofen FRG; [11]JPL, Pasadena CA; [12]USGS, Flagstaff AZ; [13]NASA HQ, Washington DC.

The geometry of the December 1990 Earth/Moon encounter by the Galileo spacecraft was such that the western half of the nearside, the western limb, and parts of the eastern farside were illuminated and in view.[1,2] The Galileo Solid State Imaging system (SSI)[3] obtained multispectral images for these regions and following preliminary calibration, color visualization images were compiled using combinations of band ratios[4] chosen on the basis of telescopic spectra and laboratory spectra of lunar samples.[5] Ratios of images taken at 0.40 and 0.76μm are sensitive to changes in the slope in the visible portion of the spectrum, and ratios of 0.97 and 0.76μm relate to changes in the strength of near-infrared absorptions due to variations in iron-rich minerals such as olivine and pyroxene. Results of the analyses of compositional heterogeneity of the crust[5] and maria[6] are presented elsewhere. Here we discuss some characteristics of the Orientale basin and its surrounding ejecta and the characteristics of the South Pole-Aitken region of the farside (Fig. 1).

The Orientale Basin (~900 km diameter) is the youngest large multi-ringed impact basin on the Moon. Its exterior ejecta deposits[7] (the Hevelius Formation) extend about one basin diameter away from the Cordillera Mountains at the edge of the basin. Its interior is composed of multiple rings, various basin-related deposits[7,8](Montes Rook Formation- knobby deposits and massifs; Maunder Formation- fissured light plains) and post-basin mare units.[6] The large size of the basin suggests that during the impact event, excavation may have penetrated to great depths within the crust, perhaps even through the crust and into the mantle. Earth-based telescopic observations[9] and Apollo remote sensing experiments[10], which were limited to the eastern side and the northern edge of the basin, suggested that the ejecta in these areas was composed predominantly of mixtures of anorthositic components with no evidence for olivine-rich or ultramafic assemblages. On the basis of these earlier data it was concluded that Orientale excavated primarily upper crustal material.

The Galileo data provide multispectral images of the entire Orientale ejecta deposit and show that for the most part the Hevelius Formation appears similar to typical feldspathic highlands deposits such as the soils at the Apollo 16 site. Although there are some variations within the Hevelius, there is no suggestion of distinctive concentric development of subunits or a major radial variation within the unit. There is no evidence for enhanced mafic content within about one basin radius from the rim outward. To a first order, these observations suggest the Hevelius Formation is derived primarily from highland crustal material. Within the basin, the spectral properties of the Montes Rook and Maunder formations appear as distinctive annuli suggesting subtle variations in feldspathic materials. Lowell, a crater within the Montes Rook Formation, appears to be characterized by a relatively higher abundance of mafic material, suggesting the presence of more iron-rich and perhaps deeper material at least locally in the basin interior. Fresh craters on ring massifs within the basin are characterized by low abundances of mafics, consistent with anorthositic materials.[9] More detailed analysis is underway to assess the significance of variations within the basin interior.

In the SE quadrant of the distal portions of the Orientale exterior deposits, Galileo data reveal a distinctive region where the Hevelius formation itself and the bright craters superposed on it show evidence for higher abundance of mafic minerals than typical highlands. This region, centered near Schickard, is the site of small patches of mare material and also several dark halo craters, superposed on the Hevelius Formation, whose spectra suggest that they have excavated mare material from beneath the Hevelius.[11] The distinctive mafic nature of this region revealed by the Galileo data strongly suggests that pre-Orientale mare material underlies a 2-4 x10^5 km^2 area beneath the Hevelius formation, and that this deposit is on the scale of a major maria, such as Crisium or Humorum. The presence of this mantled mare further supports and extends the evidence that mare volcanism was important prior to the end of the basin forming epoch.[12] We are presently examining evidence for other possible pre-Orientale cryptomaria.

A major anomaly in the color visualization images of the lunar highlands is seen within the South Pole-Aitken basin region and is currently under investigation. The basin interior appears distinctive from surrounding highlands and has an enhanced mafic component in highlands materials particularly in the SE part of the basin. The interior is also characterized by low albedo in monochromatic images. In addition, albedo images show evidence for basin ring structure near the limb. This ancient (pre-Nectarian) basin is about 2000 km in diameter and is the largest well-documented basin on the Moon.[13] Although mare materials occur as patches on the basin floor,[13,6] the general characteristics of the region seen in Galileo data strongly suggest that the highland materials that make up the basin interior are unusually rich in mafic minerals. This material is in contrast to the less iron rich materials of the smaller Orientale basin and suggests that the South Pole-Aitken basin may contain an ancient cryptomare, or that the basin-forming event may have penetrated deeper into iron-rich lower crustal material, or that it excavated mafic mantle material. Apollo gamma-ray data for a portion of the interior show enhanced iron content[14] and these images suggest that material with relatively high iron content may be significantly more widespread. Present data analysis is focused on the documentation of these anomalies, their distribution, and implications for basin excavation depths.

These initial results confirm the utility of multispectral imaging for regional lunar geological and compositional analysis. We are presently working on further calibration of the data[5] and unit definition and characterization in the assessment of impact basins and crustal heterogeneity.

1) F. Fanale (1990) EOS, **71**, 1803; 2) M. Belton *et al.*, this volume; 3) M. Belton *et al.* (1990) Space Sci. Rev., in press; 4) A. McEwen *et al.*, this volume; 5) C. Pieters *et al.*, this volume; 6) R. Greeley *et al.*, this volume; 7) D. Wilhelms (1987) USGS PP-1348; 8) J. Head (1974) Moon **11**, 327; 9) P. Spudis et al. (1984) JGR **89**, C197; 10) A. Metzger *et al.* (1977) PLPSC **8**, 949; 11) B. Hawke and J. Bell (1981) PLPSC **12**, 665; J. Bell and B. Hawke (1984) JGR **89**, 6899; 12) P. Schultz and P. Spudis (1979) PLPSC **10**, 2899; 13) D. Stuart-Alexander (1978) USGS Map I-1047; 14) A. Metzger et al.(1974) G&CA **2**, 1067.

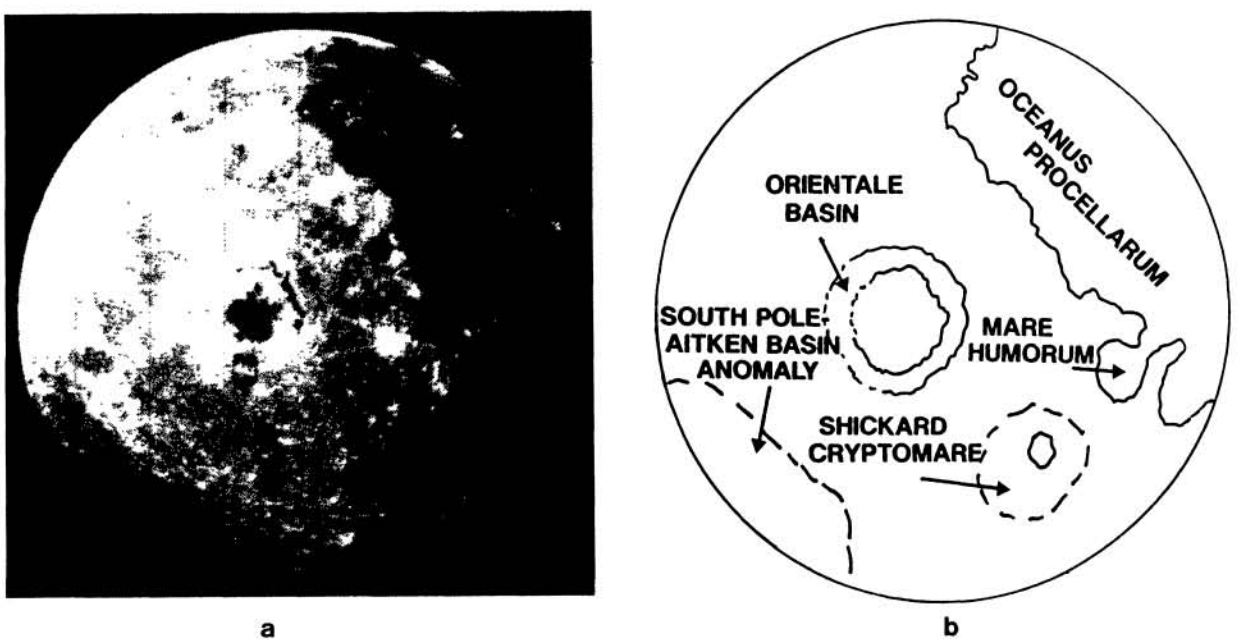

Fig. 1. Galileo SSI image (a) of the lunar western limb and parts of the farside and location of features (b).