SCHICKARD CRYPTOMARE: INTERACTION BETWEEN ORIENTALE EJECTA AND PRE-BASIN MARE FROM SPECTRAL MIXTURE ANALYSIS OF GALILEO SSI DATA.
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Introduction: (1,2,3). This region (Figure 1) also contains small patches of relatively fresh mare, indicating some local post-Orientale volcanism has occurred in this area (4). Analysis of ratio images from the Galileo SSI instrument confirms the strong mafic affinities of the dark halo craters and the enhanced mafic content of the light plains (5). T. It is unlikely that this region represents a zone of enhanced mafic content of the ejecta alone, and it is interpreted to indicate mixing of pre-Orientale mare with ejecta from the Orientale basin, either during the emplacement process or by post-emplacement vertical impact mixing (3). Spectral mixture analysis is used to deconvolve Galileo SSI data into the relative contributions of the mixed spectral components in the surface material. The results will be used to define the extent of pre-Orientale volcanism in the area, and to investigate the dynamics of ejecta emplacement.

Analysis: An image-based, linear spectral mixture model is used to analyze the mixture systematics (6,7). Although a non-linear model may be more appropriate (e.g. 8,9), such an approach requires that the data be calibrated to a very high degree of photometric accuracy. However, the primary difference between methods is the absolute magnitude of the endmember abundances fractions. The general spatial associations and systematics will be similar. Careful analysis of inherent spectral variability, and interactive refinement of mixture solutions leads to the selection of 3 spectrally distinct endmembers (Figure 2): mare (Humorum), highland (Hevelius formation), and fresh crater (Byrgius). 5 channel Galileo SSI data (relative to the spectral properties of Mare Humorum) for the region shown in Figure 1 were deconvolved into the percent spectral contribution of the three endmembers using a least squares model. The average fitting error was 1.58 DN, approximately the noise level of the data. Additional endmembers cause the least squares solutions to be unstable and result in unrealistic endmember abundances (i.e. >1.0 or <0.0). Calculated endmembers abundances provide a framework for interpreting the relative contributions to the measured multispectral data. Subtle compositional differences (e.g. TiO₂ abundance) within these major units are not distinguished, but may be inferred from band-residual images (10) or analysis of ratio images. Shown in Figure 3 is the mare fraction map. The abundance values have been density sliced into discrete abundance levels and the lower bound (25%) is chosen to mark the lower limit of confidence for an unambiguous mare signal.

Results: The two zones of high abundance on the floor of the Schickard impact crater correspond to the small patches of post-Orientale mare identified by (4); the rest of the floor shows moderate to low abundance. The east, south, and west crater walls show an absence of mare indicating a surface dominated by highland components. Most of the light plains and discontinuous facies of the Hevelius formation within and between the Schickard and Schiller craters, and in the northern half of the Schiller-Zuccius Basin also exhibit moderate to low mare abundances. West of the main mare-bearing zone several small isolated regions of mare are detected which correspond to patches of light plains material within the continuous facies of the Hevelius formation. The discontinuous patches of "mare" detected south and east of this main zone are artifacts of shading due to the highly variable illumination near the terminator. From the mare fraction map in Figure 3, a minimum areal extent of pre-Orientale mare is determined to be =3-4 x 10⁵ km². Evidence from dark halo craters suggests additional mare patches exist west of this main area (1,3). These areas are not detected in this analysis and may be covered by a greater thickness of ejecta or are smaller than the spatial resolution of the SSI instrument.

The mare fraction image in Figure 3 also provides quantitative information on the mechanism of ejecta emplacement. Three profiles of mare abundance for the transects indicated in Figure 1 are shown in Figure 4. Profile A indicates the background level of variation for low to zero mare abundance. Profile B crosses the southern portion of the cryptomare. There are typical background levels until 1.5 R where the abundance of mare begins to increase until the peak at 2.75 R is reached which is followed by a sharp decline to background levels. Profile C crosses the...
abundance. Profile B crosses the southern portion of the cryptomare. There are typical background levels until 1.5 R where the abundance of mare begins to increase until the peak at 2.75 R is reached which is followed by a sharp decline to background levels. Profile C crosses the post-Orientale mare patches and therefore exhibits greater variability in abundance values. Nevertheless, a similar progression to B, from low values through steadily increasing values, followed by a steep drop to background levels, is observed. The proportion of highland ejecta to mare target material decreases as a function of radial distance from the Orientale basin within the cryptomare area. We are currently characterizing these systematics quantitatively to determine if they are consistent with a ballistic erosion model for ejecta emplacement (11) or instead reflect the decrease in highland ejecta with radial distance in the discontinuous ejecta.

References:
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