TOPOGRAPHY OF THE ORIENTALE BASIN, James W. Head, Edmund Robinson, Geological Sciences Dept., Brown University, Providence, RI 02912; and Roger Phillips, Lunar & Planetary Institute, 3303 Nasa Road 1, Houston, TX 77058.

The topography of unfilled and filled impact basins is extremely important in determining the initial basin geometry, degradation history, influence of viscous relaxation processes, volumes of mare fill, geometry of loads applied to basins, and nature of gravity anomalies associated with the basins. Topographic data exist for parts of several nearside basins. However, only limited topographic information has been available for the youngest and least modified large lunar basin, Orientale. Orientale topography is important because of the relative youth of the basin, its lack of significant modification by impact processes, and its thin central mare fill, which preserves the initial topography and morphology of most of the basin interior. The purpose of this paper is to summarize the available topographic data on Orientale and to present a preliminary contour map of Orientale (Figure 1,2) derived from Earth-based telescopic profiles of the western limb obtained at different librations.

Topographic Data Sources - Shadow measurements derived from Lunar Orbiter IV coverage of Orientale provide local elevations for many features within the Orientale basin. A summary of measurements is presented in Figure 3 of (1). Several photogrammetric profiles obtained from analysis of Lunar Orbiter IV frames are presented in Figure 5 of (2). The Apollo laster altimeter obtained topographic profiles across the northern edge of the basin (3,4) and the Apollo 17 Lunar Sounder Experiment obtained profiles over the same region (5). Zond 7 and Zond 8 photographs of the Orientale region represent a significant but as yet unrealized source of photogrammetrically-derived topographic data. Earth-based photographs of the limb region at different librations provide an important source of data on general basin topography (6,7). These data have the advantage of providing multiple parallel profiles of basin topography for the eastern one half of the basin. Their disadvantages are their lack of detailed control, the obscuring effects of high topography lying in front of or behind the actual limb profile, and the lack of data for the western part of the basin. We present here a preliminary topographic map produced from the limb measurements (Fig. 1,2) and briefly discuss some observations. We are presently comparing the topography with data from other sources.

Discussion - A major feature of the topography of Orientale is the central depression, lying within the inner Rook peak ring, approximately 6 km below the level of this first mountain ring plateau. A portion of this topography may be due to thermal contraction of the basin substructure (9), to the thin volcanic fill, and to subsidence in response to this load (10). The geometry of this inner depression is such that subsequent flooding by extrusions would produce a thick basaltic load concentrated within the peak ring. Its edge would correspond more closely to the edge of the inner depression than to the position of the peak ring itself (11). The presently observed topography shows that the inner Mare Orientale lies several kilometers below the mare patches at the base of the basin rings (Lacus Veris, Lacus Autumni). We are presently analyzing the topography in relation to these and other basin-related processes.

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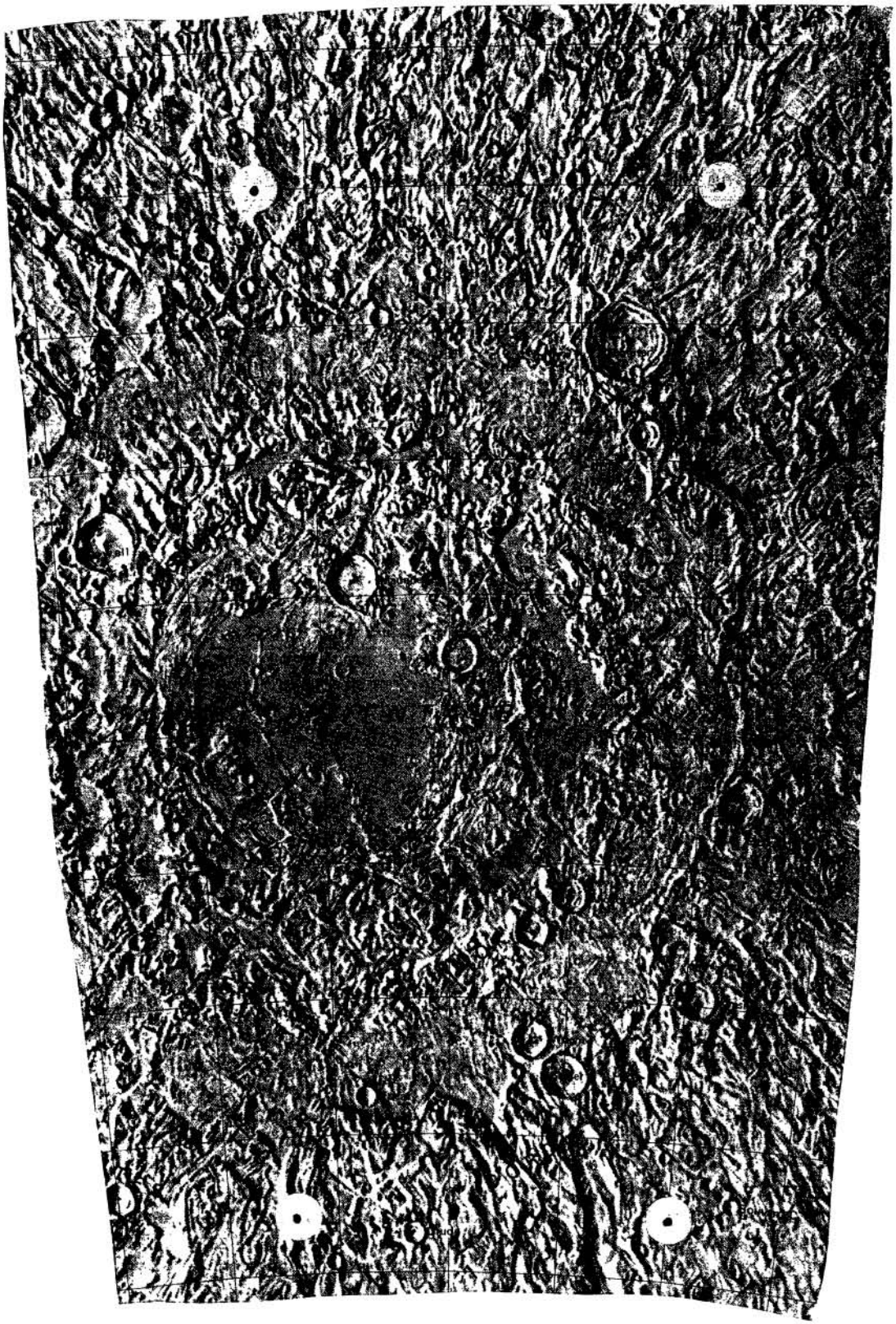

Figure 1. Location map of Figure 2. Portion of U.S.G.S. Map I - 1089. White dots represent corners of topographic map in Figure 2.

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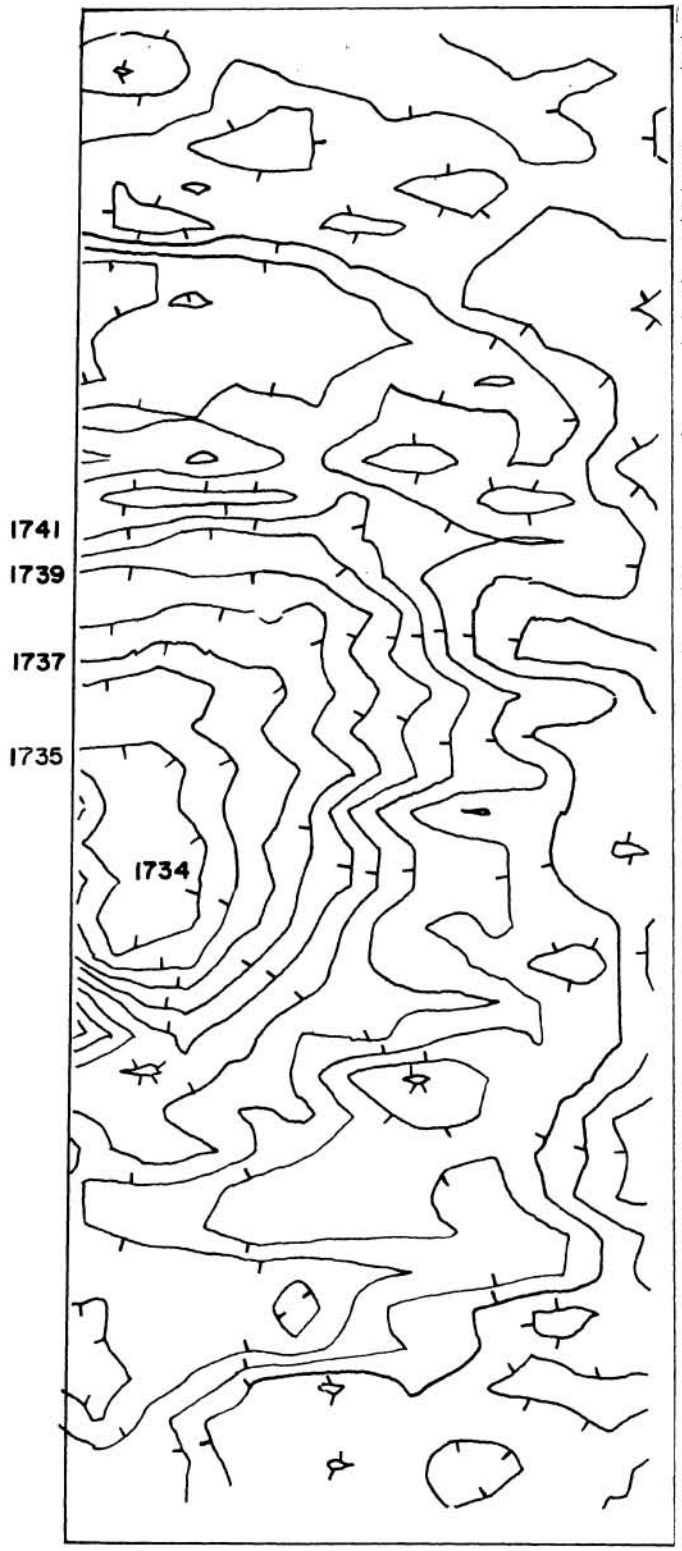

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Figure 2. Preliminary topographic map of eastern Orientale. The topography and geology of western Orientale differ from eastern Orientale (12). Stereographic projection centered on 18.8°S, 265°E. Data base is 624 elevation measurements acquired from earth-based telescopic limb profiles (6). Figure of projection is a sphere of 1730 km. Coordinates are in inertial system and were converted to lunar center of mass by a linear combination of inertial position vector and the appropriate transformation vector (8). Contour interval is one km. Contour program adapted from (13). 1734 is a point elevation in the basin interior. Copies of the map, scaled to 1:5,000,000 can be obtained from the first author.

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