GEOLOGY AND DEPOSITS OF THE HERTZSPRUNG BASIN, LUNAR FAR SIDE. Karen R. Stockstill [1,2], Paul D. Spudis [2] 1. Dept. Geol. Sciences, Michigan State Univ., East Lansing MI 48823 2. Lunar and Planetary Institute, Houston TX 77058

Hertzsprung (center: 2° N, 128° W) is a relatively well-preserved impact basin of Nectarian age on the far side of the Moon [1]. At 570 km diameter [2], it is one of the intermediate-sized lunar basins and thus is a member of an important class of feature, one transitional between two-ring basins, such as Schrodinger (320 km dia.), and true multi-ring structures (i.e., those that clearly display 3 or more rings), such as Orientale [1,2]. Intermediate-sized basins also excavate material from depths intermediate between the two classes of features, thus giving us additional information about compositions and lithologies occurring at middle levels of the lunar crust. We here report our initial findings on basin geology and compositions and relate these findings to our ongoing study and use of basins to probe the nature of the lunar crust [2,3].

Basin setting, morphology, and rings. Hertzsprung basin is located in the vicinity of some of the topographically highest region of the Moon (Fig. 1). This anomalously high region is probably related to its position adjacent to the rim crest of the large South Pole-Aitken basin, the largest impact crater on the Moon [4]. Hertzsprung displays well developed topography, having an average depth of 4.5 km, rim height of 1.06 km, and total estimated volume of 640,000 km^3 [5]. The basin is significantly mantled by deposits of the younger, Orientale basin, particularly in its southeastern sector. In addition, terrain radially lineated to Orientale laps over the basin inner ring and merges into raised lobes of highland plains material that make up the inner basin floor material of Hertzsprung. These observations suggest that caution must be exercised in interpreting basin compositions, as Orientale ejecta may make up significant fractions of the material seen.

Hertzsprung displays two conspicuous rings, its main rim of 570 km diameter and an inner ring of 270 km diameter [1]. Traces of additional rings are visible, including fragmentary segments defining rings 400 km and 140 km in diameter [1, 2]. The basin topographic rim crest (570 km ring) displays scarp-like morphology, similar to the Cordillera of Orientale, while the inner ring is rugged and massif-like, comparable to the Rook rings of Orientale [1]. We interpret the 570 km ring as the structural equivalent to the rims of complex craters [6]. On that basis, the excavation cavity of Hertzsprung would be on the order of 300-350 km diameter, excavating ma

terials as deep as 40 km below the surface, although the vast bulk of ejecta would be derived from depths shallower than about 25 km [2]. As the local crustal thickness in this region appears to be on the order of 70 to 90 km [7], modeling of basin excavation suggests that only the upper half of the crust would be excavated by the impact which created Hertzsprung basin.

Composition of Basin Deposits We have previously reported area-averaged Fe and Ti concentration data for the Hertzsprung basin [8] based on the low resolution maps derived from Clementine data [9]. Those results (Table 1) suggested that the ejecta from Hertzsprung is exceptionally feldspathic relative to the ejecta of other basins, such as Humorum or Nectaris [2]. For this study, we have made new maps of Fe content for Hertzsprung deposits (Fig. 2) at full Clementine resolution (~ 250 m/pixel). Our new data confirm the mafic-poor nature of Hertzsprung deposits (Table 1), and values of Fe for basin ejecta (i.e., those deposits outside the basin rim crest) are comparable to our earlier estimates [8]. Hertzsprung ejecta is basically gabbroic anorthosite to anorthositic gabbro composition. In addition, we note that zones of nearly zero Fe content occur in association with massifs of the prominent inner (270 km diameter) basin ring. On the basis of this extreme Fe depletion, we interpret these massifs as surface outcrops of nearly pure anorthosite. Such anorthosite massifs are characteristic of many basins, including Orientale [2,3], Humorum [10], and Nectaris [10, 11]. To date, most surface outcrops of pure anorthosite on the Moon occur within the massifs of basin inner rings, suggesting that the processes responsible for creating these massifs expose material that is uncommon at or very near the lunar surface. On the basis of analogy with central peaks of complex craters, we believe that basin inner rings are sub-megaregolith basement rocks, probably derived from depths greater than a few kilometers to several tens of kilometers.

The results of our study of Hertzsprung basin support the emerging picture of a lunar crust made up of three principal zones ("layers"). The uppermost zone is impact-processed and polymict; its bulk composition is roughly equivalent to anorthositic gabbro (FeO ~ 4-6 %). The clastic ejecta of Hertzsprung basin (Table 1) is roughly of this composition, consistent with a proportional growth excavation model [2]. Below this zone, extending to depths of perhaps 10 to

40 km, is the fragmentary remnant of the original, anorthositic lunar crust. Such rocks are now brought to the surface only by the uplift and exposure during the modification stage of basin formation in the form of ring massifs. below this zone, extending to the mantle, is a more mafic region with a basaltic bulk composition. In detail, this zone probably consists of a series of complex, Mg-rich plutons and KREEP-rich lithologies. It is present in the sample collection in the form of basaltic impact melts (the "LKFM" melt rocks; [2, 12]).

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Table 1. FeO contents of selected basin geological units

| Unit	FeO
Inner plains	1.85 ± 0.87
Inner ring massifs	1.93 ± 0.95
Basin exterior-west	2.49 ± 0.68
Basin exterior-southeast	3.48 ± 0.89
Average ejecta[8]	3.23 ± 0.26
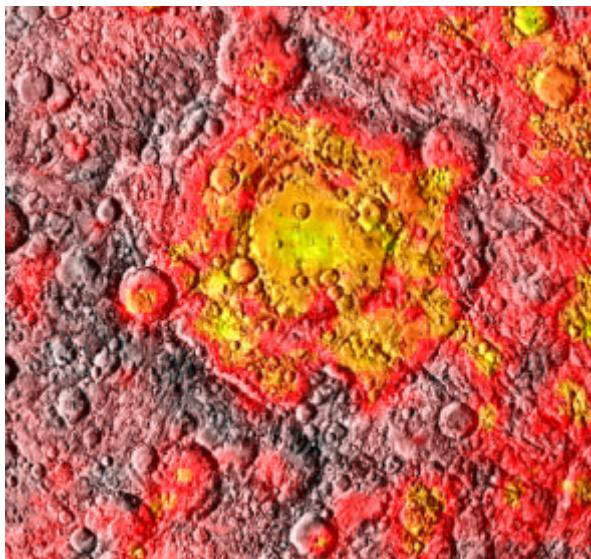
Figure 1. Topographic map of Hertzsprung basin. Colors indicate elevation at 500 m intervals: yellow (lowest, at center) = +1 km to white (highest, at rim crests) = +7 km.
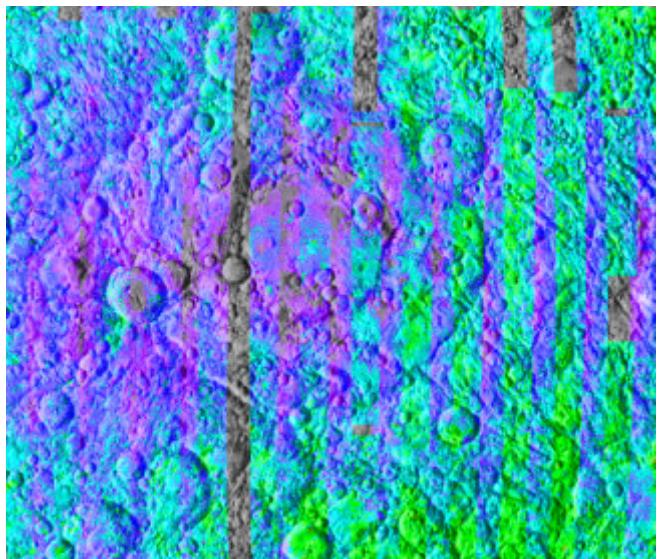
Figure 2.: Map of the FeO content of Hertzsprung basin deposits (all in wt.%). Vertical stripe at left center is orbit of missing data.   Key: blank (gray) = < 1, purple = 1, blue = 2, light blue = 3, green = 4, yellow = 5.