DISTRIBUTION AND CHRONOSTRATIGRAPHY OF EJECTA COMPLEXES IN THE HUMORUM BASIN MAPPED FROM LROC AND LIDAR DATA. W. A. Ambrose[1], [1]Bureau of Economic Geology, The University of Texas at Austin, University Station, Box X, Austin, TX 78713-8924, william.ambrose@beg.utexas.edu.

Introduction: The Humorum Basin is a multiring basin of Nectarian age [1]. It is ~900 km in diameter, measured from the outer ring (Fig. 1), although a diameter of ~1,200 km is also inferred [2]. The basin rings are well developed on the west, south, and southeast margins. They are discontinuous to the northeast, where they have been covered by Nubium and Procellarum basalts.

Humorum ejecta occur in a morphological continuum consisting of asymmetric secondary craters, elongate scours, and crater chains, all radially distributed from the basin center. Regional-scale lidar data indicate ~30 asymmetric secondary craters >5 km in diameter, 45 scours >15 km long, and >10 crater chains >20 km long (Fig. 1). In addition, high-resolution Lunar Reconnaissance Orbiter Camera (LROC) photographs reveal a population of small-scale ejecta features (Figs. 2 and 3) that are more numerous and more closely spaced than previously documented from Lunar Orbiter data. Humorum ejecta are well preserved on the southeast and south margins of the basin, but poorly preserved on the southwest and west margins, where they are overlapped by Orientale ejecta (Fig. 1).

Asymmetric Secondary Craters: A population of large-scale, asymmetric secondary craters associated with the Humorum Basin has polygonal outlines and narrow rims. These asymmetric secondary craters range in diameter from 5 to 40 km and are shallow floored (commonly <1.5 km deep). Many are teardrop or acorn shaped and elongate, reflecting low-angle impacts. LROC data record a population of asymmetric secondary craters at smaller scales (commonly <2 km in diameter) below the resolution of regional lidar data (Figs. 2 and 3). Similar morphologies for low-angle impacts have been demonstrated experimentally [3, 4]. The trajectory and source area of asymmetric secondary craters are inferred from the orientation of their teardrop-shaped and tapering rims, which point away from the basin center. Asymmetric secondary craters in other Nectarian basins such as Nectaris and Crisium are well documented [5, 6, 7, 8]. Minor asymmetry in small-complex primary craters, ascribed to postimpact rim subsidence, has been described for many examples [9, 10]. Asymmetric secondary craters are differentiated from these small-complex primary craters by narrow rims and an absence of significant slumps [6, 11]. Asymmetric secondary craters also exhibit similar levels of degradation with genetically associated impact basins. For example, the population of large-scale asymmetric secondary craters, crater chains, and scour features in the Humorum Basin exhibit moderate to high cratering density values (typically ≥ 0.005 km^{-2}) by craters with diameters ≥ 0.5 km.

Scours and Crater Chains: Other Humorum ejecta consist of scours that occur as furrows or valleys with converging rims away from the basin center. A population of ~45 large-scale scours defined from regional-scale lidar data range in length from 18 to 110 km and width from 4 to 45 km (Fig. 1). Length: width ratios for these large scours vary from 2.1:1 to 5.8:1. In contrast, high-resolution LROC data reveal a population of closely and regularly spaced (50- to 150-m), narrow scours that form distinctive lineated terrain, particularly on the southeast margin of the basin (Fig. 2). Crater chains associated with Humorum ejecta consist of aligned craterlets individually 6 to 20 km wide and collectively up to 60 km long. They are well developed southeast of the basin, where they overlap major Pre-Nectarian craters Wilhelm, Heinsius, Montanari, and Longomontanus. A smaller population of crater chains occurs northeast of Schickard.

Chronostratigraphy: Asymmetric secondary craters and genetically related scours and crater chains are unique morphological features that can be used to constrain estimated ages of overlapped, extrabasinal landforms such as other craters, scarps, and ejecta in other terrains and basins. Craters confirmed to be Pre-Nectarian in age, owing to being overlapped by Humorum ejecta, include Bayer W, Capuanus, Lagalla, Longomontanus, Mee, Montanari, Tycho J, Tycho W, Wilhelm, Wilhelm G, Wilhelm GA, Wilhelm J, and Wurzelbauer. In contrast, a great number of craters are inferred to be post-Nectarian in age, on the basis of their overlapping of Humorum ejecta. They include Brown E, Cichus, Clausius B, Clausius BA, Clausius C, Clausius D, Clausius H, Cichus A, Cichus G, de Gasparis B, Fourier, Fourier F, Hainzel H, Hainzel N, Hainzel NA, Hainzel O, Hainzel R, Hainzel Y, Heinsius E, Heinsius G, Heinsius O, Heinsius Q, Hippalus, Lagalla J, Lehmann C, Mee C, Mee D, Mee K, Mee T, Mersenius H, Mersenius P, Noggerath D, Palmieri Aa, Tycho D, Vitello, Vitello T, Wilhelm D, and Wilhelm DA. In addition, Hainzel V, Hainzel W, Hainzel Y, Heinsius M, and Vitello K are Nectarian in age, owing to their asymmetric morphology, orientation of major axes, and being overlapped by undegraded craters inferred to be Imbrian or younger in age.

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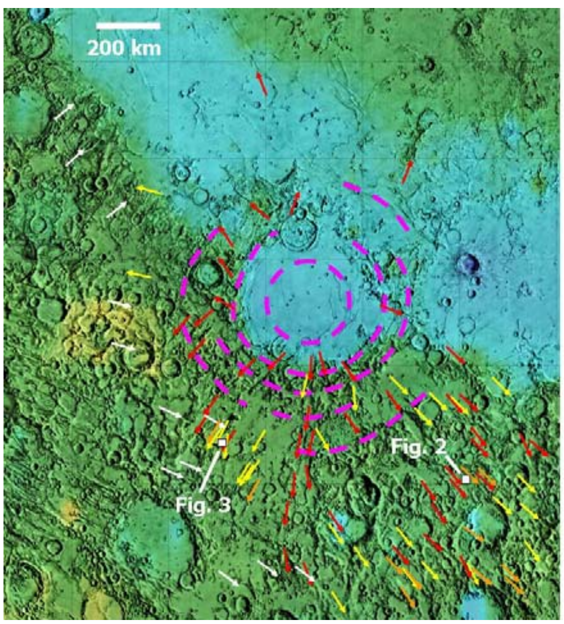

Figure 1. Lidar map of Humorum Basin, with asymmetric secondary craters indicated by yellow arrows aligned along major axes of craters and pointing toward beaked rim. Scours and crater chains shown by red and orange arrows, respectively. Selected Orientale ejecta indicated with white arrows. Major basin rings, inferred from scarps and concentric, topographically positive features, shown as dashed purple lines. General areas of Figs. 2 and 3 shown as white rectangles. Data source [12].

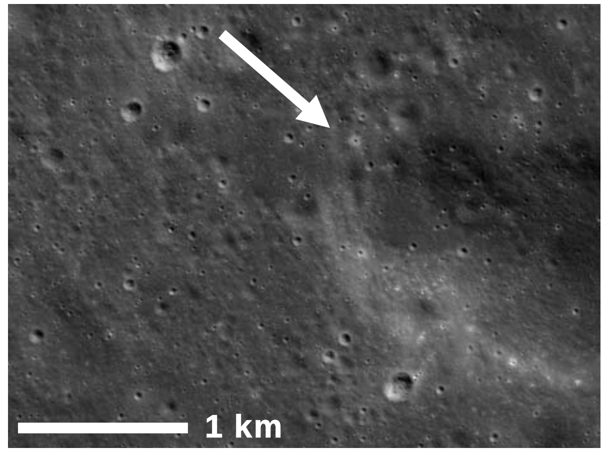

Figure 2. Asymmetric secondary crater (arrow) southeast of the Humorum Basin. This elongate crater (major axis >1 km long) is flanked on the west by closely spaced, southeast-trending scours that collectively form lineated terrain. Image is from north part of LROC photograph LRO-L-LROC-3-CDR-V1.0/M127083045LC. Area of photograph indicated in Fig. 1.

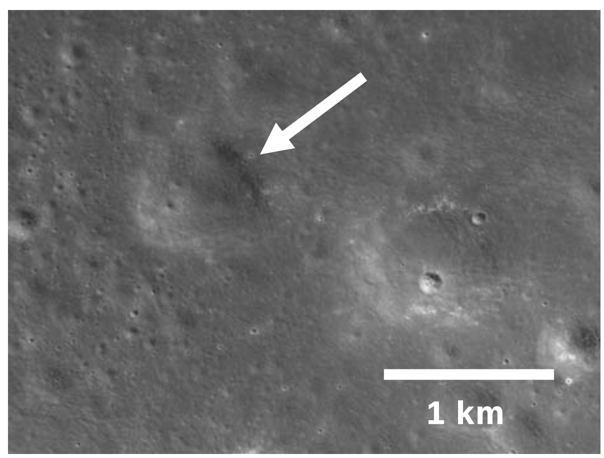

Figure 3. Asymmetric secondary crater (arrow) southwest of the Humorum Basin. Image is from south part of LROC photograph LRO-L-LROC-3-CDR-V1.0/M127239119LC. Area of photograph indicated in Fig. 1.