GEOLOGY OF GILGAMESH, GANYMEDE: NEW INSIGHTS FROM STEREO AND TOPOGRAPHIC MAPPING P. Schenk, Lunar & Planetary Institute, Houston, TX 77058, schenk@lpi3.jsc.nasa.gov.

Gilgamesh is the largest and youngest well-preserved impact structure and may be an important time-stratigraphic marker in Ganymede's geologic history [1]. It is also an important analog to multiring basins (i.e., Orientale) on the terrestrial planets, and obvious differences between Gilgamesh and these other basins provide important insights into internal processes and compostion on the icy satellites. Using Voyager stereo images and a new topographic map covering ~60% of the basin, we have remapped the geology of Gilgamesh and are investigating the formation and relaxation of this major impact feature.

GEOLOGIC UNITS & STRUCTURES

Synoptic Voyager mapping and a new topographic map of the large multiring basin Gilgamesh show that this structure has 5 major geologic units and at least 4 main structural and topographic rings, making Gilgamesh a true multiring basin. The 300-km-wide central depression consists of two units, a smooth unit marked by several quasi-radial lineaments, which is surrounded by a hummocky unit consisting of small hills <5 km wide. The central depression has a slightly domical shape. The 300-km-diameter inner ring is an incomplete ring of massifs, some of which have sharp inward-facing scarps 1-3 km high. The eastern portion of this ring is missing. The main basin rim consists of a prominent inward-facing scarp with relief of 1-3 km and a diameter of 590 km. The scarp is centered on a broad gentle rise and is the most prominent topographic feature in the basin (except to the south where it is absent). Between the inner ring and the topographic rim is a zone of chaotic massifs 2 to 10 km across. Some linear structures are apparent within this zone. Topography within the massif zone varies considerably and includes an anomalous depression nearly 3 km deep with respect to the basin proper. This depression may be the remains of an ancient impact structure.

Beyond the crater rim, the topography slopes off gently. At a diameter of ~770 km lies another topographic and structural ring defined by an inward-facing scarp roughly 1 km high. The surface slopes gently outward from this scarp, suggesting that this ring formed as a tilted fault block. Morphology in the region between the rim and this outer ring is characterized by small hummocks and rugged relief. Outside this ring, the morphology is smoother and obscures prexisting grooves. This zone extends out to a diameter of 1075 km, beyond which can be identified numerous large secondary craters. Together these two zones represent the contiuous ejecta deposit. The outermost ring consists of a Valhalla-type graben structure at roughly 1050 km diameter.

GEOLOGIC INTERPRETATION

The major topographic ring at 590 km is interpreted as the main crater rim. This is confirmed by scaling of the continuous ejecta blanket, based on mapping of smaller craters using

Voyager images [2]. The smooth central region is interpreted as an uplifted central core analogous to bright domes in the center of central dome craters. Radial lineaments in this unit are probably analogous to fractures observed on central domes by Galileo [3]. In this case, the inner ring is analogous to a central pit rim. Thus, most features within Gilgamesh appear to be analogous to those observed in smaller impact craters and basins on Ganymede and Callisto.

The total absence of secondary craters in the western sector of Gilgamesh indicates impact was oblique [4] and may be constrained to have occurred at 20-30°. This allows us to estimate the projectile diameter (including scaling of the transient crater from the observed diameter [5]) at roughly 45 km.

BASIN TOPOGRAPHY

Despite relief of 1-3 km associated with individual ring structures, the total relief across Gilgamesh is nearly negligable. The rim is elevated roughly 1 km above the surrounding plains (although some massifs are nearly 2 km high). The central depression and massif zones are at roughly the same elevation as the surrounding plains, however, indicating that the relaxation of Gilgamesh is almost total. (Contrast this with Orientale which is roughly 8 km deep). Whether this relaxation occurred promptly or over long periods is unclear. The inferrence that complex craters on Ganymede form and relax rapidly [6], together with the obvious differences between Gilgamesh and Orientale and the general lack of relief associated with other large basins on Ganymede and Callisto, suggest that Gilgamesh may also have reached its present state rapidly. Otherwise, a more lunar-like morphology might have been preserved. If so, it also seems unlikely that Gilgamesh could have reoriented Ganymede.

REFERENCES

[1] Passey and E. Shoemaker, in Satellites of Jupiter, Univ. Arizona Press, Tucson, 1982; G. Neukum, pers. comm., 1997. [2] F. Ridolfi and P. Schenk, LPSC XXVI, 651-652, 1995. [3] e.g., K. Homan et al., EOS, 78, F419, 1997. [4] D. Gault and J. Wedekind, Proc. Lunar Planet Sci 9, 3943-3875, 1978. [5] W. McKinnon and P. Schenk, Geophys. Res. Lett., 22, 1829-1832, 1995. [6] P. Schenk, J. Geophys. Res, 96, 15635-15664, 1991.

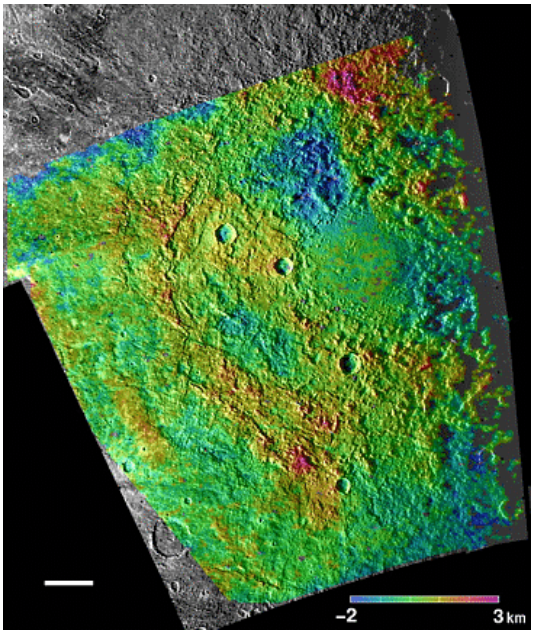

Figure 1. Color-coded topographic map of Gilgamesh, Ganymede. Scale bar is 100 km, north is towards top.