FIELD OBSERVATION OF A POSSIBLE IMPACT STRUCTURE (TSENKHER STRUCTURE) IN SOUTHERN MONGOLIA. G. Komatsu[1,3], J. W. Olsen[2], and V. R. Baker[3], [1]International Research School of Planetary Sciences, Universita' d'Annunzio, Viale Pindaro 42, 65127 Pescara, Italy (goro@sci.unich.it); [2]Department of Anthropology, University of Arizona, Tucson, AZ 85721, U.S.A.; [3]Lunar and Planetary Laboratory, University of Arizona, AZ 85721, U.S.A.

Introduction: Compared with North America and Europe, little is known about impact structures in Asia despite its areal extent and a large span of geological ages. In Mongolia, only one impact has been identified to date [1]. Here we report results of our 1998 expedition to a hypothesized impact crater named Tsenkher Structure (43°37'N, 98°22'E, GPS coordinates 43°38'41.1"N, 98°22' 08.5"E) [2] in southern Mongolia. We visited the site as a part of the Joint Mongolian-Russian-American Archaeological Expedition conducted in May and June of 1998.

Geological setting: The Tsenkher Structure was identified in the transition zone between the Gobi Desert and the Altai Mountain Range. This area is characterized by ranges and basins. The ranges originated as Paleozoic island arc assemblages [3] and were later subjected to transpressional deformation during late Cenozoic [4]. The area also experienced Carboniferous and Permian intrusive events. The basin fills are Mesozoic, mostly Cretaceous in age, but thin Quaternary alluvial materials overlie the Mesozoic sequence. The Tsenkher Structure is located in the middle of an east-west trending basin about 10-20 km wide. The basin is tilted slightly toward the south. The Tsenkher Structure must be younger than Cretaceous, and its preservation indicates an age as young as Quaternary.

Structure: The Tsenkher Structure is relatively well-preserved with a raised rim outlining its circular shape (Figure 1). The rim to rim distance is about 3.6 km (previously reported 3.2 km [2]). The rim lacks its northwestern segment, and it is fluvially dissected radially. The area inside the rim is filled with fluvial sediments, which were deposited from north to south. There is a major spillway connecting the inner part of the structure with a radar-dark fan-shaped area outside of the structure to the south. The radar-dark area is actually a channel incised in the gravel-covered valley floor. The channel floor is covered with fine-grained fluvial sediments making the area dark in the radar images. The maximum rim height may reach 50 meters. The rim surfaces are covered with rock fragments ranging in size from 1 to 50 centimeters, with occasional boulders exceeding one meter in size (Figure 2). These rock fragments cause the radar bright signature of the rim (Figure 1). Because of the heavily-fractured nature of the rim and the desert varnish apparent on rock surfaces, it is very difficult to observe any stratigraphic sequence. On the eastern side of the structure, we observed a raised outer rim (Figure 3), about 1 to 2 km outside the inner rim. This outer rim is lower than the inner rim in height. The area between the inner and outer rims is covered with desert pavement, and this area gently dips down and outward.

We are in the process of analyzing samples from Tsenkher in order to confirm or reject the impact hypothesis. If this structure is an impact crater, it would be the second one identified in Mongolia. The outer rim is possibly a rampart, which is commonly observed with Martian craters. The rampart implies that the impact occurred in a ground water layer or permafrost zone.

Late Pleistocene and early Holocene stone artifacts were found around the margins of a currently desiccated playa a few kilometers south of the Tsenkher Structure. These artifacts, fashioned by direct percussion and, in some cases, subsequent pressure flaking, are made on a variety of raw materials including jasper, chert, and an as yet unidentified fine-grained metamorphic rock. We are investigating a link between the structure, particularly the possible ponding inside the rim, and human occupation in the area.

References:

[1] MacHone, J.F., and Dietz, R.S. (1976) Meteoritics, 11, 332-334 [2] Komatsu, G. et al. (1998) LPSC [3] Sengor, A.M.C., and Natal'in, B.A. (1996) In The tectonic evolution of Asia, Cambridge Univ. Press [4] Cunningham, W.D. et al. (1997) Tectonophysics, 277, 285-306

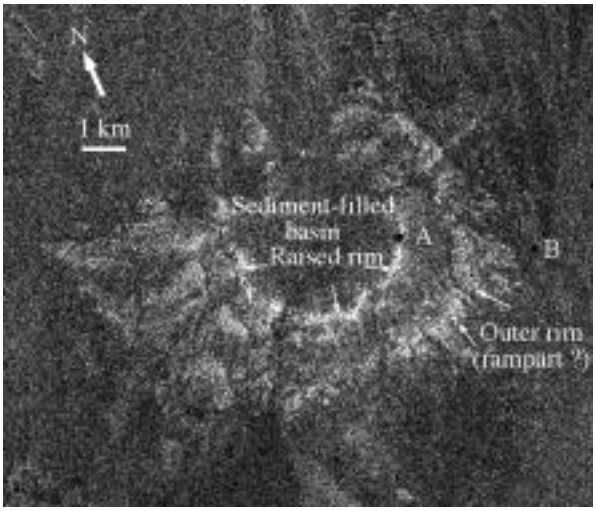

Figure 1. RADARSAT imagery of the possible impact structure in southern Mongolia. Fig. 2 and Fig. 3 were taken from point A and B to the west respectively. The image was provided by Canadian Space Agency/Agence Spatiale Canadienne (1997)

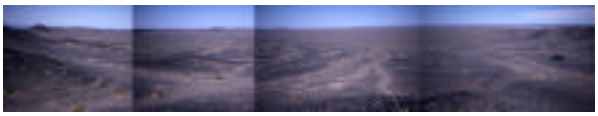

Figure 2. Inside the inner rim.

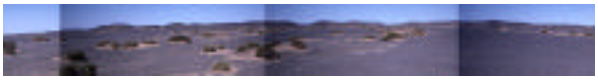

Figure 3. Outer rim.