THE TSENKHER STRUCTURE IN THE GOBI-ALTAI, MONGOLIA: PRELIMINARY RESULTS FROM THE 2007 EXPEDITION. G. Komatsu[1], J. Ormö[2], T. Bayaraa[3], T. Matsui[4], L. Gereltsetseg[5], S. Tserendug[3], K. Goto[6], D. Gomez-Ortiz[7], and S. Demberel[3], [1]International Research School of Planetary Sciences, Università "G. d'Annunzio", Viale Pindaro 42, 65127 Pescara, Italy (goro@irsps.unich.it), [2]Centro de Astrobiologia, Instituto Nacional de Tecnica Aeroespacial, Ctra de Torrejon a Ajalvir, Km 4, 28850 Torrejon de Ardoz, Madrid, Spain, [3]Research Center of Astronomy and Geophysics, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia, [4]Department of Complexity Science and Engineering, Graduate School of Frontier Science, University of Tokyo, Tokyo 113-0033, Japan, [5]Paleontological Center, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia, [6]Tsunami Engineering Laboratory, Disaster Control Research Center, Graduate School of Engineering, Tohoku University, Aoba 06-6-11, Aramaki, Sendai 980-8579, Japan, [7]Área de Geología, Dpto. de CC. de la Naturaleza y Física Aplicada, ESCET, Universidad Rey Juan Carlos, C/Tulipán s/n, 28933 Móstoles (Madrid), Spain.

Introduction: The Tsenkher structure located deep in the Gobi-Altai region of Mongolia has been proposed to be an impact crater based primarily on geomorphological observations [1]. In order to investigate the validity of this hypothesis, we conducted an expedition to the structure in the fall of 2007. Here we summarize our preliminary results from the expedition.

Geomorphology and stratigraphy: Tsenkher is a near-circular structure occurring in a structural basin (Fig. 1). The rim-to-rim diameter of the apparent rim is on an average 3.6–3.7 km, but varies from 3.5 km up to about 4 km. The rim of the structure is continuous except for the northern section where breaching seems to have allowed influx of alluvial materials from the north.

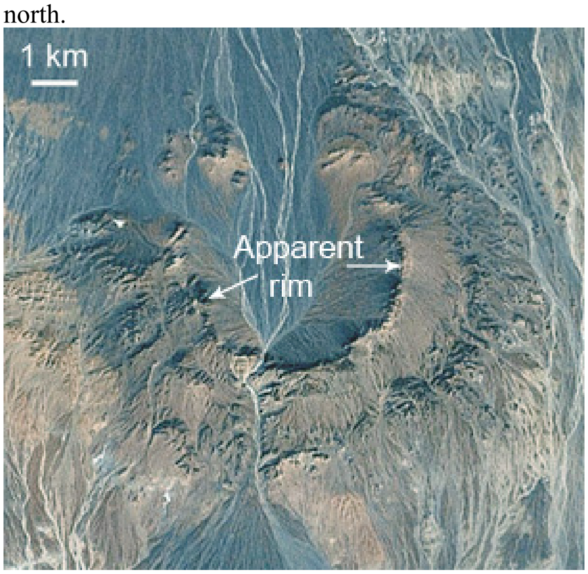

Fig. 1. Tsenkher structure in the Gobi-Altai region, Mongolia.

The exposed basin fills are mostly Quaternary alluvial materials derived from the mountain range called Edrengiyn Nuruu, to the north. Sedimentary bedrock of probable Paleozoic and Mesozoic ages is exposed in windows through the alluvial deposits. The Paleozoic bedrock is deformed and dipping steeply (Fig. 2). Its rock sequence includes fine-grained sandstones, siltstones, and cherts.

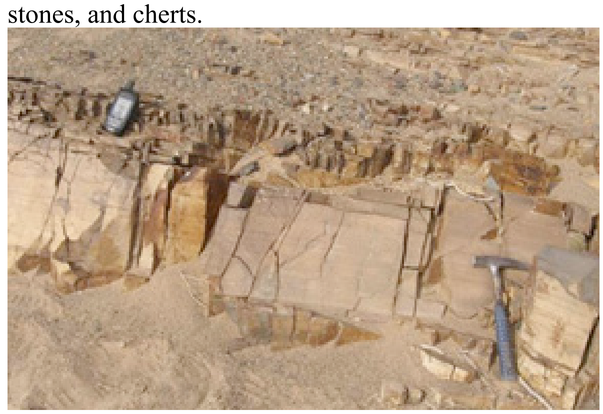

***Fig. 2.** Outcrop of a variety of the sedimentary bedrock of Paleozoic age, a reddish-yellowish sandstone, exposed to the west of the Tsenkher structure.*

The lower part of the rim consists mainly of strongly fractured and tilted rocks. The rim rock sequence is similar to that of the Paleozoic sedimentary bedrock exposed outside the Tsenkher structure, implying that some fraction of the rim formed by structural uplift. The uplifted strata show an upward transition into a polymict breccia. The reddish-yellowish fine-grained clasts dominate, giving the breccia the same general color as the uplifted strata (Fig. 3).

***Fig. 3.** Reddish-yellowish clast breccia of the western rim.*

From the rim outwards there seems to be an increase in the number of greenish and dark fragments in the breccia (Figs. 4 and 5). This variety of the breccia does also appear harder and more resistant to erosion. Our preliminary microscopic study revealed that the clasts in the studied breccia are volcanic (such as andesite and basalt) or sedimentary. Many of the clasts are highly rounded, implying defacement before or during their incorporation in the breccia.

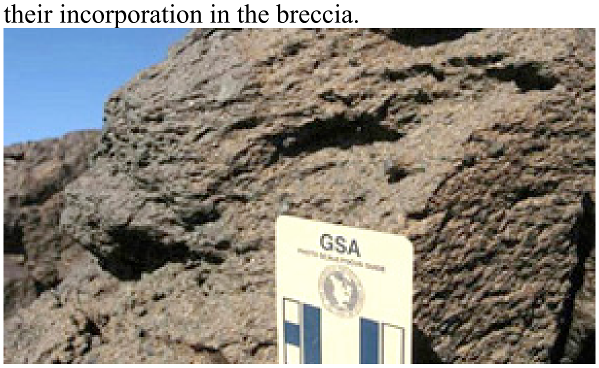

Fig. 4. Breccia blocks rich in greenish and dark clasts.

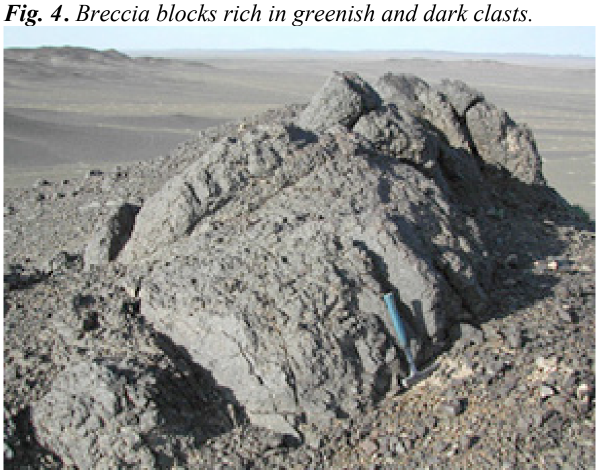

Fig. 5. Breccia blocks darkened by desert varnish overlying reddish-yellowish rocks. Western rim.

Fig. 6. Dark-toned breccia fragments scattered over the reddish-yellowish Paleozoic sedimentary bedrock. At the outer edge of the western circum-deposit.

This breccia variety is observed on the circum deposits outside of the rim [1]. It is especially prone to be darkened by desert varnish. In the western circum-deposit, this coloring makes the breccia distinguished from the underlying Paleozoic sedimentary bedrock that is reddish-yellowish in color (Fig. 6). The unit boundary drawn using satellite imagery [1] as the probable ejecta extent clearly coincides with the outer limit of the breccia distribution. The breccia deposit extends up to about one crater radius or more outside the apparent rim. On the eastern side, it is concentrated in an outer ridge [1] at about one crater radius outside the apparent rim.

At one location within the putative ejecta layer to the south of the structure there is an exposure of a polymict breccia with pumice or scoria clasts (Fig. 7A) and dark clasts with contact alteration of the matrix (i.e., possible melt fragments) (Fig. 7B), thus complying with the definition of a suevite [2].

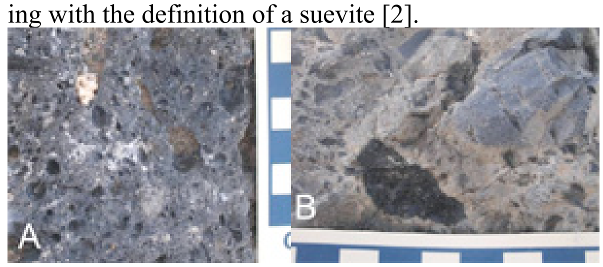

Fig. 7. A) Detail of pumice/scoria clast in a breccia. B) Dark clast in the same breccia with a surrounding alteration zone. Location within a breccia deposit to the south of the Tsenkher structure.

Geophysical survey: During the 2007 expedition we also conducted magnetic and gravity surveys of the Tsenkher structure [3]. Modeling of the geophysical data shows a bowl-shaped, rootless structure, thus contradicting alternative causes of formation such as intrusive dome or volcanic caldera.

Discussion: An explosive origin (such as impact, maar/tuff ring or caldera) of the Tsenkher structure is advocated based on the following observations; 1) near-circular (uplifted) rim, 2) presence of breccia, 3) unconformable relationship between the breccia and underlying sedimentary rocks in a breccia layer (ejecta layer) extending to great distances outside the apparent rim, and 4) presence of breccia with possible melt fragments. Intrusion and salt tectonics are unlikely origins. Volcanic origins are not ruled out. However, the impact hypothesis is favored because of 1) isolation of the Tsenkher structure from other known volcanic fields, 2) general absence of volcanic rocks in the exposed bedrock and uplifted rim materials, and 3) geophysical surveys indicating a rootless structure.

References: [1] Komatsu G. et al. (2006) *Geomorphology, 74*, 164–180. [2] Stöffler D. and Grieve R. A. F. (1994) *LPS XXV*, 1347–1348. [3] Ormö J. et al. (2008) *LPS XXXIX,* Abstract.