CIRCULAR GEOMORPHOLOGIC FEATURE NEAR URENGOY, WEST SIBERIA. D. Rajmon, Houston, TX, USA, drajmon@yahoo.com.

Introduction: Mid-resolution satellite images on maps.google.com show prominent circular feature ~4.5 km in diameter with central darker core located at lat. 66.273 ° and lon. 78.444 °; ~40 km north of the town of Urengoy, Tyumen district, Russia (see attached figure). High-resolution image does not show the structure well because it is covered under snow. The appearance of this structure is anomalous for the area and thus attracted attention. The feature makes an impression of slightly raised rim and raised central darker area. However, closer image inspection reveals that the northeastern section of the rim is defined by Bolshaya Yar'yakha river (Болшая Ярьяха) and the eastern to southern rim by its tributary placing the structure outline at a topographic low. Left bank tributaries of these rivers flow radially from the middle of the annular zone between the core and the rim of the structure. The right bank tributaries (flowing from outside of the structure) form irregular dendritic pattern. The western rim is a bit diffuse, partly defined by a string of lakes. The NW segment of the rim appears overprinted by an area with many lakes. Individual rim segments appear fairly linear defining an overall hexa- to septagonal outline. The core is 1.5 km in diameter and shows radial grooves (drainage pattern or some structural elements). It is rimmed with lakes in the NW to SW and two lakes are present on the west central part of the core. The digital elevation model on Google Earth indicates the highest elevation (40-44 m above sea level) in the SE segment of the annulus (consistent with the radial drainage). From there, the elevation drops outward toward the river (37-38 m asl) and inward (37-38 m asl) and the whole western half of the structure is sloping down toward west (25-30 m asl along the western rim).

Regional geology: The structure is located within the West Siberian basin, a prolific hydrocarbon producer. The supergiant Urengoy gas field is located about 60 km west of the circular structure. The basin was established on crystalline Archean and Proterozoic basement. The basement is overlain by a widely, but not completely, metamorphosed and folded Paleozoic units. These units are bounded by a major regional unconformity associated with Hercynian uplift during the Permian. The top of the Paleozoic section is 6.5-7.5 km below surface at the Urengoy field. Late Permian through Early Triassic extension created north-south trending rifts. The largest of these rifts is the Koltogor-Urengoy rift system, which extends for 1200-1300 km from the southeast of the city of Nezhevartovsk to, and under, the Taz gulf in the north. This rift system bounds the Urengoy field anticline and runs under the circular feature. The deposition in the rifts resumed with siliciclastics and volcaniclastics capped by the ~250 Ma flood basalts. The sedimentation then continued through several cycles of continental, lacustrine and marine siliclastics through Mesozoic and Cenozoic. Notable within these sequences are the deep marine organic rich Upper Jurassic Bazhenov shales, the principal source rocks within the basin. Besides siliciclastics, coal deposits occur within the Lower Jurassic, the Albian-Cenomanian Pokur Formation and in the Oligocene. Thin limestone beds occur in the western part of the basin within Aptian-Cenomanian and marls occur throughout Aptian-Eocene. Much of the Oligocene-Miocene sediments were eroded during Pliocene. The Mesozoic to Cenozoic sediments have been periodically deformed along the rejuvenated linear basement structures. Significant transpressional deformation affected the whole basin in early Oligocene generating uplifts, inverted structures, broad anticlinal structures and positive flower structures. Near surface faults in the region around the circular feature are trending NW-SE with vertical and right lateral offsets. Associated extension and Riedel fractures are trending NE-SW and N-S [1-3]. Quaternary fluvial and lacustrine deposits overlie the erosional surface of Eocene-Oligocene sediments. Meandering rivers and thermokarst lakes dominate the surface geomorphology.

The circular structure is located on a regional N-S trending positive gravity and magnetic anomalies corresponding to the Permian graben structures. The resolution of these regional potential fields data is too coarse to resolve the 4.5 km circular feature.

Interpretation: The geologic reviews of the area cited above mention no recent igneous activity, no salt, no carbonate karst and no shale diapirism. The geomorphology suggests the circular feature is too large and established for some time for it to be of thermokarst or nuclear explosion origin. The author is not aware of any glacial or periglacial feature consistent with the discussed circular feature. The closest periglacial feature could be a collapsed pingo although the core of the discussed feature is ~2.5 times larger than the 600 m diameter of the largest known pingo [4, 5]. Transpressional tectonic origin is possible although the unique character of the feature in a wider area and a distinct central symmetry reduce the probability of such origin. The proximity of major oil and gas accumulations demands consideration of origin via gas eruption. In that case, other similar features would be

expected in the area, possibly arranged along faults. No such features can be observed on satellite images and were not mentioned in the above geological reviews. The nature of the feature is consistent with impact origin and there is no information currently available to the author arguing against such origin. The polygonal outline of the feature indicates the regional faults controlled its formation to some extend.

Age: The circular pattern appears to control recent drainage and appears to be overprinted by periglacial geomorphology. This suggests pre-Holocene age. The feature manifests itself in the surface units, which could be Pleistocene or pre-erosion Eocene-Oligocene deposits. The age of the feature thus can be tentatively constrained to Eocene-Pleistocene or 55.8-0.0115 Ma [calibrated with 6].

Tektite context: Interestingly, the structure is located ~50 and 80 km ENE of two locations where three fragments of natural glass described as tektites "urengoyites" were found and reported by Masaitis et al. [7]. The discussed feature was, in fact, discovered unexpectedly while trying to determine the field coordinates of the reported tektites.

References: [1] Vyssotski, A.V. et al. (2006) Mar. and Petrol. Geol. 23(1): 93-126. [2] Galushkin, Y. et al. (1999) AAPG Bulletin 83(12): 1965-1979. [3] Grace, J.D. and G.F. Hart (1990) in Structural Traps III: Tectonic Fold and Fault Traps, E.A. Beaumont and N.H. Foster, Editors. AAPG. p. 309-335. [4] http://en.wikipedia.org/wiki/Pingo [cited 6 January 2009]. [5] Anderson, E. (2006) http://www.geomorphology.org.uk/pages/education/alevel/coldenvirons/Lesson%2020.htm [cited 6 January 2009]. [6] Gradstein, F.M. et al. (2006) A geologic time scale 2004. Cambridge University Press: Cambridge, UK. 589. [7] Masaitis, V.L. et al. (1988) LPS XIX: 728.