



The circular Uneged Uul structure (East Gobi Basin, Mongolia) – Geomorphic and structural evidence for meteorite impact into an unconsolidated coarse-clastic target?

Martin Schmieder^{a,b,c,*}, Hartmut Seyfried^c, Ochir Gerel^d

^a School of Earth and Environment, The University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Perth, Australia

^b Western Australian Argon Isotope Facility, Department of Applied Geology & JdL Centre, Curtin University, GPO Box U1987, Perth, WA 6845, Australia

^c Institut für Planetologie, Universität Stuttgart, Herdweg 51, 70174 Stuttgart, Germany

^d Department of Geology, School of Geology and Petroleum Engineering, Mongolian University of Science & Technology, P.O. 46, Box 520, Ulaanbaatar 210646, Mongolia

ARTICLE INFO

Article history:

Received 9 May 2012

Received in revised form 18 November 2012

Accepted 28 November 2012

Available online 11 December 2012

Keywords:

East Gobi Basin

Unegt subbasin

Mongolia

Remote sensing

Domal deformation

Possible impact structure

ABSTRACT

The Uneged Uul structure is a ~10 km circular, complex, multi-ridged domal feature in the Unegt subbasin of the East Gobi Basin, southeastern Mongolia. As revealed by remote sensing and recent field reconnaissance, the central part of the Uneged Uul structure comprises a complex central peak of outward-radiating curved ridges, composed of stratigraphically uplifted greenschist-facies basement schists, surrounded by an annular moat. The most prominent feature of the structure is a central annular ridge ~3 km in diameter composed of pebble-boulder conglomerates and gravels of the Upper Jurassic Sharilyn Formation, surrounded by three outer domal ridges composed of Lower Cretaceous conglomeratic sandstones and gypsum clays. Jurassic conglomerates forming the main part of the central annular ridge show effects of severe internal deformation. The original population of pebbles, cobbles and boulders appears moderately displaced and mostly broken but nowhere aligned along shear planes or foliated. Primary sedimentary features, such as cross-lamination or imbrication, have been obliterated. We explain this penetrative brecciation as a result of dissipative shearing caused by a strong and rapid singular event that in magnitude was beyond the range of the common crustal tectonics recorded elsewhere in this region. Disrupted and chaotically distributed conglomeratic sandstone beds in the central annular ridge dip in highly variable directions on a local scale but show an apparent SE–NW trend of bedding plane alignment. Further outside, the tilted and uplifted Upper Jurassic to Lower Cretaceous strata of the domal area are overlain by the flat-lying Upper Cretaceous, which stratigraphically constrains the timing of deformation at the Uneged Uul structure to most likely the Early Cretaceous. Endogenic formation models, such as magmatism and salt, gypsum, or mud diapirism, fail to explain the nature of the Uneged Uul structure. The Uneged Uul structure bears a set of geomorphic and structural features resembling those at some eroded complex impact structures on Earth. Morphologically similar central peaks are observed at the Spider and Matt Wilson impact structures in Australia; the central annular ridge reminds of that at Gosses Bluff in Australia; the outer domal ridges might correspond to ring-like features as known from Tin Bider in Algeria. We, therefore, cautiously propose that an impact may have produced the Uneged Uul feature causing structural uplift (~1000 m) of basement rocks at its center. So far, no convincing evidence for shock metamorphism could be proven by field work and petrographic analyses. However, it is likely that at the time of the deformation event the unconsolidated conglomerates were highly porous and possibly immersed in groundwater buffering the propagation of sudden stress-reducing deformation. Further studies will be in order to unravel the nature of the Uneged Uul structure, which should be considered a promising possible impact structure.

© 2012 Elsevier Ltd. All rights reserved.

1. Introduction

Despite the large extent of arid and semiarid areas in Mongolia, only ten meteorites have been recovered to date (Bischoff et al., 1996; Meteoritical Bulletin Database, 2012) to illustrate the more

* Corresponding author at: School of Earth and Environment, The University of Western Australia, 35 Stirling Highway, Crawley, WA 6009, Perth, Australia.

E-mail address: martin.schmieder@uwa.edu.au (M. Schmieder).

recent cosmic history of this country. Likewise, only one meteorite crater, the ~1.3 km in diameter Tavan Khar Ovoo (*Taban Xap Oboo*, Mongolian for ‘five black rocks’; also known as Tabun Khara Obo) crater (44°08′ N, 109°39′ E), has so far been proven of impact origin in Mongolia (Masaitis, 1999; Amgaa and Koeberl 2009; Earth Impact Database, 2012). Apart from this impact structure, a second circular feature, the ~3.6 km Tsenkher structure, has been proposed to be of potential impact origin

(Komatsu et al., 2006; Ormö et al., 2010) but still lacks evidence for shock metamorphism according to the criteria established by Stöffler and Langenhorst (1994), French (1998), and French and Koeberl (2010). In addition to a number of impact structures previously recognized in the former Soviet countries of Central Asia (Masaitis, 1999), the Xiuyan impact crater was recently discovered in eastern China (Chen et al., 2011), and one of the geologically oldest terrestrial impact structures, Dhala, is located in northern India (Pati et al., 2008). A review of the rapidly evolving impact research in Asia is given by Reimold and Koeberl (2008).

Remote sensing has influenced impact research since its beginnings, when Galileo pointed his first telescope at the Moon as early as in 1610 (e.g., Melosh, 2011). Apart from general reviews of the

remote sensing of impact structures (e.g., Abels et al., 2000), some of the recent studies focused on the detection of possible impact structures in arid environments, such as the Gilf Kebir 'crater field' in SW Egypt (Paillou et al., 2003), the Arkenu (Paillou et al., 2004), Jebel Hadid (Schmieder et al., 2009), and Ibn Batutah (Ghoneim, 2009) structures in Libya, or the Faya basin and Mousso structure in northern Chad (Schmieder and Buchner 2007; Buchner and Schmieder, 2007). However, remote sensing methods alone have failed to reliably prove circular geologic features as of impact origin. In particular, field reinvestigations of some of the aforementioned structures revealed a magmatic, non-impact, origin for the Gilf Kebir (Orti et al., 2008) and the Arkenu structures (Cigolini et al., 2012). Thus, the ongoing quest for an extended dataset of

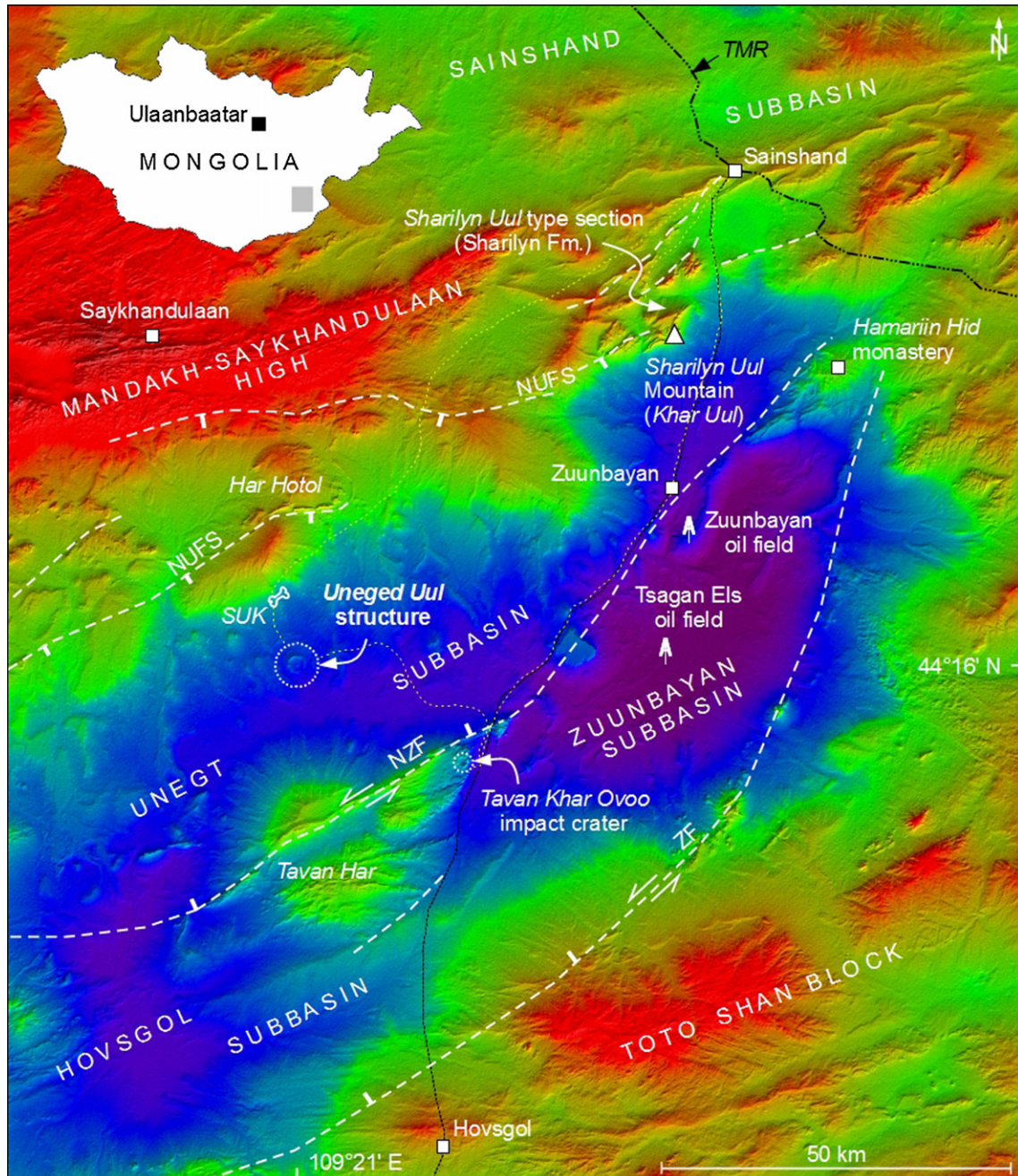


Fig. 1. Color-coded terrain map (SRTM) of the East Gobi Basin and its subbasins, illustrating the most prominent structural features of the Mongolia–China border region. White dashed lines indicate major fault systems, such as the North Ueged Fault System (NUFS), as well as the sinistral North Zuunbayan (NZF) and Zuunbayan (ZF) Faults. Locations mentioned in the text are indicated. Bone symbol: *Shine Us Khuduk* (SUK) dinosaur location. TMR: Transmongolian Railway. Black dotted lines: main unpaved tracks; yellow dotted lines: field trip route. Height ranges from ~700 m (Tsagan Els oil field; violet blue) to ~1,300 m (Saykhandulaan region; red). Inset map shows location of the area in Mongolia. (For color interpretation in this figure legend the reader is referred to see the web version of this article.)

Download English Version:

<https://daneshyari.com/en/article/4731233>

Download Persian Version:

<https://daneshyari.com/article/4731233>

[Daneshyari.com](https://daneshyari.com)