

**A BUDDHIST MONASTERY REVEALED BY UAV SURVEY AND GROUND PENETRATING RADAR
IN EASTERN MONGOLIA.**

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In 2012, imagery appeared online (fig 1) via the Google Earth and Bing platforms, to reveal the remains of a circular and well-planned site, on the west bank of the River Kherlen, 25 km south of Mongonmorit soum (49U 0313413 /5320799 (48 0.806N/108 29.833E). Since 2008 a joint University of Bristol / National University of Mongolia expedition had been studying the landscape archaeology of the upper Kherlen Valley, and this feature was of immediate interest (Horton, Dashtseveg & Myagmar 2012). Radiating buildings from a number of central structures were visible in the light snow cover. We undertook a GPS and magnetometer survey in 2014 (Horton *et al* 2015) mapping the features (only visible as grass marks), but realised that the site was ideal for testing GPR technologies in the Mongolia grasslands. In April and September 2016, we used UAV survey to capture a detailed map of the site, and then employed GPR to investigate specific features.



T Figure 1. Satellite image showing the Dzuun Khuree Monastery on the west bank of the Kherlen River.

The site is locally known as Dzuun Khuree (Maidar 1972,100), Kherlen golyn zuun khuree, Khoegshin Khuree (Erdenebileg 2014) and Uvgun khuree (Rinchen & Maidar, 1979, 56). There is a memorial on the edge of the site, marking the former monastery that had survived here until its suppression in 1937. There is no doubt the features captured in the UAV imagery are

the remains of this monastery, as it was mapped by Klyagina-Kondratiyeva (2013) in 1929, and recently included in the *Documentation of Mongolian Monasteries* project. The monastery belonged to the 'yellow robe' (Gelugpa) sect of Buddhism and was located at the foot of the worshipped Togos Kharkhan mountain; at its height, it had around 1200 monks and had become one of the biggest religious and trade centres in central Mongolia (Erdenebileg 2014). According to another source, it had been the monastic city of the second Bodg Jebtsundamba, Luvsandambiydonmi (1724-1757) and renowned as "... one of the five cherished places of Undur Gegeen Zanabazar (1635–1723) in Mongolia" (Tsedendamba 2009). Various dates are given for its foundation. Oral traditions place it in 1691 (DOMM Study 2004). One archive record from the monastery before its suppression suggested an original foundation in 1665, and its move to its present location in 1783. Another source gives 1701, while Pozdneev (1971, 303) cites the *Erdeni-yin Erike* chronicle that it was founded in year 50 of Enkh-Amgalan Khan (1711). There are however reasons to believe the monastery may be considerably older than these records suggest – a view that was also shared by Pozdneev who visited the site as a working monastery in 1896. The monastery was suppressed in 1937, the buildings destroyed and the monks dispersed (Erdenebileg 2014).

Description of the site.

The site is located on a flat alluvial terrace, between the Kherlen river and two smaller streams. On the surface there is very little to see, beyond discoloured grass towards the end of the summer, and low mounds marking the position of 28 stupas that surround the site. The UAV survey was conducted with a DJI Phantom 3 Professional, and the orthomosaic (fig 2a) processed using the drone deploy platform (<http://dronedeploy.com>). Elevation, and hill shade imagery from the DEM (fig 2b) were also generated from high resolution images (2 ins/pixel).

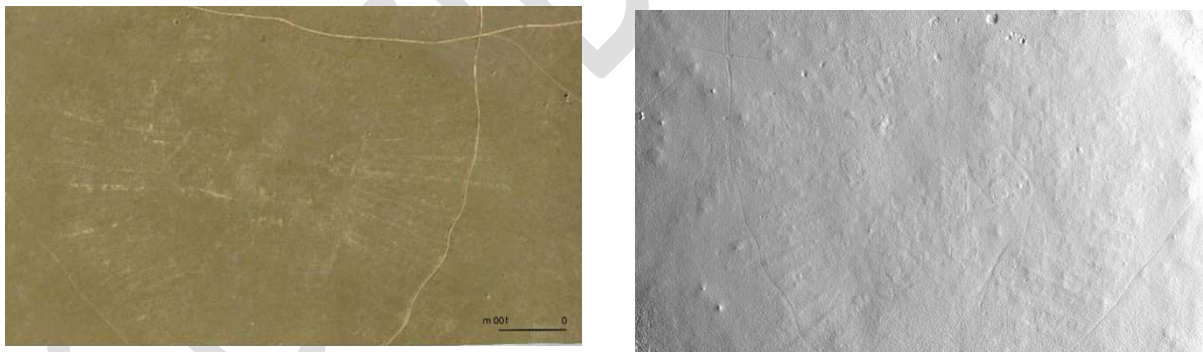


Figure 2: Dzuun Khuree UAV orthomosaic photograph (a) and hillshade model (b) of monastic site. Survey in 2016

From this data and the ground surveys, a detailed and accurate plan was compiled (fig 3). The monastery covers an oval area of 750 x 600m. In the centre, there are seventeen temples or religious colleges, while east and west are 24 radiating *aimags* or monastic dormitories, each sub-divided into individual cells, that housed traditional *ghers*. Between the temples and the *aimags* is a path that may represent a processional route around the central precinct while there is a central axis through the site that runs east-west, as well as north and south entrances. The temples have traces of internal structures laid out with small stones, including circles and squares. These could have been to demarcate *gher* temples. At least three temples also contained a grid of timber posts that supported a floor and timber superstructure. The most impressive, temple five, has a grid of 9x9 posts, with three circles marked out to the north, representing small *ghers* within the temple enclosure.

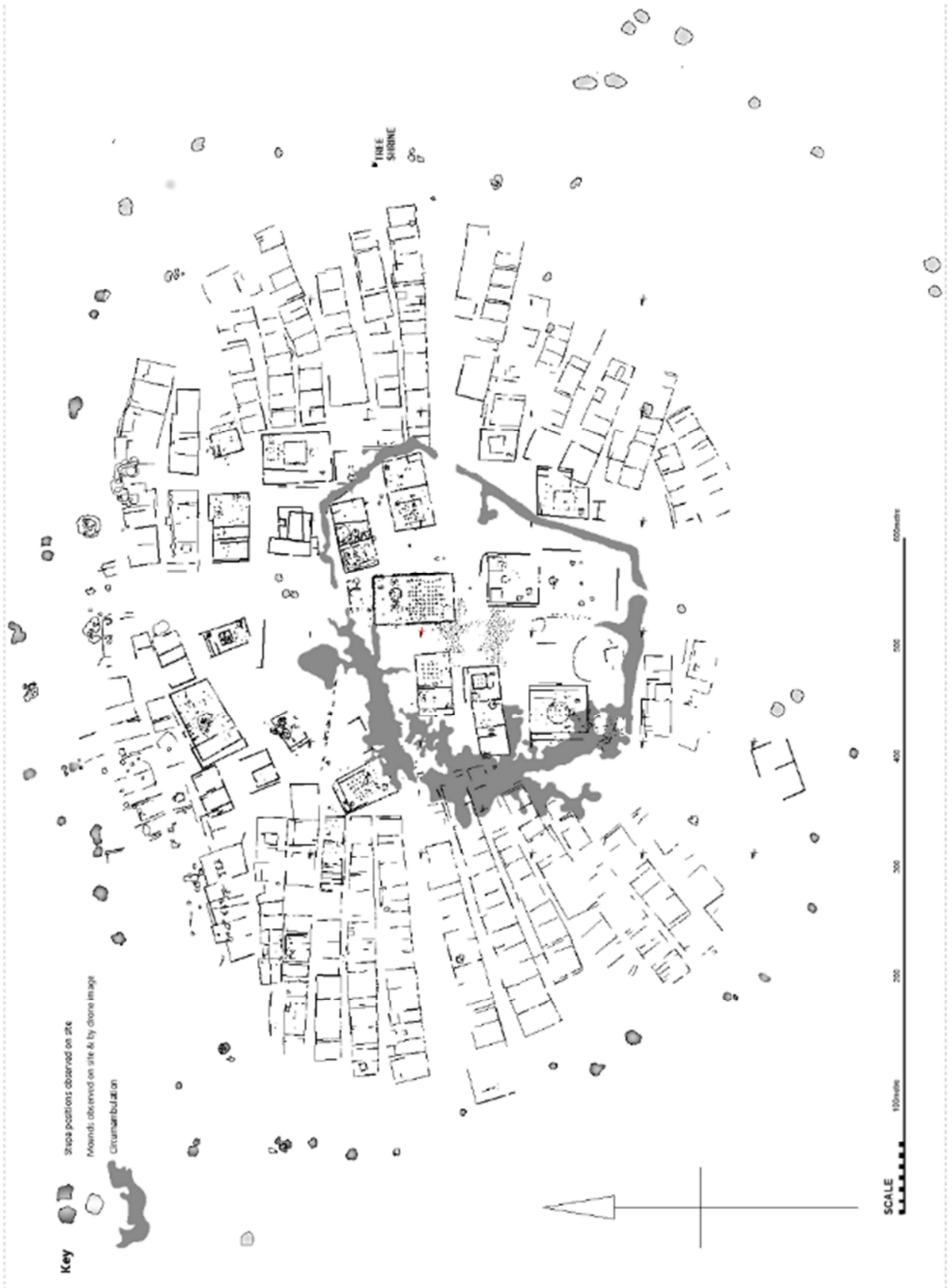


Figure 1: Plan of the Dzuun Khuree monastic site, compiled from UAV imagery and on-site survey, 2014-2016.

The walls of each temple were probably of timber construction, built on slightly raised banks, that could be the base of earlier mud-brick walls. We conducted ground penetrating radar surveys over several of the temples; that of temple 5 was the most informative (fig. 4), enabling an estimate for post hole depth of around 0.8m, the locational of additional *Gher* structures, and suggestion of sub-features below two of the *Gher* enclosures. Similar anomalies were also found below other *Gher* temples.

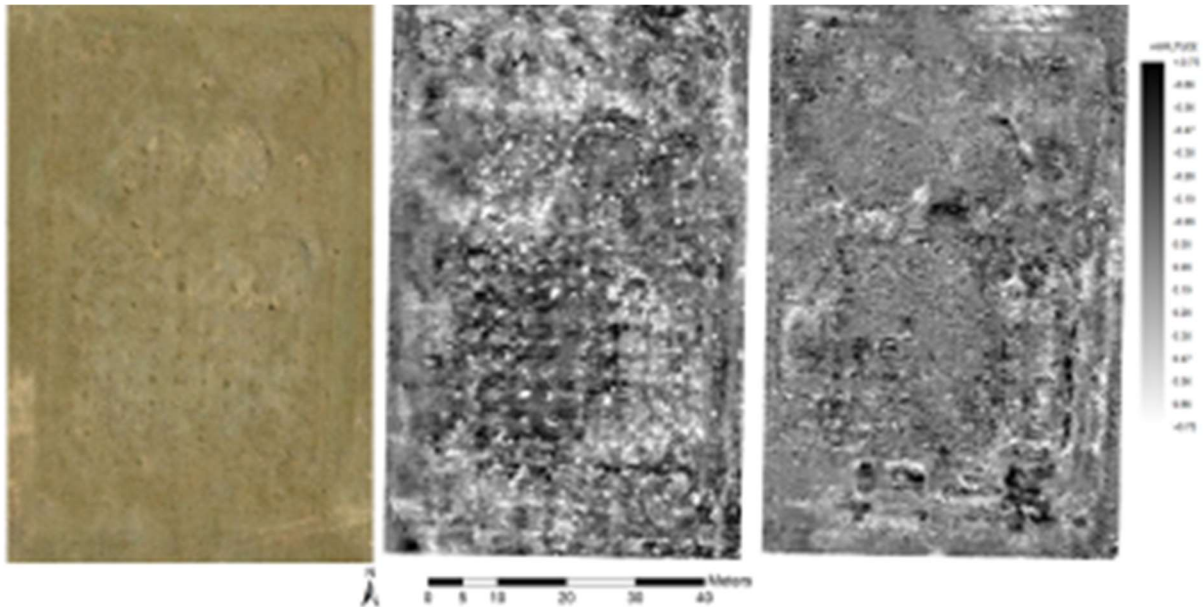


Figure 4: Temple 5, UAV image and ground penetrating radar time-slice image at 1ns and 4ns (approximately 0.2m and 0.8m depth at velocity of 1.5m/ns)

Surrounding the site were a number of gravel mounds, mostly along the north and west sides, around 8m in diameter and up to 1.5m high; some contained fired red and grey mud bricks and stone slabs. Most were heavily robbed, but 28 could be recognised as stupa bases. Several also contained broken terracotta plaques (fig 5), of particular fineness and of a form associated with the Zanabazar revival in the seventeenth century continuing into the nineteenth century (Berger & Bartholomew 1995, 304). On the eastern side of the site was a tree shrine (fig. 6), where the tree stump had been venerated, with a ring of stones and a single step. While the veneration of trees is often found in Buddhism, it is unusual in the treeless Mongolian landscape.



Figure 5: Terracotta plaques, from disturbed context of stupa two. Probably sixteenth century, Zanabazar period. Buddha in mediation, in Single Lotus pose

Discussion

The Dzuun Khuree monastery is unusual in its circular form, with its large number of central temples and radiating *aimags*, and may reflect the plan of secular camps or *orda*. Most Mongolian monasteries have a rectilinear plan, and the only other known circular examples are the Ikh Khuree and adjacent and still-surviving Gandan monastery in Ulaanbaatar; both

recorded on a plan of 1913-5, now in the Zanabazar Museum. Ikh Khuree, then known as Urgu, was founded in c. 1639, and moved on multiple occasions, before settling at Ulaanbaatar in 1778 (Berger 1995, 66). Gandan was founded in 1809. Dzuun Khuree may therefore predate these. Another clue that it may be earlier is the grid of posts to support the floor and superstructure found in at least three of the temples; this arrangement is recorded for example in the thirteenth-century 'Great Hall' temple at Karakorum (Franken 2015) and indeed in wider Buddhist architecture in Japan and China. The possibility that the monastery might belong to the Mongol period should not be wholly discounted.



Figure 6: Lone tree shrine at periphery of temple complex

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Captions

Figure 1. Google Earth / DigitalGlobe image showing the Dzuun Khuree monastery on the west bank of the Kherlen river. Taken 10/10/2012.

Figure 2 Dzuun Khuree UAV orthomosaic photograph (a) and hillshade model (b) of monastic site. Survey in 2016.

Figure 3. Plan of the Dzuun Khuree monastic site, compiled from UAV imagery and on-site survey, 2014-2016. Drawn by Vito Pecchia.

Figure 4. Temple 5, UAV image and ground penetrating radar time-slice image at 1ns and 4ns (approximately 0.2m and 0.8m depth at velocity of 1.5m/ns)

Figure 5. Terracotta plaques, from disturbed context of stupa two. Probably seventeenth century, Zanabazar period. Buddha in mediation, in Single Lotus pose.

Figure 6. Remains of a tree shrine, with remaining stump and stones used to mark site. Facing north east.