

## ARCHAEOLOGICAL RESEARCH OF THE KHITAI DYNASTY'S BALGAS CITY RUINS - CULTURAL HERITAGE ON THE STEPPE, USING GIS

H. YAMAGUCHI<sup>a,\*</sup>, K. KIYAMA<sup>b</sup>, N. SHIMIZU<sup>c</sup>, E. ALTANGEREL<sup>d</sup>

<sup>a</sup> International Research Center for Japanese Studies, 3-2 Oeyama-cho, Goryo, Nishikyo-ku, Kyoto 610-1192 Japan - yamahirog@gmail.com

<sup>b</sup> Hokkaido University, Kita 8, Nishi 5, Kita-ku, Sapporo, Hokkaido 060-0808 Japan - Kiyama720@aol.com

<sup>c</sup> Nara University, 1500 Misasagi-cho, Nara-shi, Nara-ken 631-8502 Japan - nachikichi1515@hotmail.com

<sup>d</sup> Institute of Archaeology Mongolian Academy of Sciences, Jucov street-77 Ullanbaatr-51, Mongolia-  
enkhtur2001n@yahoo.com

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### ABSTRACT:

We have been researching on Chintolgoi balgas city ruins of Khitan period in Mongolia in partnership with Institute of Archaeology Mongolian Academy of Sciences. The Khitan (Liao) Dynasty was founded by Yelu Abaoji of the nomadic Khitan in 916. Its domain extended from Primorye in Russia in the east to Central Asia in the west. As well as this in the eleventh century, the Dynasty ruled a portion of China.

Chintolgoi balgas is located in Bulgan aimag, Central Mongolia. The region is in the area of Tuul river basin, and there are three fortresses besides Chintolgoi balgas. The interval between these castles is about 20 km. The name of the fortresses from the west includes, Helmedenji, Ullan Kherem, Chintolgoi balgas, and Khar Bukh. It is thought that these fortresses were built in the Khitan period, and worked for governance issue and the management of the northern region. In particular, Chintolgoi balgas is assumed to have been the central role of the function.

Hence, we have been trying to execute a survey of slight undulations (using GPS, laser range finder, and electro-optical distance measurement), archaeological excavations using digital recording instrument, and geophysical surveys (using Ground Penetrating Radar), etc. a current investigation at Chintolgoi balgas.

The result of the investigation using these various techniques resulted in diverse information and knowledge. Furthermore, we gathered the topographical information and the aerial photographic map around Chintolgoi balgas.

How can we organically organize such three-dimensional information of digital cultural heritage for digital documentation and utilization? Using a pathway to approach this problem, we have been applying GIS as the temporal-spatial information technology platform. As well as this we not only research but also campaign for the protection of cultural heritage through various efforts such as designing and handing out brochures to society. This article below presents our various research methods and processes in this experiment.

### 1. INTRODUCTION

Chintolgoi balgas castle ruins were built as one of the three fortresses by the Kitan Dynasty in the north-western region in 1004. Not only are they assumed to be Chinsyu fortress ruins but also considered to have contributed to the peace preservation, road traffic and trade stability. (Nagasawa1957)。

The fortress was preserved well and thus, traces of roads on the surface can be identified even at present. Therefore, to some extent the situation of inside the fortress can be inferred. As well as this observation results are utilized in survey maps made by prior researches. However, the preceding survey maps lack the exact location and scale of ruins and undulation of detailed topography of the whole fortress. Moreover the old environmental survey of the surrounding area of the fortress

hasn't yet been executed. Furthermore, we perceive it necessary to conduct a conscious survey concerned with the fortress of local residents to preserve the Cultural Heritage Site.

In this project of research, we decided to plan a multilateral survey and execute various three-dimensional surveys such as an excavation survey of kilns considered to have produced pottery, a survey of old environs of the fortress, an interview survey of local people and the preparation of pamphlets to be distributed.

This research is undertaken in cooperation with Institute of Archaeology, Mongolian Academy of Science. The survey has been conducted continuously for two weeks from the beginning of August since 2006.

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\* Corresponding author. Hiroshi. YAMAGUCHI. International Research Center for Japanese Studies, 3-2 Oeyama-cho, Goryo, Nishikyo-ku, Kyoto 610-1192 Japan - yamahirog@gmail.com

## 2. TOPOGRAPHY OF THE FORTRESS AND HISTORICAL ENVIRONMENTS

Chintolgai balgas is located approximately 16 km west of Dashinchilen district, Bulgan aimag prefecture. The northern and the eastern latitudes are 47°52'30.70"N and 104°14'47.15"E. This location is 35 km south of the confluence of the main stream of the Tuul river and a tributary of the Khar Bukh river. There are four large castle ruins, located at intervals of 20 km from the west, Helmendenji, Ullan Kherem, Chintolgoi balgas, and Khar Bukh in the surrounding.

In 1004, the Kitan Dynasty was forged into the center of Mongol plateau and founded the fortresses, which were created in an attempt to stop a northern group.

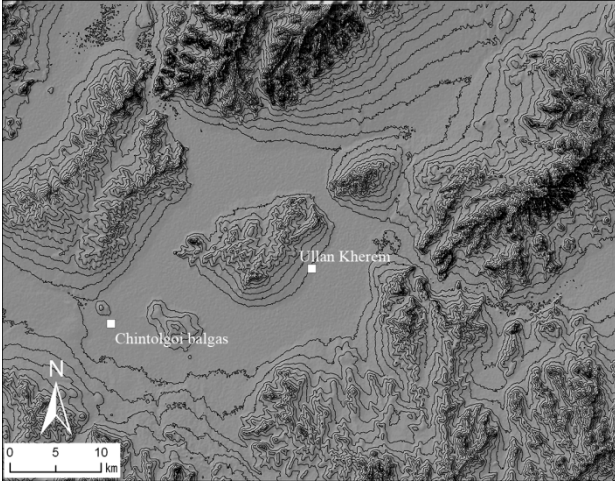


Figure 1. Topography of the surrounding area of Chintolgoi balgas

Chintolgoi balgas is situated in the slight highland along the former river roads of the Tuul river tributary where there is a marsh in the surrounding area. In the northern side of the fortress, there is a separated hill called Chintolgoi. In Kitai period, a beacon was set on this particular hill. Chintolgoi balgas fortress was built on the easy slope of the hill. The fortress has levelled and made the land horizontal and as a result of this it shows differences in the north and south castles. Relics were scattered throughout the west of former river roads and thus, it can be estimated that places of residency spread out on the west of the fortress. Moreover, there are large-scale ruins in the west side of the fortress.

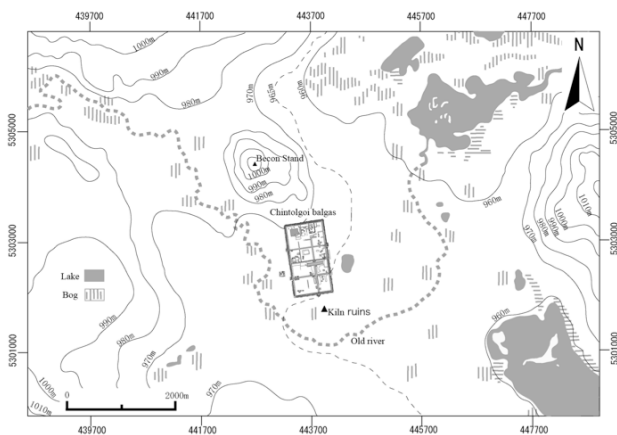


Figure 2. Topography around Chintolgoi balgas

## 3. OUTLINE OF THE PROJECT

### 3.1 CONSTRUCTION OF THE PROJECT

This project consists of 8 categories.

Category	Contents
A	Topographical Survey
B	Geophysical Surveys
C	Excavations
D	Relics Distributed Survey
E	Pollen Analysis
F	Soil Analysis
G	Hearing Investigation
H	Interpretation of an Aerial Photograph
I	Regional Topographical Map Analysis
J	Satellite Image Analysis

Table 1. Construction of the project

A is a topographic survey of the fortress. The purpose of this survey is to grasp the shape, construction and scale of the fortress.

B is a geophysical survey of the kiln zone of the fortress. The purpose is to do a non-destructive survey of existence of kilns and to make clear an area of distribution.

C is an excavation survey of kilns. The purpose is to reveal manufacturing techniques of producing eating utensils considered to have supplied the fortress.

D is an analysis pollen of the soil of around the fortress. The purpose is to explain paleovegetation of around the fortress.

E is a survey of the soil in and around the fortress. We aim at explaining the environmental changes from the soil science point of view by analysing ingredients and sedimentation of the soil.

F is a conscious survey of local residents of Chintolgoi balgas. The purpose is to conduct an interview survey of existence of knowledge and interest in Chintolgoi balgas and to make use of the survey in contribution and general knowledge to the locals of Cultural Heritage Site.

G is an environmental survey of the fortress based on satellite images. The goal is to grasp the natural environment of the fortress examining not only the topography but also the inundate roads of the river and the vegetation of environment of the fortress.

### 3.2 Research system of the project.

In this project, as mentioned above, we comprehensively handled the multi-spherical scientific information as follows.

Category	Type of data	Instruments used in acquisition and utilization of positional information.
A	Topographic Data	<ul style="list-style-type: none"> <li>• TS(Total Station)</li> <li>• LRF(Laser Range Finder)</li> <li>• STATIC –GPS, RTK-GPS</li> </ul>
B	Geophysical Survey Data	<ul style="list-style-type: none"> <li>• RTK-GPS</li> </ul>
C	Data of Excavation	<ul style="list-style-type: none"> <li>• TS</li> </ul>
D	Relics Distributed Survey	<ul style="list-style-type: none"> <li>• GPS (Point Positioning)</li> </ul>
E	Pollen data	<ul style="list-style-type: none"> <li>• GPS (Point Positioning)</li> </ul>
F	Soil data	<ul style="list-style-type: none"> <li>• GPS (Point Positioning)</li> </ul>

G	Hearing Investigation Data	• GPS (Point Positioning)
H	paper map 20000: 1	• GIS
J-1	ASTER GDEM	• GIS
J-2	SRTM	• GIS

Table 2. Method of acquisition and information handled in this project

GIS is introduced to combine various information in the base of technology (Table 2). In addition to this there are historical records of the castle structure activity, trade and movement of people, excluding the information mentioned above.

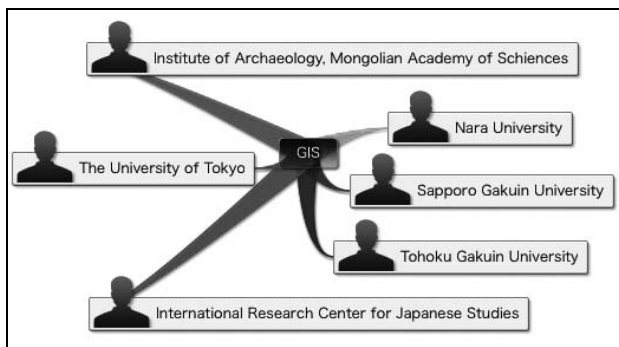


Figure3. Sharing and manipulating of information using GIS

### 3.1 Instrumentation used in the survey

In the research, the following instrumentation is used according to the purpose:

- Total Station (SOKKIA SET610S)
- Laser Range Finder(Laser technology Impulse200 and electronic compass of MapStar and ArcPad6.0)
- STATIC –GPS (Leica GPS system1200)
- RTK-GPS (Leica GPS system1200)
- GPS (Stand Alone Positioning, Garmin GPS60CS)
- GIS (Esri ArcGIS9.2)

## 4. RESULTS OF THE RESARCH CHINTOLGOI BALGAS

### 4.1 Methods of the survey

Chintolgoi balgas fortress is huge castle ruin. It is spread out more than 1km from south to north. Accordingly, we set a standart of survey based on Kinematic measurement and STATIC measurement using GPS in order to easily forward the task.

We set the datum point, based on long time STATIC measurement using GPS. The frame of reference used for the survey is UTM– 48N. We then conducted a compass survey of standart survey and RTK-GPS measurement to survey the remnants of the fortress and detailed topography. We also made a survey map of 3 dimensional data using GIS.

According to the 3 years survey in which we have almost finished surveying the results show rampart, street, the interior buildings and topography. We have been also able to survey a part of the remnants that spread out of the fortress. As a result we have been able to accurately record the position of the ruins, scale and connection with the geographical features. The survey map we made this time has brought further important

information by overlapping a survey map made by Altangerel (Очир et al 2005 p.120). And, it can be useful for other categories of surveys as all survey data converted to GIS data. This is an important point, as I will further relate the results of the survey in the following paragraphs.

### 4.2 Results of the survey

Chintolgoi balgas is located in the rolling hill within the slight highland along the old river road. The whole fortress slopes gently down from northwest to southwest. The fortress's height above sea level is 970m in north side and 962 in south side. The surface of the earth is built to make it closer horizontality to the inside of the fortress. A slope of the south fortress is slightly steep compared to the north one. The maximum difference between the north and the south fortresses is 3m. As a result of the survey, we discovered that the land of the fortress was levelled in large scale to make it horizontal while the fortress was built. We also discovered clear height differences between the north and the south fortresses.

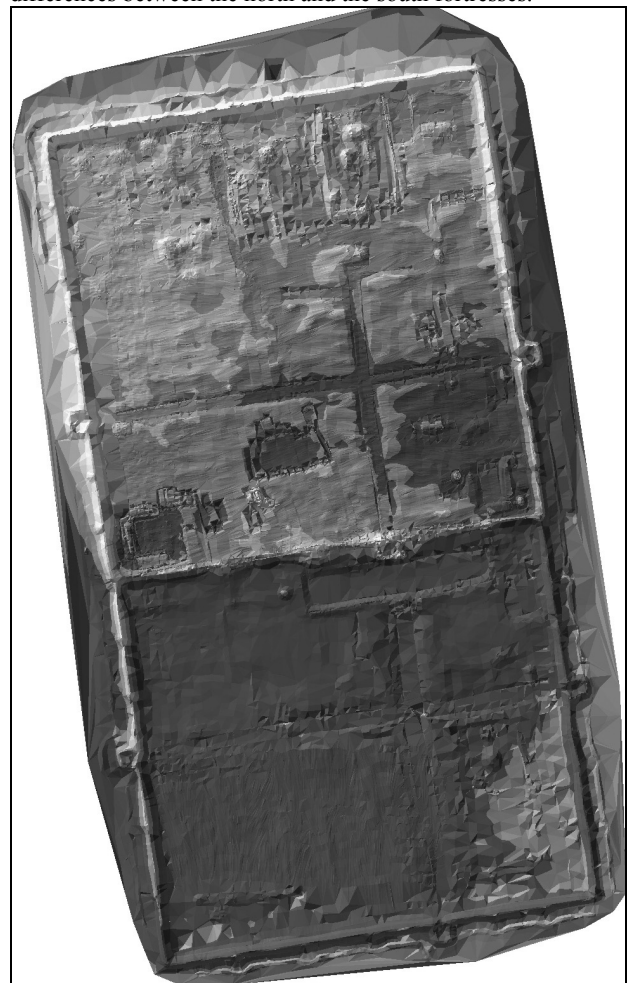


Figure4. General view of Chintolgoi balgas

Chintolgoi balgas is large scale fortress. The long side distance of the fortress is 1256m in west side and 1268 m in east side. The short side distance of the fortress is 654m in north side and 656m in south side. The limits between outside of the fortress are rampart of the fortress, moat and outer rampart of the fortress. There are 3 gates in each, northern and southern fortresses. As well as this protection features are put up on the ramparts.

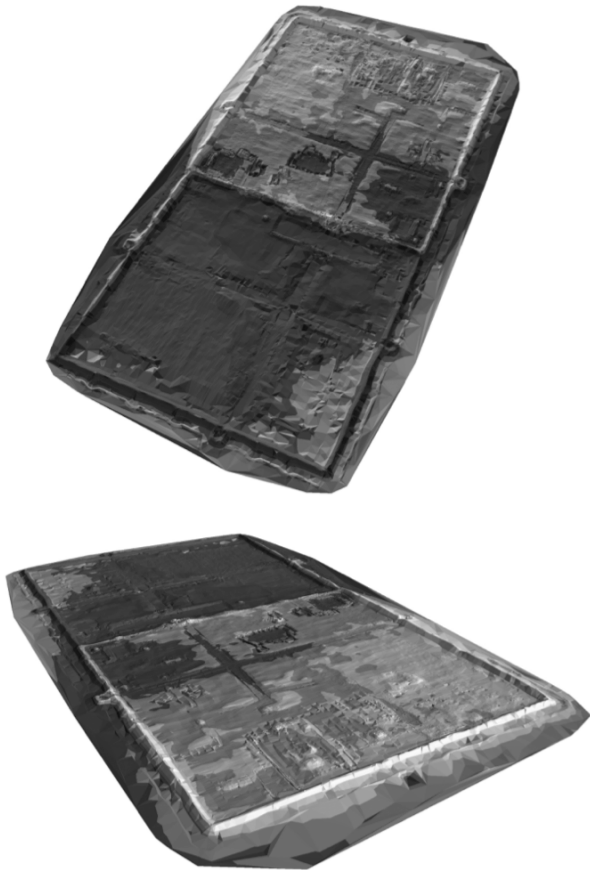


Figure5. Birds-eye view of Chintolgoi balgas

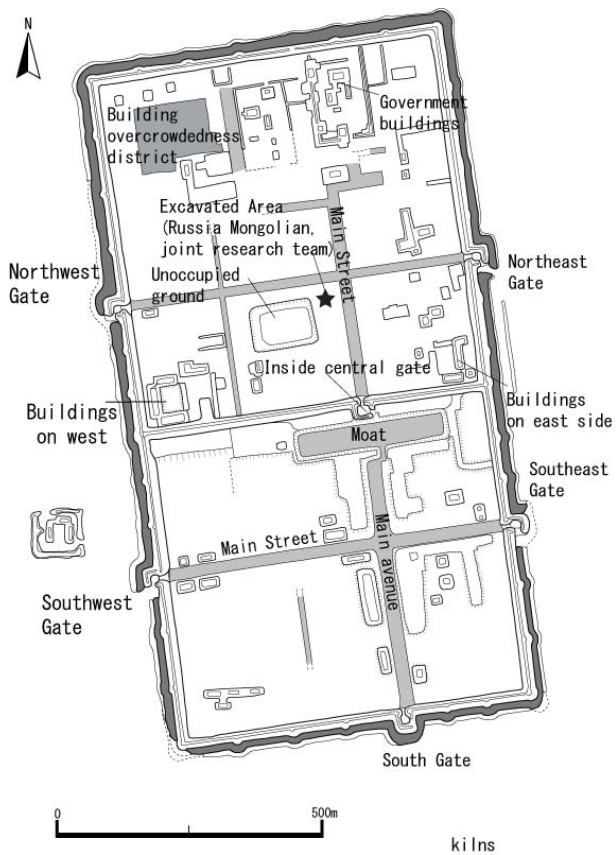


Figure6. Layout of archaeological monuments

Many roads were constructed inside the fortress. The broad central streets are built to connect with the gates. Furthermore, traces of buildings and large complex features inside the fortress can be distinguished by observing. Some of those complexes are possibly pagoda and temples. The existence of tile-roofed buildings on the foundation stones also shows evidence of public facilities.

## 5. TRIAL DIGGING SURVEY OF KILNS

### 5.1 Positions and peculiarities of kilns

Kilns are located in 300m southeast from the south gate of the fortress. Due to Geophysical Surveys, we obtained an assumption that there are a great number of kiln ruins within an approximate 100m space on all sides. The parts of kiln ruins are low rises. Every rise holds a large amount of carbide and as well as this fragments of pottery and tile are scattered on the surfaces of the rises. It can be indicated by just observation with the naked eye.

### 5.2 Trial digging of kilns

We conducted this trial digging on the larger rises of the surrounding area. Measurement survey and underground exploration showed for almost for certain the existence of kiln ruins. And the possibility that kilns have been destructed building nests for small animals. Hence the reason in which we chose these particular parts.

On the occasion of the kiln survey, we were able to grasp the distribution of kilns integrating the topography survey and geophysical investigation by using GIS. We were also able to set up appropriate survey section to gain more division in a few destructions combining the result of the survey and the observation of the surface of spots.

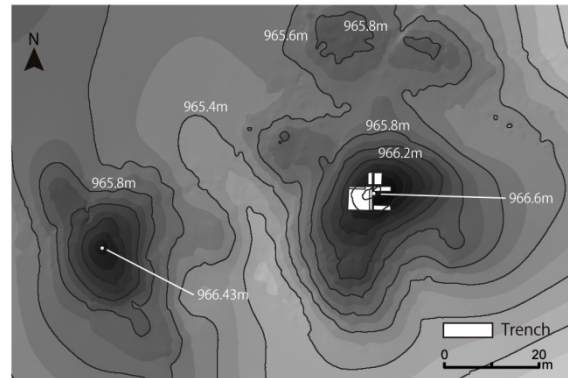
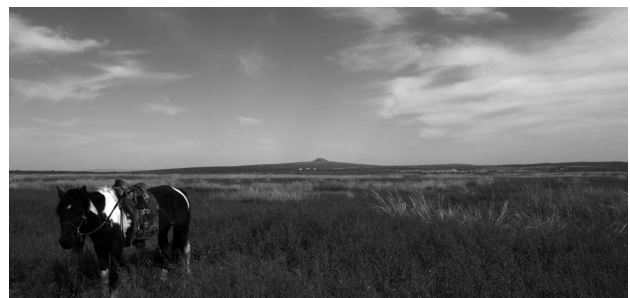


Figure7. Topography and excavation sections of kilns



Photograph2. Landscape of the interior Chintolgoi balgas



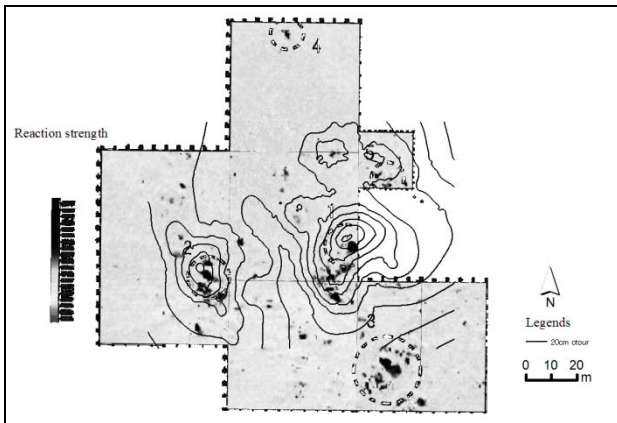


Figure9. Topography and excavation sections of the kiln ruins

### 5.3 Results of trial digging of the kiln ruins

At the trial digging, we excavated a part of the objective kilns. As a result, kiln was in the hemisphere and its diameter resulted in about 7m. A tile covered in the bottom of the kiln was confirmed as well.



Photograph1. Photo of the kiln in excavation survey.

## 6.CONCLUSION OF CHINTOLGOI BALGAS SURVEY

As I mentioned above, in this project we have improved methods of investigation and conducted not only topographical survey of Chintolgoi balgas castle ruins, but also geophysical survey and excavation survey of kilns combining various measurement techniques.

However, the survey of waterways and outer remnants, elucidation of the whole kilns and documentation found relics, which are currently under assignment at present. In addition to this, there have been conductions of surveys in ancient environs and the resolution of the local residents. We intend to continue the survey of Chintolgoi balgas castle ruins in future as well.

## 7. A COMPARISON BETWEEN CHINGOLTOI BALGAS AND THE FORTRESSES AROUND IT

### 7.1 Topographical survey of Ullan Kherem

In 20km northeast of the neighbourhood of Chintolgoi balgas fortress, there is Ullan Kherem, a castle ruins built in the same Khitan period. I am presenting this as it is thought to deepen comprehension comparing the two objects.

The survey methods used in Ullan Kherem is the same as the methods used in Chintolgoi balgas. Namely, we used Total station and RTK-GPS for the topographical survey of the castle ruins.

In the TS survey, we emphasized on laying spots that can plainly show not only the shape of the castle but also the upper and lower ends of the eastern rampart and the moat. We set up the standard piles used in the survey as the datum points in the same longitude as the central north-south eastern rampart of the citadel. On this occasion, we used GPS (Stand Alone Positioning) to measure the longitude and we set up local coordinates concerning to the 2 standarts setting the south side one in the datum points O ( $X=0, Y=0, Z=0$ ). We decided to use GIS and the reference points measured by GPS in transforming the local coordinates into global coordinates.

We conducted RTK-GPS survey in the GPS based survey. However, in the case of point positioning using 1 GPS, the origin coordinate errors are wide. Accordingly, we obtained more precise positioning information by conducting STATIC survey for about 6 hours. The reason we made observation survey for 6 hours is the far distance to IGS (International GNSS Service) network. The two nearest IGS networks are Ulanbator 190km and Irkutsk 480km. We revised the reference points disposing after using data based on STATIC survey and IGS.

In the topographical survey based on RTK-GPS, we automatically recorded once at 2-second intervals moving a walk. On the occasion of the survey, we attached importance to a movement of carrying a rucksack connected with an antenna because it is dangerous to be holding a 2 m antenna for 5 hours on the rough land.

### 7.2 Results of the survey of Ullan Kherem

As a result of the survey, the following features of Ullan Kherem castle ruins became clear.

The position of the ruins is  $47^{\circ} 55' 49''$  latitude and  $104^{\circ} 32' 28''$  longitude.

1. The interior of the fortress surrounded by twofold eastern rampart and moat in 4 sides covered an area of 26 ha.
2. The periphery of the ruins is about 2.6km. It displays an abridged square and measures 540m in north-south and 480m in east-west. North—west side is higher and slopes down to south-west.
3. A protection feature is built on the rampart. Outside of the protection feature contrasts with the flat surface.
4. Castle gates are built in the each centre of south, west and east parts of the rampart.
5. Inside of the fortress is largely divided in to 4 parts by 20m wide streets.
6. There are large sections to arrange building ruins considered to be the fundament ruins and the tower ruins. But, small sections occupy the majority of the interior fortress.

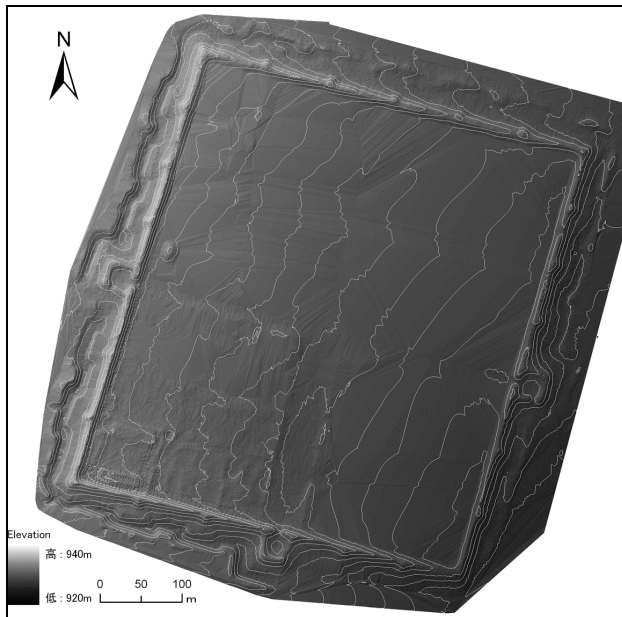


Figure 10. Topographical survey map of Ullan Kherem

### 7.3 A comparison between Chintolgoi balgas and Ullan Kherem

Compare to Chintolgoi balgas, there is no large-scaled buildings in the half part of Ullan Kherem. However, protection of Ullan Kherem is extremely complicated and, the structure of the interior fortress differs. It implies the difference of functions and characters of each castle in the area of the Tuul river. Furthermore, it is assumed that castles holding such different functions were systematically related and they undertook the administration and management of their relevant areas.

## 8. CONCLUSIONS

We completed the survey focused on Chintolgoi balgas fortress of Mongolia, regarding use of GIS and the methods of the survey, mixing the results of this project to date. In the next project, we are planning to make the environmental change clear based on convergence of people, agriculture and the ceramic industry. Accordingly, I suppose more multilateral surveys will be required and in that case, I will consider it necessary for GIS to combine various information regarding Cultural Heritage sites, which will be increasingly bear.

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