

Archeologic Site Mapping and the Image Processing in the Semi-arid Mongolian Grassland

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Abstract

One of the interesting problems for the conservation of Mongolian steppe land is the survey of the recent and the ancient cultivated field. The traditional food production in the Mongolian grass land has been the nomad of sheep that is a tender and sustainable way for grass land. But in the last several decades the large scale cultivation has been done by machine under the Russian support. The stripes of wheat field is being used alternately every other year. Some fields are not used now. It is one of the serious problems whether the large scale cultivation by machine is sustainable or not. The image from the satellite may be useful for detecting the change of large scale cultivation which was begun in the 1960's. We are now starting to survey on the ground and on the satellite image. And we are feeling the necessity of the help of middle scale air photo.

And the another subject is the recent findings of some evidences of the ancient cities and the cultivated field. That needs the more large scale air-photo and the near-ground sensing technology. I want to report some easy image-processing methods for the help of archeologic site mapping.

1. Avraga Palace, the capital of the Early Mongolian Age and the trace of cultivation in the Suujiin Plain, East Central of the Mongolia (Figures and Photos No.1-10).

By the archeologic investigation of the Gorvan Gol Project 1990-94, the site of avragin burgas was concluded as the site of the city at the beginning of Mongolian age when the Chingis Khane was living and as the site of holy place of all the past Khanes later. The remnants of the city were found in the dry steppe.

The plan of the city was mapped by hand. The stereo-graphic pair of Fig.4 is drawn from the survey map. Three different street pattern of the city, the remnant of low wall in the north west side of the city and the remnant of the shallow channel outside of the wall were recognized.

The plant mark may be closely related with the micro relief of the site like a example of Nos.6

and 8. Photo 5, a pair of stereo-graph in 16 colors in CRT screen, is a false relief map made from the mono-chrome air photo. The relief image of Photo 5 shows the difference of brightness of the land (the dryness or poorness of the soil). The method will save the old or dim photos.

Line picture of fig.7 is made by stressing the edge of the plant or shadow mark of the photo 6.

The mapping methods of No.5 and 7 may help the rapid survey of archeologic site in the field, because the drawing of the outline is the first of all of the mapping work.

Trace of rectangular field pattern is found from the air in the lower part of the Suujiin basin (Photo 10), but it is not recognizable on the ground .

2. Kharaholin(Kharakhorum), the Capital of the Ancient Mongolian Empire and the trace of the cultivation, West Central of the Mongolia (Figures and Photos No.11-13).

The details of the capital city of the Mongolian Empire during the 13th to 14th century become evident by the recent investigation (Shiraishi,1996). Trace of field pattern was found in the north inside of the city wall. As the height of the wall is less than 2 meters, Shiraishi(1996) thinks that the wall of the city was not made for the defence to the enemy but to the animals.

Cultivation is also conformed in the picture in the beginning of this century in nomadic Mongolia (Photo 14).

Maps and photos

- 1 Studied spots A: Avragin Burgas site in the Suujiin Plain
 K: Kharaholin (Kharakhorum Capital site)

- 2 LANDSAT/TM image to show the Suujiin Plain from "Gurvan Gol" Report,p.53.
TM image,Sept.24,1994 was processed by Sakata and others,Tokai Univ. Research and Information Center. D: Delgerkhaan, T: Tossn nuul, AB: Avragin Burgas site,
E : baruun Saarly river, З :Zoon Saarly river, A :Avrag river K : Kherlen River

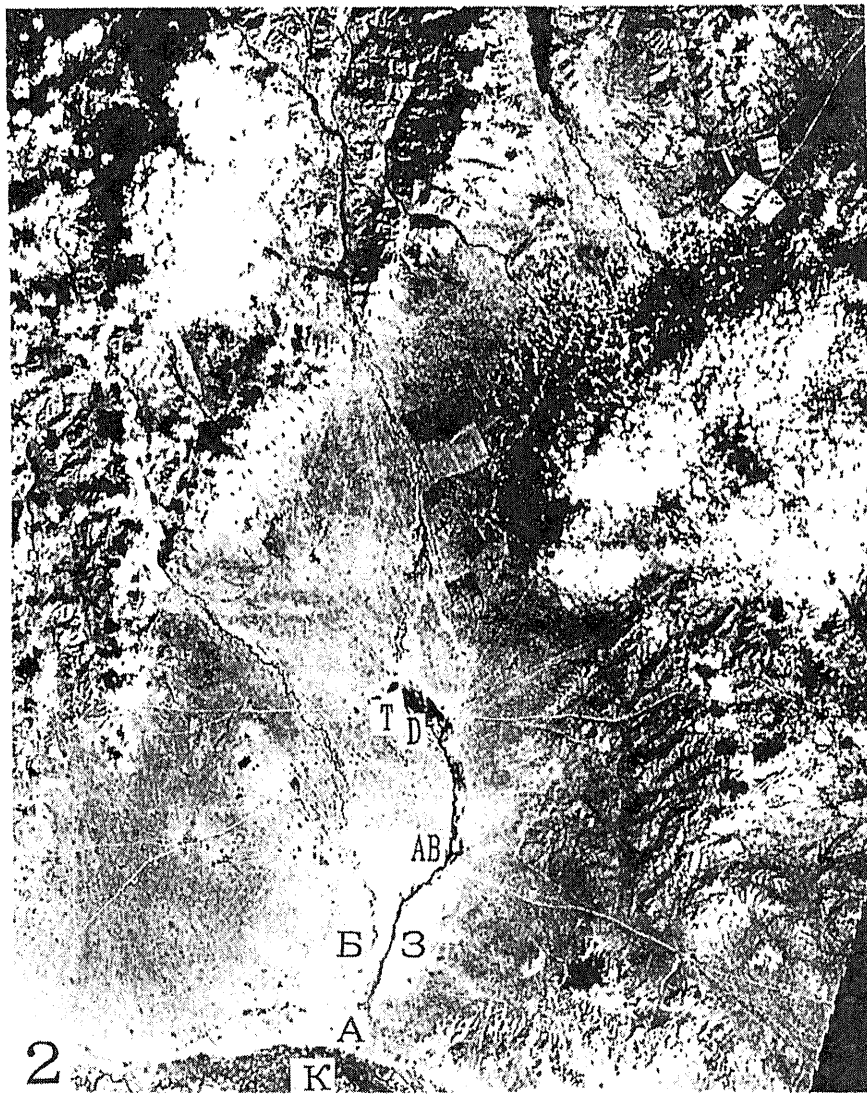
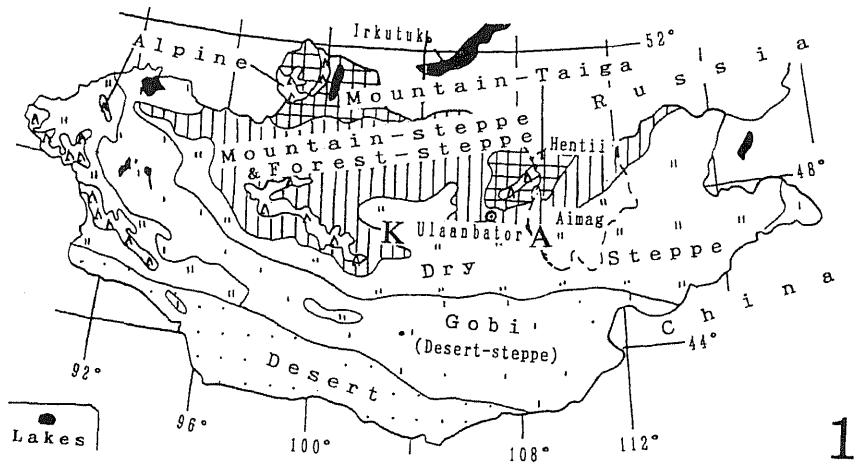
- 3 Plant mark of the Avragin Burgas site in the dry steppe of the Suujiin Plain.
The photo was taken by helicopter from the north to the south. Photos 3,6 and 8 are from "Gurvan Gol" Report(1994).

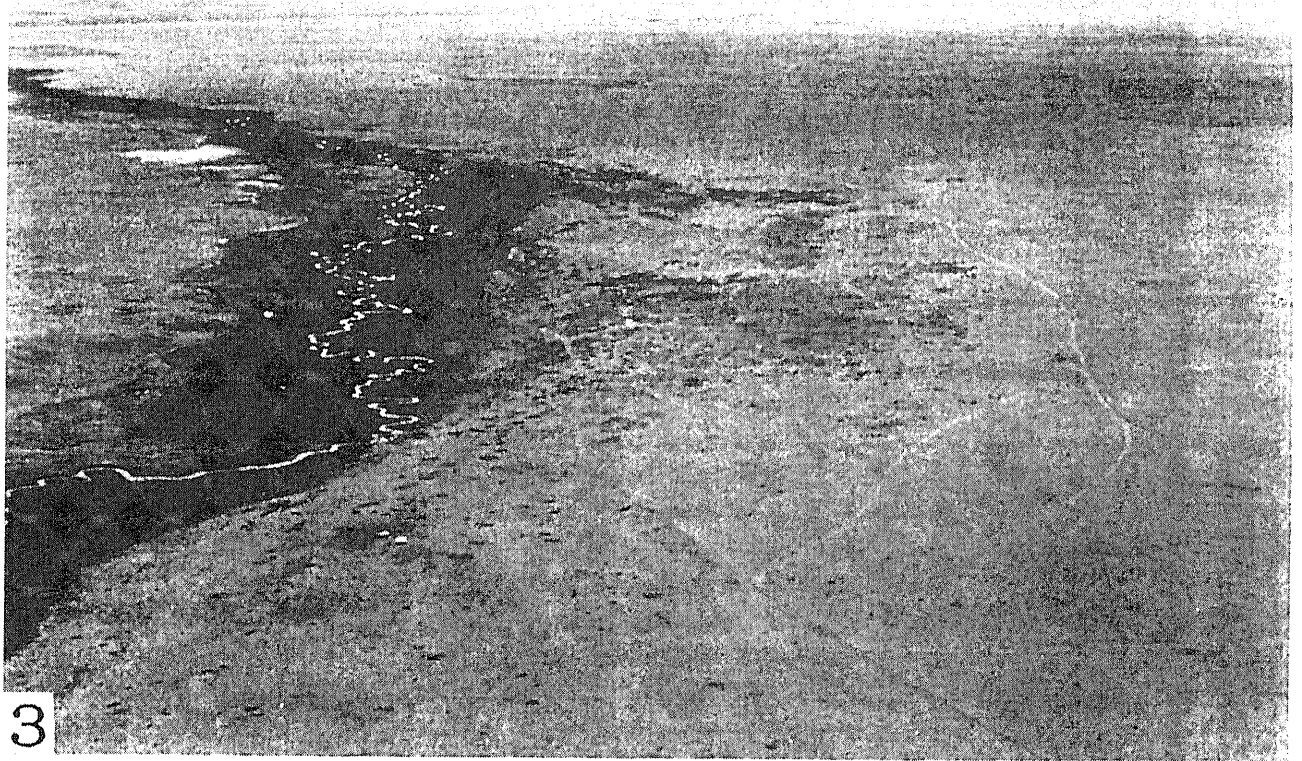
- 4 A pair of stereo-graph to show the topography and the plan of the Early Mongolian City.
The stereo-pair were computed from the contour lines of the survey map.
The survey of the base map was done by Katoh Sinpei, Tsurumaru T., Shiraishi N., Katoh Sinji, Miyake T., Furuya T. and Akojima I. on foot. The remnant of crank shaped channel outside the bank is not shown.

- 5 Stereo-pair to show the plant mark and the plan of the archeologic site.
The brightness (dryness or poorness of the soil) in 16 colore grades in CRT screen is made from mono-chrome air photo. The color grades in this print is not same as the image in the CRT screen.
- 6 Stereo-pair of photo showing the remnants of the ancient city blocks.
Some holes may be the excavating holes made by Mongolian archeologist during 1960's.
- 7 Edge line map made from the Photo 6.
- 8 Plant mark on the mound of the largest boulding in the ancient palace.
- 9 Surveyed map of the same site as photo 8. Contour interval is 0.1 meter.
- 10 Rectangle plan of "former cultivated field(?) by Chinese during the 19th C.(?) " in the lower part of the Suujiin basin.
Light colored part in the right half is the denuded part by the recent cultivation.
- 11 Old and new field patterns near the Kharakhorum site.
More than three field patterns are superimposed in the recent cultivation.
Black line was added to show the plan of low wall of the Mongolian Empire Capital and the small rectangle is the wall of temple made after the destruction of the capital during the 16th century. Photo by the Mongolian parmission.
- 12 Field pattern inside of the city wall.
- 13 Plan of the Kharakhorum site newly surveyed by Shiraishi(1996).
- 14 Mongolian cultivation in the beginning of the 20th century.
This picture is copied by hand from the famous painting of "A day of Mongolia---Spring" (Sharav?, 1915). The original picture is in the Central Museum of Fine Arts, Ulaanbator.

Acknowledgement

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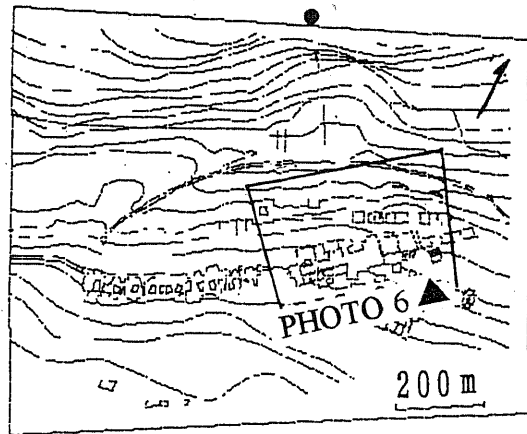
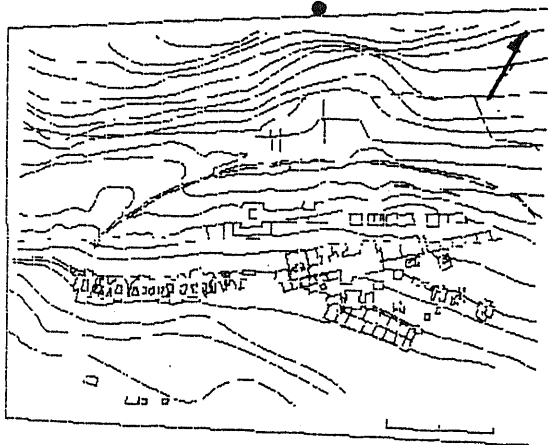
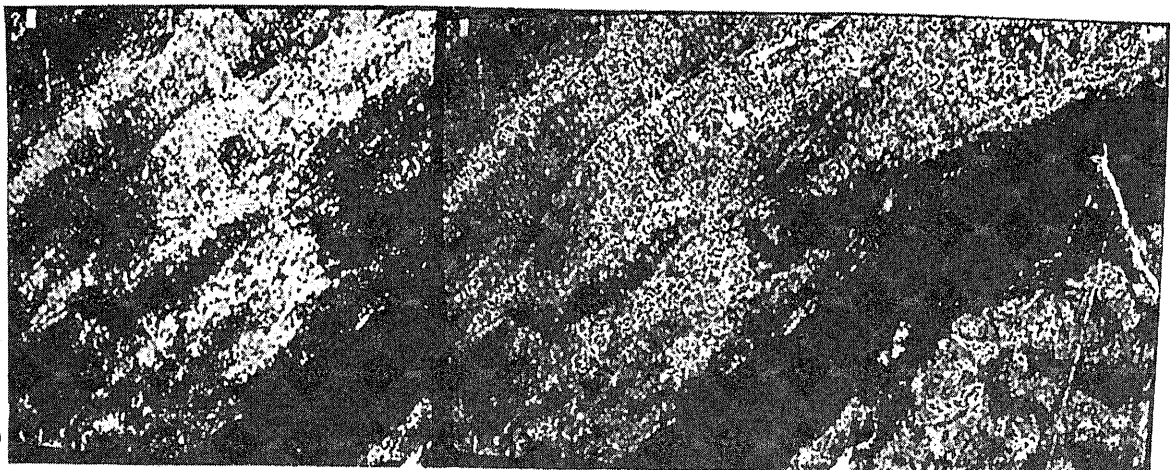


PHOTO 3
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PHOTO 6
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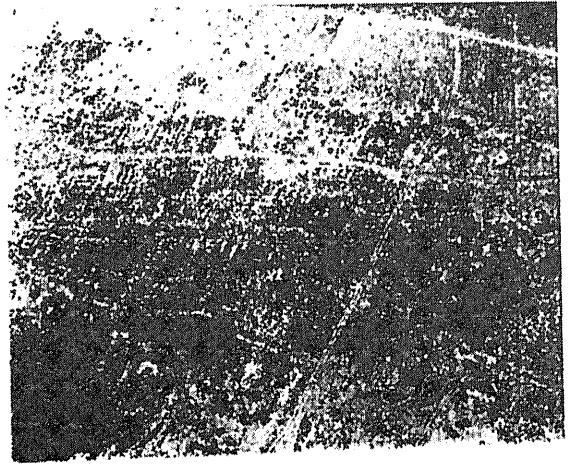
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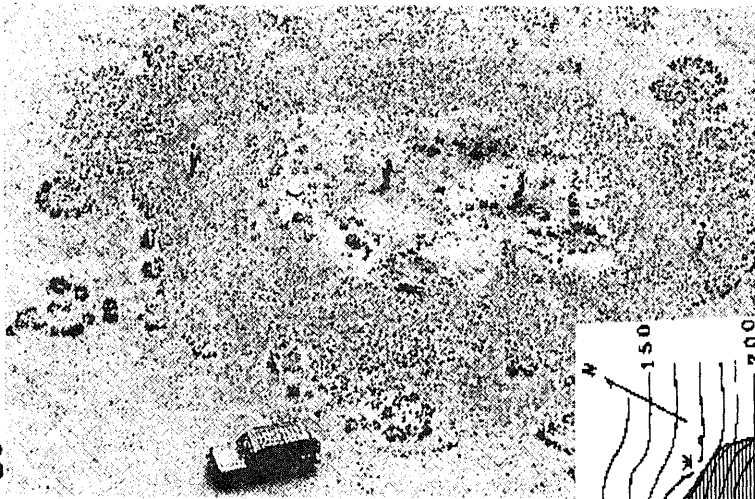
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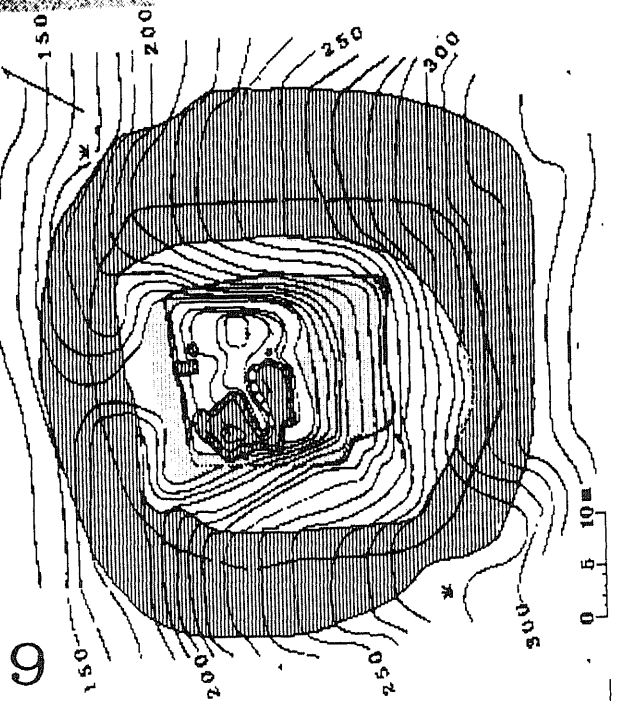
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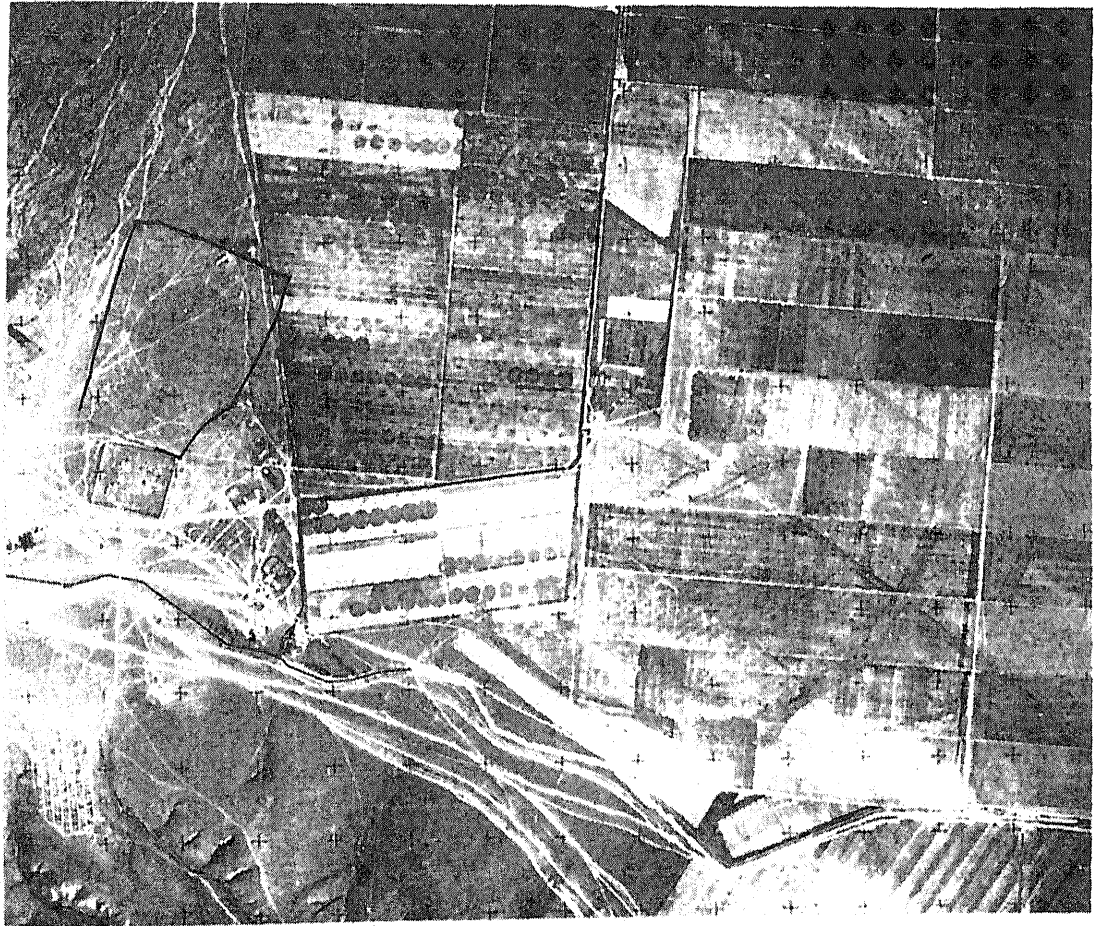


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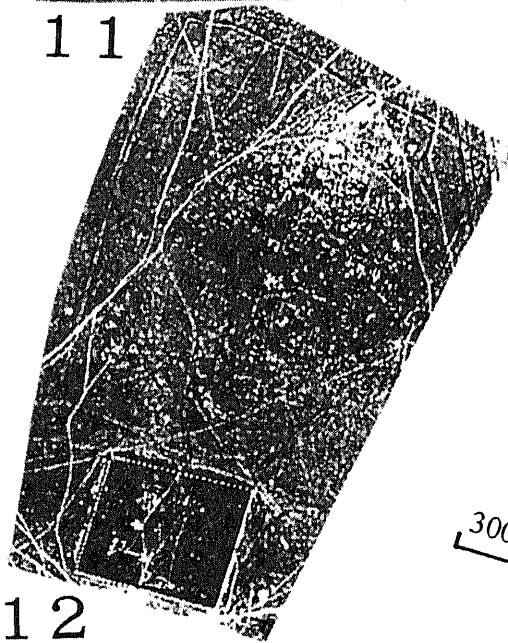


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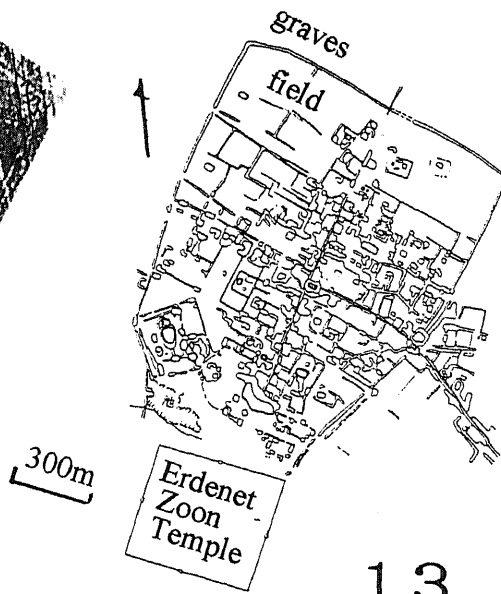




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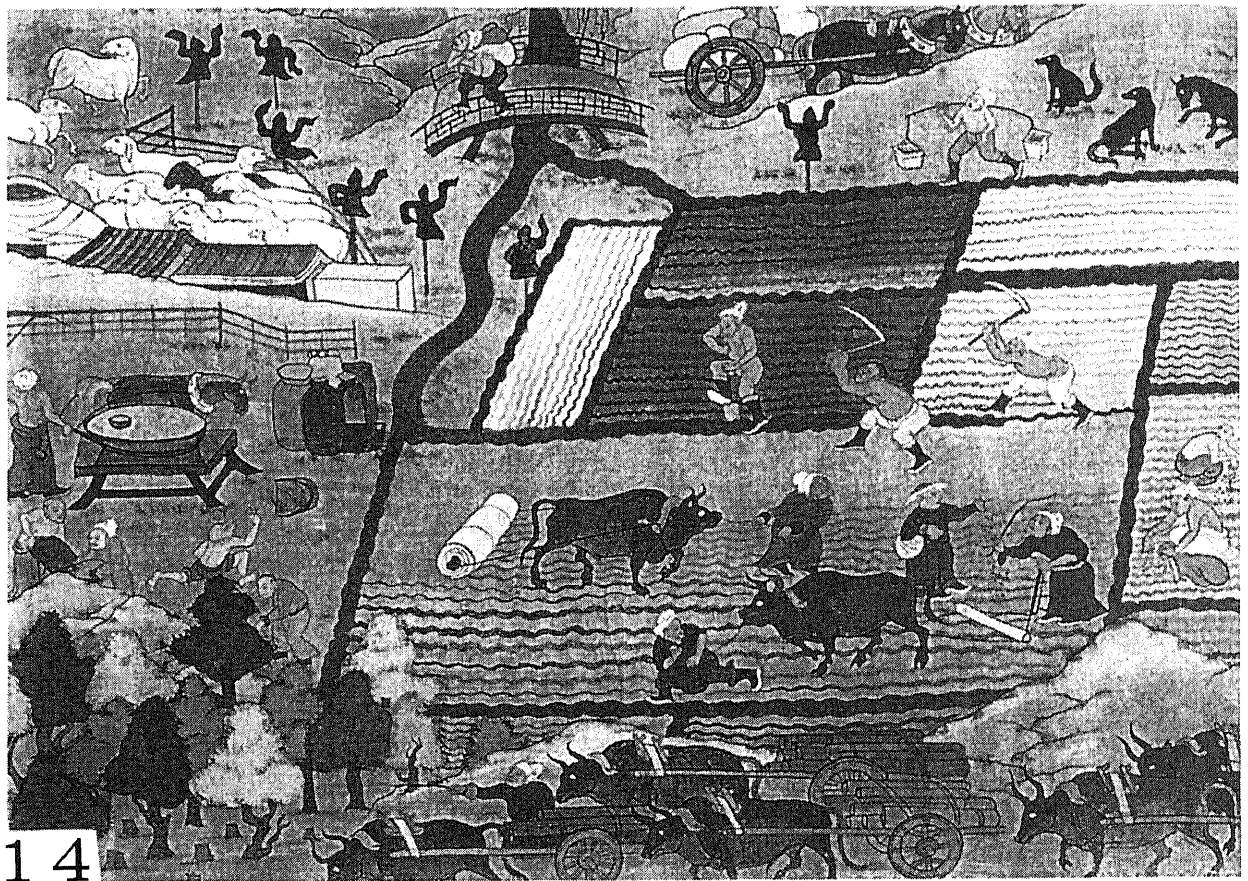


1 2



1 3

Shiraiishi(1996).



14 Mongolian cultivation in the beginning of the 20th century.

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