

The Making of the Base Maps of the Ancient Sites in the Mesopotamian Region based on ALOS Data

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Abstract

There has been no detailed map of the ancient sites lying in the Mesopotamian region. Therefore, we attempt to make such map based on ALOS data. We begin to develop it especially from Iraq, where fieldwork cannot be carried out and the urgent actions are demanded for protection of the cultural heritages.

Keywords: Mesopotamia, Ancient sites, Base map

1. INTRODUCTION

From 1956 downward, many archeological expedition teams have been dispatched from Japan. As a result, in recent years around 10 archaeological expedition teams have been organized annually. These dispatched expedition teams have advanced the investigation through the excavations and conducted research about the ancient trade routes, the cultural diffusions and such. However, the investigation has been confined to only some of the representative ancient sites, and it has not yet achieved to comprehend the geographical distribution of all the ancient sites lying over the whole of West Asia. Furthermore, present Iraq, which was the heartland of the Mesopotamian civilization, has been politically unstable in recent years, and the disputes and wars have never ceased. As a consequence, the valuable cultural heritages have become the targets of destruction, the looting and the illegal diggers [1]. Pic.1 below was taken after the collapse of the Saddam Hussein's regime in 2003, to show the condition of the conservation room of the Iraqi National Museum after the looting was taken place.



*Picture 1. The conservation room of the Iraqi National Museum after the looting was taken place
Taken by Ken MATSUMOTO in May, 2005*

In order to protect the ancient sites, an accurate database about the geographical distribution of the ancient sites should be developed. Then, it is advisable to utilize it for managing and patrolling these sites. We have been developing a digitalized database based on the existent research reports and maps [2] of the ancient sites. But, the locations of all the ancient sites have not yet been fully identified, therefore the investigation into their geographical distribution first needs to be conducted. Especially, marshland stretching the southern part of Iraq, which is called Mesopotamian marshland, is the very important region as the cradle of the first Mesopotamian civilization, where some newly discovered ancient sites lie among several hundreds of the already confirmed ancient sites. These sites have been newly identified as a result of the diversion and drainage of water of this marshland in order to use land for agriculture by the Saddam Hussein's regime from 1990th downward. However, since 2003 when this regime was collapsed, this region's inhabitants have started to destroy the water canals and banks, and to open the water gates in order to recover the lost marshes. Thus,

this region has been gradually submerged again by these activities, and many ancient sites are now under the condition of submergence. So, before these sites are completely submerged, the making of their distribution map is urgently needed. Pic.2 is showing today's marshland.



Picture 2. Today's marshland

Fig.1 is the half-finished digitalized map showing the locations of the ancient sites in Mesopotamian marshland. The extent of Mesopotamian marshland was to be estimated by data, which were obtained by Landsat between 1973 and 1977.

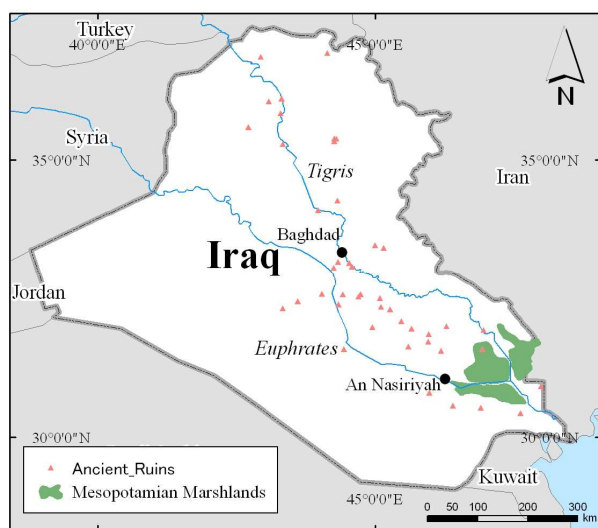


Figure 1. The locations of the ancient sites and Mesopotamian marshland

For the database and the distribution map of the ancient sites, a base map is needed. However, in Iraq it has been difficult to develop the maps or obtain the aerial photographs until now. One of the topographical maps, which is now available for us is the Soviet Military Topographic Map, which was made and issued during 1970s with a scale of 1:100000 and covers the whole of Iraq. However, the scale is too small to comprehend the details of the ancient sites. The date is old, so it is suitable to understand the geographical condition of the past, but we

need to be careful to utilize this map as the base map of the ancient sites. As the recently available topographical maps, we have UNIRAQ and such thematic maps, which have been developed and issued by the international organizations. For their base layers, Landsat and such satellite images have been applied, so it is possible to comprehend the geographical condition of the recent years. But, the areas mainly cover the urban regions only.

In terms of protection of the cultural heritages, the detailed satellite images covering the whole of Iraq need to be utilized for the map of the ancient sites.

We have already started to develop the map of the ancient sites based on the varying types of the satellite images of the Mesopotamian region. So far, we have tried to apply the images of QuickBird, SPOT5, FORMOSAT2, Terra ASTER, LANDSAT and CORONA. But, the objective region is extensive. So, only a few satellite images of the ancient sites with high-resolution have been applied so far. However, by the application of the satellite images of ALOS, which have been available since 2006, it is possible to develop the base map of the ancient sites covering the extensive region and with high-resolution. Concerning about the development of the base map of the ancient sites by the ALOS images, we have already confirmed its effectiveness by the analysis of PRISM and AVNIR2 data and the making of a distribution map of the ancient sites of the kingdom of Jordan, where field work is possible.

So, in this report we will mention that as a database for the base map of the ancient sites of Iraq, where it is difficult to conduct fieldwork, we have started to apply the pan-sharpen images, which can be made by superimposing PRISM data over AVNIR2

2. Applied data and a method to develop the base map of the ancient sites

2.1. Applied data

Lately applied data of geographical information shall be indicated as follows.

Satellite Image:

ALOS AVNIR2 (2006)

ALOS PRISM (2006)

Terra ASTER VNIR (2000)

Landsat ETM+ (2000-2001)

Landsat MSS (1973-1977)

Topographic Map:

Soviet Military Topographic Map with the scale of 1:100000 (completed during 1970's)

City Name:

GEOnet Names Server data (2007)

The applied software for the analysis of data is ESRI ArcInfo9.1, Leica Geosystems ERDAS IMAGINE9.1 and Visual Learning Systems Feature Analyst4.

2.2. The method to develop the base map of the ancient sites

The objective region for developing the base map of the ancient sites is intended to cover the whole of the Mesopotamian region. The work should begin from the southern part of Iraq, where the urgent actions are especially necessary, and then it should extend to the entire West Asian region called the Fertile Crescent.

Firstly, in order to identify a secular change of Mesopotamian marshland in southern Iraq, Landsat data was applied. For the identification of marshland, a legend of Soviet Military Topographic Map with the scale of 1:100000 was used as reference data, and then marshland was to be identified by the application of information about the size, shape, texture, pattern, spatial relevance and such. On Fig.2, the change of diminished Mesopotamian marshland, which occurred between 1973 and 2001 are being indicated.

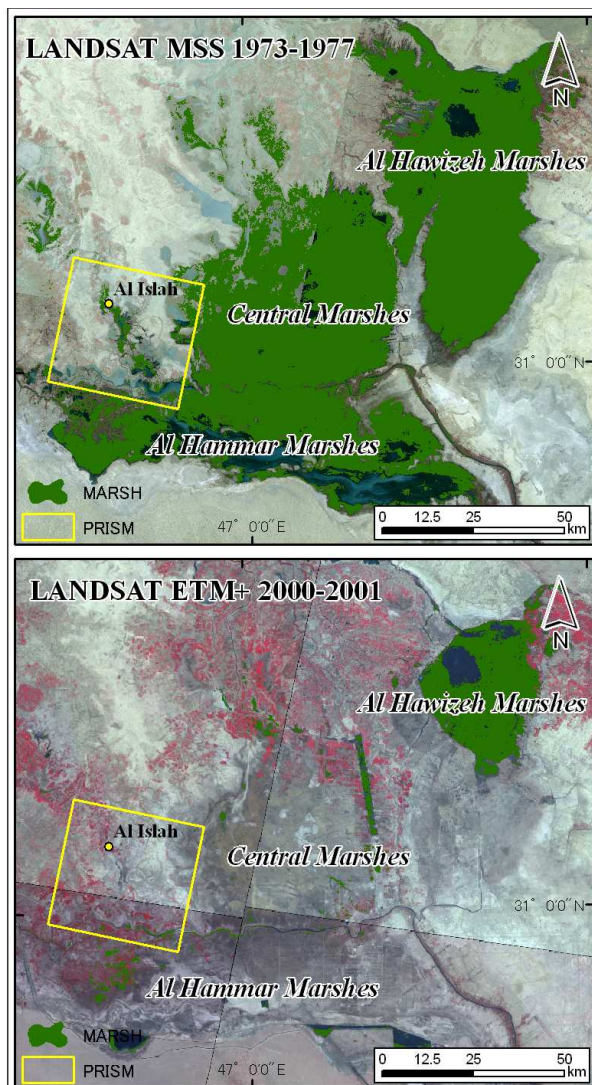


Figure 2. The secular change of Mesopotamian marshland

At the time of the year 2000, some marshes still existed in the north of Al Hawizeh Marshes, however the marshes extensively decreased in Central Marshes and Al Hammar Marshes.

Fig.3 is three different periods of satellite images showing Al Hammae Marshes under the condition of submergence. From the satellite image of the year 2006, it is clear that the marshes were already recovered.

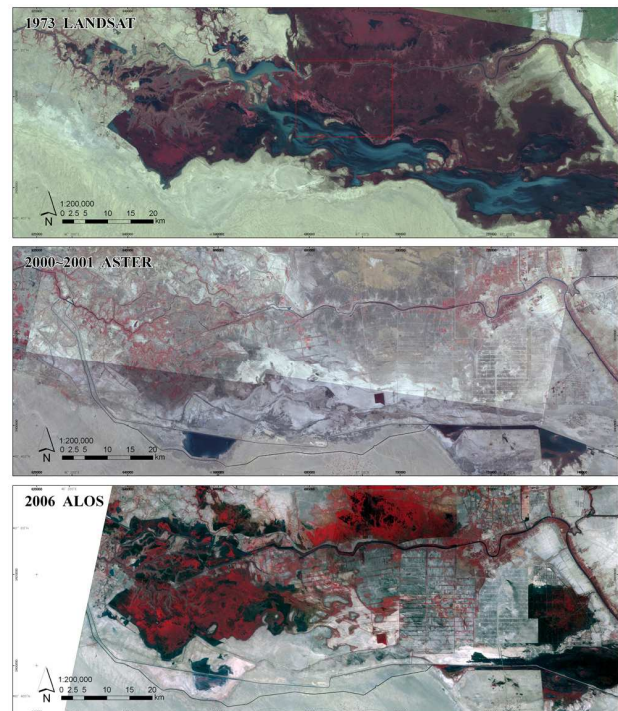


Figure 3. Al Hammar Marshes under the condition of submergence

Fig.4 is showing the enlarged region around Al Islah.

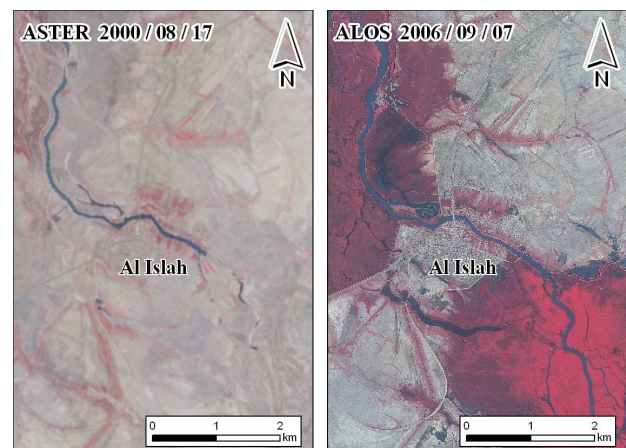


Figure 4. The change around Al Islah between 2000 and 2006

As far as analyzing the images of ASTER data, which were obtained on 17th August, 2000, the rivers only reached Al Islah, and the more southern region was bare-land. But,

according to ALOS data of 7th September, 2006, the same region is submerged again.

In this report, we attempted to develop a base map of the ancient sites within the scope of ALOS PRISM's one image, which has scanned information of Dhi Qar Governorate (its capital city is An Nasiriyah), the northwest of Al Hammar Marshes. (The yellow frames indicated on Fig.2)

As the base map of the ancient sites, ALOS data will be applied. But, it is difficult to enter into Iraq, therefore for the position adjustment of a satellite, PRISM data was applied as it is. Then, based on positional information of PRISM data, geometric correction was conducted to develop the pan-sharpen image. The developed data is under the control of GIS, so the necessary parts can be cut and printed out. The Fig.5 shows the base map of the ancient sites with a grid of the 2 km meshes for the printing purpose.

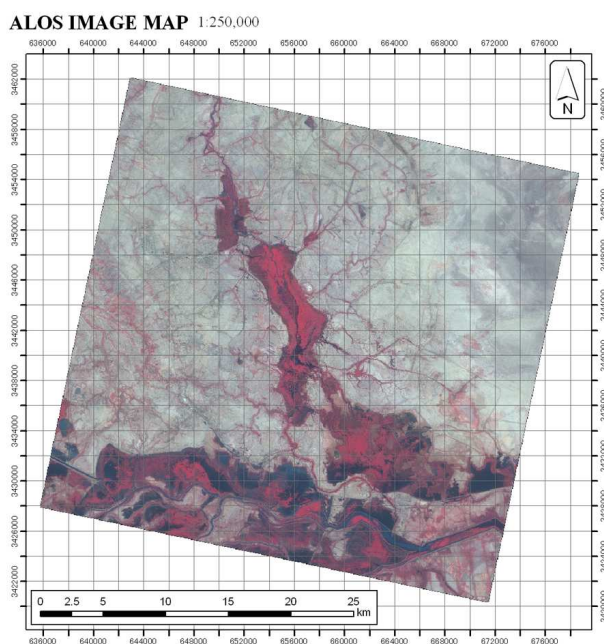


Figure 5. The example of the base map of the ancient sites for the printing purpose

3. CONCLUSION

There is an issue about the development of the base map on an experimental basis. It is about accuracy for extraction of DSM from PRISM. The layers of the contour lines are to be added to the base map of the ancient sites, so extraction of DSM from the three-way images of PRISM was attempted. But, shapes of some spikes and holes like errors occurred. These errors may have been occurred, because the relative heights within the subjective region are approximately only 10m and an image of bare-land has less gradation sequence. Thus, for our future issue concerning about a region with less relief, we have to attempt to extract elevation data with high-accuracy.

Other kinds of data also need to be added in order to

improve degree of completion as the map of the ancient sites. Of course, further information about the ancient sites has to be added by the existent research reports and such. The legend of Soviet Military Topographic Map has some legends relating to the ancient sites, so its digitalization will continuously be carried out.

Furthermore, for Jordan and Syria, where fieldwork has been carried out, we would like to attempt extraction of the ancient sites from the satellite images by the application of a method of object-based image analysis. As a result, we improve accuracy of extraction of the ancient sites, then we would like to adapt this method to Iraq, where it is difficult to enter.

In addition, the base map of the ancient sites, which was developed on the experimental basis, is planned to utilize for the patrolling of the ancient sites by the Iraqi State Board of Antiquities and Heritage and for the making of a risk map showing the locations of the ancient sites, which have been under the threat of destruction. The southern part of Iraqi marshland, which will be submerged again, is a place for the cradle of the first world civilization 6000 years ago. There are still many historical mysteries, so we expect that the application of our developed map for the urgently necessary investigation will be a great cause for solving those mysteries of the ancient civilization.

Acknowledgement

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Reference

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