

SYGIS - THE FINNISH ARCHAEOLOGICAL PROJECT IN SYRIA

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ABSTRACT:

Surveying and mapping the archaeologically unexplored mountain of Jebel Bishri in Central Syria is the first step for protecting and preserving ancient remains in the area. The mountainous region covers over one million hectares of desert-steppe and steppe type environment between Palmyra and the Euphrates River. Finland with its growing modern information technology has initiated the study of the area with remote sensing methods from the air and space and with digital documentation techniques on the ground. In many ways the area is culturally and environmentally an important mosaic. Culturally it is defined by the Euphrates River, the Silk Road and the Roman Eastern Frontier (the so-called *Limes*). Environmentally it is a border zone between desert and sown; between nomads and village agriculturalists who have been affecting the area for millennia in the changing situations of world powers. The aim of the Finnish SYGIS (the Syrian GIS) project is to produce GIS-based maps, expand the awareness of the location and types of the remains and support the traditional ways of life in the area. The mapping will help the Syrian authorities to protect the remains from looting and preserve them in the future construction works in the area.

1. INTRODUCTION

Surveying and mapping the archaeologically unexplored area of Jebel Bishri (the Bishri Mountain) in Central Syria is the first step for protecting and preserving ancient remains in the area. The SYGIS project, the archaeological GIS (Geographic Information Systems) mapping of the Jebel Bishri area, was initiated by Finnish archaeologists and remote sensing specialists in 1999. During the respective year the project was accepted to NASA's world monitoring program through German Aerospace Center (DLR). Beside the funding received from the Academy of Finland

and the Nordic Research Academy (NorFA) Nokia Co. has sponsored the project. The awareness of the locations of the remains will help the Syrian Antiquities Department to prevent looting (cf. Abdulrahman 2001) in the area and to take the sites into account in the future protection and preservation plans. The need for national archaeological inventory, i.e., an archaeological information system (cf. Leech 1999), in Syria is emphasized through this project initiated by the Finnish know-how in information technology.

The area of Jebel Bishri is situated between Palmyra and the Euphrates River (34-36° N

latitude, 39-40° E longitude) and belongs to the Greater Southwestern Asian Arid Zone (Zarins 1992). According to the definition given by ACSAD (the Arab Center for the Studies of Arid Zones and Dry Lands), the area of Jebel Bishri covers over one million hectares. The mountain is a continuation of the Palmyrenian Range (see, e.g., Syria, Space Image Atlas by General Organization of Remote Sensing, Damascus 1996) and corresponds its general geological character with limestone, marble, sandstone and salts. On the Euphratine side there also exist marl terraces.

Culturally the mountain is limited with the Silk Road to the south, the Roman Eastern Frontier to the west and north, and the Euphrates River to the north and east. Environmentally the area has been an important border zone through millennia: between desert and sown; between nomads and village agriculturalists in the changing situations of world powers. Jebel Bishri has been mentioned as a central nomadic breeding ground already in the Mesopotamian cuneiform sources dating to the 3rd millennium B.C. (see, e.g., Buccellati 1966).

Through the basic mapping the SYGIS project wishes not only to build the awareness of the ancient remains in the area but also to study the past and present development of the nomadic life and sedentarization processes. This long-term perspective offers new approaches for planning enduring development in the region, and therefore ethnoarchaeological themes have been applied into the project design. Co-operation with the GIS and Remote Sensing Laboratory of ACSAD has been enhanced in the project.* ACSAD has an environmental GIS project of its own in the area of Jebel Bishri to combat against desertification.

*** Co-operation between SYGIS and ACSAD**

The SYGIS project and ACSAD have together planned computer and GIS education for the staff of the Syrian Antiquities Department using Jebel Bishri as an area for a case study. The plan is to help to generate the standardization of the Syrian Antiquities Department recording and documentation system as well as initiating the

building up of a database with GIS applications from different sources including remote sensing data.

2. SURVEYING AND MAPPING JEBEL BISHRI IN SYRIA

2.1. Remote Sensing Data for Prospecting and Mapping

Actually the first applications of the remote sensing methods in archaeology started in the close neighbourhood of Jebel Bishri in the 1920s. Father A. Poidebard (Poidebard 1934) and Sir Aurel Stein (see, e.g., Stein *apud* Kennedy 1982) made aerial surveys over the Roman Eastern Frontier, i.e., the so-called *Limes*. A. Poidebard especially utilized different times of the daylight and seasons with various vegetation covers in prospecting ancient remains in the region (Brooks, R.R. - Johannes, D. 1990).

Following the footsteps of the early pioneers D. Kennedy and D. Riley have been using remote sensing methods in the Roman Desert Frontier (Kennedy 1982, Kennedy - Riley 1990) for decades. D. Kennedy has also introduced the CORONA declassified satellite photograph archives (EROS, US government) for the study of archaeological sites on the outer side of the Euphrates in Turkey (Kennedy 1998). In the application of the CORONA declassified satellite photographs Kennedy's studies have been followed by J. Ur on the Habur Plains in northeastern Syria (Ur 2003) and by SYGIS on Jebel Bishri in Central Syria. GORS (General Organisation of Remote Sensing in Syria) has recently produced an archaeological space atlas illustrating distinguished ancient remains in Syria. Desert-steppe areas are ideal for prospecting with satellite images, because remains are more often visible on the surface when depositional processes caused by agriculture or direct human interference do not exist (see, e.g., Scollar 1990: 1).

The Finnish SYGIS project working in the area has applied satellite technology with image processing and GPS (the Global Positioning

System). The project has used LANDSAT-7 images (sensor: ETM, Path/Row 172/000, Lat/Lon: 35:18:000/39:28:20, bands 123456789, level: SYSCOR, Cal: Pre-Flight; Rsmpl: NN, scene: full floating, format: GEOS, Acq. Date 1999-11-29) for mapping and environmental study. LANDSAT-7 ETM offers optical multispectral channels (see Fig. 1) with 30 m pixel and a panchromatic channel with 15 m pixel. Surveying larger areas has been carried out with the multispectral channels, and close-look-ups have been executed with the panchromatic channel. LANDSAT images are particularly applicable for the archaeological prospecting

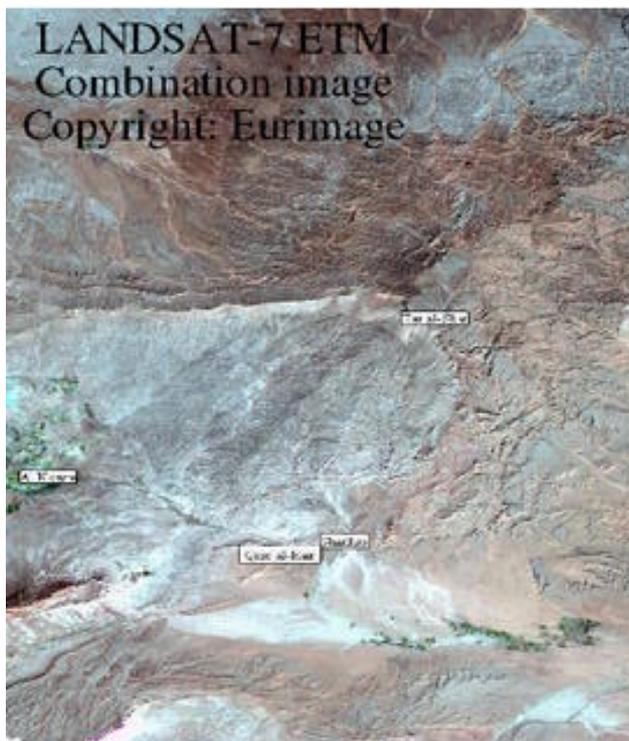


Figure 1. *LANDSAT-7 ETM multispectral combination image showing Tar al-Sbai, our case study area at Jebel Bishri.*

that is utilizing environmental indicators such as the availability of water sources and the existence of oases in the desert. Queries for such purposes can be made with the ArcInfo program.

The NASA shuttle radar topography mapping mission (SRTM) 2000 into which the SYGIS project was accepted through DLR provides with X-SAR/SRTM, i.e., radar data such as DEM tiles -based topographical models of Jebel Bishri. The data can be fused with LANDSAT images.

The panchromatic channel of LANDSAT-7 ETM is sufficient for general field maps showing environmental features and roads. Because accurate maps are not available in Syria, the project has produced field maps from the panchromatic channel in Finland. The images were first orthorectified using British military aviation maps (TPC G-4C-4D scale 1: 500 000). After that the field maps were produced in different scales from 1: 50 000 to 1: 20 000 using the MapSheets Express program of ERDAS which can be downloaded without charge from the internet.

Archaeologically only larger sedentary remains such as castles and tells are visible in the kinds of resolutions offered by the panchromatic channel of LANDSAT-7 ETM. From the orthorectified panchromatic channel one is able to obtain UTM coordinates for such larger remains. The panchromatic channel has also served our study in locating and mapping the layouts of the present-day semi-nomadic villages, such as Shanhas 1.4 km from Eastern Qasr al-Hair (see Fig. 1. and Shanhas: <http://www.helsinki.fi/hum/arla/sygis>).

CORONA declassified satellite photographs (optical panchromatic, pixel 1.8 m) and QuickBird images (optical panchromatic, pan-sharpened, 4 channels, pixel 0.6 m) are especially applicable for distinguishing different types of structures. Before using the CORONA satellite photographs they need to be scanned from a film to reach a good spatial resolution. The prices of the CORONA satellite photographs are inexpensive (ca. 20 USD for a photograph covering even hundreds of square kilometers), but the QuickBird images belong to a completely different price category (ca. 1150 USD for a piece covering 8 km x 8 km).

Therefore after a general survey by LANDSAT images one needs to choose a specific small lot for a QuickBird image surveying. According to our experience, it is advisable to make a preliminary visit to the region before choosing a specific area. This is how we chose an optimal number of visible ancient remains in the area of 8 km x 8 km.

2.2. Archaeological Field Survey on the Ground: a Case Study at Tar al-Sbai

The first field survey in 2000 concentrated on the area of Tar al-Sbai on the southwestern edge of Jebel Bishri (Figure 1.). The semi-circular escarpment of Tar al-Sbai (i.e., Circle of the Sbai tribe) is remote and most difficult to reach over the desert-steppe, and therefore the area is largely unaffected by interference of modern humans. The escarpment is ca. 4 km long. The area is a border zone between the Fida'an and Sbai Bedouin tribes. Graves at the edge function as territorial markers for the Fida'an tribe governing the mountain. The territory of the Sbai tribe covers the western piedmont area where the village of Shanhas is situated. The second field survey in 2003 is aimed to focus on the northeastern edge of Jebel Bishri that faces the plain of the Euphrates River with agricultural fields. The case studies of these two environmentally different areas are used for comparing the types of remains and the cycle of the sedentarizing nomads in the area.

The afore-mentioned British military aviation maps and the LANDSAT image -based field maps have been used with different technical equipments in the digital recording and documenting of the sites and structures on the ground. Sites were defined as detectable locations of human activity. The transect for surveying was defined by natural features such as the space between the edge and the road following the edge. Field walking in 15 m intervals was carried out inside the transect.

First GPS was applied to acquire the UTM coordinates for the recognized sites. Altitude was recorded with a digital altimeter that was calibrated with the detailed information of the Syrian Petroleum drillings in the area, because Bedouins dismantle the national datum points for superstitious reasons. Each site was photographed with a digital camera. An EDM (Electro-optical distance measuring equipment) was used for detailed mapping of the site locations and measuring the extent as well as the shape of the sites. A US military digital compass was used for the accurate direction searching on the ground. Traditional tape measures and cameras were used, and some important sites were also drawn by hand. Apart from a few pottery sherds the surface finds chiefly consisted of flints the distribution of which was recorded *in situ* with the EDM. All the documentation, both the digital and traditional, was recorded on special field forms which were filled *in situ* at each site.

The edge of Tar al-Sbai is crowded with structural remains extending from Upper Palaeolithic rock shelters (e.g., UTM 0517906, 3907065) offering evidence of the early activities of *Homo sapiens* to present-day Bedouin tent-bases and hunters' blinds (e.g., UTM 0518052, 3904927). The area represents a kind of a prehistoric thematic park in which visibility, landscape and a view must have played a decisive role. Beside the Palaeolithic rock shelters of the *apri* type the ancient structural remains consist of cairns/tumuli and stone circles that date from the Epipalaeolithic to the Early Bronze Age. The circles with inserted cairns are typical of the Chalcolithic cultures of this Greater Southwest Asian Arid Zone, including Sinai, the Negev as well as southern and eastern Jordan.

The distribution of the sites according to the UTM coordinates are produced as GIS maps using the MapSheets Express and ArcView programs. With the UTM coordinate information obtained by GPS and EDM on the ground the visualisation of the locations for the

archaeological sites can be produced on the panchromatic satellite images. We have also produced detailed GIS maps from the sites A19 and A 27 at Tar al-Sbai. A computerized 3-D animated view 13 km towards the western Plateau was constructed from the site A 27 which is located on a protruding spur. (See Tar al- Sbai with the visualisation of the site locations on a satellite map and views in a Power Point slide show: <http://www.helsinki.fi/hum/arla/sygis>).

Preference to build and live at the edge of the escarpment is obvious at Tar al-Sbai, because the number and density of the remains diminish from the edge towards the central parts and summit of the mountain. Environment largely dictates the type of archaeological remains in the area. The plateau beneath is covered with dozens of square kilometers by accumulated open Palaeolithic sites exemplified with countless flint tools and debitage extending to the oasis of Al Kowm (see Fig. 1.), where a Swiss archaeological team is working. On the western piedmont area of Jebel Bishri we also encountered Late Roman graves in the neighbourhood of the Eastern Roman Frontier zone.

The study of the riverine side of the mountain has started in 2003. As expected, it is covered with sedentary remains. According to our satellite image and photograph prospecting, several small tells exist between the mountain edge and the Euphrates. Radar equipments will assist in the study of the plateaus accumulated with silts beneath the mountain due to run-off mechanisms after the rainy seasons. Marble quarries used by Mesopotamian civilizations are already detectable in the area.

3. CONCLUSIONS AND DISCUSSION

LANDSAT-7 ETM image has served as a good source for general field surveying and mapping, as an aid for constructing topographical models and

for environmental queries. The visualisation of the locations for the archaeological remains of mobile people is possible with the panchromatic channel of LANDSAT-7 ETM when the UTM coordinates have been obtained on the ground.

However, our field study *in situ* in the region of Jebel Bishri, especially at Tar al-Sbai, made it clear that apart from the larger sedentary remains, the smaller structures such as the flimsy remains of nomadic and hunter-gatherer habitation sites remain undetectable with the LANDSAT images. Images with better spatial resolution are needed for the actual recognition of the remains such as rock shelters, stone circles and cairns/tumuli representing mobile cultures. The CORONA declassified satellite photographs and QuickBird images are especially helpful for this purpose.

In the study and mapping of Jebel Bishri region certain issues concerning the ancient remains of mobile cultures and their preservation have evolved. The representation of the hunter-gatherer or nomadic sites has been strikingly scanty in the protection works of the cultural heritage programs even if these sites provide landscapes with rich human past and are worth preserving in their genuine appearance. The focus on the cultural heritage of the sedentary remains and civilizations with written sources is dominating. Recently critical views have, however, been expressed concerning the imbalance, e.g., in the World Heritage List (see, e.g. Jokilehto 1998).

For example, in the Near East the nomadic life has endured from the Neolithic Period and has shaped the local cultural thinking not to mention the past hunter-gather activity of mankind that easily exceeds the period of agricultural and sedentary life. Jebel Bishri offers grounds for studying the tent-based nomads' and village herders' past compared with the present day cycle in the region. The area has been a rich cultural and environmental mosaic for millennia.

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