

# Remote Sensing Work in Palmyra/Syria



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**Abstract** The existence of a pre-Roman settlement of Palmyra is attested by literary sources. But, the location of this early settlement was unknown until recently. By several reasons its location was supposed to be located in the area outside the later Roman city. In 1997 and 1998, a geophysical prospection in the area south of the Wadi was carried out. A zone of about 2 ha was prospected by Caesium–Magnetometry. About 100 m<sup>2</sup> of this zone was measured also by electric resistivity. Result: Without excavation, a complete city plan can be recognized under the sand. Based on the magnetogram, small stratigraphic archaeological excavations proved a dating of these building structures between the third century BC and the third century AD. Thus, the location, date and part of the urban structure of ancient Palmyra were proved. Furthermore, the whole area can be protected now as antiquities zone by the Syrian authorities.

**Keywords** Palmyra · Syria · Hellenistic · Caesium–Magnetometry · Electric Resistivity · Satellite Pictures · Magnetogram

## Introduction

All the antique ruins to be seen today at the ancient town of Palmyra in the Syrian desert are dated from the first century BC to the eighth century AD, that is, from the Roman imperial time up to the early mediaeval/early Islamic period (Figs. 1 and 2).

According to written antique sources, an important settlement – called POLIS (= city) in Greek texts – did exist at Palmyra in pre-Roman times already. As any traces of this ancient city were found never inside the Roman city wall even by deep sondages, the location of this early settlement was supposed to be located outside the later Roman city.

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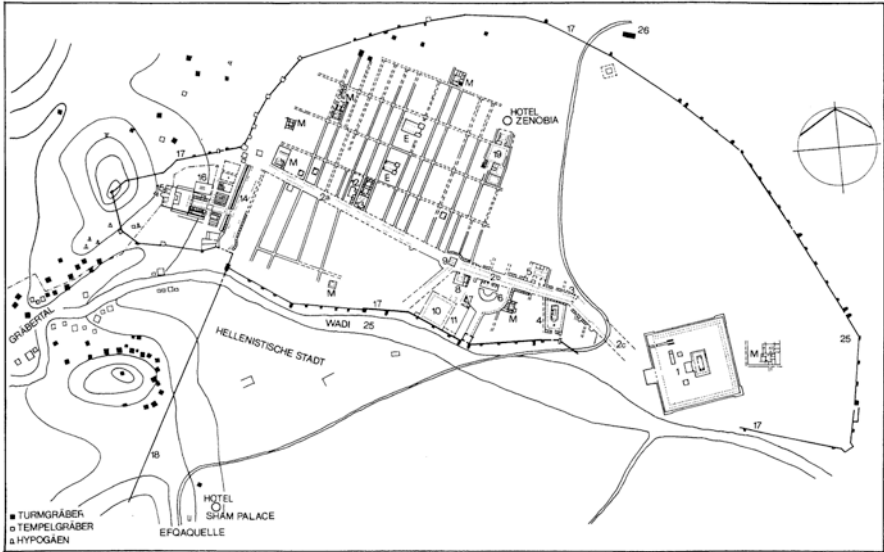


Fig. 1 Palmyra, General plan

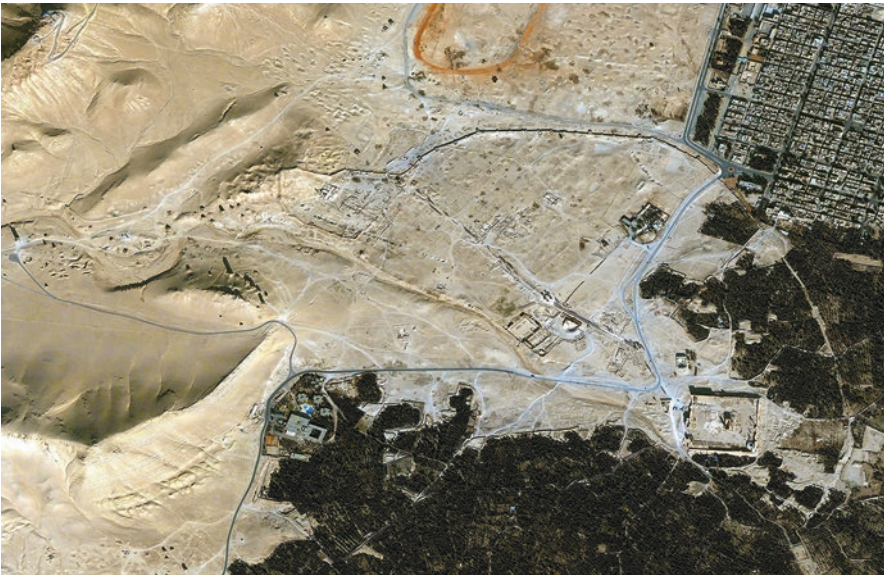


Fig. 2 Palmyra, Satellite picture. (Digital Globe, European Space Imaging, 2011)

## Archaeological Excavation

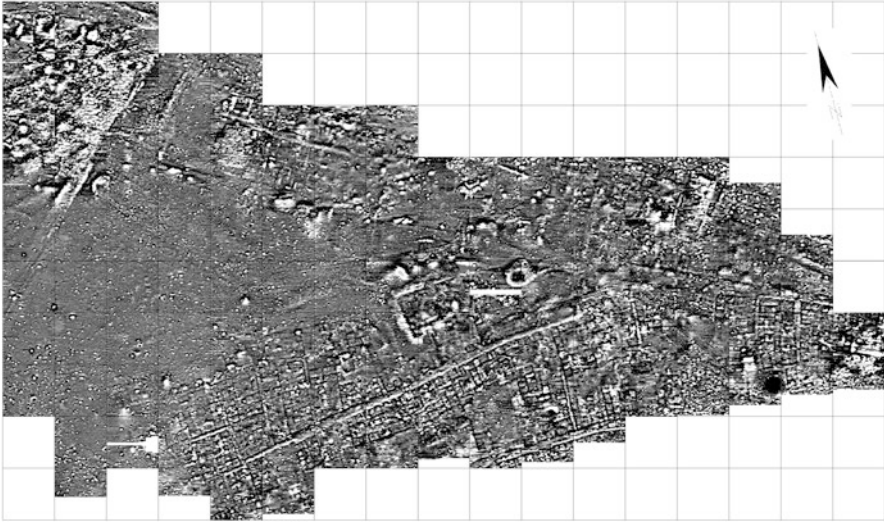
In 1997, an international archaeological mission started a project on the location and research of this pre-Roman settlement of Palmyra. By several reasons, it was supposed to be located south of the roman town in the area between the Wadi al-Kubur and the oasis gardens. In this area, today only a few ruined walls can be made out above ground (Fig. 3).

In March 1997 and 1998, a geophysical prospection of this area was carried out combined with a digital ground modelling based on photogrammetry. A zone of about 20 ha was prospected by Caesium–Magnetometry within 40 × 40 m grids. Within this zone, a smaller area of about 100 m<sup>2</sup> was measured also by electric resistivity. With this method, archaeological building structures of different density hidden under the sand can be made visible without any excavation (Figs. 4, 5, 6 and 7).

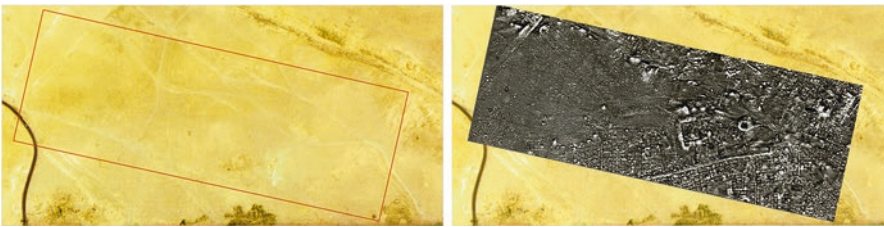
The magnetogram shows a widespread city plan with street systems and adjacent buildings. Two main streets oriented NW–SE, resp., SW–NE join in a V-shaped conjunction in the East. The northern main street runs parallel to the Wadi at a distance of about 80–90 m. This road is the prolongation of the main route connecting Palmyra with Emesa/Homs in the West. Between the street and the Wadi, several large square house structures (perhaps peristyle houses) can be recognized.



**Fig. 3** Palmyra, Area of the 'Hellenistic town' south of the Wadi, view from SW



**Fig. 4** Magnetogram of the area of the 'Hellenistic town'



**Fig. 5** Palmyra, Area of the 'Hellenistic town', satellite picture without and with the montage of the magnetogram

The southern main road is linked with another parallel road further in the south by several more-or-less rectangular smaller side roads. The main road is the prolongation of the main route connecting Palmyra with Damascus in the SW. A dense layout of smaller-scale houses can be recognized north and south of the main road down to the parallel road in the south and even further south.

In the very centre, within the angle between the two main roads, a large square building of about  $40 \times 40$  m can be seen, the so-called Khan (see below). West of this monumental structure, there is an empty space without any building structures. Maybe it was used for camel caravans or for nomad's tents.

Finally, in the westernmost part, a city wall is visible. Outside the wall, many burned structures can be recognized, probably burned tombs.

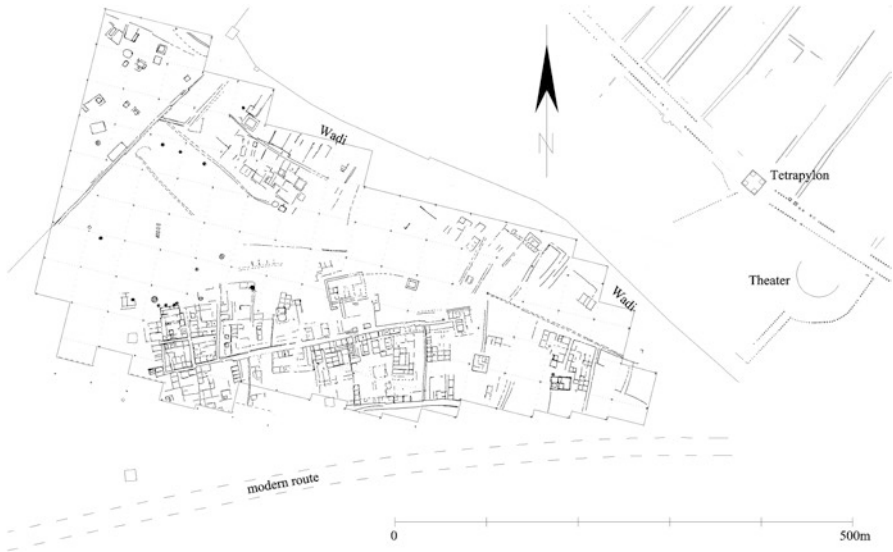


Fig. 6 Palmyra, interpretation of the magnetogram



Fig. 7 Palmyra, satellite picture with the interpretation of the magnetogram (in red)

Based on this first interpretation of the magnetogram, two small-scaled stratigraphic excavations were started (Fig. 8). The one (sondage I) had the aim to date the building structures visible on the magnetogram. The other (sondage II) should clear up the dating and the interpretation of the monumental building in the very centre.

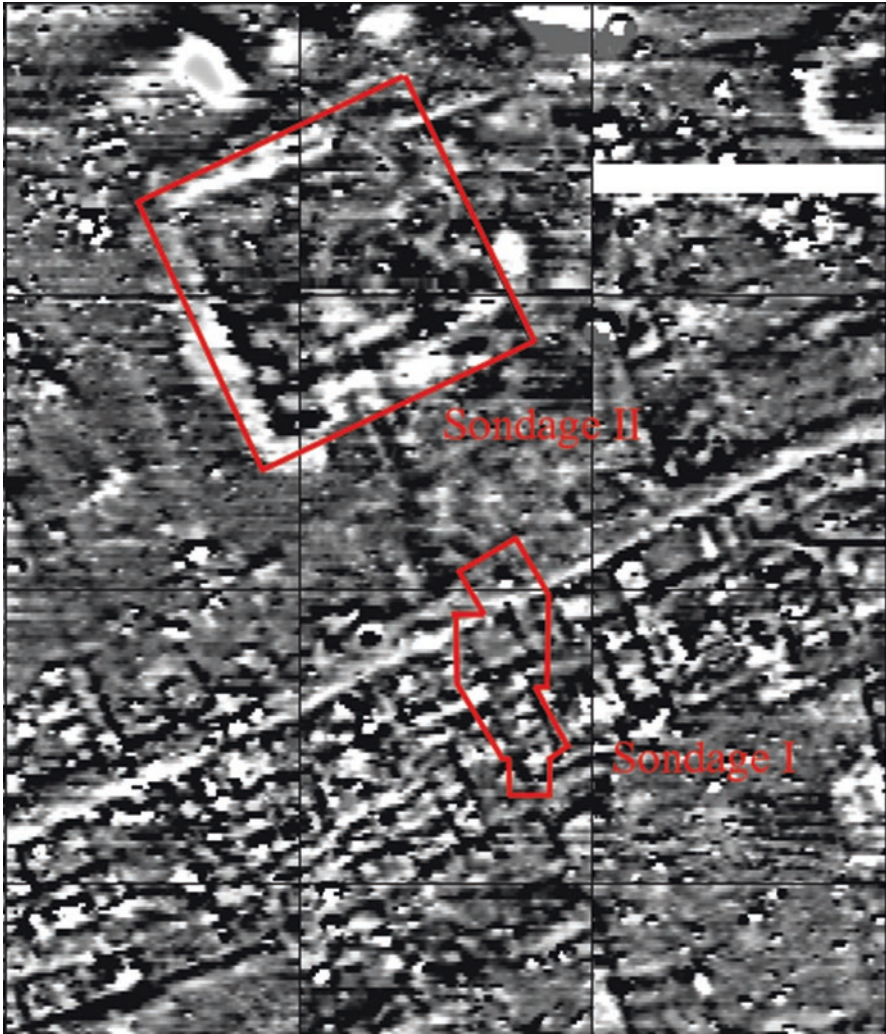


Fig. 8 Palmyra, Magnetogram with sondage I and II (in red)

With sondage I (Fig. 9) a section of the main road was excavated with adjacent dwellings. In the middle of the main road existed a water pipe line and a well. The latter as well as the earliest building structures south of the road can be dated to the second half of the third century BC by the small finds correlated with these structures. In general, the sounding proved a relative and absolute chronology of building activities from the third century BC up to the third century AD.

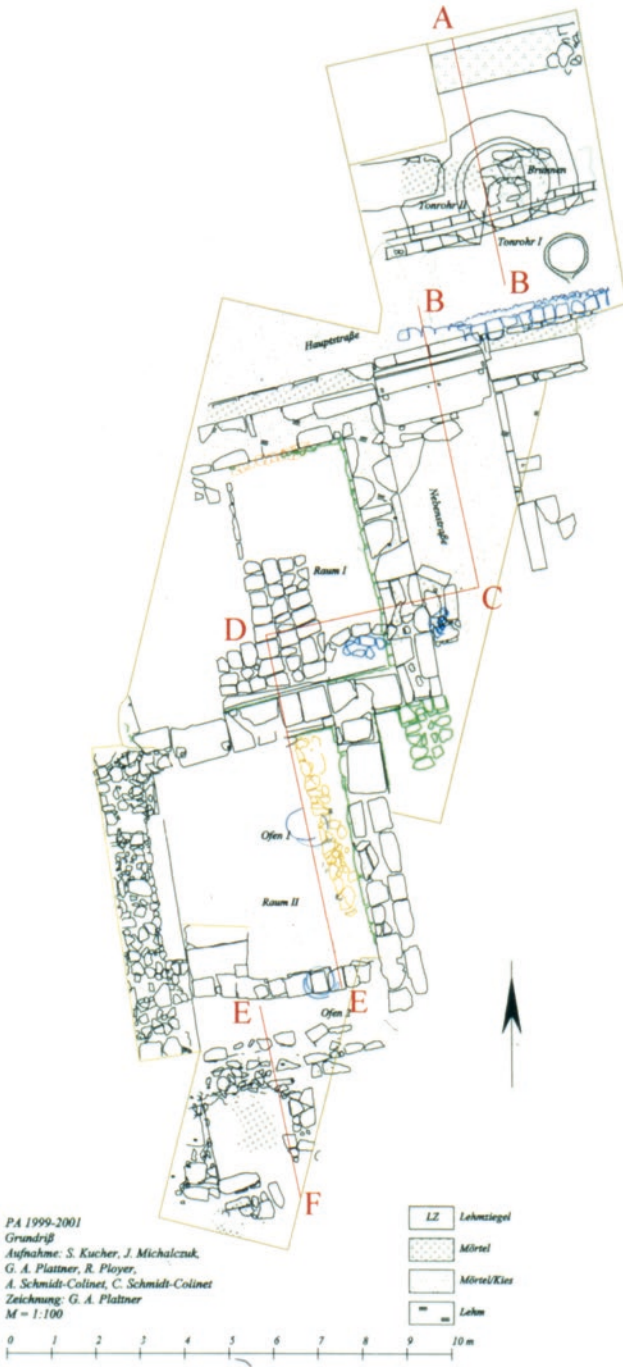


Fig. 9 Palmyra, Sondage I, ground plan

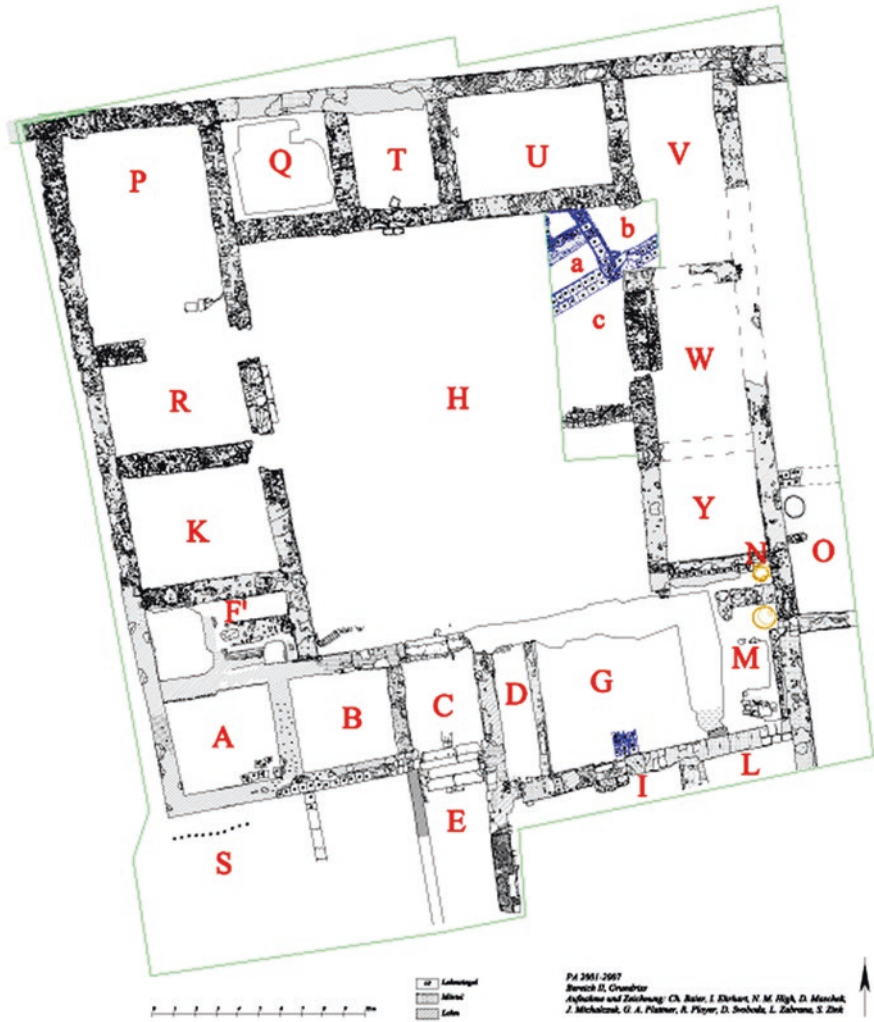


Fig. 10 Palmyra, Sondage II, Groundplan of the 'Khan'

With sondage II (Fig. 10) the residence of a noble family ('Khan') was excavated. The courtyard building with adjacent rooms existed from the middle of the first century BC up to the third century AD according to the small finds. The small finds also attest a worldwide international global trade of the owners of the house.



## Results

The existence, location and part of the urban structure of so-called ‘Hellenistic’ town are proved in the area south of the Wadi. For the future: The discovery of the early settlement of Palmyra in the area south of the Wadi enables the Syrian authorities to protect this area and to declare it as an antiquities zone. For the future, further research combining different methods (radar satellite pictures, aerial photographs, excavations, etc.) in the area could clear up the many new questions concerning early Palmyra. The new GPS-map of K. Schnädelbach (Fig. 11) will be a basis for such research on the urban development of ancient Palmyra.

The IT section of the German Archaeological Institute (DAI) in Berlin provides trainings in information technology in cooperation with the UNESCO Field Office in Beirut. There, Syrian experts acquire methodical know-how and practical skills in the application of IT to the process of digital documentation of Syria’s cultural heritage. A central component of the training is using Geographic Information Systems (GIS) as a key tool in urban planning – the example used here is Palmyra (Fig. 12).

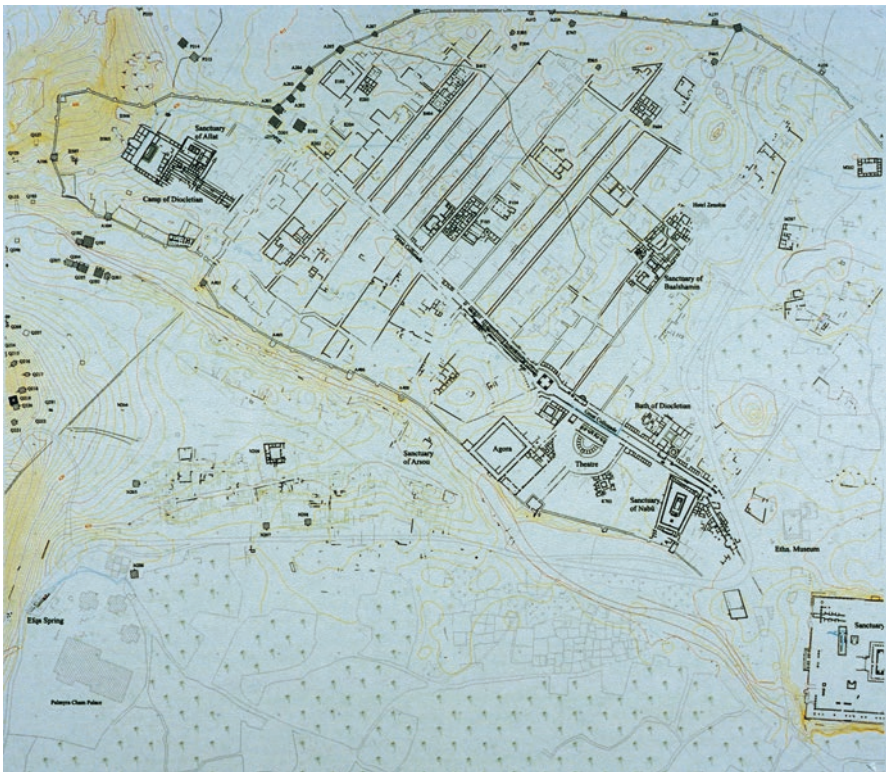


Fig. 11 Palmyra, GPS-plan

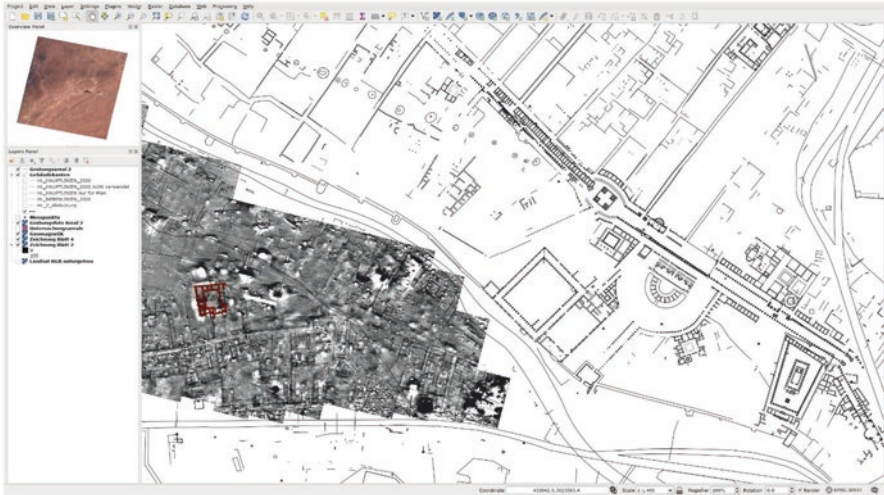


Fig. 12 Digital map of Palmyra, GIS Screenshot, work status spring 2017

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