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on the Archaeology of the Ancient Near East
Volume 3

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Edited by
Rolf A. Stucky, Oskar Kaelin and Hans-Peter Mathys

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Enzo Cocca – Andrea Genito – Bruno Genito – Giulio Maresca

A WebGIS about the Italian Archaeological Activities in Sistan, Iran (60s–70s of the 20th century): Archaeo.Pro.Di.Mu.S.

Between the 60s and the 70s of the past century archaeological researches were carried out in Iranian Sistan by an IsMEO team headed by Umberto Scerrato. The Archaeo.Pro.Di.Mu.S. project aims at revising the old archaeological data related to sites of historical period in the region by means of a WebGIS.

by Bruno Genito and Giulio Maresca

In the autumn of 1959, IsMEO (Istituto per il Medio ed Estremo Oriente) started its archaeological activities in the eastern Iranian region of Sistan with a series of preliminary campaigns (Anonymous 1959; 1961a; 1961b). From 1962 the attention of the IsMEO focused on the site of Dahāne-ye Gholāmān, in the vicinity of the village called Qal'a-ye Now, at about 30 km south-east from the city of Zabul. Preliminary analysis both on pottery fragments collected during surface surveys and on the planimetric schemes of the buildings detectable at the site (thanks to the peculiar phenomenon of the saline outcrops leaving whitish traces in correspondence of the old buried walls) soon led to the conclusion that it was probably an important site of a possible Achaemenid age (Scerrato 1962). At Dahāne-ye Gholāmān, the late Prof. Umberto Scerrato directed several seasons (1962–1965 and 1975–1977) of excavations and restoration activities (Scerrato 1966a; 1966b; 1970; 1972; 1974; 1979; Mariani 1977; 1979), revealing a huge complex of buildings – including some having a monumental character – which could have represented the main urban centre of the Achaemenid satrapy mentioned as *Zranka* in the royal Achaemenid inscriptions (also known as *Drangiana* in classical sources) and one of the few archaeologically documented urban settlements on the Iranian Plateau for the Achaemenid period. Alongside with its historical and archaeological importance, the significance of the site from the perspective of the history of religions was

also soon underlined, particularly with reference to the evidence brought to light at building QN3 (Gnoli 1966; 1967).

Beside the main archaeological activities at Dahāne-ye Gholāmān, the scientific interest of the IsMEO team headed by Scerrato was attracted by two other smaller sites. The first one was the fortified citadel of Qal'a-ye Tepe, located in the upper Posht-ab area, at about 15 km north-east of the city of Zabul, in the vicinity of the village of Kazemabad and near the ruins of the Islamic sanctuary known as Bibi Dust.

In 1961 and 1962, the site was object of a series of soundings aimed at investigating the development of its fortification system, characterised by a double wall curtain. Excavations made it possible to detect with certainty only three phases in the life of the citadel (each one divided in several sub-phases), dating back to a very wide time span between the 3rd century BC and the 15th century AD. A fourth and more ancient phase was very partially detected by the excavator at some of the trenches but, unfortunately, the high level of the aquifer (and also the necessity to increase the logistic efforts towards the important discoveries made in the meantime at Dahāne-ye Gholāmān) prevented further deepening in the excavations.

More limited in time and also in space, instead, were the activities carried out at the fortified citadel of Qal'a-ye Sam (Maresca 2016), located at about 20 km west of Dahāne-ye Gholāmān, 27 km south-west of Zabul, towards the western limit of the present-day Hilmand delta. After a preliminary survey carried out during the 1960 campaign, the IsMEO Archaeological Mission excavated some trenches in 1964, together with the drawing of a preliminary plan of the structures visible inside the perimeter of the citadel (thanks to the same phenomenon of the saline outcrops as in the case of Dahāne-ye Gholāmān). Three phases were detected at the site by Scerrato, who proposed a chronology dating back to the very first Parthian (or even late Seleucid) period for the most ancient of them.

Even if the political events leading to the Islamic Revolution in 1979 marked an end for the Italian field activities in Sistan in a time when the publication of those archaeological efforts was only at a preliminary stage, the attention of the IsMEO (later IsIAO, Istituto Italiano per l'Africa e l'Oriente) and (from 2003 onwards) of the Chair of Iranian Archaeology and Art History, headed by Prof. Bruno Genito at the Università degli Studi di Napoli «L'Orientale», given to those archaeological excavations never ceased during the following decades, as testified by the publication of several contributions regarding various issues related to those scientific activities, as recently summarized (Genito 2012: 365–366; Genito/Maresca et al. 2013: 183–184).

Many questions remain, nevertheless, still open¹ and a further scientific effort is needed in order to give to the complexity of data from those archaeological activities a more useful and well-defined form.

An overall re-interpretation of the data, taking into account also the particularly long time elapsed since the end of the field activities carried out by the IsMEO in Sistan, could not be considered completely accurate and effective if not supported by a meticulous reconstruction, re-organization and re-examination of the extant dataset by means of modern technological tools (Genito i. p.). In this perspective, the activities of Archaeo.Pro.Di.Mu.S. (Archaeological Project Digital and Multimedia Sistan) are intended as a powerful and essential research instrument for the overall digital management of the documentation produced during the excavations at the sites of Dahāne-ye Gholāmān, Qal'a-ye Tepe and Qal'a-ye Sam.

Being a digital systematic way to store, organize and manage by means of a WebGIS the chartaceous photographic dataset and (together with it) the huge amount of related archaeological information produced by the Italian archaeological activities at those three sites², ArchaeoPro.Di.Mu.S. can be considered as a sort of continuation of another scientific project, promoted in 2003 by CISA (Centro Interdipartimentale di Servizi di Archeologia) at UNO (Università degli Studi di Napoli «L'Orientale») and directed by Prof. Bruno Genito. That project, called *DI.AR.IN.S. – Digitalizzazione ARchivio INformatizzato Sistan*, focused on the digital acquisition of the main bulk of data regarding the IsMEO archaeological activities at sites of historical period in Sistan and was developed in the frame of a wider effort by CISA aimed at the creation of a Web Portal called «ArcheoZone: Portale dell'Archeologia Classica ed Orientale» (www.archeozone.it).

- 1 At the present state of art, the questions posed by the evidence represented by the historical Sistanic sites of Dahāne-ye Gholāmān, Qal'a-ye Tepe and Qal'a-ye Sam do not seem to leave much room for possible alternative interpretations (quite or strongly different) from the ones already given by the excavator, Prof. Umberto Scerrato. After more than forty years since the end of the field activities carried out by IsMEO, in fact, the assumptions made at the time of the excavations still have their merits and remain very fertile, because they are based on the strong intuitive capability of Scerrato, and formulated with an acute and rigorous attention to the material evidence unearthed. The issues raised at that time are still standing and very little can be added, at least in the near future, without a new complete season of extensive researches in the area.
- 2 The activities of recovery, recognition, retrieval, organization and, finally, digitalisation concerned about a thousand of photographic films of different frame (18×36; 6×6; 6×8), thousands of excavation photographs, more than two thousands photographs of finds, hundreds of excavation slides, hundreds of excavation plans, dozens of drawings of finds, inventories and lists of the most significant objects found, as well as excerpts from the excavations diaries and hundreds of pages of handwritten notes by the excavator and other members of the team headed by him (Genito/Maresca et al. 2013; Maresca i. p.).

The present Archaeo.Pro.Di.Mu.S. focused on making systematically available on-line the large amount of data already digitally processed; it is meant to be a fundamental step of a more articulated path which will eventually lead (within a few years) to the definitive and comprehensive chartaceous publication of the archaeological activities carried out by the IsMEO at the sites of Dahāne-ye Gholāmān, Qal'a-ye Tepe and Qal'a-ye Sam. In addition, the digital frame of the archive will permanently remain a system susceptible of continuous improvement, since new data potentially produced in the future will be constantly uploaded into the system to be processed and «re-queried» in order to gain new information, which, in its turn, could lead to other forms of «integrative» and/or up-to-date publications, both on-line (by means of the already existing WebGIS Archaeo.Pro.Di.Mu.S. platform) and chartaceous (conference proceedings, thematic papers etc.).

by Enzo Cocca and Andrea Genito

Introduction

The Archaeo.Pro.Di.Mu.S. is meant to be a support to the Italian archaeological activities carried out between the 60s and 70s of the 20th century in Sistan. The data collected in all the excavations have been stored in a spatial geodatabase and managed by webgis. This method of management and collection of archaeological data and multimedia contents allows a spatial research of images and spatial correlations between semantic elements such as archaeological data from excavations that otherwise could not be chronologically and stratigraphically related

Archaeo.Pro.Di.Mu.S.

Photography is a research instrument for analysis and verification, indispensable to any kind of archaeological investigation. The Archaeo.Pro.Di.Mu.S. is to be located within this context of investigation and research of the past by the excavation documentation through the modern technology. The need for a complete management of the whole photographic documentation from the excavations at Dahāne-ye Gholāmān (Sistan) begins from the use of photography as a tool to be consulted and interrogated. It is, therefore, possible to associate all kind of spatial and archaeological information to any photographic archive.

The data sharing over the web is the easiest way to make the user able to consult and query all the information provided from a system administrator.

The project provides a data entry and data visualization structure through a WebGIS. The collected data will be managed in a spatial RDBMS PostgreSQL/PostGIS with an appropriate graphical interface. This structure was designed to manage the photographic archive of the archaeological activities at Dahāne-ye Gholāmān (Sistan) in the 60s and 70s of the XXth century by IsMEO.

The structure is developed on three access levels:

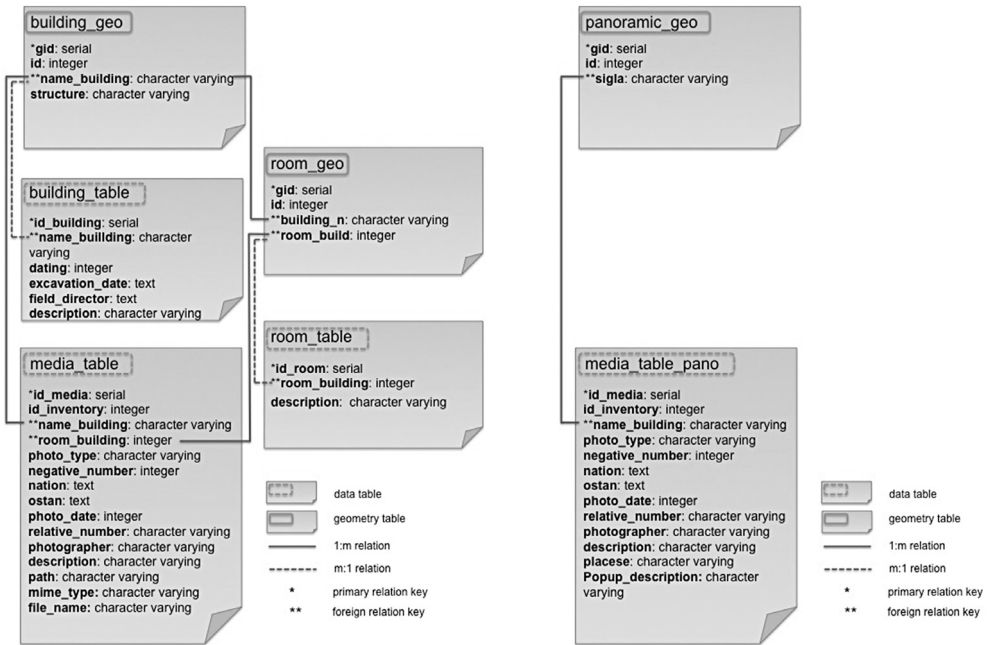
1. User: public access. The user login to the webgis to the data displaying, querying and searching;
2. Registered User: private access. The user login by personal credential to download multimedia file;
3. Administrator: private access. By personal credential the user can be able to insert, delete and update the data through the webgis.

Logical Sistan Database Schema of Archaeo.Pro.Di.Mu.S.

The image schematically illustrates (**figs. 1–3**) the Sistan relational database (RDBMS), the structure of the data and connections. A WebGIS architecture will be realized on this structure. It will be focused in order to storage and consult the photographic documentation and the information data of the excavation's activity at Dahāne-ye Gholāmān.

The following tables³ will be placed inside the database:

1. building;
 2. building_table;
 3. room_building;
 4. room_table;
 5. media_table.
- 3 In the relational databases and flat file databases, a table is a set of data elements (values) that is organized using a model of vertical columns identified by their name (attributes fields) and horizontal rows, the cell being the unit where a row and column intersect (records). A table has a specified number of columns, but can have any number of rows. Each row is identified by the values appearing in a particular column subset which has been identified as a unique key index.

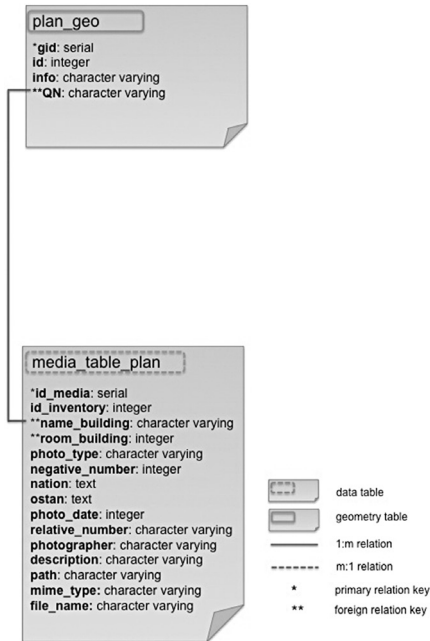


Building: table (geometries) of the building, inside the following attributes fields will be placed:

- *gid*: serial numerical progressive, table's primary relation key;
- *id*: building's numerical progressive identification;
- *name_building*: alphanumeric value, building's name and foreign relation key with *building_table*, *room_building*, e *media_table*;
- *structure*: alphanumeric value, architectural elements typology.

Building_table: building's descriptive table, inside the following attributes fields will be placed:

- *id_building*: serial numerical progressive, table's primary relation key;
- *name_building*: alphanumeric value, building's name and foreign relation key with *building_table*;
- *dating*: integer numerical value, building's dating;
- *excavation_date*: textual value, building's excavation date (or temporal range);
- *field_director*: textual value, excavation director's name;
- *description*: alphanumeric value, building's description.



Figs. 1-3. Database logical schema of Archaeo.Pro.Di.Mu.S. project

Room_building: building’s room table (geometry), inside the following attributes fields will be placed:

- *gid*: serial numerical progressive, table’s primary relation key;
- *id*: room’s integer numerical identification;
- *building_n*: alphanumeric value, building’s name, foreign relation key with building table;
- *room_building*: room’s integer numerical identification (nominal) of each building, foreign relation key with room_build table.

Room_table: building’s room descriptive table, inside the following attributes fields will be placed:

- *id_room*: serial numerical progressive, table’s primary relation key;
- *room_building*: room’s integer numerical identification (nominal), foreign relation key with room_build table;
- *description*: alphanumeric value, room’s different typology description.

Media_table: information's table about the excavation's multimedia material, and the frame's scan path in the digital archive. Inside the following attributes fields will be placed:

- *id_media*: serial numerical progressive, table's primary relation key;
- *id_inventory*: integer numerical progressive, excavation's frame numeration used for storing during the archaeological mission;
- *name_building*: alphanumerical value, building's name and foreign relation key with *building_table*;
- *room_building*: integer numerical identification (nominal), rooms of each building, foreign relation key with *room_build* table;
- *photo_type*: alphanumerical value, scanned frame typology (24 × 8; 6 × 6; 6 × 8);
- *negative_number*: negative's identification integer numerical progressive;
- *nation*: textual value, photographic material nation origin;
- *ostan*: textual value, photographic material region origin;
- *photo_date*: textual value, photographic material production's year (or temporal range);
- *relative_number*: alphanumerical value, relative numeration assigned by a single user to own photographic material;
- *photographer*: alphanumerical value, operator who realized the frames;
- *description*: alphanumerical value, frame's element synthetic description;
- *path*: alphanumerical value, server file's path of the archive's frame;
- *files_name*: alphanumerical value, assigned names to the archive's frames scans.

WebGIS

This WebGIS project has a dual purpose. It will be used both for entering and consulting the data.

The managed data are of three types:

1. alphanumeric;
2. geometric;
3. multimedia.

The alphanumeric data are archaeological information (description, name of building, type of environment etc.) on architectural features excavated at Dahāne-ye Gholāmān.

The geometry data type (polygons) are represented just by the excavated architectural features.

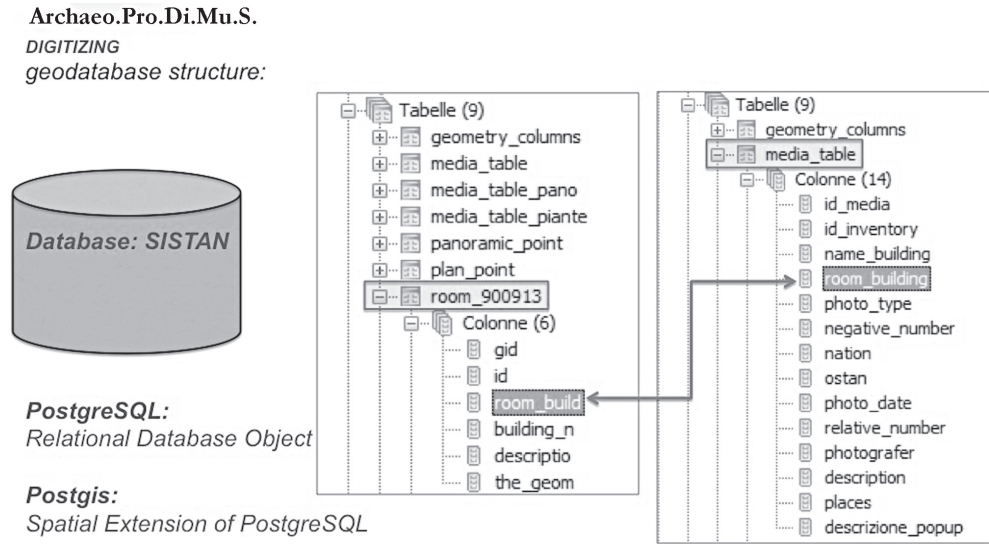


Fig. 4. Example relationship schema 1: M between room table and media table in Archaeo.Pro.Di.Mu.S. project

The multimedia data are represented by the whole photographic archive consisting of approximately 13, 000 frames that have been scanned at high resolution.

All the photographic archive will be external to the database (figs. 4–5), and accessible (from the database) via path. This allows a faster multi-user consultation, avoiding any database’s crashes risk.

The WebGIS will be written entirely in html, php and javascript languages. It will use Open Source technology able to make the data available according to web services based on OGC standards (Open Geospatial Consortium), such as WMS, WFS, WCS, CWS. The viewing and sharing of the data in the web services mentioned will be achieved through Mapserver and Geoserver libraries.

As already mentioned the WebGIS system will have two kinds of display modes: user mode and administrator mode.

In the user mode, the access is public and you can query the database with a specific widget, display the alphanumeric results, and associate media files in an appropriate form. The images archive can only be downloaded if the user is registered (registered user). In the administrator mode, the access is allowed through credentials. Whoever accesses through this mode will be able to insert, delete and update the database.



Fig 5. Example view of relationship with media table in WebGIS of Archaeo.Pro.Di.Mu.S. project

Software Used

Server Side

- *PHP: server-side scripting language designed for web development Apache: server Web;*
- *PostgreSQL: Relational database object;*
- *PostGIS: spatial extension of PostgreSQL;*
- *GeoServer: map server.*

Client Side

- *HTML: Hypertext Markup language;*
- *Javascript: prototype-based scripting language that is dynamic, weakly typed, and has first-class functions;*
- *OpenLayer: pure JavaScript library for displaying map data in most modern web browsers, with no server-side dependencies;*
- *JQuery: multi-browser JavaScript library designed to simplify the client-side*

scripting of HTML – Interaction Client/Server Side;

- *AJAX: Asynchronous JavaScript And XML.*

Conclusion

The access, the distribution, and the use model of information today offer new ways to improve the research activities and the differing modes of a cultural heritage preservation. Through the WebGIS services implementation everyone can access to the geographic information using only a remote connection via the most common browser and/or Open Source GIS client.

The spatial information provided by the Archaeo.Pro.Di.Mu.S. is at an embryonic and experimental stage, in which it's aimed at making the data entry mode easier and making available in real time such information to everyone.

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