IRANIAN CENTER FOR ARCHAEOLOGICAL RESEARCH
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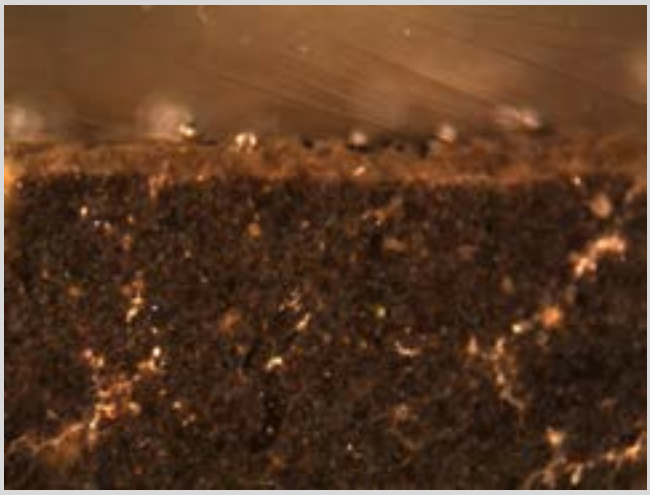
ALMA MATER STUDIORUM - UNIVERSITA' DI BOLOGNA
INTERNATIONAL ASSOCIATION OF MEDITERRANEAN AND ORIENTAL STUDIES - ISMEO

FROM PALACE TO TOWN

Report on the multidisciplinary project carried out by the Iranian-Italian Joint Archaeological Mission on the Persepolis Terrace (Fars, Iran), 2008-2013

1. Topography, Diagnostic and Conservation

edited by
Alireza Askari Chaverdi and Pierfrancesco Callieri



with contributions by
Hajar Askari Chaverdi, Angela Bizzarro, Julian Bogdani, Luca Colliva, Carla Gianturco, Giolj Francesco Guidi, Marisa Laurenzi Tabasso, Lorenzo Lazzarini, Giuseppe Morganti, Paolo Pastorello, Shahram Rahbar, Saeid Rahmati, Stefano Ridolfi, Reza Sheikholeslami, Maryam Soleimani, Sven Stefano Tilia, Giorgio Trojsi, Azam Zare

Roma 2017

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FROM PALACE TO TOWN - 1

This volume has been prepared with the contribution of the Italian Ministry of Foreign Affairs and International Cooperation, Directorate General for Cultural and Economic Promotion and Innovation, Office VI-Archaeology, and of the Ministry of Education, University and Research, Project PRIN 2007ZKPPSM.

Cover image: Polished section Micrography of a sample from the "Unfinished Palace" in Persepolis, showing the stone with micro-fissures filled with secondary calcite and the thin superficial layer. 33x (see Fig. 50).

ISBN: 9788898392636
DOI: 10.12977/from_palace_to_town

2017 BraDypUS
via Oderisi da Gubbio, 254 00146 Roma
CF/P.IVA: 14142141002
http://bradypus.net
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Contents

2

The Archaeological Relational Database

Julian Bogdani and Luca Colliva

The online relational database system used by the Iranian-Italian Joint Archaeological Mission in Fars to store and organise all archaeological data collected during the field and study campaigns was conceived and realised in 2007. The information system was built with a larger framework in mind: the to be database system should constitute a common platform for different research projects active in Asia, capable to collect and link research data and analysis, providing a unified descriptive structure and a simplified querying system. Ten years later, the database system is still the main core of the information system of the Fars project and other important international projects in Asia.

[LC, JB]

Structure of the Database[1]

The database is subdivided into seven forms connected to each other:

A. Site
B. Complex
C. Stratigraphic Unit
D. Object
E. Samples
F. Collection
G. Files

All forms are designed to permit including as many data as possible, although it is not compulsory to fill out all the available fields.
To minimize compiling times and input errors, the forms include as many drop-down menus as possible; additionally, this system permits a greater standardization of the forms.
The "SITE" form (Fig. 8) allows collecting data related to the investigated sites, during both survey and excavation, and includes fields for storing a preliminary description of the site, together with topographic and chronological data. This form can also include data regarding collected archaeological materials, iconography and restoration work.

1 - The original nucleus of the database currently used by the Iranian-Italian Joint Archaeological Mission in Fars was created in 2007 within the Paikuli Project, directed by prof. Carlo G. Cereti and realized by IsIAO, Italian Institute for Africa and the East, on behalf of the Italian MAECI Task Force Iraq.
Archaeologist Barbara Fatigoni, responsible for the archaeological sector of the Paikuli Project, and the present writer proposed the creation of a relational database capable of collecting and linking research data from excavation and survey activities, together with those from studies and analyses of archaeological materials.
According to the proponent's idea, the project was developed with the active support of the main IsIAO archaeological missions in Asia; indeed, the database aspired to become a common platform in which the different missions of the Institute could exchange and compare data, still respecting their specific needs and necessities.
In addition to the project proposers, the creation of the various database saw the participation, in alphabetical order, of Pierfrancesco Callieri, Carlo G. Cereti, Anna Filigenzi, Maria Vittoria Fontana, Marco Galuppi, Roberta Giunta, Luca Maria Olivieri, Fabrizio Sinisi and Gianfilippo Terribili.
The platform was developed by Julian Bogdani who had already developed advanced skills experience in the design and creation of archaeological databases other than a long lasting collaboration with the proponents. He proposed to build the database as an online tool, a solution that allows the simultaneous access to the database of all members of a mission, both in Iran and abroad, guaranteeing not only a constant access to the data but also the possibility of multiple concurrent activities of cataloguing and study.
Ten years after conceiving the project, despite the sudden closure of IsIAO resulting in the migration of all its archaeological missions to some of the main Italian universities, we can say that our purposes have been achieved, at least partly. To date, in addition to the Iranian-Italian Joint Archaeological Mission in Fars, the first to adopt and implement the database, similar databases developed from that original nucleus are currently used by MAIKI - Italian Archaeological Mission in Iraqi Kurdistan of Sapienza University of Rome and the Italian Archaeological Mission in Pakistan of the ISMEO.

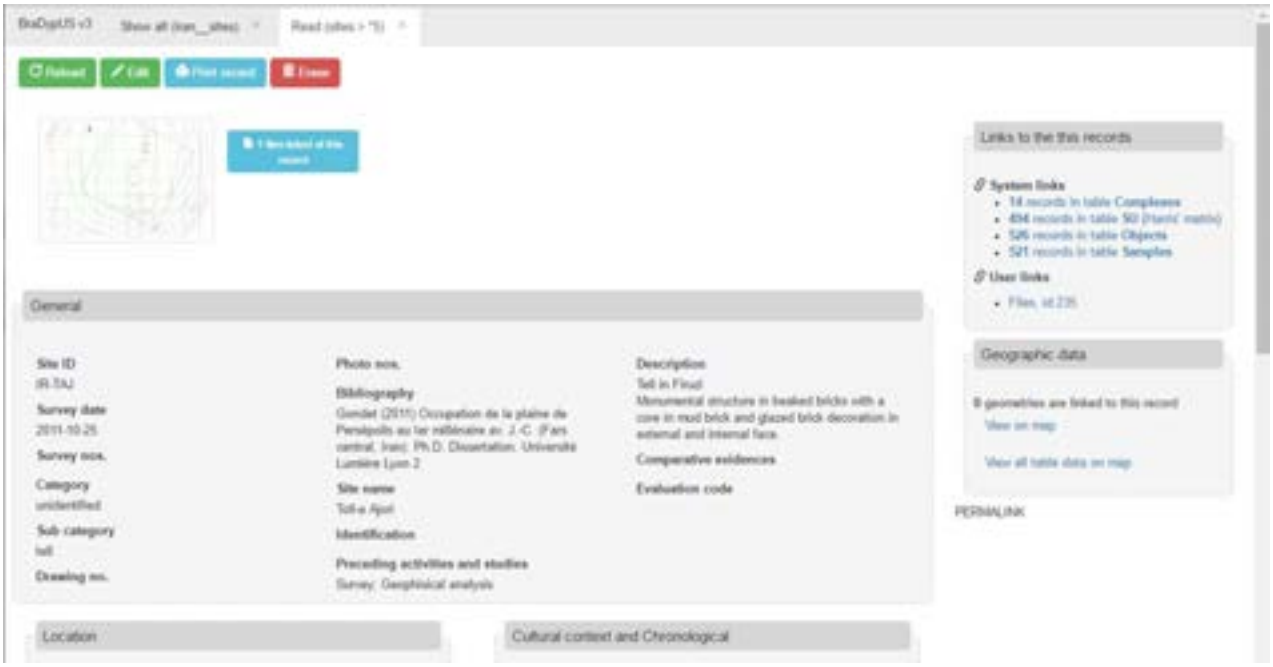

Fig. 8 - The SITE form.

The "COMPLEX" form (Fig. 9) collects data on the subunits identified on each site, be they special structures needing a form, areas of the site with distinguishing features or excavation trenches. Even in this case, it is possible to include topographic, historical or iconographic data together with a brief description of the complex.

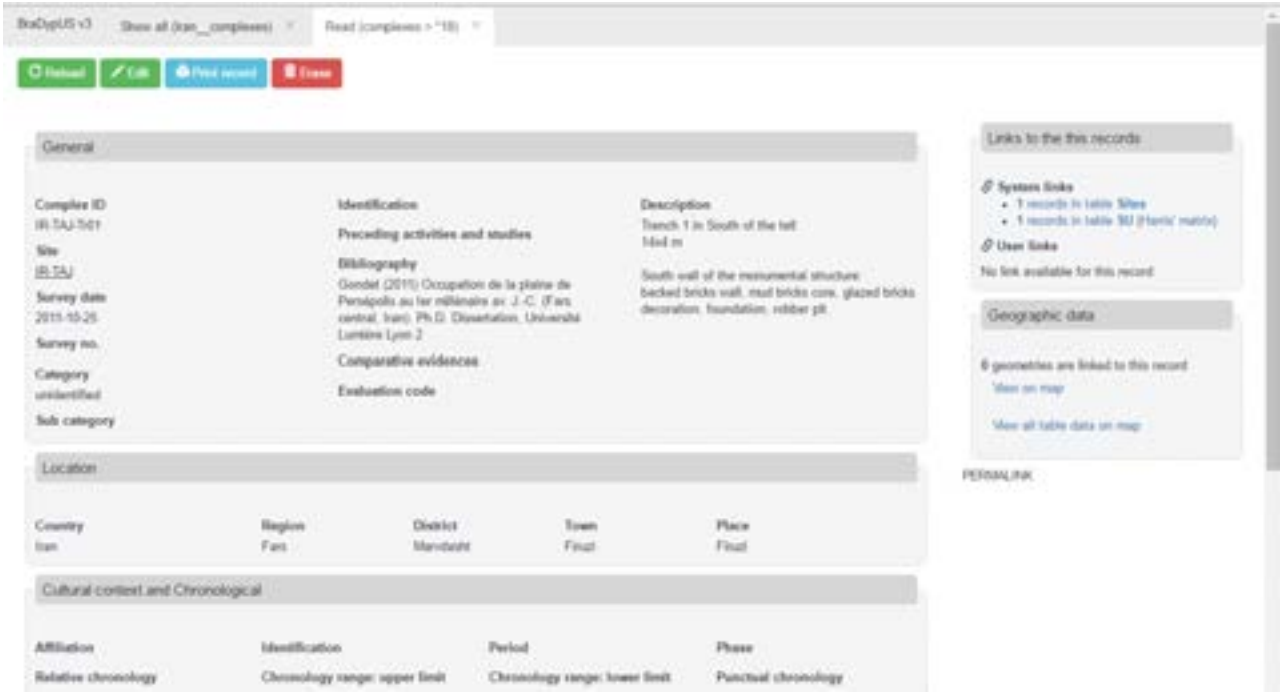

Fig. 9 - The COMPLEX form.

The "SU" or "Stratigraphic Unit" form (Fig. 10) collects data on the stratigraphic units identified during the excavation. The form is based on the standards proposed by the Italian Ministry of Cultural Heritage and Tourism - MIBACT and is articulated into "Stratigraphic Unit" or "SU", "Structural Stratigraphic Unit" or "SSU" and "Negative Stratigraphic Unit" or "NSU". It is possible to enter the form with data relating to the description of the stratigraphic unit, its position, composition and conservation, together with those regarding its stratigraphic relationships, both physical and chronological.

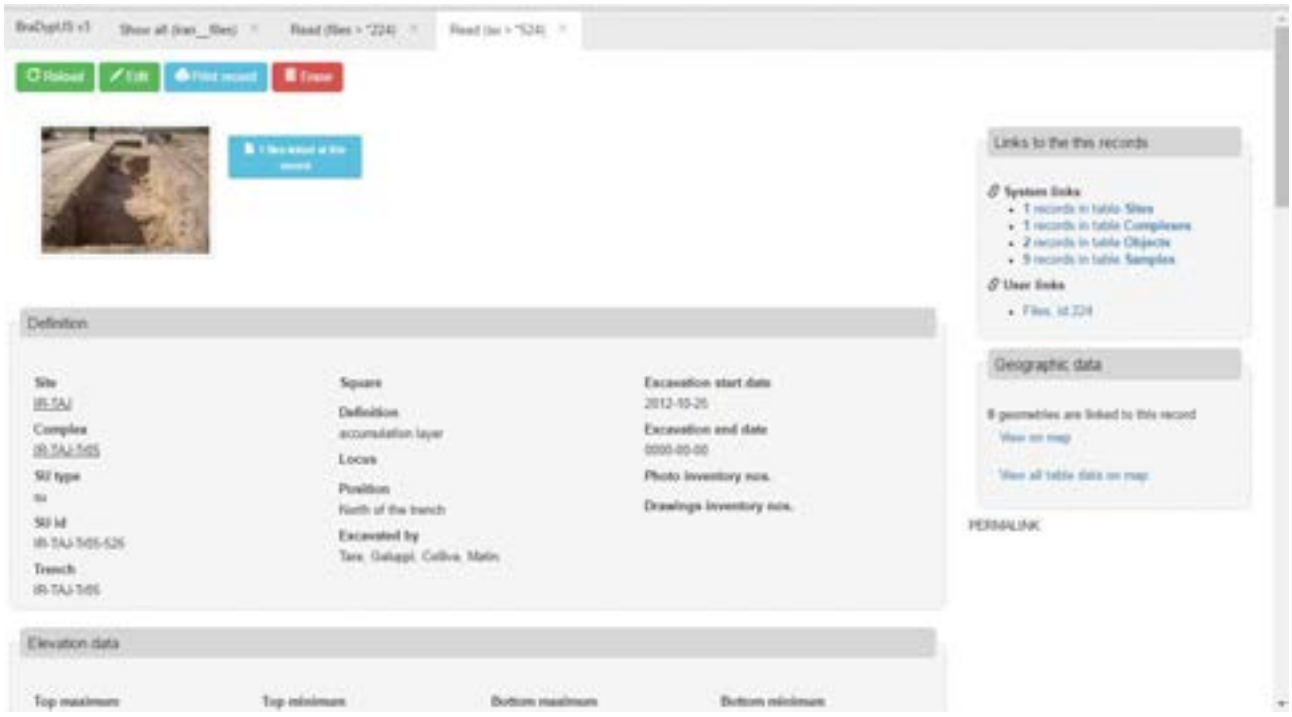

Fig. 10 - The SU form.

The "OBJECT" form (Fig. 11) collects data on a single object. It is possible to insert data both on objects from excavation and museum collections; the fields are designed to provide a complete description of the studied object (i.e. materials, working techniques, etc.) together with information on its cultural horizon and chronology. The presence of inscriptions, mason marks or technical devices (i.e. tenons or sockets) can also be recorded together with data and results of any analysis or restoration interventions.
The Iranian-Italian Joint Archaeological Mission devoted particular attention to the study of the ceramic materials hence the “OBJECT” form includes fields for a complete description of the shape, decorations and fabric of the recorded sherds.

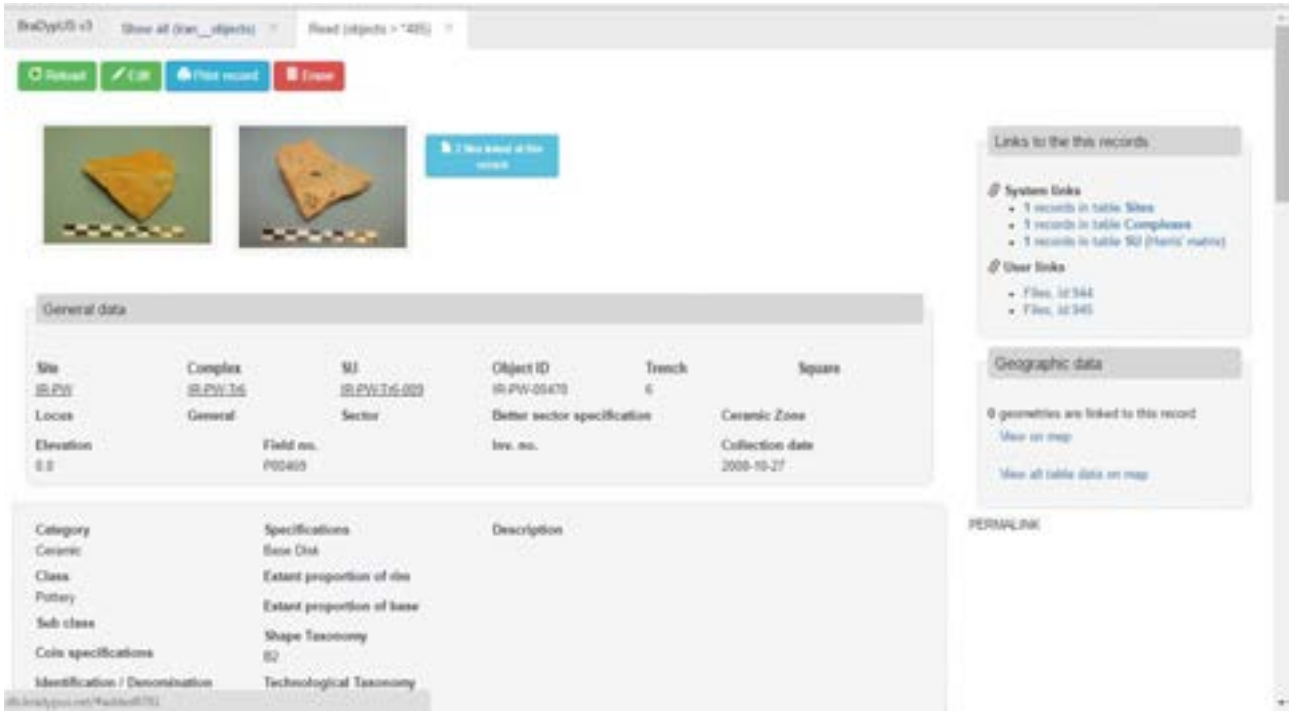

Fig. 11 - The OBJECT form.

The "SAMPLES" form (Fig. 12) allows to record data regarding samples of materials (i.e. soil, bones, charcoal, etc.) collected for sampling and analysis, together with data on any analysis. carried out on the recorded samples.

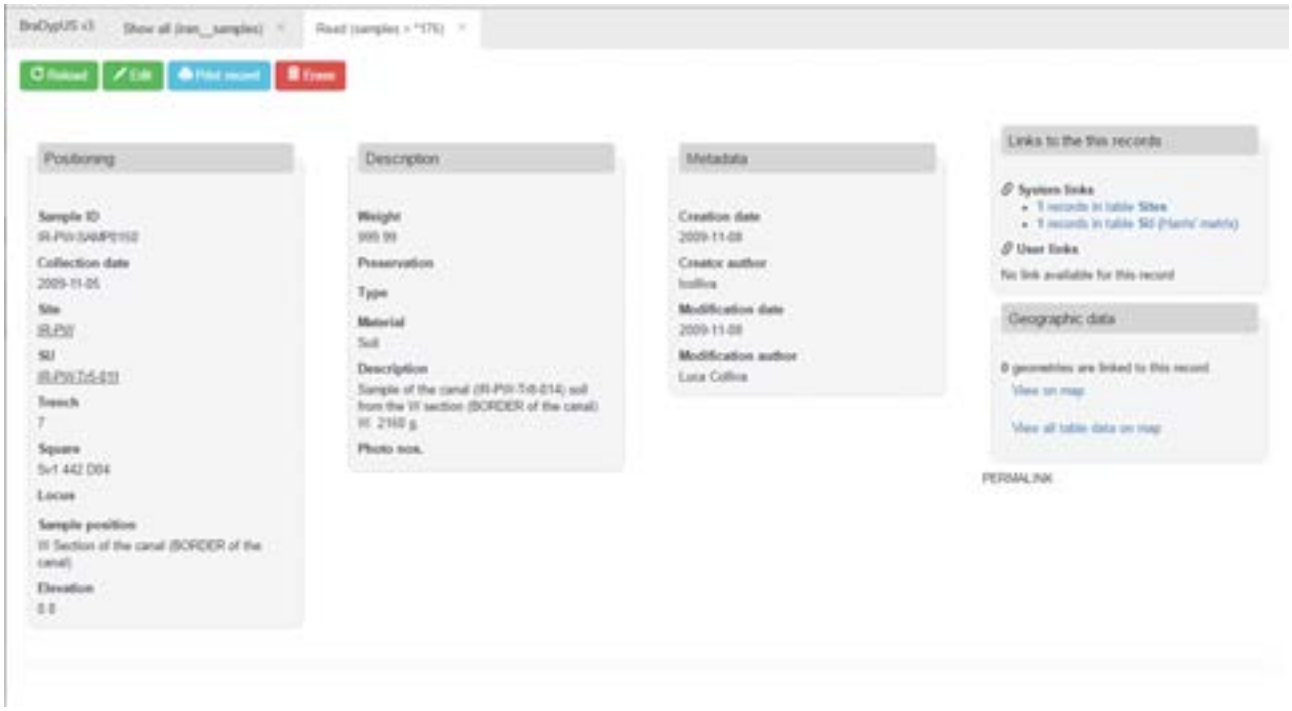

Fig. 12 - The SAMPLES form.

The "COLLECTION" form gathers administrative and geographic data related to the storing of the studied objects.
Finally, the "FILES" form (Fig. 13) collects metadata regarding the graphic (i.e. photos, drawings, etc.) and textual documentation related to the materials entered in the previous forms; it is possible to connect images and files to any form of the database.
Moreover the relational database system allows linking together different forms so that each compiled form will show all the other forms linked to it: for instance, a Site form will show a direct link with all its Complexes, all the Stratigraphic Units identified in these Complexes and all the Objects found in these Stratigraphic Units.

Fig. 13 - The FILES form.

The Database incorporates an advanced search system (Fig. 14) that allows not only to look for individual words or sentences but also to search multiple data combination in different fields of the form thanks to the numerous available search options.

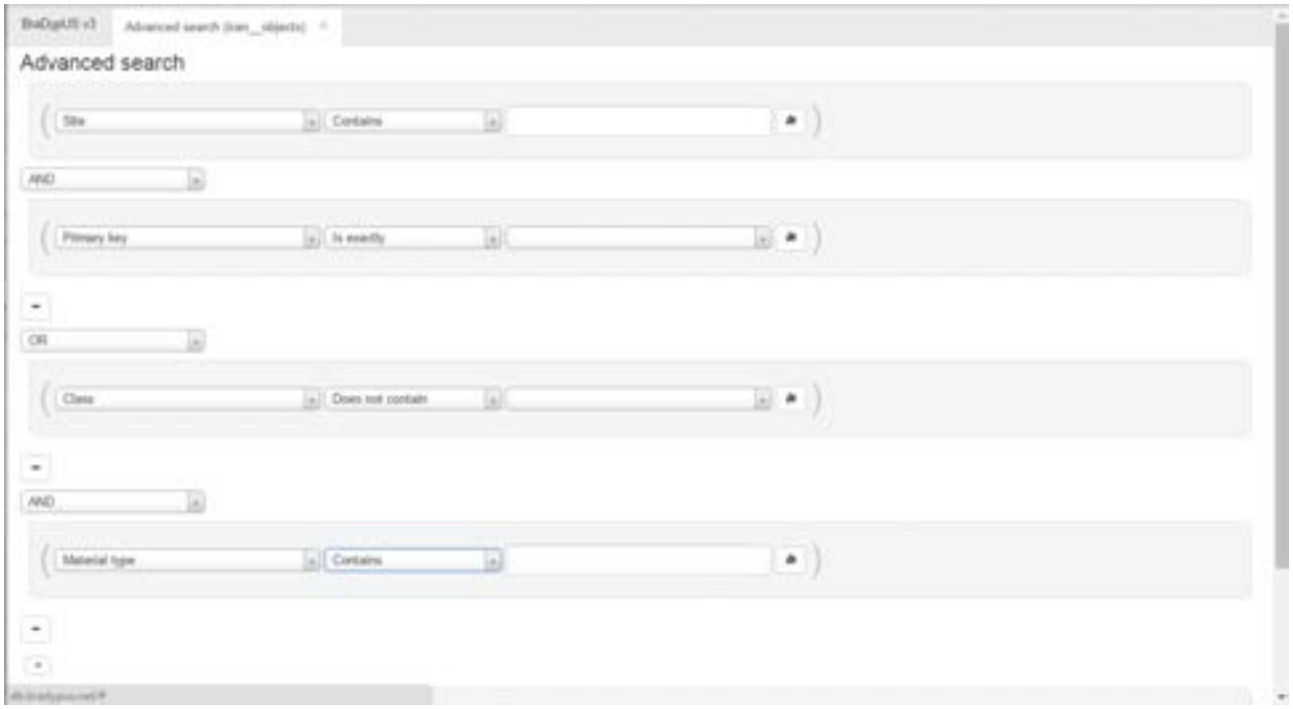

Fig. 14 - The advanced search system.

(L.C.)

Software and Technical Data

The database managing system is entirely network based; this means that multiple users can work simultaneously on the data, keeping all actions in sync. No software is needed to access and work with the database; a modern web browser is the only required tool for the user to start working. This means that the database can be accessed and used with any operating system and from any device (Fig. 15). Recently mobile device support has been added, to permit a comfortable use from tablets and smartphones.

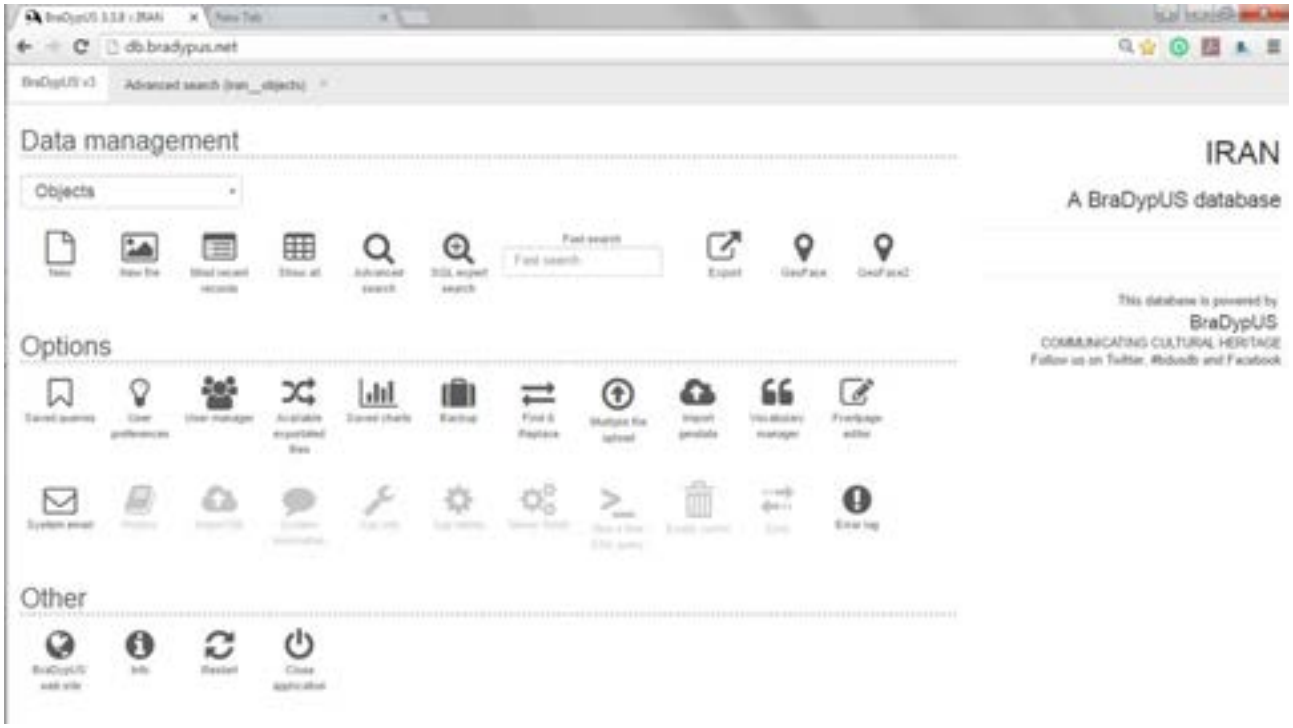

Fig. 15 - The database operating on Google Chrome web browser.

BraDypUS[2] is normally available as a SaaS (software as a service) platform, all databases being available on the internet at http://db.bradypus.net[3]. Each research project has an own user list, authorized to access the data on different levels (see below)[4]. This feature provides very detailed control over who can access data and how this access is performed.
However, it happens often with archaeological projects to work for a limited time (the duration of an excavation campaign, for instance) in places where no internet connection is available. To fulfil this need, BraDypUS databases are made available also in offline mode. The user is supplied with a very easy to use (one-click install procedure) bundle, which is an exact copy of the online version that can be run on a personal computer or notebook[5] acting as a terminal client or a server on a local area network. Creating a simple local network (wired, Wi-Fi or both) permits the simultaneous use of the database by all connected users, a perfect mimic of the online database.
For the time of the offline usage, the online copy can be "frozen", a special mode that grants read-only access to all registered users, but prevents any editing or new insertion that would create serious synchronisation issues with the offline copy. Once the offline work is finished a simple and automatic synchronisation operation can be performed to push local (offline) data to the main online repository.
The protection of the data is an important issue, which has been addressed creating different user profiles. Each BraDypUS database has an own list of users, structured as follows:

- **Suspended** (waiting status) users. Anyone can apply for a user account to the database, supplying their name, email address and a password. An administrator will then evaluate the request to approve or reject it. Meanwhile, these users will have a waiting status that grants no access to the database.
- **Read only** users can read and perform any query to all data but can perform no edit or new insertion. This profile is usually suitable to external collaborators, students, etc., that need to visualize and analyse the data, but should not be allowed to change anything.
- **Read and write own records** is a special user profile that grants full access in read mode to the entire database, permits the insertion of new records and their editing, but does not permit editing or deleting records added by others. This user profile is suitable for data-entry actions, for instance when students or collaborators are invited to contribute by adding data and maintaining their data up-to-date, but should not be allowed to make any change to data entered by other users.
- **Read and write** users have full access to the entire database. They can perform any query and edit or delete any record in any available table.
- **Administrators** inherit all access privileges of read and write users and also have access to special maintenance and configuration operations, like editing the vocabularies, managing users (upgrading and downgrading user privileges), changing all database and table configuration settings, etc.
- **Super-administrators** inherit administrator privileges and have access to special functions related to the development and network management. Only highly technically trained users can be trusted to become super-administrators.

To obtain granular privileges, each record is automatically signed by the system with the identity of the user who created it.
Administrators can easily (on click procedure) perform full backups of the available data and download and save to a secure location the backup files. In the same easy way, older backups can be easily restored to replace existing data. This is a delicate task, because involves the entire database data and can be performed only by administrators.
Available data can be exported in few clicks in other open formats (Fig. 16). The following formats are currently available (other can be added on demand):

1. JSON (JavaScript Notation Object, http://www.json.org/)
2. Microsoft Excel (XLS)
3. SQL (Structured Query Language, Insert queries; https://it.wikipedia.org/wiki/Structured_Query_Language)
4. CSV (Comma separated values, https://it.wikipedia.org/wiki/Comma-separated_values)
5. HTML table
6. XML (Extensible Narkup Language, https://it.wikipedia.org/wiki/XML)

2 - BraDypUS system was conceived in 2006 in the context of the didactic workshops on archaeological documentation at the Bologna University. At a first stage the software was called BDUS, acronym for Banca Dati Unità Stratigrafiche (Database for Archaeological Contexts). In 2008 the camel-case BraDypUS codename was adopted, with a clear reference - in the uppercase letters - to the original name.
3 - Recently the database is being served over secure connection (SSL, Secure Sockets Layer) in order to provide a higher level of security.
4 - Typically a user can be a super-administrator, an administrator, a read&write user, a user who can insert new data and edit only the data he inserted, a read only user and, finally, registered users that are still waiting to be approved by an administrator; these do not have any access on the data. Administrators (and super-administrators) can change in any time the access profile of each user.
5 - The main operating systems are supported: Windows, Mac OS and Linux.

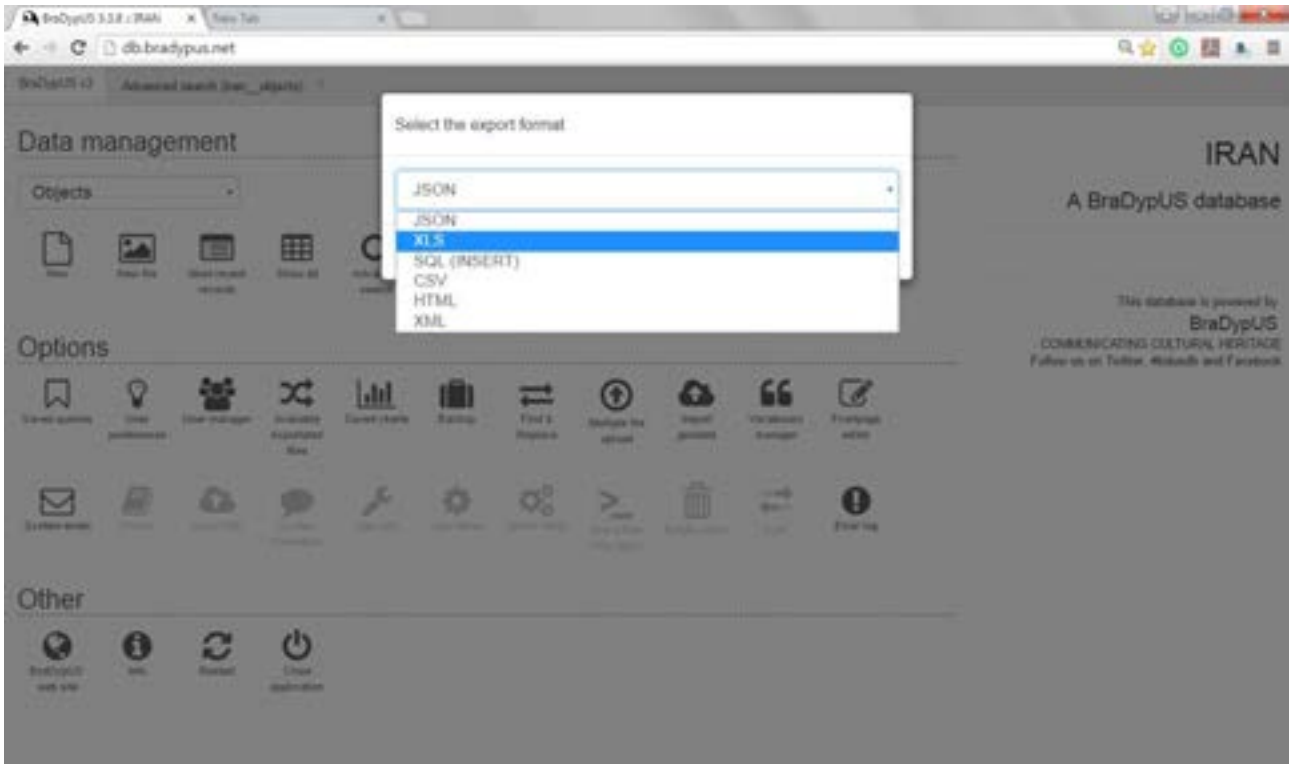

Fig. 16 - The database exportation procedure.

The database managing system integrates tools to easily build graphs and diagrams, visualise and graphically analyse complex data. Directed graphs - Harris' Matrix diagrams - can be used to visualize stratigraphical relationships of layers, and bar charts can be of great help in analysing big amounts of data, like pottery findings.
Finally, the web database user interface is intended to be available in different languages. At present Italian and English are fully implemented, and other languages can be easily added.
BraDypUS database system is currently being used by several international projects, dealing with different chronological and cultural milieux, not only to record excavation information, but also to handle archive and museum data. The database can be linked to web portals aimed at promoting and disseminating Cultural Heritage[6] or to more complex web-GIS platform to obtain real time built maps or advanced thematic atlases[7]. By a precise will, ethical and methodological decision only open source software and libraries have been used and the database system itself is released with an open source (MIT) license.

(J.B.)

6 - See, for example, J. Bogdani, Un archivio digitale multidisciplinare per la gestione e la conservazione di un patrimonio culturale a rischio: il progetto Ghazni (Afghanistan). *ARCHEOFOSS. Free, Libre and Open Source Software e Open Format nei processi di ricerca archeologica. Atti del IX Workshop (Verona, 19-20 giugno 2014)* eds P. Basso, A. Caravale and P. Grossi (*Archeologia e Calcolatori*, Supplemento 8), Sesto Fiorentino 2016, pp. 236-245, available at http://www.progettocaere.rm.cnr.it/databasegestione/open_block_pages_sup.asp?IDyear=2016-01-01.
7 - J. Bogdani, The archaeological Atlas of Coptic Literature. A question of method. *Vicino Oriente* XXI, 2017, pp. 59-69.