**Philology and technology in the Hesperia databank**
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## 1. The Hesperia databank: aims and scope[1]

Ancient indigenous languages of Spain (Palaeohispanic languages) are attested through a limited number of extant documents and sources. They thus belong to the group of so-called "fragmentary languages" or *Restsprachen*.[2] The number of inscriptions known to date is above 2,000. An updated comprehensive edition of all these inscriptions had been for a long time a desideratum for the scholars working on the languages, epigraphy and history of Ancient Spain and, in general, for those working on the languages, epigraphies, and cultures of the Mediterranean in the Antiquitly.[3] The task of producing such an edition was undertaken by Jürgen Untermman, who has published since 1975 the successive volumes of his *Monumenta Linguarum Hispanicarum*.

However, the number of inscriptions in Palaeohispanic languages grows steadily every year and there are important findings from time to time[4]. Due to this fact, any printed edition grows older very quickly and the production of supplements cannot keep up with the publication of new findings. Furthermore, the field of Palaeohispanic languages and epigraphy is very lively, so that new interpretations that provide a deeper understanding of the language and contents of the inscriptions are proposed every year. Progress in our understading of the writing systems employed for these languages also have a direct impact on the study of the inscriptions and, even, in the way that we have to transliterate them.[5] E.g.,

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[1] This paper is part of the research Project FFI2009-13292-C03-02, financed by the Spanish Ministry of Science and Innovation.

[2] For this concept see Untermann (1980, 1989).

[3] Before Jürgen Untermann's *Monumenta Linguarum Hispanicarum* (Untermann 1975-1997), the last complete editon dated back to the end of the 19th century (Hübner 1893).

[4] Among the new inscriptions known in the last years, some relevant findings have been a Celtiberian letter on lead (Lorrio – Velaza 2005) and a new addition to the meager corpus of Lusitanian inscriptions (Carneiro et al. 2008).

[5] Palaeohispanic inscriptions are for the most part written in various related scripts known as "Palaeohispanic" scripts. They are ultimately derived from the Phoenician script, but have

Ferrer (2005) has recently shown that the differentiation between voiced and voiceless stops is more widespread and systematic in the Levantine Iberian script than it was previously believed.

In the era of electronic publishing the best solution appears to be the production of an electronic corpus that can be updated and modified as new inscriptions appear and improvements in the reading and interpretation of published inscriptions are proposed. This has been the aim of the Hesperia databank since its very beginnings. It has been designed to content comprehensive information about the ancient indigenous languages of Spain, Portugal and Southern France. It includes indeed the extant inscriptions in those languages (Iberian, Celtiberian, Lusitanian and less well identified languages), but also other linguistic records, such as the indigenous names (personal names, god names, and place names) that appear on Latin inscriptions or are trasmitted by Latin and Greek sources.

Palaeohispanic languages are still not so well understood. Iberian is an isolated language and much of its grammar is still poorly known. As for Celtiberian, further progress can be made by comparison given that it belongs to the family of Celtic languages; however, the interpretation of the longer texts in this language is still much debated. Furthermore, some of the scripts used for these languages are not completely deciphered.[6] This fact had to be borne in mind when designing and developing the databank, given that one of its main goals had to be to contribute to a better understanding of the Palaeohispanic languages. In this sense, the searching devices had to play a fundamental role inside the databank: they had to be flexible enough and allow for complex combinations in order to be useful when trying to find morphological or syntactic patterns of the languages included in the databank.

Work on the databank began in the late nineties at the Department of Greek Philology and Indo-European Linguistics of the Universidad Complutense (Madrid) under the direction of Javier de Hoz. Researchers from other institutions joined in later and this is now a joint project of research teams of the Universities of Madrid (Complutense), Basque Country and Zaragoza, with the participation of researchers from the Universitat de Barcelona, as well.

Given the diversity of materials that need to be included in the databank, it has been organized as a series of different related tables.[7] The technical specifities of each database will be described in section 2 of this paper. The database of inscriptions is by now almost complete and large parts of the onomastics database have already been produced, too. The

characteristics of their own, such as the fact that they combine alphabetic and syllabic signs. Further information on these scripts can be easily found in the introductions of the various volumes of MLH; for a recent general overview, see Velaza (2004).

[6] This is the case with the so-called southern Iberian script and, especially, with the south-western (or Tartessian, according to some scholars) inscriptions.

[7] A general overview of the databank can be found in Orduña – Luján – Estarán (2009). In this paper we will focus on the description of the more technical details of the databank. See also the posters availabe at http://eprints.ucm.es/8672/1/Hesperia.pdf.

latest additions to the databank have been the database for coin legends[8] and the database for the lexicon.

The databank will be accesible for public use at the web page of the Hesperia project.[9] Given the complexity of the tasks involved in the development of the databank and some legal aspects, such as dealing with copyrighted materials (e.g., photographs of the inscriptions), making it wholly accesible will still take some time. However, relevant parts of the databank will be available for public consultation at the web page of the project in the first months of 2011.

## 2.  The Hesperia databank: technical description

### 2.1. Software and hardware

The "Banco de Datos Hesperia" ("Hesperia databank") was originally developed on a FileMaker platform,[10] but the limitations of this software, especially concerning the accessibility through the Internet, made clear that a new approach was desirable. The new database was designed using open source software, mainly the LAMP platform: Linux as the operating system installed in the server, Apache as the web server, MySQL as the database server, and PHP as the programming language for the web interface. Other Open Source programs are also used: for the maps generation, the MapServer software, developed by the University of Minnesota, and for the PDF output, the TCPDF PHP Class. Some Javascript functions are also used, even some JQuery functions, these being at this time the only AJAX features in Hesperia.

Hesperia runs in a dedicated server, with an Ubuntu 9.2 Linux distribution (formerly a Fedora Core 4), placed at the Universidad Complutense de Madrid. The access to the database is made through a web interface, so only a web browser is needed. For the time being, some Javascript functions are known to work only in Firefox, but this applies only to the introduction or modification of data, so that for the visiting users every browser works fine.

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[8] On this see section 2.4 below and the information provided by M.ª José Estarán in section 3 of Orduña – Luján – Estarán (2009), as well as the poster that she presented at the "X Colóquio sobre Línguas e Culturas Paleo-Hispânicas" at Lisbon (26-28 february 2009), available at the e-prints server of the Universidad Complutense de Madrid (http://eprints.ucm.es/8672/1/Hesperia.pdf).

[9] http://hesperia.ucm.es/.

[10] The original design of the database in File-Maker and the user-friendly organization of its main view into various tabs were made by Fernando Quesada. It is at this stage that the Hesperia databank was first described by Luján (2005).

### 2.2. MySQL

In this section we will discuss only the internal structure of the MySQL tables; we will refer later in another section to the actual presentation of these tables in forms. We will use in this section the terms "rows" and "columns" as usual in the database terminology. These terms correspond to the more generally used "records" and "fields", which we will use when dealing with the forms.

From an internal point of view, Hesperia is organised in just one MySQL database, with several tables: epigraphy, anthroponymy (corpus), anthroponymy (analysis), theonymy, toponymy, numismatic legends, mints, lexicon and bibliography.

Most tables are independent from one another, with the only exception of the numismatic database, in which the table "legends" has a column "mint name" who points to the same column in the table "mints".

In the anthroponymy section there is no such connection between both tables, as the column "name" in anthroponymy (analysis) could point to several columns in anthroponymy (corpus): nomen, cognomen, ethnonym, filiation. The same is true for the theonymy table, which in fact is theonymy (analysis). We will explain later the contents of these tables.

The table "lexicon" is also independent from the "epigraphy" table, although in the epigraphy form some data are taken from the "lexicon" table.

All the tables have an "id" column which identifies in a unique way each row in each table. This column contains an auto-incrementing value, and is useful also for the navigation between the rows, and to make links to them between the different forms and searchers.

The images of inscriptions or coins have been kept apart from the MySQL database. They are stored through a web form in directories identified with the id of each row. These directories are automatically created when one image corresponding to a certain row is uploaded for the first time. This approach makes easier to manage the possibility of uploading an unlimited number of image files for each row, and to relate each file with the corresponding credits information, which is also stored outside the MySQL database, in a text file with the same name (except the file extension) as the image file, and located in the same folder. Another advantage is that the MySQL files have a size that makes very easy to make backups. On the other hand, the folder with image files can be packed in compressed files of an appropriate size to be downloaded and stored in a backup.

### 2.3. Epigraphy

This is the main form in Hesperia, and as many elements are very similar in the other forms, we will describe it in more detail (see Figure 1).


[FIGURE 1 ABOUT HERE]


All forms in Hesperia have some common elements: in the upper part, a row with links to the different forms, and at the right side, the navigation buttons, the buttons to delete or create new records, and links to a searcher and to a PDF generator for the current record.

Most forms are also divided in tabs, depending on the number of fields. The epigraphic form is in this sense the biggest one, with more than fifty fields, so that up to five tabs were needed to present all of them without forcing the user to scroll down the page to see all the fields. Only the epigraphic form has a common section with some fields visible irrespective of which tab the user is seeing. These fields contain mainly information about the name and

location of the site, the inventory reference of the museum, as well as the epigraphic references: the specific Hesperia reference, and the MLH one that points to the widely used *Monumenta Linguarum Hispanicarum* (MLH).[11] The Hesperia reference consists in an abbreviation of the Spanish "Provincia" of French "Departement", followed by a number corresponding to a site, and after a dot, a number corresponding to the number of inscription in this site.

The tabs in the epigraphic form organize the fields, apart from the common upper section, according to these contents: Generalities, Text and Critical Apparatus, Epigraphy and Palaeography, Illustrations, Archaeological Context and Bibliography.

From a technical point of view, these tabs are standard HTML forms in different PHP files, in which only the "text", "textarea" and "select" form elements are used. Some "select" fields are in fact a combination of "text" and "select", using Javascript to make the "text" box appear only when the option "Others" is selected, or when there is stored information introduced this way. This combination is what is properly named "combo-box", although sometimes this name is also used improperly for the "select" element itself.

Below, another form allows for filtering the records according to some fields contained in a "select" element, so that the browse buttons allow only for the navigation through the records matching with the criteria introduced in a text box. The total number of matching records and the position number of the current record in this set are displayed next to the filter form. The filter is preserved when changing tabs or saving changes, until a new filter, or a blank filter, is set. If no filter is set, the total number of records in the database is displayed.

The "Generalities" tab consists mainly in general information about the epigraphic support of the inscription: material, object, shape, size, type, number of lines, etc. It can also contain the name of the person responsible of this information. In addition, a line containing a user name and date is automatically added each time one record is modified. There is also a "veto" field, which allows for marking a record as non accessible to the visitors, so that it will not be displayed in the open version.

The "Text" tab, together with "Epigraphy" and "Archaeological Context", are the only ones allowing text formatting in some fields, to a limited extent. This has been achieved in a simple way that allows keeping the contents as clean as possible from text tags or attributes that could disturb the searches. In fact, there are two PHP files for each of these tabs: one is the real form which allows for entering or modifying the data, the other being a duplicate in which the fields allowing format are not real form fields, but <p> ("paragraph") tags with CSS style attributes set, so that they are visually like field forms, even with scroll bars when necessary, but in fact they are not and so the format can be seen. This format is introduced in the original form by means of buttons that allow for introducing simple HTML tags for bold, italics or underlined text (see Figure 2). This approach has been used only in "textarea" fields, in which long text can be introduced. In the open version, only the duplicate and non editable tabs with format will be visible.

[INSERT FIGURE 2 ABOUT HERE]

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[11] Untermann (1975-1997).

Apart from this duplicity, the "Text and Critical Apparatus" has another feature in order to present in a clear manner the complexities of the multiple variants of reading in the text. In this case, the two textareas in the form correspond to only one in the formatted duplicate, in which the text has blue coloured sections, corresponding to such text sections with variants. In fact, these blue sections are links with a "mouseover" Javascript function that opens a floating window which is formatted in the shape of a bubble over the corresponding section of text and contains the variants for this section (see Figure 3).

[INSERT FIGURE 3 ABOUT HERE]

This is made by means of a set of PHP functions that split the text and the critical apparatus using the marks $ and & that delimit the text sections with variants, and the variants themselves. As each variant is introduced in order in the corresponding field – each set of variants ending with a semicolon – it is easy to program a function which matches each text section with its corresponding variants. The entering of the variants, otherwise cumbersome, is now made easy with buttons that activate Javascript functions, which automatically switch between the "Text" and "Critical Apparatus" fields, copying in the later the selected parts of the text, and surrounding it in both fields with the $ and & marks.

One important aspect in the "Text" tab is the encoding problem. In the transcription of the Palaeohispanic languages three signs with diacritical marks are used: ś, ŕ, and m̂. Until recently, R, s and Y where used respectively to represent them, and they were transformed accordingly in the formatted section, as well as in the PDF output. But now it has been decided to shift to Unicode, so that these signs are entered as they are, by means of a button that inserts the diacritical mark over the sign. There are also buttons to insert the epigraphic marks "underline" and "dot bellow", which are encoded as Unicode diacritics, and so can be ignored by the searcher.

The "Epigraphy" tab contains fields about the language and signs of the inscriptions, as well as two textareas to insert epigraphic and palaeographic commentaries, in which some formatting is possible by means of buttons, as we have said. We are working in a new field containing the lexical information. We will refer to it later, in the "Lexicon" section.

The "Illustrations" tab contains only the form to upload the image files, which appear, as soon as they are uploaded, in a table with cells automatically added each time a new image is uploaded. Each cell displays the image in a reduced size ("thumbnail"), which is a link to the image in its original size, in a new window with text fields allowing to enter the credits of the image, and a name (otherwise, the filename is used instead). These are displayed then under the thumbnail, with a button allowing for deleting the image.

The "Archaeological Context" contains also information about the dating of the inscription. Two fields "X" and "Y" contain the geographical coordinates of the site in decimal degrees, if available, or at least of the corresponding town (municipality). These coordinates are used by the MapServer program to link each record, with all its information, to a point in a map. Besides, a form at the bottom part allows for uploading images of the archaeological context, which are stored in a sub folder of the image folder for each record.

Finally, the "Bibliography" tab allows for entering the *editio princeps* and the philological and archaeological bibliography.

The searcher is at this time divided in two sections: one advanced text searcher, specifically to make searches in the "Text" and "Critical Apparatus" fields, and a global searcher, allowing for searches in every field, or several fields at a time, searching for the records containing all or one of the criteria, depending on the selected option "and" or "or".

In the last one the results can be ordered by every field or by date of last modification, in ascending or descending order.

The advanced text searcher, apart from including more options (ignore distinctions such as sibilants, vibrants, etc.), works internally using the PHP regexp ("regular expression") engine,[12] while the other one uses the less powerful MySQL (POSIX) one. The most important advantage of the PHP regexp engine relies in its ability to ignore Unicode diacritics, i.e., the epigraphic marks for doubtful signs or, as an option, the diacritics in *ś*, *ŕ* or *ḿ*.

The results are displayed as a table showing in the first column the site name, in the second the reference, in the third the text (with the matching text in red in the case of text searches), and in the last column a link to the entry of the record, and a checkbox that allows to include each marked result in a PDF file or display it in a MapServer map.

Under the table of results, the number of results is displayed, along with the buttons allowing for generating either the PDF file or the map. In the first case, a new page allows for selecting the fields that should be included in the PDF file (see Figure 4).


[INSERT FIGURE 4 ABOUT HERE]


A clone of these searchers, accessible through the "Charts" link in the upper part, allows for generating pie charts of the selected results, classifying them according to a selected field (see Figure 5).


[INSERT FIGURE 5 ABOUT HERE]

## 2.4. Numismatics

This form is organized in four tabs: general information, numismatic legends, language and writing, and bibliography. All of them display the information contained in the "mints" table, except the second one, "legends", which also works in a different way: it has no real form-fields, but only a table displaying in order the different legends attested for each mint, with a link allowing for editing or deleting each legend. The real form is shown once the user follows the link "edit": a floating window appears, with all the fields containing the information related to this legend. It is in this window that the images of coins with a specific legend can be uploaded and displayed.

We have to stress the fact that Hesperia is mainly an epigraphic database, so the main goal of the numismatics section is to display the epigraphic information contained in coins, hence our approach based on the legends, neglecting other numismatic information such as series, weights, or distribution of the findings. The only geographical information contained in this forms is thus the coordinates of the mint, if known.

In the "Language and writing" tab there is a "radio button" control to indicate if there is bilingualism at the mint level. If not, i.e., if all the coins from this mint are written in the same language and writing system, the text fields to enter and display this information appear in the same "Language and writing" tab. If the option "yes" is selected, these fields are not displayed here, but in the edition window for each legend.

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[12] See Orduña 2004.

## 2.5. Onomastics

This form has four tabs: Anthoponymy and Theonymy (Corpus), Anthroponymy (Analysis), Theonymy (Analysis) and Toponymy. The last one is at this stage a work in progress.

This form is basically devoted to Palaeohispanic names contained in Latin inscriptions, so the form contains no information about the inscriptions themselves, only the location, which is important to know the distribution of the Palaeohispanic names (see Figure 5).


[INSERT FIGURE 6 ABOUT HERE]


Thus in the "corpus" tab each record corresponds to one individual, with one field for each element of their onomastic formula, and for the theonym, if it is a votive inscription. We also have here the epigraphic information concerning the reading of the inscription, only related to the names themselves, as well as the location and the geographical coordinates allowing for generating maps. If the coordinates fields are not empty, a button appears allowing for generating a map with the point of the location in red, and the map can be saved and displayed statically in this form.

Both "analysis" tabs have, in fact, an analysis of the information contained in the "corpus" tab, and their structure is very similar. The main field in both cases is "Name", in which the commonest or standard form of an anthroponym or theonym is selected, all of its variants or related names (or at least those that are so considered) being gathered in a different field, separated with periods, so that the appropriate button generates the distribution map of all the inscriptions containing not only the main name, but also its variants. The map can be saved and inserted in the form.

## 2.6. Lexicon

This form has no tabs, and its main fields are "Lemma" and "Commentary". The "Lemma" displays a word of a Palaeohispanic language, and the "Commentary" explains the various possible interpretations according to different scholars, in works that are referred to in the "Bibliography" field.

We are currently working on the inclusion of a field in the epigraphic form presenting the transcription of the text with each word appearing as a link to its entry in the Lexicon form.

## 2.7. Bibliography

This is a simple form containing the usual fields in a bibliographical database, with a searcher that allows for generating a PDF document with all the records found. The citation form, in the author-year format, is automatically generated and displayed on the top of each record.

## 2.8. MapServer

From a technical point of view, this MapServer application is made with static "mapfiles" and HTML templates, without using MapScript. When launched from the searcher or from the buttons in the onomastic form, the query strings are sent as POST variables. A mapfile is a text file with the .map extension, written with a certain syntax, in which definitions are made for each layer of information in the map, such as the field used as label, the level of zoom required in order to display a label, the name of the template HTML files, the symbols used, the coordinates of the map corners, and other geographical information, as the

projection.[13] The mapfile contains also the information allowing MapServer to connect to the Hesperia MySQL database. This is made through GDAL/OGR, one of the various programming libraries used by MapServer.

We have already seen several possibilities to generate maps: from the searcher in the epigraphic form is possible to generate a map with the selected results, and from each of the tabs in the onomastic form is possible to generate a map of the location of the name (inscription) in the "corpus" tab, or a distribution map of an anthroponym or theonym and its variants, in the "analysis" tabs.

There is also a direct access to the MapServer program, that can be used as an alternate way to navigate the Hesperia database, with a more "geographically-oriented" scope. Following the "MapServer" link, a map of the Iberian Peninsula is displayed, with the points corresponding to all the sites in the epigraphic database displayed by default. A different symbol is used to distinguish each different writing system, so that one point can have more than one symbol. On the right side, three radio buttons allow to switch between the epigraphic database, the anthroponyms or the theonyms.

On the right side there are also controls allowing to zoom in, zoom out or move the map. Each point in the map has a label, corresponding to the site name in the epigraphic database, or to the location of the inscription in the onomastic database. This label is only displayed when zooming in. There is the possibility of including layers from external servers via WMS (Web Map Server) connections. For the Spanish area this is most interesting, as there are at least two excellent free public services allowing WMS connections, i.e., the SIGPAC of the Ministerio de Medio Ambiente y Medio Rural y Marino, and the ICC (Institut Cartografic de Catalunya), this one only for Catalonia. By means of check box controls, it is possible to select this layers, that display topographical maps or orthophotos at a scale of 1:5000 m. This layers can only be displayed when a certain zoom level is reached. In the case of the SIGPAC, at first topographical maps are displayed, and at a closer sight they are replaced by orthophotos, while the ICC topographical maps have transparency, so that they can be displayed over the orthophotos.

There is also a little reference map in which a square line represents the area displayed in the main map. By clicking on this map is possible to drag this area.

There are two operation modes: navigation and information. The first one is used to move or to zoom in and out. When the information mode is selected, the action of clicking over a point shows a list of all the inscriptions within an area of ten kilometres around this point. This tolerance is necessary, because otherwise it would be very difficult to click exactly over the desired point, and we would obtain no results. The list contains selected information for each inscriptions, such as the site name or the text, and a link to its entry in the epigraphic or onomastic form.

Finally, at the bottom there is a form allowing to launch searches directly from the MapServer application. As this form uses the MapServer search engine, it is less powerful than the searcher in the epigraphic form, but it's faster, as the later performs a query like this: "id = 1 or id = 2 or id= 3 ...", which can be very slow, up to several minutes, if there are several hundreds of results.

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[13]    Detailed    documentation    on    mapfiles    can    be    found    at

http://mapserver.org/documentation.html.

## 3. Final remarks

In this paper we have provided a quite detailed technical description of the Hesperia databank in its current state. The complexity and variety of the materials that have to be included in the various tables of the databank and the fact that the databank had to be aimed at contributing to the advancement of our understanding of the Palaeohispanic languages have led us to develop specific strategies when using the availabe technical tools. We believe that this involves not only a progress in the way that we can face traditional philological and epigraphical problems, but also in the way that technical tools and programs can be used for dealing with this kind of materials. When compared to existing databases in similar fields, the Hesperia databank shows a greater flexibility which allows for dealing with traditional philological problems that had been left aside in other similar projects, such as the variants for the readings of the inscriptions. The search engines that run on the databank are more powerful, so that complex textual searches can be performed and they do not only run on the text of the inscriptions itself, but also in the variants. The presentation of the data is more user-friendly and the possibilities offered by the automatic generation of distribution maps of linguistic and epigraphic features are a considerable progress, too.

It is our intentation to continue the work on this databank in the following years, completing the information contained in its various tables and databases and also adding new tools that will help in their investigations researchers and scholars working in this field. As stated above, the ultimate aim is bringing together philology and technology for gaining a deeper understanding of the languages spoken in Antiquity in the Iberian peninsula and contributing to the development of models that can be applied to the study of other corpora of inscriptions and texts.

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Figure 1. Epigraphy form of the Hesperia databank

Figure 2. Epigraphy form: introduction of variants of reading

Figure 3. Epigraphy form: users' view of the variants of reading

Figure 4. Pdf-format of search results



HESPERIA BANCO DE DATOS DE LENGUAS PALEOHISPÁNICAS

**ED. PRINCEPS:** E. Sanmartí, RAN 21, 1988 (1990), 95-113 (f:96 (enrollado (2) yA), 97 (B), 102 y 103 (detalles); d:97 (A), 99(B))
**BIBL. FILOL:** Panosa 1999 10.30; Velaza Chronica II, 1.6
**BIBL. ARQUEOL:**
**IMÁGENES**

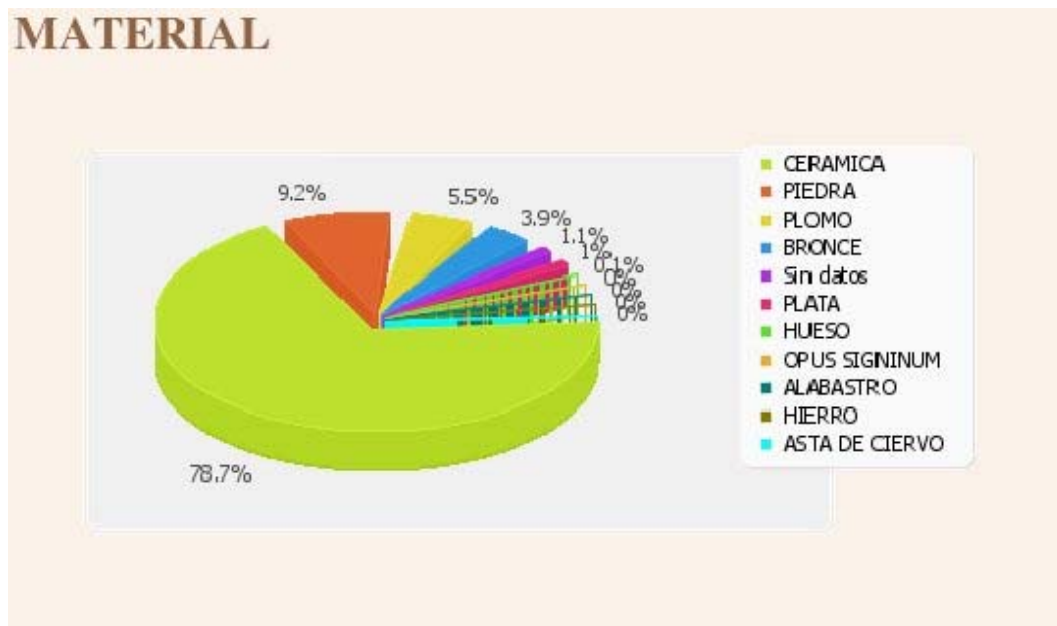Figure 5. Pie charts automatically generated for selected results of searches.

Figure 6. Onomastics form: "analysis" tab

Figure 7.