

A NEW METHOD FOR STUDYING THE LETTERING OF INSCRIPTIONS FROM ANCIENT MACEDONIA USING MODERN INFORMATION TECHNOLOGY

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Abstract

This paper presents the methodological background and initial results of the research work carried out as part of an ongoing project, co-financed by the Greek Government and the European Union (MIS 5004509). Although ancient Greek epigraphy is an important tool for the advancement of historical research and has repeatedly demonstrated its potential for invigorating classical studies, the use of inscriptions as source material often poses particular problems for epigraphists and researchers alike, especially when the text does not provide reliable chronological criteria other than the style of lettering and letter form. Recognizing the importance of photographs of securely datable inscriptions for the study of Greek epigraphy, the project aims at collecting photographic illustrations for as many securely dated inscriptions from ancient Macedonia as possible and integrating the material into an easy-to-use epigraphic database. The usefulness of the database for the study of lettering in Ancient Macedonia from the 4th century B.C.E onwards is presented with particular regard to the so-called "First Macedonian District".

Keywords: Greek epigraphy, ancient Macedonia, inscriptions, palaeography, cultural informatics, epigraphic database.

1. INTRODUCTION

Much of our knowledge of the political, economic and social history of the ancient world, the institutions and the cults of the Greek cities, and the dialects of the Ancient Greek language derives from information culled from inscriptions. They constitute a great mass of material, which is, moreover, constantly being augmented by new finds, and preserve a wealth and diversity of content that make them a primary source for every discipline dealing with antiquity (history, archaeology, philology, linguistics, numismatics, the study of religions, etc.), while inscriptions of specific content have from time to time been of particular interest to the fields of law and the exact and technological sciences. The primary duty of the science of epigraphy is to ensure the systematic study and publication of inscriptions so as to make them available to researchers, a task that imposes the use of specific rules for the restoration and dating of inscriptional texts.

Dating an inscription is usually one of the most difficult problems facing the epigrapher. Safe, accurate dating is important for two reasons:

- 1) However interesting the content of an inscription may be, it loses much of its value if it cannot be situated in a specific chronological framework (Woodhead 1967, 52).
- 2) As archaeological finds, inscriptions are part and parcel of archaeology, can shed light on the nature and the function of a monument, and can help date it.

In some cases the text of the inscription provides sufficient information to establish a dating. The name of an archon, the number of an Olympiad or the specification of a year in a calendar that can be converted into the Christian era system all allow the precise dating of an inscription, while the mention of a ruler or other known historical figure or event can establish a framework date. Sometimes the dating of an inscription is facilitated by external factors, such as the presence of a relief that can be dated on morphological criteria or various *termini post* and *ante quem* fixed by a disaster or some other event (Klaffenbach 1966; Guarducci 1987; Woodhead 1967).

In most cases, however, palaeography is the only criterion remaining to the scholar as a basis for dating the inscriptional monument. The general impression of the lettering and the shape of individual letters are elements that permit the inscription to be placed within a particular time frame. If a dating based exclusively on letter shape is to have any validity, however, the inscription lacking chronological indicators must be compared with others from the same general area that have been dated with greater certainty. The reliability of a dating reached in this manner depends entirely on the experience and resources of the individual epigrapher.

The need to refer to depictions of dated inscriptions is not a matter of interest to epigraphers alone. Although the publication of an inscription should as a rule be accompanied by a dating, it not infrequently happens that the archaeologist or editor avoids expressing an opinion as to the period to which the inscription belongs. In this case, the only options open to the reader or researcher who wishes to make use of the information furnished by the text are either to ignore the inscription as not belonging to the period in which he is interested or to try to draw his own conclusions regarding its date, assuming that he has both sufficient knowledge of the subject and access to the monument or to photographs of it (Woodhead 2009, 52).

In view of the inherent difficulties in the study of inscriptions and the importance of access to photographic material, our programme aims to assemble all the inscriptions that can be safely dated on the basis of the information provided by the text itself. Locating and photographing this material, which comprises 780 inscriptions, necessitated both bibliographical research and on-the-spot investigation in museums and archaeological sites. To permit the handling of the resulting volume of material a database was compiled, into which we entered: 1) photographs of the securely dated inscriptions from Macedonia, 2) information about each inscription (find-place, date, publication details, text), and 3) tables showing the evolution of individual letters. Once the programme has been completed, the database will provide free access to anyone who is interested in the evolution of the lettering of inscriptions in Ancient Macedonia, so that it may serve as a basic tool for the archaeologist, the epigrapher, the historian, the philologist, the linguist, the teacher, and anyone else who is interested in using the information furnished by the dated inscriptions of Macedonia.

2. METHODOLOGICAL BACKGROUND

The collection and publication of photographic material and the creation of tables depicting the evolution of lettering has been a desideratum of the disciplines dealing with antiquity, and of epigraphers in particular, since at least the end of the 19th century. This need led to the publication of the *Imagines Inscriptionum Graecorum Antiquissimarum* (Roehl 1893, 1907³), containing depictions of representative inscriptions from all over Greece and Asia Minor. Most of these depictions are not photographs but drawings, some of them not very accurate. The relatively small number of inscriptions corresponding to each of the thirty-six geographical units covered by this work meant that Roehl's collection, while de facto of limited usefulness, did meet the need for visual reference material from different parts of the Greek world.

By the beginning of the 20th century A. Wilhelm was voicing the need for a more complete compilation to replace Roehl's collection. According to the grand plan announced at an international archaeology convention in 1905, the new collection would be palaeographically oriented, comprising illustrations of Greek inscriptions with an important bearing on the evolution of lettering (Wilhelm 1905). Wilhelm's scheme proved far too ambitious to come to fruition, however, and later attempts focused on gathering material from limited geographical regions (see e.g. Blagg 1976; Meimaris 1992) or specific time periods (see e.g. Gray 1948; Jeffery 1990). It should be noted, though, that as the two most important cities in the ancient world Athens and Rome enjoyed pride of place in archaeological research, with the result that scholars working in those

areas had access to a wealth of photographic anthologies and lavishly illustrated studies that allowed them follow changes in lettering through illustrations of inscriptions (Graindor 1924; Kirchner 1935; Gordon 1958-1966; Tracy 1990). The need for inscriptions to be accompanied by photographs rather than a transcription (in addition to the lemma, *apparatus criticus* and commentary) has been recognized by the editors of epigraphic corpora, as evidenced by the pages of photographic plates accompanying the volumes of the *IG*, the *IK* and other series. In recent years digital technology has made the location of epigraphic sources much easier. In the newer databases of epigraphic material (Europeana Eagle Project, Epigraphic Database Heidelberg, etc.) every effort is made to ensure that all inscriptions are accompanied by photographs.

While collections of photographs of inscriptions are certainly useful for the study of the overall style of lettering, tables illustrating the evolution of individual letters make it easier to follow the way in which the shape of each letter changed from place to place and from period to period. Such tables of individual letters were inserted into a host of handbooks of epigraphy (for the evolution of the Attic alphabet, see e.g. Larfeld 1898; for the epichoric alphabets of the Greek world, see Jeffery 1990; Guarducci 1987). Given the quantity of studies focusing on individual letters (see e.g. Gordon 1921; Duncan 1961; Pritchett 1963; Gorissen 1978) and the fact that the presence of a single characteristic letter can lead to conclusions about the date of the whole inscription (for the controversial subject of, for example, determining precisely when the three-barred sigma ceased to be used in Attic inscriptions and the four-stroke sigma was adopted, see recently Bolmarcich 2014), the tabulation of the evolution of individual letters is a useful aid in epigraphic work (for cautious remarks on the matter, see McLean 2002, 43).

With regard to the epigraphy of Ancient Macedonia, the collection of securely dated inscriptions from the region has been an object with scholars since at least the 1950s. Marcus Tod, the most important authority on the dating systems of Ancient Macedonia, sought to gather photographs of all the inscriptions that could be dated by any criterion other than letter shape (Tod 1953). Six decades after the publication of his final work on Macedonian dating, his object has still not been achieved, for the following reasons:

a) Although since 1972 a considerable number of compilations of Macedonian inscriptions have been published, much of the epigraphic material remains scattered in old and hard to find editions without photographs.

b) The photographic documentation of many of the existing collections is either incomplete or of poor quality.

The Macedonian scholar who most perfectly understood the advantages that could come from harnessing the new technologies to the service of epigraphy was most certainly Ioannis Touratsoglou. His efforts to assemble photographs and offprints of dated inscriptions began in collaboration with epigrapher J. M. R. Cormack in 1974. His initial object was to create a photo album of dated inscriptions of Macedonia, to be called the *Corpus Imaginum Inscriptionum Graecarum Macedoniae* (Touratsoglou 1979). Later, judging the albums to be inadequate as tools for the study of lettering, he sought to create a database that would include all the inscriptions of Roman Macedonia, with tables illustrating the evolution of individual letters and informative notes on each inscription (Touratsoglou – Bellas 1996). Unfortunately for scholars in the field, neither project was completed. For his decision to turn over his rich photographic archive to our programme's academic consultant, Prof. P. Nigdelis, we take this renewed opportunity to express our warmest thanks to Dr Touratsoglou.

It should be clear from the foregoing that the requirements for an epigraphical study that follows developments in lettering are: 1) study of the phenomenon of writing within clearly defined geographical boundaries; 2) diachronic examination of the phenomenon; 3) use of photographs, not transcriptions; 4) construction of tables charting the evolution of individual letters; 5) use of new technologies in epigraphy. With these as its guidelines, our programme aims at facilitating the study of lettering throughout the entire territory of Ancient Macedonia, making use of all the available dated inscriptions.

3. DESCRIPTION OF THE PRIMARY MATERIAL

The study on the development of Greek script in Ancient Macedonia is based exclusively on epigraphic material that can be dated by means of its textual content and not on the basis of letter shape. The primary material is inscriptions written on stone that either bear chronological indicators in older dating systems that can be converted into the Common Era system or contain internal elements that make safe dating feasible. More specifically, the primary material includes:

Absolutely dated inscriptions based on:

- a) Double dating (most commonly Actian and Macedonian era)
- b) Actian dating (Augustan regnal year)
- c) Anonymous dating accompanied by some other indication of date

- d) Some other, less widespread, dating system (Antonine regnal year, colonial era)
- e) Mention of some living ruler or member of the corresponding dynastic house
- f) Mention of a provincial governor or other official whose identity is known

Inscriptions permitting two possible datings and dated by:

- a) Anonymous dating
- b) Mention of a ruler or official whose identity is debated.

Inscriptions dated:

- a) By prosopographical criteria
- b) With the help of internal evidence permitting their inclusion in specific historical time-frames or connecting them with specific historical events.

4. DESCRIPTION OF THE EDTHESS DATABASE AND WEBSITE

4.1. Cultural Informatics

Information Technology (IT) has inaugurated a digital era in the field of Cultural Heritage. The Digital Cultural Heritage is characterized by digital resources of enduring value that should be kept for future generations. The continuity of the cultural heritage is an issue of concern for the communities and mainly for the academic research community. A new culture of sharing and open access to scientific knowledge has begun to establish through the science of Cultural Informatics. New information technologies are used in the fields of documentation, archiving, preservation, dissemination, digitalization and communication of cultural knowledge. They can also support the curation of the digital cultural heritage and its web presence, cultural data semantics, interoperability, functionality and sustainability. Thus, the digital cultural heritage infrastructure provides several benefits to the community. For communities like academicians, learners and scholars it provides accessible digital material, workflow support and study. Cultural Informatics has been applied to scientific areas like history and archaeology. Information related to the archaeological remains, like the inscriptions, is digitally and web available, accompanied with high-quality images, analysis of the written texts and data that permit a contextual viewing, analysis and interpretation of the past. As the inscriptions transmit direct “messages” from the ancient world, their digital distribution bridges the past to the present. EDTHESS (Epigraphic Database - Thessaloniki) is a project that focuses on the specific area of inscriptions in Ancient Macedonia and aims to create a user-friendly database on the web supporting the study of them.

4.2 EDTHESS Information Technology

Main purpose of the research project was the development of an information system (IT) for the presentation and management of epigraphic findings in ancient Macedonia. The information system consists of a web database that contains several dated inscriptions of ancient Macedonia. The logic behind the (IT) retrieving processes is to make the epigraphic records accessible to the users via simple searching or via filtering out entities with complex queries for more accurate results. The IT EDTHESS is hosted under <http://edthess.topo.auth.gr/> domain and was separately developed in three main sections:

- *Section 1:* Website of the project (Figure 1 in Table 2).
- *Section 2:* Table of the retrieval process and documentation page of the inscriptions (Fig. 2 & 3).
- *Section 3:* Database user-interface (management environment, for data entry and editing) for the epigraphic records.

The first section present and describe the project. The information is related to the research context, the methodology of the recordings, the bibliography that has been used and the contributors of the project. The website is available in Greek and English.

The second section displays the epigraphic data table with searching and documentation options. The epigraphic data table offers to the users turning on and off viewing options, advanced search for inscriptions and single tab display for each record. The viewing options trigger data lists that accompany the inscriptions and all of them form the maximum research criteria. While data lists are handled by viewing options, the complexity of the form of the epigraphic table is increased or decreased. The search function is based on active categories and can support complex queries (e.g. filter time period, place of origin, type of dating, and total search of unique letters). The search is performed either cumulatively or subtly. The results are gradually formed according to the research criteria while the researcher develops a pattern and ends up with unique conclusions. A typical example is the *Inscriptions' Letter Evolution* that features the letters' evolution in time (Figure 4). Once this view option is activated the table represents the individual letters for each inscription and the researcher with the methodology mentioned above, could search for inscription letters with unique criteria. The results of the research can be extracted into excel and pdf files, an option that permits overall control and coordination of the research process. Within the table view of the epigraphic

records there is the availability to view each individual inscription on separate page with detailed information. Inscription dating, list of isolated letters, ancient text and images of the inscriptions are some of the related documentation contents (Figure 5).

The third section of EDTHESS concerns the management ability of the epigraphical records with add, edit and remove functions. After a secure connection to the web database, one is able to manage the inscription records through a custom made front-end environment. The user interface (UI) supports access to all the information of each epigraphical record and editing and also the ability to add new information level for specific documentation fields. A typical example is the relational tables that contain special letters and characters for each inscription. Authorized users have the ability to add new letters and special characters, which are automatically presented as additional database fields for all the inscriptions.

The EDTHESS has been fully developed with source code and it's not based on a ready-made platform. Web site development has been implemented in Microsoft Visual Studio software in ASP.NET Framework and database development in Microsoft SQL Server software.

4.3. EDTHESS Development Approach

The information system EDTHESS was developed under the modern MVC (Model View Controller) solution that the Visual Studio provides. The MVC is a recent dynamic web design approach that replaces the methodology of older Web-Forms. This solution was chosen because of its ensured reliable operation and long-term sustainability. For this purpose, a set of technologies were embedded within the ASP.NET Framework. The source code was mainly deployed in C# language. C# is responsible for *front to back end* communication (user interface UI to database) while it ensures normal operation and hosting properties on the server. Special functions have been developed for CRUD capabilities (create, read, update, delete) related to the management features that are mentioned above, as well as all the necessary functions for managing relational tables within the database.

The documentation of the epigraphical records and the search table were developed by a setting up DOM (Document Object Model) element that "serves" all the required data to JavaScript through AJAX requests to the server. Relational data are being delivered at the webpage DOM element through LINQ queries. The search logic within the table was deployed with JavaScript and jQuery. Open source libraries were used for the source code development. JavaScript library, LINQ library for database queries, Datatable.net open source JavaScript API for epigraphical records table (data pagination, style properties, export capability) and bootstrap open source library for webpage custom layout. The static webpages were developed with C# and CSHTML and the layout was customized with CSS.

The implementations of MVC based web applications, is growing rapidly in the web technology and it is gradually supported by additional modules, APIs, SDKs, security libraries and other capabilities. A sustainable IT system is crucial. In the case of EDTHESS, the information system is a digital tool for inscriptions' researchers and greatly improves efficient conduction of research.

4.4 EDTHESS Database Synopsis

The database of EDTHESS information system was developed in Microsoft SQL Server. It was entirely designed as a solution to the needs and digitization requirements of the inscriptions in Ancient Macedonia. The main system ontology was designed in the form of UML Diagrams and the IT architecture was developed using SQL Server tables. Some virtual usability scenarios were designed to complete the structure of the database. During the design process of the database, all the tables' needs and correlations were revealed (Figure 6). The special letters' collections and inscriptions' isolated pictures for the letters stand as typical examples. In these cases, all the necessary correlations have been identified (one to many, many to many etc.) and the operational scenario has been modeled. The next step was the development of a fully functional interactive scenario (user interface integration and communication with the database). From the evaluation process, special behaviors emerged to the database and UI logic. Lastly, the system entered a beta testing period and it was gradually formed in its final version.

Table 1: EDTHESS Information System Development with Programming Languages and features

Microsoft Visual Studio - Deploy under ASP.NET Programming Languages	
Web pages development	Developed with MVC under C#, CSHTML and JavaScript
Web pages pagination styles	Developed with CSS
Web page theme and responsive styles	Developed with Bootstrap open source library
Table pagination and list entities	Developed with Databables.net open source JavaScript API under MIT license.
Search engine logic development	Developed with JavaScript and jQuery modules
Data tables served at web page	Accessed at server with AJAX requests
Relational data queries	Developed with LINQ
CRUD (create, read, update, delete) operations at related data - front end with back end connection	Developed with C#
Microsoft SQL SERVER	
Database development with relational tables	Developed with MSSQL

Table 2: EDTHESS Information System Image Gallery and Database Diagram

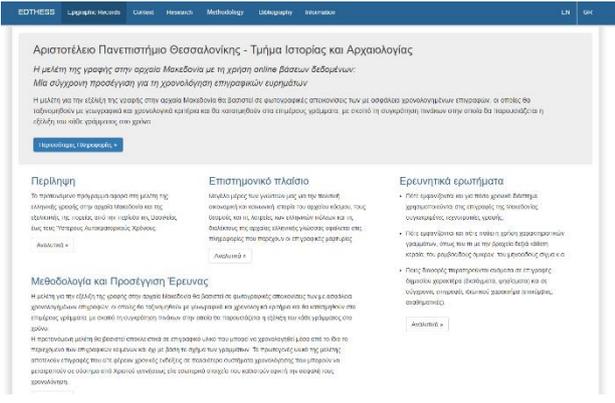


Figure 1: EDTHESS Main Page UI.
<http://edthess.topo.auth.gr/>

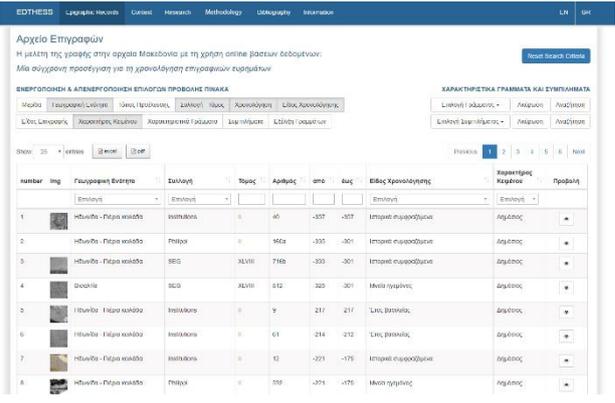


Figure 2: Epigraphic Data Table UI.
<http://edthess.topo.auth.gr/el-gr/CustomSearch/Epigrafes>

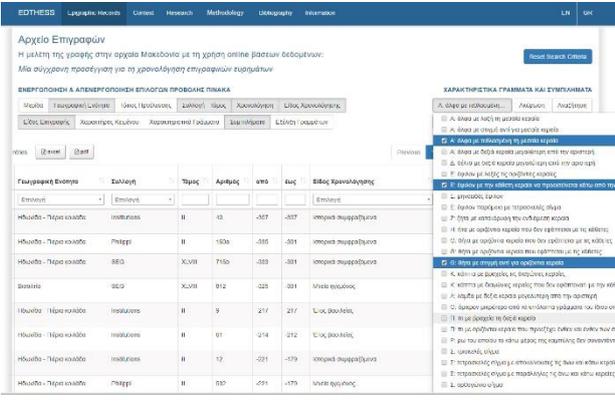


Figure 3: Epigraphic Data Table Search Logic.
<http://edthess.topo.auth.gr/el-gr/CustomSearch/Epigrafes>

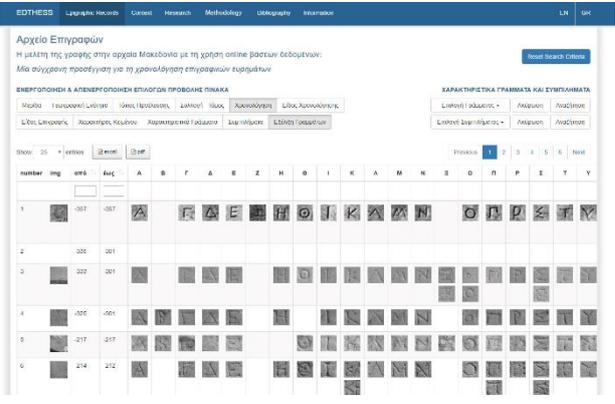


Figure 4: Epigraphic Data Table Letter Mapping.
<http://edthess.topo.auth.gr/el-gr/CustomSearch/Epigrafes>

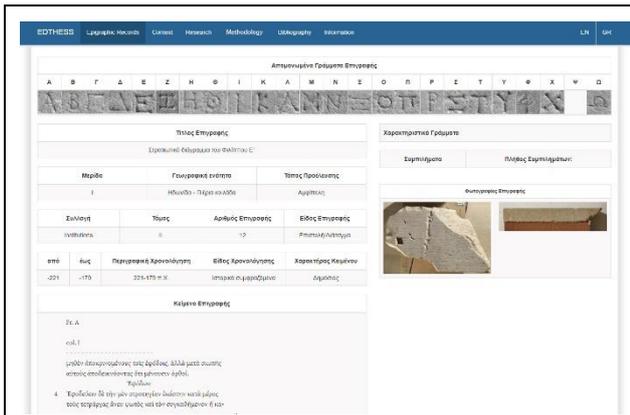


Figure 5: Epigraphic Record Unique Page UI.

<http://edthess.topo.auth.gr/el/EpigrafesData/Details/147>

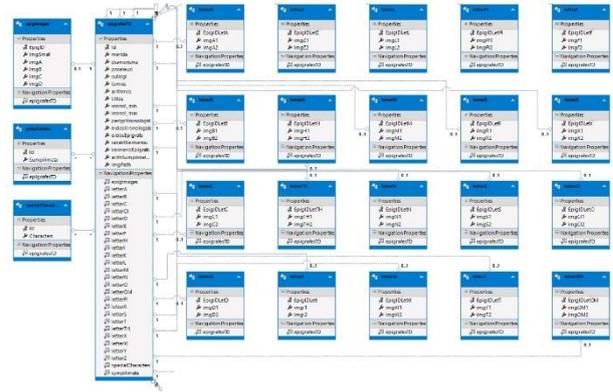


Figure 6: EDTHESS Database Schema.

5. OVERVIEW OF THE EVOLUTION OF GREEK SCRIPT IN THE “FIRST MACEDONIAN DISTRICT”

The securely datable inscriptions from the area between the rivers Strymon and Nestos, which since the middle of the 2nd century BCE was known as the “First Macedonian district”, constitute roughly 20% of the material integrated into the database. Most of the inscriptions were found in Amphipolis, the capital of the district, but all major cities of the area are also represented in the study.

The first known inscriptions from this region predate the Macedonian conquest and belong to the 6th century BCE, a period when settlers from the neighboring island of Thasos were attempting to extend their presence in the mines of Mount Pangaion and to establish permanent colonies, despite strong opposition from local Thracian tribes. The most famous of these inscriptions is an epigram honouring a certain “Tokes” who lost his life in young age fighting for his beloved Eion, a fortified harbour town in the estuary of the river Strymon (see inscription No.1 in the table below). Although the text does not provide any information about the historical context within which the battle was fought, it is reasonable to assume that the epigram testifies to the war between Greek colonists from Thasos and/or Paros and the local Thracian tribe of the Edonians (Isaak 1986, 6-8). The script used in the inscription is the easily identifiable archaic alphabet of Paros/Thasos, whose main characteristics was the use of a broken form of O open from below to indicate the short vowel *ö*, and the used of a closed O to indicate the long vowel *ö* and the diphthong *ou* (Jeffery 1963, 294).

All inscriptions dating after the conquest of the region by King Philip II were written in the standard Ionian alphabet which is still in use today. Soon after the fall of the city in 357, the people of Amphipolis issued a decree (No.2 in the table below) condemning political opponents of Philip II to perpetual exile, one of whom is commemorated by contemporary literary evidence. Even though the form of the letters is not different as compared to what was commonly being used in Macedonia in the fourth century BCE, the text is arranged in a way that very rarely occurs in Northern Greece. The letters are aligned both vertically and horizontally in a style known as *stoichedon*, which was dominant in official texts from Classical Athens and it is not surprising that the same style was employed for official documents in Amphipolis, a city which was originally an Athenian colony.

Throughout the fourth and third century an instantly recognizable style was used in inscriptions of both official and private nature. Letter forms like the omicron smaller than the other letters of the same line, the pi with a short right stroke, the sigma with slanting outer strokes and the small omega wide open from bellow appear without significant variation in all sorts of inscribed monuments during this period (see No.3 in the table below). Signs of evolution can be observed in specific letters, such as the alpha with a broken middle hasta, which appears for the first time towards the end of the third century BCE, and the sigma with parallel outer stokes, which appears a little earlier. With the help of the EDTHESS database it was possible to single out a tendency that was characteristic of the end of the third century and the first half of the second century BCE. During the reigns of the last two Kings of Macedon, the parallel outer strokes of specific letters such as

epsilon, mi and sigma exhibit a noticeable curvature which is not attested in other periods (No. 4). Private inscriptions of this period do not show great signs of experimentation, but it should be noted that the lunate sigma, a letter form that became very common in the Imperial Age, appears unexpectedly early in some of the deed of sales from Amphipolis dated in the fourth and third century BCE.

Toward the end of the 2nd century BCE and throughout the 1st century BCE the letters are squared off and the engraving is usually deep (No.5). From the material collected for the database it was possible to establish that this style continued to be implemented in the beginning of the first century CE, a period when epigraphic evidence becomes increasingly scarce. Available evidence from the first century CE suggest that plain letter forms with small if any serifs were often preferred (No.6). The only noticeable advancement concerns the letter epsilon, which in sometimes is designed with five bare instead of four (see e.g. No 7). Once again, private inscriptions tend to imitate the style of public documents, even in cases when the stone-cutter was rather unskilled or amateur.

From the end of the 1st century to the middle of the 3rd century CE Macedonian cities witness a proliferation of the type of letters and overall style of lettering employed in inscribed monuments. Inscriptions with preference to circular letter forms, such as the lunate epsilon and sigma (No.8) co-existed alongside with inscriptions using letter forms with acute angles, such as the linear omega (No.9) or the rhomboid omicron (No.10). Another significant development is the noticeable influence of cursive handwritten script over inscription on carved on stone (No.11). Besides the multitude of styles and letter forms, a noteworthy new element is the increasingly wide-spread use of ligatures, a sufficient method for saving space and reducing workload by combining two or more letters together.

Table 3: Characteristic letters from selected inscriptions mentioned above

No.	Inscription's info	Alpha	Epsilon	Omikron	Pi	Sigma	Omega
1	SEG XXVIII 249 Amphipolis 520-490 BCE						
2	Institutions II 40 Amphipolis 357 BCE						
3	SEG XLVIII 716b Amphipolis after 332 BCE						
4	Institutions II 29 Amphipolis 179-171 BCE						
5	SEG LI 786 Amphipolis 105/4 BCE						
6	SEG LIV 617 Serres 1 st half of 1 st c. CE						
7	Philippi II 555 Ano Metalla 106 CE						
8	Bas-Strymon 60 Serres 122/3 CE						
9	SEG XLVII 875 Nea Kerdyllia 201-209 CE						
10	IGBulg V 5901 Sandanski 218/9 CE						

11	IGBulg IV 2266 Sandanski 237/8 CE						
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6. EPILOGUE

While the study of lettering in ancient Macedonia is of immediate importance for epigraphers and archaeologists working in the region, the great historical value of the material that has been assembled in the data-base is also of interest to those in many other fields. The collection of all the safely dated inscriptions from Macedonia and their classification by evolution and geographical distribution makes it easier to utilise the information they contain: this facilitates the study of political and social phenomena and the composition of the populations of Macedonian cities, as well as the tracking of local particularities of language and nomenclature. If this material is to be used for the further study of Ancient Macedonia it must be freely available. For this reason we propose the creation of a website that by the end of 2019 will allow free access to anyone who is interested in the evolution of the lettering of inscriptions in Ancient Macedonia, so that it may serve as a basic tool for the archaeologist, the epigrapher, the historian, the philologist, the linguist, the teacher, and anyone else who is interested in using the information furnished by the dated inscriptions of Macedonia.

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