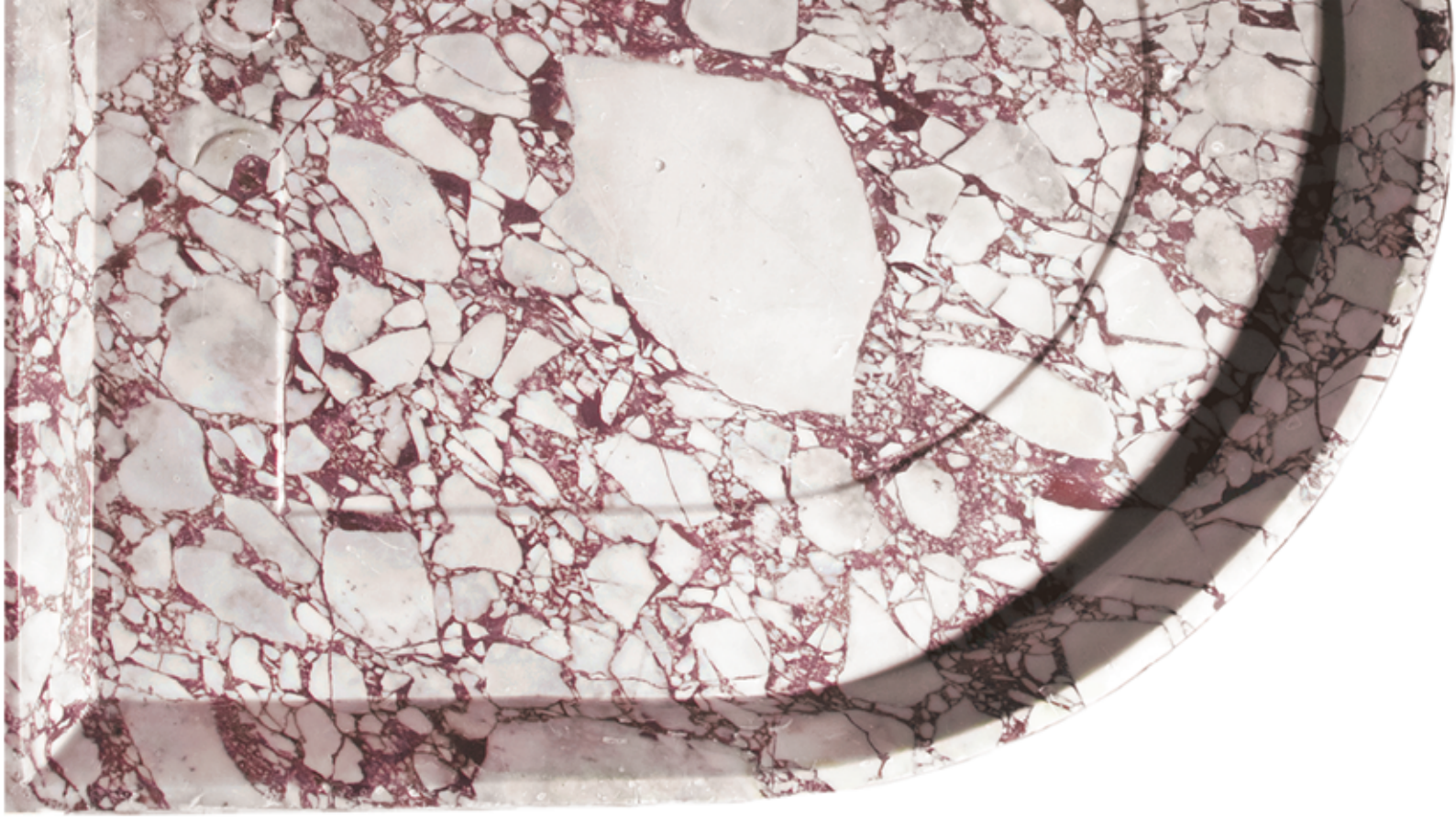
A Database and GIS Project about Quarrying, Circulation and Use of Stone During the Roman Age in Regio X - Venetia et Histria. The Case Study of the Euganean Trachyte

Previato, Caterine; Zara, Arturo



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CONTENT

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A DATABASE AND GIS PROJECT ABOUT THE QUARRYING, CIRCULATION AND USE OF STONE DURING THE ROMAN AGE IN *REGIO X - VENETIA ET HISTRIA*. THE CASE STUDY OF EUGANEAN TRACHYTE

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Abstract

This paper is about a database and GIS project concerning the study of the quarrying, circulation and use of stones extracted in *Regio X* (*Venetia et Histria*) during the Roman age. The project aims at taking a census of the ancient quarries of this area, and at registering and comparing artefacts, structures and infrastructures made of stones extracted in this region. To attain this goal, a specific database has been developed: it links extraction basins and related quarries, artefacts and structural elements, as well as samples taken from archaeological finds and from quarries. Thanks to the integration of the database with GIS mapping software, interesting reconstructions of commercial fluxes of stones extracted in *Regio X* have been done, useful for a better understanding of the economic relationships between ancient cities and the surrounding territories.
In the past few years, this tool has been used to collect published and unpublished archaeological and archaeometric data about Euganean trachyte, one of the most significant stones quarried in *Regio X*. The database has proven useful and has contributed to the obtaining of an integrated study of the chronology of the samples, the quarries of provenance and the cities of final destination and to reflections about the commercial dynamics of Euganean trachyte in Roman Northern Italy.

Keywords
ancient quarrying and use of stone, GIS, database

1. The research project

Since 2009, the University of Padua has been developing a multi-disciplinary research project concerning the quarrying, the circulation and the use of stones extracted during the Roman age in *Regio X* (*Venetia et Histria*), providing for the use of a database linked with a GIS.

In this region indeed, which nowadays includes the North-East of Italy, part of Slovenia and Croatia, there are numerous extraction basins where stones of great quality (limestones and volcanic stones) have been quarried up to the present day.

The main areas that were exploited in ancient times are the Istrian peninsula, the Karst, the Cansiglio Valley, the Euganean Hills, the Berici Hills and the Lessini Mountains. In these basins, lots of quarries dating back to the Roman age have been identified (Fig. 1).

The stones from these sites were widely disseminated in Northern Italy in the Roman age, thanks to their quality and to the presence of a ramified road system and navigable rivers[1].

The research, which employs a multi-disciplinary approach, aims at reconstructing the historical and economical scenarios that revolved around the supply and use of the stones of this area.

On the one hand, the project consists of taking a census of the ancient quarries of *Regio X*, in order to understand which natural resources were exploited in the Roman age, both collecting published data and surveying the region. So far, the survey has taken an interest in the Istrian peninsula, the Karst region, the Berici Hills and the Euganean Hills[2]. In this way, many previously unknown quarries have been identified.

On the other hand, the project aims at studying and registering artefacts, structures and infrastructures made of stones extracted in the region. In particular, the project aims to increase knowledge about the different choices made in construction processes and based on the technical properties of the stones. In fact, in ancient times stone materials were not used at random.

More resistant stones, such as those of volcanic origins, were employed for basements and foundations (irregular or shaped blocks) or for paving roads, as can be clearly seen in the pavement of a *decumanus* in

1 BUONOPANE 1987; LAZZARINI, VAN MOLLE 2015; PREVIATO 2015b.

2 BONETTO, PREVIATO 2013; PREVIATO 2015a, 411-457; PREVIATO, VENTURA [in press]; GERMINARIO *et al.* 2017a.

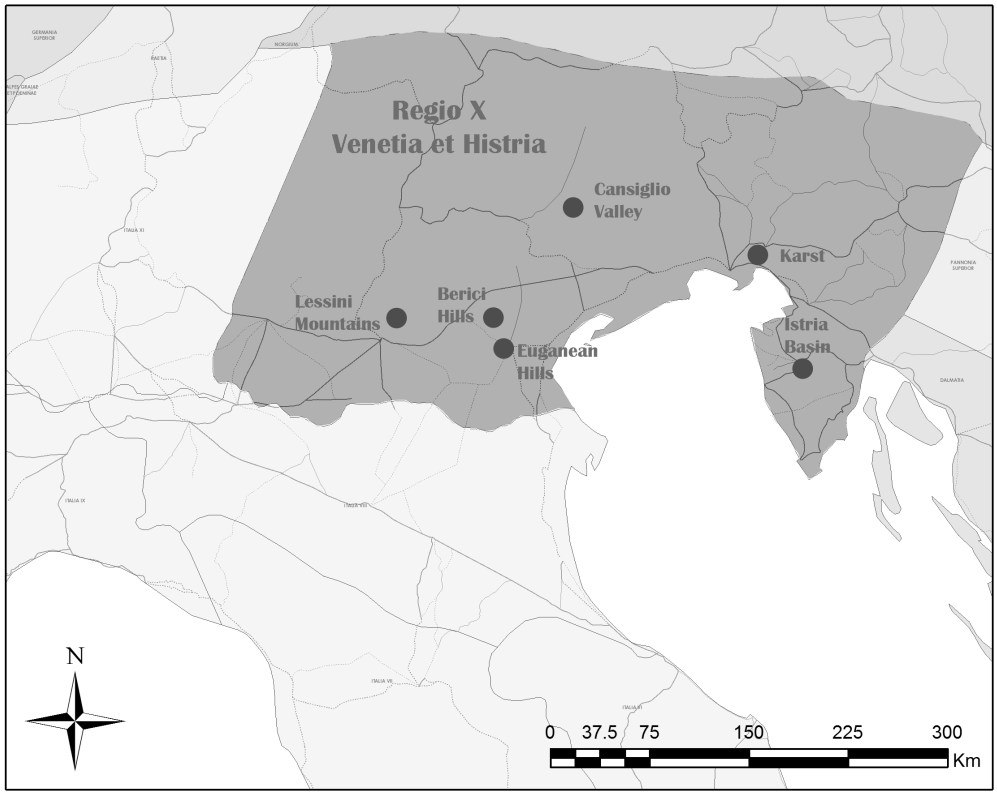

Fig. 1.
Map of *Regio X - Venetia et Histria* with the main extraction basins exploited in the Roman age

Quarto d'Altino/*Altinum* (Venice), in which flagstones were made of Euganean trachyte and some of them, reused several times due to their strength, were marked to help in the right arrangement after maintenance works[3]. On the other hand, the upper part of structures was built taking into account aesthetics too and so architectural elements, such as lintels or capitals, were often carved and richly decorated in soft stones (e.g. limestones of Berici Hills), which were easier to carve than hard stones. Likewise, in infrastructure such as bridges, substructures were built using stones characterized by resistance to water erosion, while superstructures were made with stones of low specific weight (e.g. Aurisina limestone). An example is the Roman bridge on the paleo-Reghena river in Concordia Sagittaria/*Iulia Concordia* (Venice), which has piers and arches in Euganean trachyte, and parapets in Aurisina limestone[4].

Great attention to the choice of stone is also evinced in Roman artefacts of *Regio X*: everyday tools such as rotary querns were produced exclusively in volcanic stone, while sculptures and gravestones were often carved in imported marbles or, since the proto-historic age[5], in sandstones or limestones. The statue base of *T. Annius Luscus* is a case in point: coming from the *forum* of Aquileia (Udine), the base is in Aurisina limestone and the great quality of the inscription is due to the skill of the engraver and also to the softness of the stone[6].

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2. The database schema

To handle this large amount of published and unpublished information, a database has been developed. This paper aims at describing its set up and proving its usefulness.

The database has been created using *Microsoft Office Access*™ software. The name of the database is *Ancient Quarries Database*; its model is relational, with a table-based format, which contains all available data (Figs. 2-3). A section of the database is devoted to the geological and technical aspects of ancient quarrying and use of stone: it can be used to collect data on extraction

3 CRESCI MARRONE, TIRELLI 2002-2003.

4 GALLIAZZO 1995, 218-222, n. 448.

5 A gravestone carved in the so-called Pietra di Nanto (Vicenza limestone), dating back to the 6th century BC, was found in Camin, in the modern suburbs of Padova (PELLEGRINI, PROSDOCIMI 1967, 324-328, Pa 1): this artefact is one of the evidences of the exploitation of the Berici basin since protohistorical age, that continued in Roman times.

6 *AE* 1996, 685 = LETTICH 2003, p. 34, n. 31 = *AE* 2003, 678.

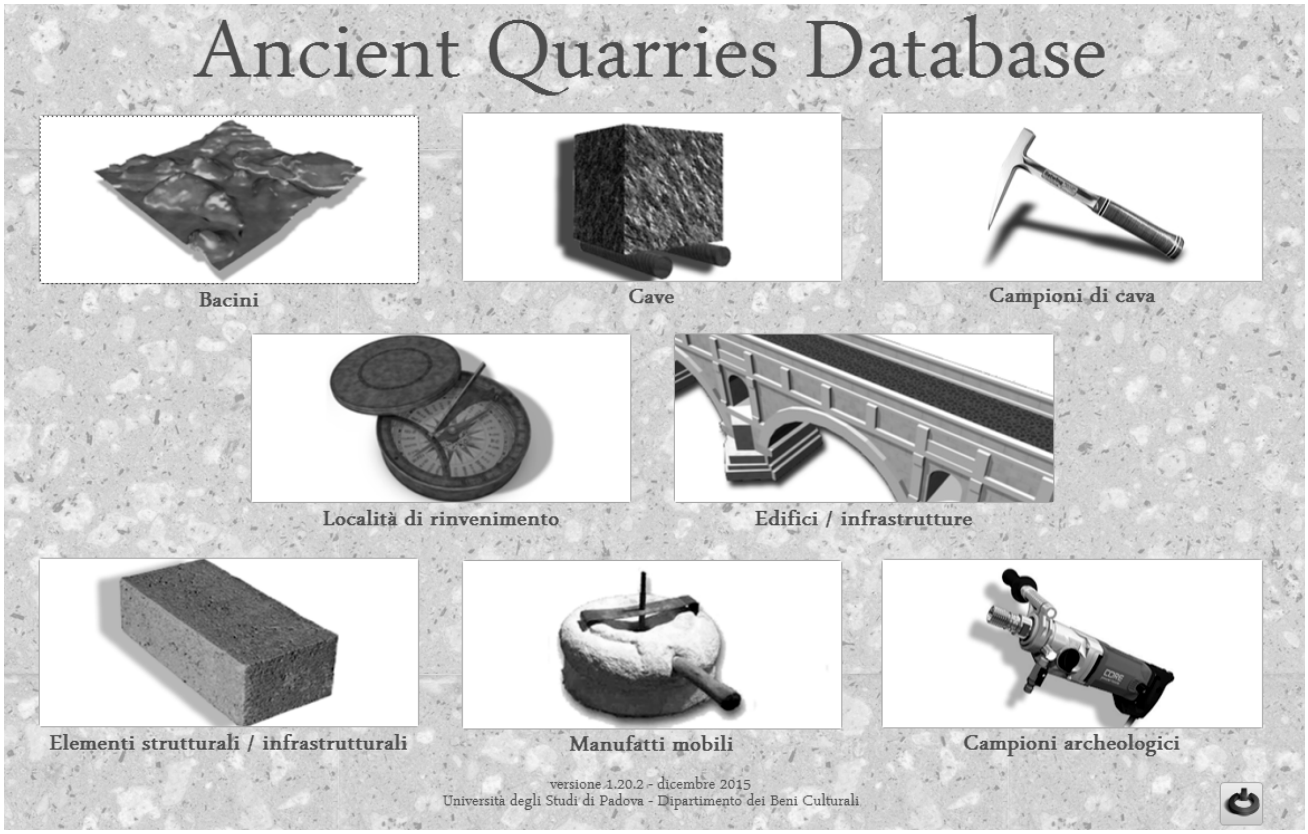

Fig. 2. Homepage of the Ancient Quarries Database showing the buttons that open the main forms. The database was built using the software Microsoft Office Access™

basins, quarries and stone samples. On the other hand, another section is devoted to the description of archaeological stone finds. The relationships between the tables give the possibility to merge geological and archaeological data, and so to make them more useful and functional for users.

There are 9 tables arranged into the following forms. Three forms are devoted to extraction basins and quarries: bacino estrattivo (= extraction basin), cava (= quarry), campione di cava (= quarry sample). Six forms are devoted to archaeological finds: località di rinvenimento (= archaeological site), edificio/infrastruttura (= building/infrastructure), elemento strutturale (= structural element), manufatto mobile (= artefact), campione archeologico (= archaeological sample) and arco cronologico (= chronology).

— Bacino estrattivo (= extraction basin). This form contains information about the name of the extraction basin, the name of the geographical region where the extraction basin is situated, and a geological description of the basin. A button permits the filtering of quarries belonging to the extraction basin under investigation.

— Cava (= quarry). This form is used to collect information about ancient quarries. It is made of 28 fields. In the first part the name of the quarry can be filled in, as well as the name and the geographic coordinates (decimal degrees format) of the site of the quarry, and the name of the extraction basin to which it belongs. Afterwards, there are some fields for the geological description of the stone/stones extracted in the quarry, and another allowing the specification of how it is / they are commonly used, selecting a value from a list of choices. Moreover, there are some fields that contain data about the layout of the quarry, its dimensions and its history; other fields are about tool marks. Furthermore, the user can insert data about roughed-out products, artefacts, archaeological finds, tools or epigraphic data found in the quarry. Moreover, there are some fields to describe the rock waste, the internal logistics as well as structures and buildings connected with the quarrying activity. The last section is about the exploitation chronology, the dating elements related to the quarry and the bibliography about the site. Two sub-forms permit redirection to the stone samples taken in the quarry and to the archaeological samples related to that quarry.

— Campione di cava (= quarry sample). This form collects information about stone samples taken in the quarries. In the first section the user can

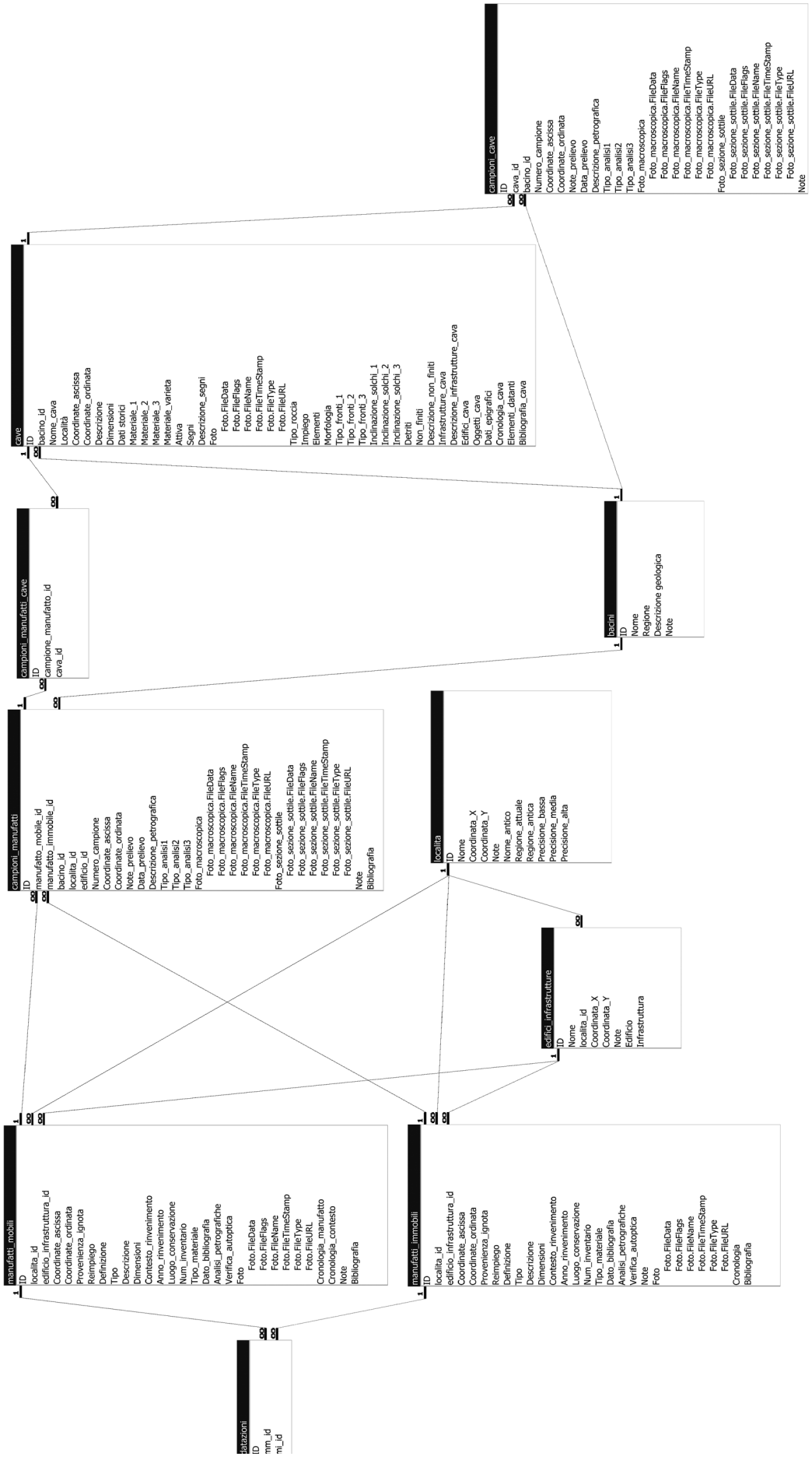

Fig. 3. The structure of the database: table relationships and joins

Fig. 4. Form of the "elemento strutturale" (= structural element). Example of a record inserted in the database. A *decumanus* in Quarto d'Altino/*Altinum* (Venezia) in Euganean trachyte (2nd century AD)

specify the sample identification code, the extraction basin and the quarry from which it has been taken, the sampling point coordinates, notes about sampling and the date. Moreover, a field is given for the petrographic description of the sample, and another one for the kind of archaeometrical analysis undertaken.

— Località di rinvenimento (= archaeological site). This form allows us to collect in the database the information related to the sites in which archaeological finds were discovered. As a first step, latitude and longitude must be indicated, as well as the confidence level of the information (three degrees, according to accuracy of coordinates). Other data, such as the actual or the ancient name of the region, can be inserted by selecting values from lists of choices created using combo-boxes; there is also the possibility to enter a value that is not in the list. Sub-forms show buildings, structural elements and artefacts related to the archaeological site under consideration; a double-click on the listed names will open the related forms.

— Edificio/infrastruttura (= building/infrastructure). In this form you can insert in the database the building or the infrastructure in which structural elements are employed or in which artefacts have been found. A combo-box automatically shows the archaeological site related to the building. The user can add the exact coordinates of the building, while, using checkboxes, he can point out if he is recording a structure (e.g. house/*domus*; theatre) or an infrastructure (e.g. bridge; road). Here again, sub-forms show structural elements and artefacts related to the building/infrastructure and link to the record.

— Elemento strutturale (= structural element). This is a form in which it is possible to insert all information about the structural element under investigation. In the first section the name and the typology of the structural element can be selected from lists of choices, in order to prevent the introduction of ambiguous definitions. The user can insert the exact finding coordinates of the record. Combo-boxes automatically show the archaeological site and

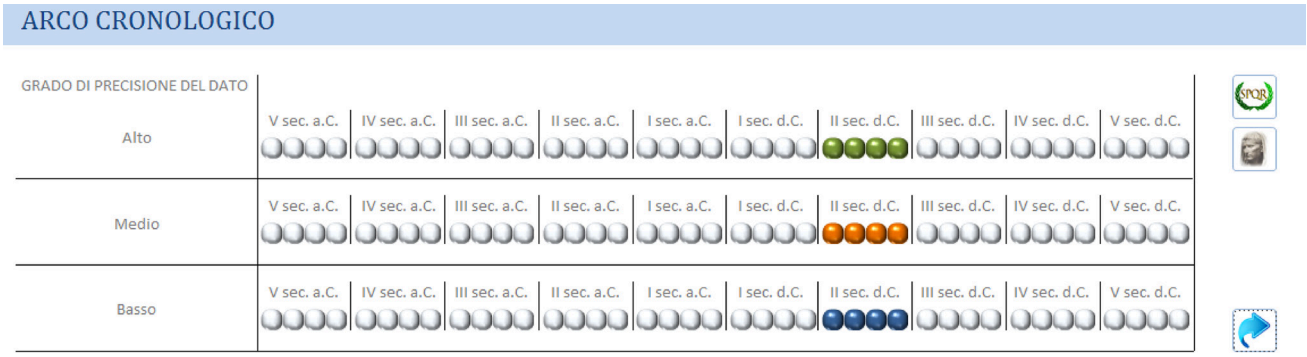

Fig. 5. Form of the "arco cronologico" (= chronology) of the record in figure 5. The different colours show the confidence level of the chronology. Low = blue; medium = orange; high = green. The two buttons on the right permit the user automatically to select the timeframe of the Roman age or of the Augustan age

the building related to the element, while text-box controls allow one to show and edit such data as description, size, finding context, actual location, kind of stone employed, chronology and bibliography. A button opens the related "arco cronologico" form, while a sub-form shows names of samples taken from the structure and redirects to the "campione archeologico" form (Fig. 4).

— Manufatto mobile (= artefact). This form is very similar to "elemento strutturale" form, and it contains the same fields and instruments. It seemed to be necessary to collect data in two different tables of the database, because of the intrinsic difference between stone artefacts and structural elements.

— Campione archeologico (= archaeological sample). This further form has been developed for stone samples taken from archaeological finds. In the first field the user can insert the sample identification code. Moreover, he can specify the archaeological site and the artefact, building or infrastructure from which it has been taken, selecting data from combo-boxes which automatically filter information. Other fields are for the sampling point coordinates, notes about the sampling and the date of sampling. The last section contains a petrographic description of the sample, the name of the extraction basin and of the quarry from which the stone comes and a list of the archaeometrical analyses that have been undertaken.

— Arco cronologico (= chronology). This form, reachable from "elemento strutturale" and "manufatto mobile" forms, allows chronological data to be added for each record. The user can fill out a timeline, in which each century is split in four parts. By using different colours, three progressive degrees of confidence can be indicated, according to the precision in dating. Such a manner of producing a chronological record makes it possible to build queries that permit structural elements or artefacts set in a specific timeframe to be extracted from the database (Fig. 5).

The ID of each record collected in the database appears in the forms. The ID can be used to standardise the names of quarries, artefacts and samples already published with the new ones.

In every form, there are buttons to create and delete records and to redirect the user to the other forms. Almost in every form, it is possible to add a picture of the record as an attachment of the database. For quarries or archaeological samples both macroscopic and microscopic photos can be inserted.

The database has been linked with a Geographical Information System (GIS), which has been used as a tool for the management of the collected data and for spatial analysis (Fig. 6).

The software used for the creation of the GIS is *ESRI® ArcGis*. Firstly, a cartographic base, consisting of geo-referenced maps of Northern Italy has been created.

The projection system that has been used is the UTM (Universal Transverse Mercator), with reference to the World Geodetic System (WGS) 1984. To represent data the point geo-referencing method has been used, for it is considered a useful tool for analysis and synthesis of historical and economical processes. Different symbols are used to distinguish artefacts from structural elements.

Thanks to the connection with the Web Map Server of the Digital Atlas of Roman and Medieval Civilization[7], a map of the Roman Empire can be up-loaded and in this way it is possible to display the Augustan Regio in which the record has been placed.

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7 http://darmc.harvard.edu/icb/icb.do [visited on December 2015].

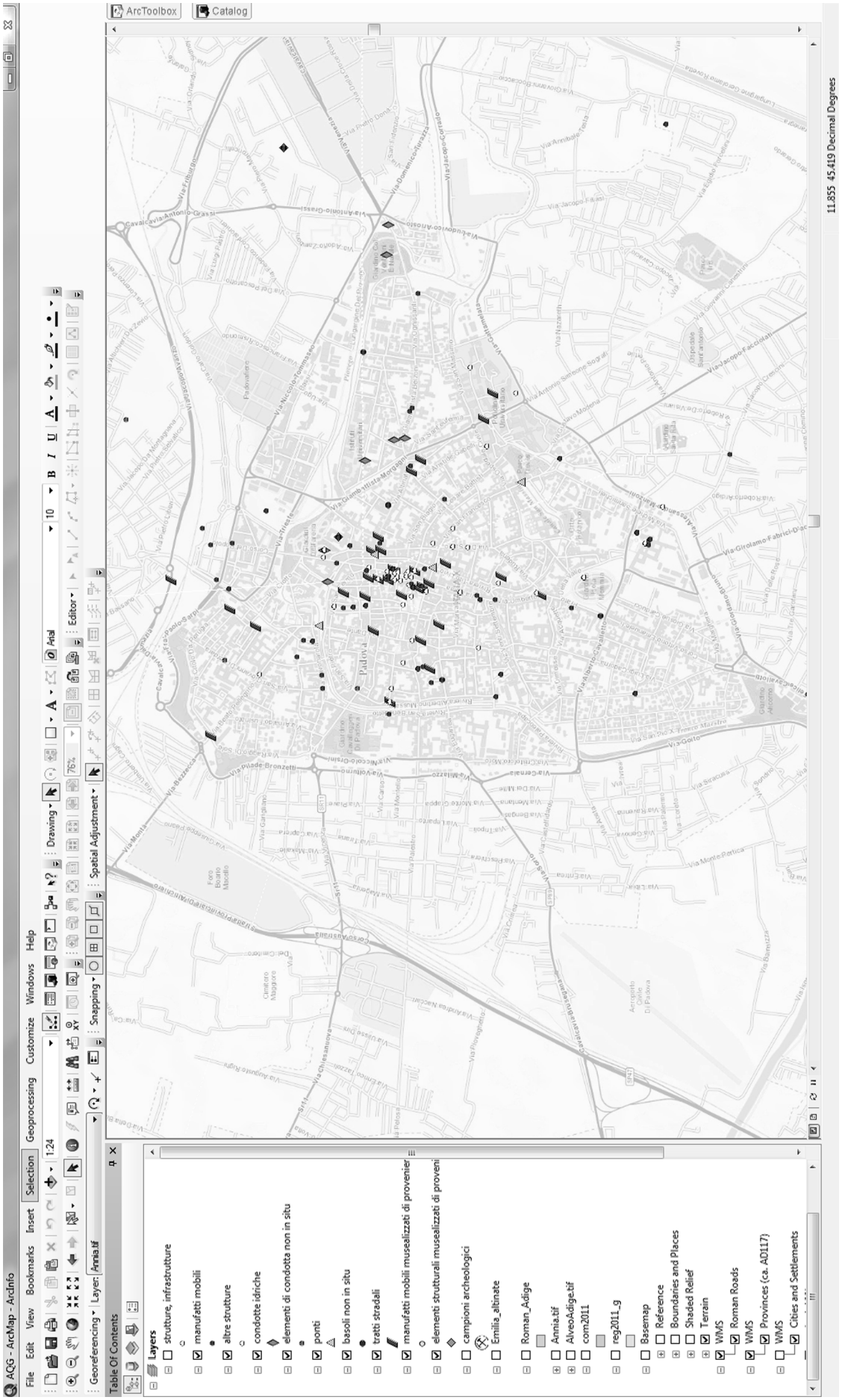

Fig. 6. A screenshot of the Ancient Quarries GIS (ESRI® ArcGIS) with the map of Padova, showing the location of the trachyte findings

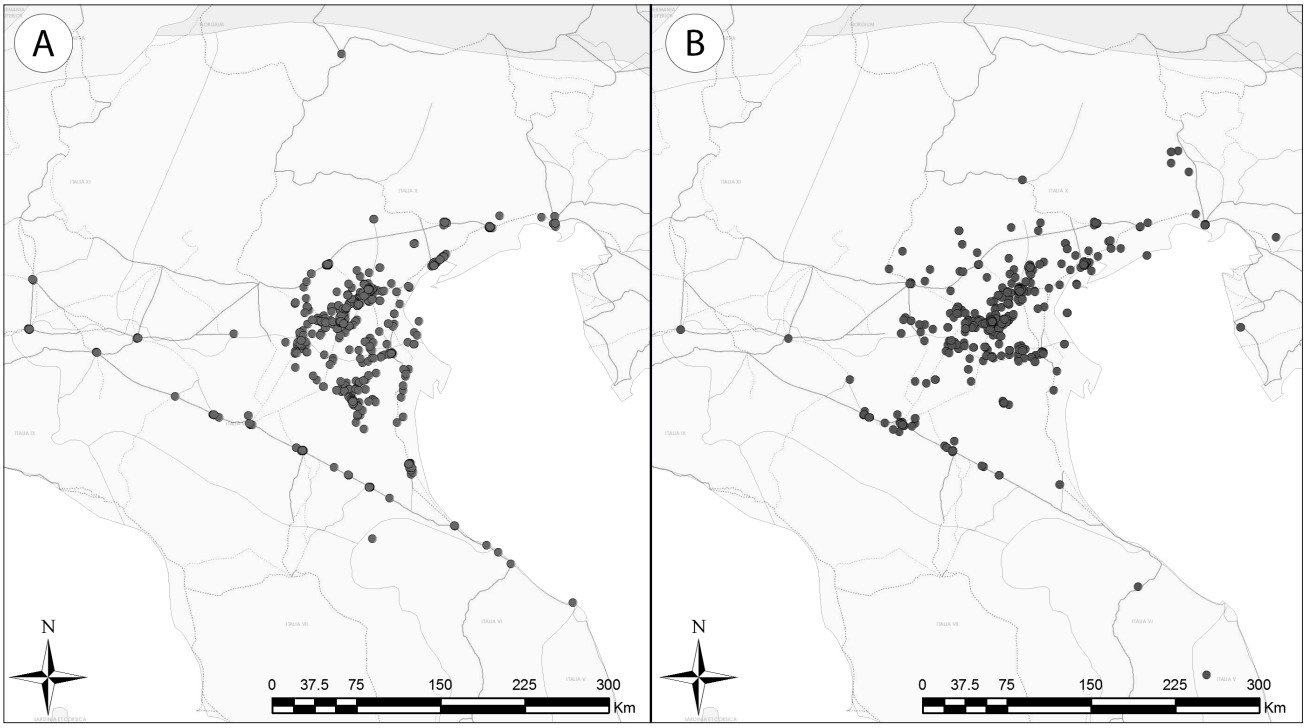

Fig. 7. Roman Northern Italy. Distribution map of structures and infrastructures (A) and artefacts (B) in Euganean trachyte

3. The Euganean trachyte case study

Thanks to the integration of the database with the GIS mapping software, interesting reconstructions of commercial fluxes of stones extracted in *Regio X* have been produced, useful for a better understanding of the economic relationships between ancient cities and surrounding territories. Specific attention has been given to Euganean trachyte[8], a volcanic rock extracted from the Euganean Hills, the most recent volcanic district belonging to the Venetian Volcanic Province, developed between the Eocene and Oligocene epochs[9]. The group of hills rises to heights of 300 to 600 m from the Padan Plain, a few kilometres south-west of Padua, and it is dominated by two rock series: first an Upper Jurassic to Lower Oligocene marine sedimentary sequence, and then a series of volcanic and subvolcanic products from the Late Palaeocene to the Late Oligocene. The most representative rock types of the Euganean District are trachyte and rhyolite, while latite and basalt occur in minor amounts[10].

Euganean trachyte has distinctive mechanical properties and especially a remarkable resistance to both abrasion and surface alteration; moreover, its well-developed columnar jointing structure favoured quarrying activity: thanks to these technical properties, along with an excellent workability, trachyte had a wide geographical spread, from protohistoric ages and even more in Roman times (Fig. 7), throughout *Regio X*, as well as in *Regio VIII* (*Aemilia*), westwards to Milano/*Mediolanum* in *Regio XI* (*Transpadana*) and to Villa del Foro/*Forum Fulvii* in *Regio IX* (*Liguria*), and to the south at least as far as Urbisaglia/*Urbs Salvia*, in *Regio V* (*Picenum*).

In all the major city centres of *Regio X*, as well as in their districts, trachyte was frequently exploited: in Padua and Este, which are very close to the Euganean Hills, the stone was employed roughly shaped for foundations or well-cut for architectural elements, but its main use was for paving roads. In fact, during the Roman age, from Vicenza/*Vicetia* to Adria/*Atria* and from Altino/*Altinum* to Concordia Sagittaria/*Iulia Concordia*, the surfaces of roads were paved mainly using trachytic flagstones, blocks shaped into polyhedrons, flat on the upper surface and narrowed towards bottom to aid housing in the roadbed.

Trachytic flagstones from the Euganean Hills has been identified eastwards to Aquileia[11], but they are employed also in Milan[12] and in all major towns along

8 MARITAN *et al.* 2013; PREVIATO *et al.* 2014; PREVIATO 2015a, 451-457; ZARA 2016; ZARA 2018.

9 So far, attention has been focused also on Aurisina limestone (Trieste Karst). About this research, see the paper of Caterina Previato in these proceedings.

10 PICCOLI *et al.* 1980-1981; ASTOLFI, COLOMBARA 2003, pp. 19-115.

11 PREVIATO *et al.* 2014; PREVIATO 2015a.

12 GREPPI, BUGINI, FOLLI 2014, 117, 122.

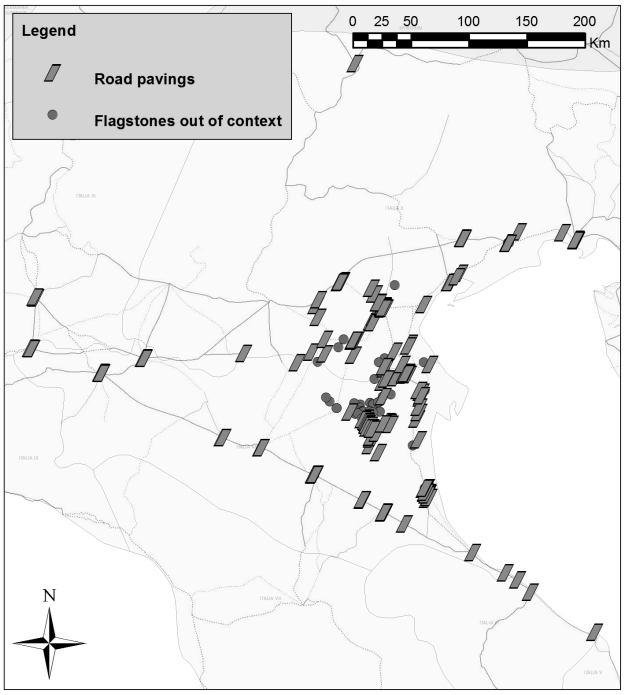

Fig. 8. Roman Northern Italy. Distribution map of road paving and flagstones found out of context in Euganean trachyte

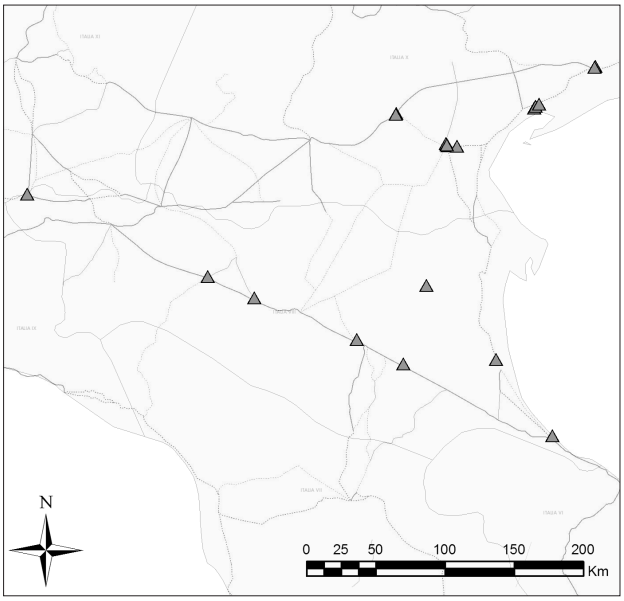

Fig. 9. Roman Northern Italy. Distribution map of bridges in which Euganean trachyte was employed as a building material

via Aemilia[13], from Rimini/*Ariminum* to Piacenza/*Placentia*: in fact, in Imola/*Forum Cornelii*, Bologna/*Bononia*, Modena/*Mutina* or Reggio Emilia/*Regium Lepidi* the network of Roman roads was laid using Euganean trachyte, but we can also find this stone material along the northernmost stretch of the *via Flaminia*[14], in Fano/*Fanum Fortunae*, Pesaro/*Pisaurum* and, to the south, in a pavement of Ancona (Fig. 8).

Euganean trachyte was frequently employed as a building material in bridges too (Fig. 9): while superstructures were often erected using limestone and, in wider terms, stones with low specific weight, trachyte blocks were commonly used in substructures, as piers, arch rings or abutments, due to the resistance to mechanical stress of this volcanic rock. Bridges with parts of the structures in trachyte are, for example, the Bridge of Tiberius in Rimini, the so-called Stone Bridge in Parma, the bridge of Augustus in Ravenna, but also the already mentioned bridge in Concordia Sagittaria and the Roman bridges of Vicenza and Padova.

A well-preserved example of these architectural choices is the San Lorenzo bridge in Padua[15]; this three-arched bridge was built between 40 and 30 BC, crossing the ancient river; since the 1950s, when long tracts of the river were filled and covered by roads, the bridge has been visible only below street level, but, thanks to this condition, its piers and arch rings can be observed closely, as well as its abutments and head walls, all structured in blocks of Euganean trachyte. Rough blocks were certainly transported down the river from the Euganean Hills and finally squared in Padova until the laying, as inferred from the presence of little trachytic aggregates in the concrete of the bridge.

As well as in architecture, Euganean trachyte was employed to carve artefacts, typically for the production of millstones, querns and mortars, but we usually find gravestones and inscriptions too. Trachytic rotary querns are involved in a long-distance trade during all the Roman age: thanks to archaeometric analysis, we know that *metae* and *catilla* of rotary querns in Euganean trachyte reached the Istrian peninsula, where proto-historic grinding tools from the Euganean Hills are identified too[16]; in the same way, Roman rotary querns carved in trachyte have been sampled in the Emilia-Romagna region[17], and, to the south, in Urbisaglia[18], nowadays in the

13 ORTALLI 1984a; ORTALLI 1984b; CAPEDRI, VENTURELLI, GRANDI 2000; CAPEDRI, GRANDI, VENTURELLI 2003.

14 RENZULLI *et al.* 1999; LUNI 2000, 125-140; RENZULLI *et al.* 2002.

15 GALLIAZZO 1995, n. 436, 208-212.

16 ANTONELLI *et al.* 2004; BERNARDINI 2004; BERNARDINI 2005; ANTONELLI, LAZZARINI 2012.

17 CAPEDRI, GRANDI, VENTURELLI 1997, 6, 28; CATTANI, LAZZARINI, FALCONE 1997; CAPEDRI, VENTURELLI 2003, 321-326.

18 SANTI, RENZULLI 2006, pp. 134-135; ANTONELLI, LAZZARINI 2010, 2084.

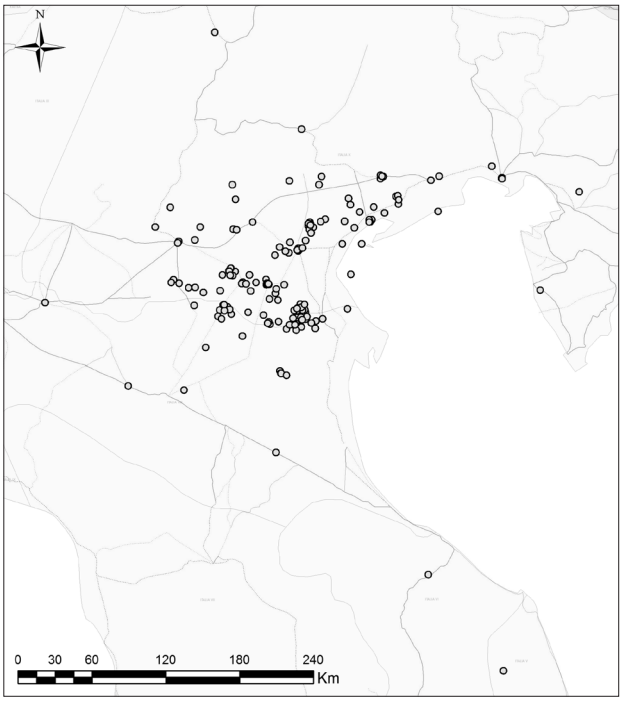

Fig. 10. Roman Northern Italy. Distribution map of millstones, querns and mortars carved in Euganean trachyte

province of Macerata, Marche, so after covering a route of over 300 km from the extraction basin of the Euganean Hills (Fig. 10).

Archaeological and archaeometric data about Roman structures and infrastructures in which the trachyte was exploited as a building material, as well as artefacts carved in this stone have been collected in the *Ancient Quarries Database*. The census makes available more than 2200 trachytic finds - more than 1500 structural elements and about 900 artefacts - dated back to Roman age. Furthermore, we have collected about 300 proto-historic finds, useful for understanding the changes in trachyte exploitation after Romanization. This catalogue includes published data, collected sifting through the papers, but also unpublished records caught by the study of finds stored in museums of the Veneto region, thanks to a planned project in agreement with Soprintendenza Archeologia del Veneto.

According to these findings, in part achieved thanks to the studies of the teams of S. Capedri, F. Antonelli and L. Lazzarini, important implications can be inferred concerning the distribution of trachyte. Indeed, an inter-regional traffic of Euganean trachyte in Roman age is unquestionable, but we can also deduce that ancient consumers were certainly well aware of the different properties that distinguish the varieties of trachyte. In fact, a combined approach, involving petrographic, geochemical and magnetic susceptibility data, allows us to definitely identify the quarry of Euganean trachyte in which architectural elements or artefacts were extracted.

For example, in the late '90s and today, 20 trachytic rotary querns have been sampled, from Croatia to Marche, and 85% of the cases are carved in trachyte from the Monte Rosso quarry, reflecting the fact that this quality of trachyte was preferred for the production of this kind of artefact, probably thanks to a low predisposition to consumption.

In the same way, we know that the stone of Monselice quarry was the most employed Euganean trachyte for paving roads: the trachyte extraction processes in Monselice were certainly supported by the presence of the Adige River, which in Roman times flowed close to the Southern offshoots of the hill[19] and so it guaranteed for the trachyte a fast and simple release onto the commercial network.

Therewithal, an integrated study of the chronology of the trachytic artefacts sampled, their quarries of provenance in the Euganean Hills and the cities of final destination allows us to reflect about some commercial dynamics. There is a case study of gravestones and other funerary artefacts in Euganean trachyte of Modena and Reggio Emilia, analysed by Capedri and Venturelli[20]: according to these researchers, almost all samples are assigned to the Monte Oliveto quarry. Yet we do not think that there was a choice linked to a particular property of this kind of trachyte, but rather that, between the 1st and 2nd century AD, there was a commercial connection between the quarry of Monte Oliveto and the Aemilian area.

Thanks to this analytical method, we can also argue about the cycle of activation, exploitation and exhaustion of the Euganean quarries. For example, a number of milestones were placed by Augustus along the way from *Iulia Concordia* to *Noricum* between July 2 and January 1 BC. These milestones, examined by P. Grossi and A. Zanco[21], were carved in Euganean trachyte both from Monte Alto and Monte Merlo, two quarries that are located in the eastern side of the group of hills, separated by a few kilometres. The simultaneous exploitation of more than a quarry might be a clue that so great was the demand for Euganean trachyte in a brief period of time that a concurrent exploitation of many quarries was necessary. In the same way, six various trachyte quarries from the Euganean Hills can be discriminated in the samples extracted from the flagstones of six roads in Bologna and two sites in Rimini. We know that the paving of Bologna's urban roads seems to be dated back

19 PIOVAN, MOZZI, ZECCHIN 2012.

20 CAPEDRI, GRANDI, VENTURELLI 1997; CAPEDRI, VENTURELLI 2003.

21 GROSSI, ZANCO 2003.

to the Augustan age[22] and an inscription gives testimony that Gaius Caesar repaved all the roads of Rimini in 1 AD[23]; at the same time, in Aquileia, Aratria Galla ordered in her last will to pave in the city a *decumanus*[24], using Euganean trachyte, as archaeometric analysis has shown[25]. In spite of the partial lack of stratigraphic dating in these sites, most of the contexts in which the trachyte was employed are dated between the 1st century BC and the 1st century AD; it follows that, in a short time frame between the end of the Roman republic and the rise of the Empire, the great demand for Euganean trachyte, especially for paving roads, forced the exploitation of a number of quarries to ensure an adequate supply on the market of Northern Italy.

In order properly to consolidate the hypothesis about the quarrying, circulation and use of the Euganean trachyte, in a multidisciplinary approach, it has been necessary to expand the sampling already made by the team of Silvio Capedri, both in Euganean quarries and in archaeological finds. Hence, the University of Padua sampled 39 trachyte quarries, placed in 17 different Euganean hills, aiming at the elaboration of a new discrimination archaeometric system[26]. On the other hand, we have sampled flagstones of the most important Roman roads, paving of *fora* and substructures of bridges in Euganean trachyte preserved in the Veneto region, to reach new information that would lead to an attempt at the reconstruction of production systems, organization of quarries, transport routes and economic trends that revolved around Euganean trachyte in Roman times. This sampling activity involved Roman structures and infrastructure of Vicenza, Padova, Este, Oderzo, Altino and Concordia Sagittaria and followed the analyses about Aquileia's roads and loading ramps in the harbour of the ancient city, but also about trachytic pipes used to build aqueducts of Padua and Este. On the whole, 46 new samples come from flagstones and kerbs, while 14 are extracted from paving of *fora* in Vicenza and Oderzo and finally 6 samples from the bridges.

The results of archaeometric analyses and so the provenance determination of trachyte employed in Roman public works of *Regio X* will be published in the coming months[27] and we hope that they can allow us to complete the knowledge of active quarries during the Roman age in the Euganean Hills; furthermore, if properly combined with the chronological and typological study of the archaeological evidences, the results, thanks to the application of the *Ancient Quarries Database*, will also contribute to give an overall view of the use of Euganean trachyte in Roman Northern Italy.

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22 ORTALLI 1992, 148; ORTALLI 2000, 445.

23 *CIL*, XI, 366; DONATI 1981, n. 15, 72-73; ORTALLI 1992, 148.

24 ZACCARIA 2003, nn. 5, 8, 309-311, 319-320, con bibliografia precedente.

25 PREVIATO *et al.* 2014, pp. 158-161; PREVIATO 2015a, 208-209, 373, 454-456, 626, 628-629, 634 con bibliografia precedente.

26 GERMINARIO 2016; GERMINARIO *et al.* 2017b.

27 ZARA 2016; GERMINARIO *et al.* 2017a; ZARA 2018.

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