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"ARCHAEOLOGIS" A QGIS PLUGIN FOR ARCHAEOLOGICAL SPATIAL ANALYSIS

1. Introduction

ArchaeoloGIS is a QGIS plugin for very basic archaeological spatial analysis. It was inspired by the accurate studies in geography, methodology and digital humanities made by the author during the years of his participation in the ERC project PAThs. The Archaeological Atlas of the Coptic Literature (https://atlas.paths-erc.eu). The first steps were taken from the studies of the road network named MOvEIT (https://paths-erc.eu/moveit/, Bogdani 2023). The coding phase started in the winter of 2021 and the validation on the practical applications presented below were carried out during the spring of the next year. The plugin is GPL-3.0 licensed and can be freely installed from the official repository (https://github.com/archeorosati/archaeoloGIS). It is developed as a QGIS Processing Toolbox script, it is still in beta version and suggestions and questions from the community are welcomed. At present, it consists of a unique script named *Tabula Peutingeriana* after the famous imperial Roman map, able to output points at a regular, fixed distance of a Roman mile along a path or network of paths. It can be used to position virtual milestones along an already provided road network, eventually helping to find the location of original ones, by counting the Roman miles from a given starting point.

It can be used to test whether the reconstruction of the road network corresponds to the distances reported in ancient sources such as the *Tabula Peutingeriana*, *Itinerarium Antonini*, epigraphic sources, travelogues, etc. The plugin is a simplified, non parametric version of the native points along geometry QGIS algorithm. Given a correct road-network, a prerequisite that the plugin can not help to build, it could be used to place archaeological sites found along roads i.e *balnea*, mail services, horse-exchange stations, *termopolia*, *villae* and to find correspondence with place names related to the counting of miles from a major city.

2. Methodology

2.1 *The study of the* Tabula Peutingeriana *in the East Rome hinterland and the metrological issue*

The *Tabula Peutingeriana* is a complex document. The name of the scroll derives from the name of the humanist Konrad Peutinger, who discovered it in the 16th century. It is a 13th century mediaeval copy of an original Roman

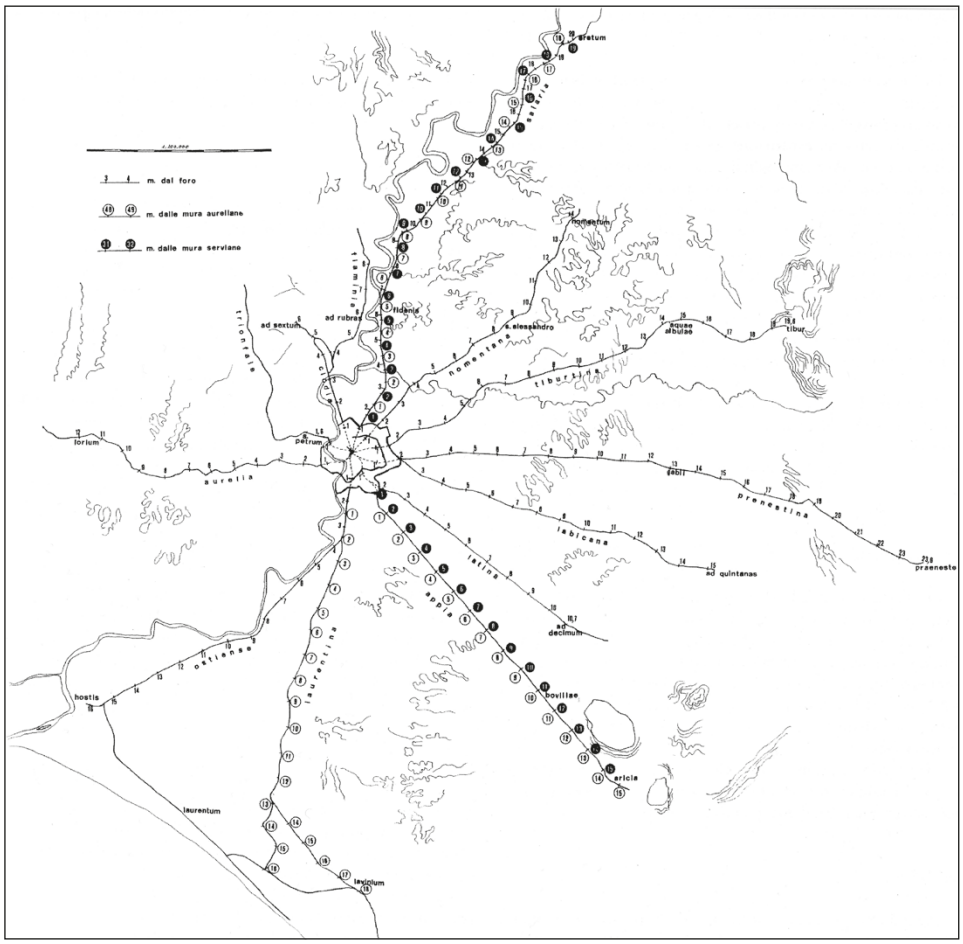

Fig. 1 – The ancient road network around Rome as reported by the *Tabula Peutingeriana* (from Passigli 1999, fig. 1).

map mainly compiled in the 3rd century CE (Diederich 2021, 374-375). The surviving copy of the map was created by in Colmar, Eastern France, in 1265. The *Tabula* is a painted parchment scroll, measuring 0,34 m high and 6,75 m long, divided into eleven sections (Rathmann 2018). The map shows the entire ancient Roman road network from Britain to Mesopotamia, including North Africa and Arabia, connected to the road networks of the other empires of Persia within India. The main bibliographical resources for the study of this exceptional source are Diedrich's agile work (Diederich 2021) and Talbert's fundamental volume (Talbert 2010).

The script being presented here was inspired by an article published by S. Passigli (1999), which reconstructed the road network within a radius of 26 Roman miles from Rome (Fig. 1). The paper applied the extensive metrology studies by G. Radke based on the ancient authors' texts, reconstructing the length of the Roman mile (*milius*) in 1481.5 m (Radke 1981, 64-66), relying uniquely on ancient sources. One of the most useful contributions on Roman metrology is the one published by M.E. Alberti (2000), fixing the length of the Roman *milius* in 1480.0 m. Moreover, field studies conducted between the 35th and 38th miles of the *via Valeria* have allowed many scholars to confirm this by measuring the distance between these milestones in 1480 m (Borsari 1890; Crainz, Giuliani 1985; Mari 2004; Buonocore 2004; Piraino 2004; Mari, Cappelli 2014).

3. Case study

In the next paragraphs, a case study based on the research of the ancient road system in the area around Rome is shown. The research is founded on a comparison between the *Tabula Peutingeriana* (hereafter TB) and the *Itinerarium Antonini* (hereafter IA) along the *via Valeria* from Rome to *Alba Fucens*.

3.1 *The road from Rome to Alba in the* Tabula Peutingeriana

On the *Tabula Peutingeriana*, *Tibur* can be reached from Rome by two different branches: 1) Rome-Nomento (13 *milia*)-*Tiburi* (10 *milia*) and 2) Rome-*ad Aqua Albulas* (16 *milia*). The second branch does not seem to cross the Anio river to Tibur, according to the map. This is because the road network between Rome and *Sublacio* in the TP crosses the *Tibur* by the Nomentana road and not by the *Tiburtina Valeria*, which is the direct and easiest connection. As Fig. 3 shows, the red segment between *Aquae Albulae* and *Tibur* stops near the Aniene river. With the exception of S. Passigli (1999) (Fig. 1), there are no publications of maps with miliaria for this section of the road. After this, the route to the colony of *Carseoli* continues beyond *Tibur: Tibori-Varie* (8 *milia*)-*Lamnas* (5 *milia*)-*Carsulis* (10 *milia*).

The first section of the *via Valeria*, from *Tibori* to *Ad Lamnas*, was largely studied and surveyed by C.F. Giuliani (1964) and published in 1964 in the carta 2 of its *Forma Italiae*. In this publication there is no mileage counting reported. The second section going from *Lamnas* to *Carsulis* was studied by C.F. Giuliani and F. Crainz and was published in 1985 in their tav. 8 (Crainz, Giuliani 1985), where the position of certain milestones found by L. Borsari (1890) was recorded. This study was later confirmed by the excavations of Z. Mari (Mari, Cappelli 2014). The last section of this road is the most debated one. It connects the colony of *Carsulis* with the Marsica territory on a mountain route that climbs over a thousand-meter pass to glide towards the heart of the

Fig. 2 – The *Tabula Peutingeriana* and the "Road to Alba".

Anio valley, at *Sublacium*: *Carseoli-in mons Grani* (7 *milia*)-*in mons Carbonario* (5 *milia*)-*ad Vignas* (5 *milia*)- *Sublacium* (7 *milia*)-Marrubio-Alba (13 *milia*).

There is not a direct connection between *Carseoli* and *Alba Fucens* in the TP, as we might have expected, and we can not tell if this is an error by the mediaeval copyist. The direct route between the city of *Sublacium* and *Marrubium* could exceed 40 *milia*, in a difficult, but not impossible (at least in summer), mountainous area often over 1,200 m above sea level. Sebastiani del Grande (2020) has reconstructed a mountainous route connecting *Carseoli* and Alba, along which there are some shrines and ancient resting places, as confirmed by surveys by the author of this paper (Fig. 5). This hypothesis is shown in Fig. 3, completed with road traces and miles indication. The dataset created for this project has been published as open data and distributed with CC BY-NC-SA 4.0 Licence (https://doi.org/10.5281/zenodo.7827642).

3.2 *The road from Rome to Alba in the* Itinerarium Antonini

The *Itinierarium Antonini* route lists the following places:

[4] *Valeria*

[5] *Ab Urbe Hadriae usque m(ilia).p(assu)m. CXLVIII sic*

309 [1] *Tiburi* m.pm..*XX*

[2] *Carsiolos m. pm. XXII*

[3] *Alba Tucentia* m.pm. *XXV* (Parthey, Pinder 1848, 146-147).

The route reconstructed from the list of places and miles is much more linear and direct than the one represented in the TP. The *via Valeria* starts possibly from the *Milius Aureus*, the *Umbellicus*, placed at the centre of Rome, S of the arch of Septimius Severus. After *Tibur*, it is easy to count

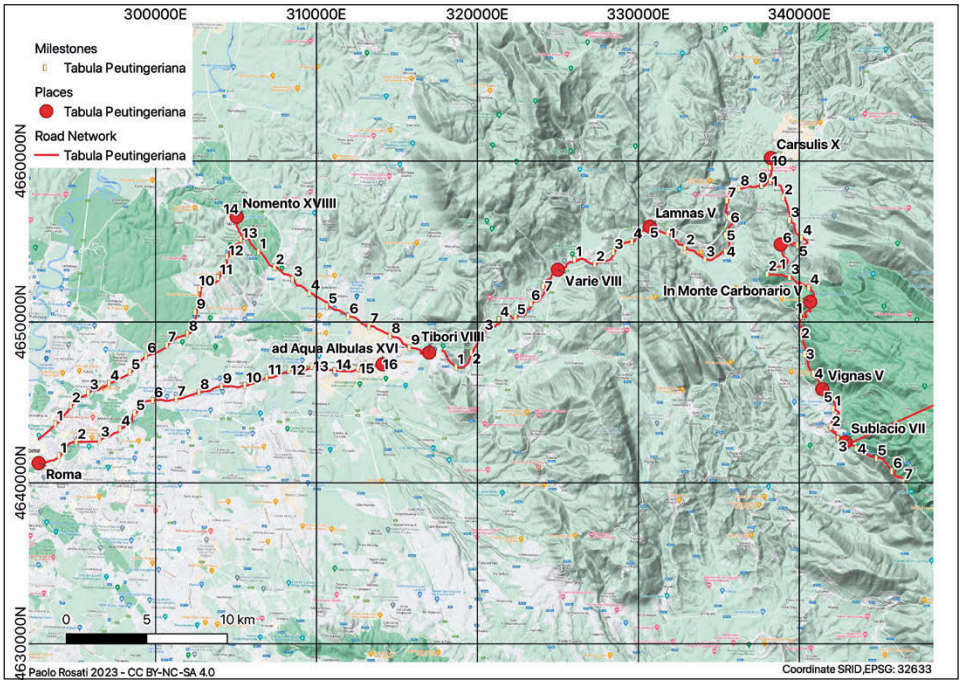

Fig. 3 – The map of the reconstructed road network between *Roma* and *Sublacio* from the study of the *Tabula Peutingeriana* (miles, places and network confirmed using ArchaeoloGIS).

the mileage to *Carsiolos*, the miles corresponding exactly with the 22 *milia* reported in the TP. Then the road goes from *Carsiolos* to *Alba Tucentia* in 25 *milia*, following the original path of the *via Valeria*, dated from the last years of the 4th century BCE (Piraino 2004).

4. Results

A piece of evidence recovered by this study is related to the exact measurement of the distance between the *Milius Aureus*, near the arch of Septimius Severus and the so-called Arcus of Gallienus, the ancient *Porta Esquilina* from which most Roman roads heading E started. This segment, as reconstructed on the ancient road system available in R. Lanciani's *Forma Urbis Romae* (Lanciani 1894) and the SITAR database (Serlorenzi, D'Andrea, Montalbano 2021), measures exactly 1480 m. Thus, the position of the ancient milestones along the eastern roads coincides whether one starts counting from the *Milius Aureus* (*Itinerarium Antonini*) or from the *Porta Esquilina* (*Tabula Peutingeriana*). The first mile of the *via Tiburtina* of the *Itinerarium*

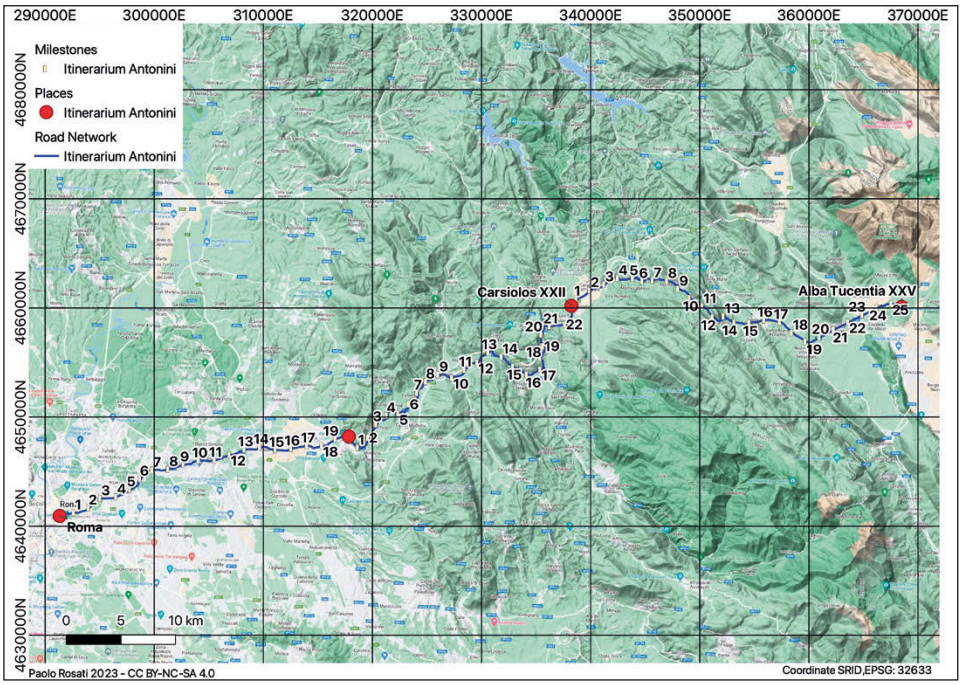

Fig. 4 – The map of the reconstructed road network between *Roma* and *Alba Tucentia* as in the *Itinerarium Antonini*, miles, places and network confirmed using ArchaeoloGIS.

Antonini corresponds to the starting point of the mile count of the same road in the *Tabula Peutingeriana*, and so on.

Despite this difference, the measures on the milestones are based on the departure from the *Umbilicus Urbis Romae*, the *Milius Aureus*. This is archaeologically testified by the 35th and the 36th milestones preserved in the Museo della Civiltà Contadina della Valle dell'Aniene in Roviano and the 37th presently at the centre of the Arsoli main square. Secondly, the plugin can be useful to demonstrate the reliability of a road network, i.e. whether the count of the miles of the road system archaeologically reconstructed corresponds with the mileage of the TP or IA. Another possible plugin usage could be to recover the original position of actual decontextualised milestones, preserved in museums or elsewhere. Moreover, when a *statio* or an important infrastructure near a major road is found by archaeological excavation, ArchaeoloGIS can help to recognise the original name available on the *Tabula Peutingeriana* or, the other way round, to search for archaeological evidence in an area where these emergencies are witnessed on the map but not yet located on the ground.

Fig. 5 – Road to *Sublacio* from *Carsulis*, an image of the archaeological evidence of the road mapped in the *Tabula Peutingeriana* (P. Rosati 2021).

5. Conclusions

The plugin and the methodology analysed in this paper are simple and intuitive and could be of some help for the field research. These are suitable tools to use with already available road networks for, such as the one provided by DARE: The Digital Map of Roman Empire (https://dh.gu.se/dare/). These tools can also be used to test new or alternative hypotheses for the reconstruction of Roman road traces, on the basis of literary, archaeological or topological studies, or a combination of them. The next steps of development will involve the implementation of other ancient units of linear measurements, such as Hellenistic *stadia*, Persian *parasangae*, etc.

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ABSTRACT

The purpose of the paper is to introduce a QGIS plugin named ArcheoloGIS. It is developed in PYQGIS and tested by the community of Una Quantum Inc. (Italy). It consists of a decorator algorithm named *Tabula Peutingeriana*, that outputs points at a regular distance, every one Roman mile, along a given path. The article shows its use, the construction of a possible dataset and its evolution, as well as a case study of its application.