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THE MAP OF ANCIENT UNDERGROUND AQUEDUCTS IN ITALY: UPDATING OF THE PROJECT, AND FUTURE PERSPECTIVES

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Abstract

The Project "The Map of Ancient Underground Aqueducts in Italy" was started in 2003 by the Italian Speleological Society, namely through the work of the Commission on Artificial Cavities. The idea of the project was originated by the huge richness that the Italian territory presents in terms of artificial cavities, in particular as regards hydraulic works (category A in the classification of artificial caves, according to the "typological tree" of the same Commission, that recently has been adopted also at the international level by the International Union of Speleology, UIS). Due to the long history of the country, and to the remarkable Roman domination that extended for centuries over wide portions of Europe and part of Asia, Italy presents on its territory a huge amount of hydraulic works, also with lengths greater than some tens of kilometres, that represent a valuable documentation of the skill and engineering techniques of the ancient communities. Because of the mostly underground development of these hydraulic works, they have often been preserved intact for millennia. Main aim of the Project was to organically collect all the material about underground aqueducts in Italy, through both direct caving explorations and analysis of the available documentation, in order to implement a detailed inventory of ancient underground aqueducts, aimed at contributing to safeguard these unique works of historical and hydraulic engineering importance. A dedicated digital datasheet, consisting of three sections, was therefore created, and used for systematically collect the relevant data and information for each single aqueduct. Even though two time and space requirements were established for inclusion of an aqueduct in the database (the upper time limit is considered to be the 18th century, and the aqueduct must be at least 400 meters long), smaller aqueduct that presented some remarkable peculiarities, or that were particularly interesting for a given territory, were also included. So far, about 140 underground aqueducts, distributed all over the Italian territory, have been identified and studied. In this paper the statistics from the Project are updated and presented, to illustrate the importance in studying this topic, and to highlight the need to develop and carry out further research, from many different approaches: archaeology, hydrogeology, hydraulic engineering, history, etc. At the same time, as already expressed in other congresses, the need to start collecting data and material on underground aqueducts outside of Italy is also discussed, starting from a preliminary bibliography of similar hydraulic works around the world.
Keywords: aqueducts, hydric resources, inventory, hydraulic works, artificial cavities, Italy.

Riassunto

Il Progetto "La Carta degli Antichi Acquedotti Sotterranei in Italia" è stato avviato nel 2003 dalla Commissione sulle Cavità Artificiali della Società Speleologica Italiana. L'idea del progetto partì dalla enorme ricchezza che il territorio italiano presenta in relazione alle cavità artificiali, con particolare riguardo alle opere idrauliche (categoria A nella classificazione delle cavità artificiali, secondo l'"albero tipologico" della stessa Commissione, che di recente è stato anche adottato a livello internazionale dalla International Union of Speleology, UIS). A causa della lunga storia del paese e della straordinaria dominazione Romana che per secoli si estese su vaste aree dell'Europa e in parte dell'Asia, l'Italia presenta sul suo territorio un enorme quantitativo di opere idrauliche, con lunghezze anche superiori ad alcune decine di chilometri, che rappresentano una valida documentazione delle capacità e tecniche ingegneristiche delle antiche comunità. Grazie allo sviluppo per gran parte sotterraneo, molte di queste opere idrauliche si sono conservate pressoché intatte per millenni. Scopo principale del Progetto era la raccolta organica del materiale esistente sugli antichi acquedotti sotterranei in Italia, sia per mezzo di dirette esplorazioni speleologiche che mediante l'analisi della documentazione esistente, al fine di realizzare un dettagliato inventario e contribuire alla salvaguardia di queste opere di ingegneria idraulica di importanza storica unica. Una apposita scheda digitale, consistente in tre sezioni, è stata quindi elaborata, e utilizzata per la raccolta sistematica di dati e informazioni rilevanti per ciascun singolo acquedotto. Due vincoli spazio-temporali sono stati stabiliti per l'inclusione di un acquedotto nella banca dati: il limite temporale superiore è definito al XVIII secolo, e l'acquedotto deve essere lungo almeno 400 metri; ciò nonostante, sono stati inclusi anche acquedotti di lunghezza minore, ma che presentano qualche peculiarità significativa o che sono di interesse per uno specifico territorio. Al momento, sono stati identificati e studiati circa 140 acquedotti sotterranei, distribuiti sull'intero territorio italiano. Nel presente contributo si riassumono i principali risultati sinora ottenuti dal Progetto, evidenziando la necessità di proseguire sulla strada tracciata, arricchendo le ricerche da vari punti di vista e con differenti

approcci disciplinari: dalla archeologia, alla idrogeologia, ingegneria idraulica, storia, architettura, ecc. Inoltre, si citano anche le attività, di recente avviate, finalizzate alla raccolta di materiale documentaristico su analoghe strutture idrauliche sotterranee al di fuori dell'Italia.
Parole chiave: *acquedotti sotterranei, risorse idriche, opere idrauliche, cavità artificiali, Italia.*

Introduction

Water has always been fundamental for the birth and development of ancient civilizations, and its availability has played a crucial role in the choice of the sites for new settlements in many periods of the human history. When the hydric resources were not present nearby, they were searched for, and hydraulic engineering works were realized, in order to collect and transport them to the inhabited areas. This was generally obtained by means of aqueducts, developed underground for most of their length (Castellani, 1999, 2001). Ancient populations (and particularly ancient Romans) understood the relevance of placing the aqueducts underground as a method of protecting their fresh water from external threats, represented by the many enemies.

The main three advantages for building the aqueducts underground were (Assante, 2007; Tassios, 2007):

i) to conceal and to protect them from enemies;

ii) to protect them from erosion and deterioration;

iii) to be less disruptive to life above ground.

The main disadvantage, on the other hand, was represented by the greater difficulties in maintaining and inspecting the systems. In addition to this, a psychological aspect has also to be taken into account: being placed underground, aqueducts could not contribute to show the greatness of Rome, as many other works did. Over time, due to the increasing power of Rome, and to advances in engineering technique as well, design of the aqueducts began to change, and at least part of the structure was build above ground, including spectacular arcade sections (Fig. 1).

Studying ancient underground aqueducts (Fig. 2) represents therefore an exciting challenge, that may open new lights toward the capability of man to collect water in the past and, more generally, to work toward a sustainable use of the natural resources (Laureano, 1995, 2001; Parise, 2012a; Parise & Sammarco, 2014). At the same time, since we still periodically experience hydrologic crises, often related to over-exploitation and degradation of the water resources, several lessons may be learned from the analysis of ancient hydraulic works (Castellani & Dragoni, 1991; Brinkmann & Parise, 2012). Water supply management is an extremely delicate matter, and deficiencies in such an issue have always been a recipe for disaster, because of the direct and cyclic nature of the routes of transmission of waterborne disease (Pike, 1999).

Studying and classifying artificial cavities

The activity of cavers in the search and documentation of artificial cavities started in Italy several decades ago, when the first multi-disciplinary studies on the topic were carried out, to highlight the remarkable presence and distribution of man-made cavities that have characterized the history of Italy in different epochs and for different purposes: rupestrian settlements, hydraulic works, religious and worship sites, underground mines and quarries, as well as other types of man-made cavities characterize the whole country, locally becoming the main marker of human activity on the environment. In 1981 the Italian Speleological Society established the National Commission for Artificial Cavities, in order to encourage local and international studies, and to create a dedicated National Register, complementary to the one dealing with the natural caves. Further, since 1999 the journal Opera Ipogea is published, entirely dedicated to artificial cavities.

The main outcome of the long work carried out by the members of the Commission resulted in the classification of artificial cavities, where, according to the function for which the cavity was, or is still, used, it can be classified in a specific type. Since the variety of underground artificial structures is very large, the classification is organised like a tree, based on seven main types, in turn divided into sub-types. The use is made easy by alphanumeric codes. Often different uses overlap in time; thus, a single site may have multiple classifications representing different periods in its life.

Following the 15th International Congress of Speleology, held in Kerrville (Texas, USA) in 2009, and the re-start of the activity of the new UIS Commission on Artificial Cavities, the issue of producing a general classification of artificial cavities became again matter of discussion. At this aim, a specific

Fig. 1: the Park of the Aqueducts: the arcade of the Claudius Aqueduct in Rome (photo C. Galeazzi).
Fig. 1: il Parco degli Acquedotti: le arcate dell'acquedotto Claudio, Roma (foto C. Galeazzi).

Fig. 2: Trajan Aqueduct: branch of Santa Fiora, Bracciano, Rome (photo C. Germani).
Fig. 2: acquedotto Traiano: Ramo di Santa Fiora, Bracciano, Roma (foto C. Germani).

workshop was organized in May 2011, and held in Turin (Italy; see Parise, 2013). On that occasion, starting from the Italian classification (Galeazzi, 2013), some adjustments were produced, both in the organization of the structure, and as linguistic improvements; further, inclusion of new typologies was also considered, which brought to adoption at the international level of the classification (Fig. 3), as presented in Parise et al. (2013).

Type A in the classification is represented by Hydraulic underground works. It includes several type of structures, from the most significant as aqueducts and drainage tunnels, to water reservoirs, wells, cisterns, etc. (Fig. 4). As a matter of fact, starting from the first congresses and workshops organized on the issue during the early 80's, it soon appeared the significant role played by this typology of works, strongly related to past history and civilization. Without the availability of water, development of settlements and villages, and establishment of a geographically stable inhabited area was not possible. This brought the National Commission on Artificial Cavities, given the remarkable importance of a huge amount of hydraulic works, with long underground stretches (Fig. 5) in Italy, to start the Project "The Map of Ancient Underground Aqueducts in Italy", entirely dedicated to research, exploration, survey and analysis of underground aqueducts, that represent a valuable documentation of the skill and engineering techniques of the ancient communities.

The Map of Ancient Aqueducts of Italy

In 2003, the Italian Speleological Society (SSI) started a project, entirely dedicated to the study and the exploration of ancient underground aqueducts, called "The Map of Ancient Aqueducts of Italy". Importance of ancient aqueducts, that were since a long time explored and studied by cavers, derives from a number of historical, engineering, and environmental reasons:

- they represent a valuable documentation of the skill and engineering techniques of the ancient communities;

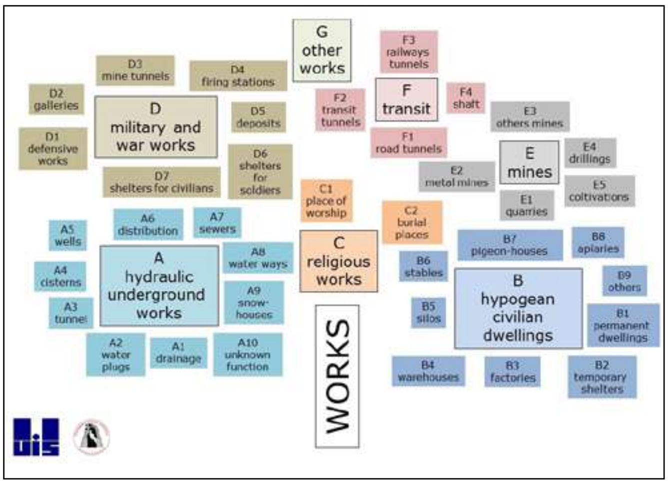

Fig. 3: typological tree of the Classification of the Artificial Cavities (after Parise et al., 2013).
Fig. 3: albero tipologico della Classificazione della Cavità Artificiali (da Parise et al., 2013).

Fig. 4: the Roman cistern in the Villa of Console Quinto Assio in Rieti, Latium (photo C. Germani).
Fig. 4: la cisterna romana della Villa del Console Quinto Assio in Rieti, Lazio (foto C. Germani).

- due to the mostly underground development, they have often been preserved intact for millennia;
- they are among the main works that testify the efforts by man to manage the territory, and to develop urban civilizations;
- even though lacking a continuous maintenance, several ancient aqueducts are still working today;
- some aqueducts might be put again at work through low-cost interventions, and constitute an additional water supply in case of droughts or during hydrologic crisis.

The main objectives of the project consist in (i) the implementation of a detailed inventory of the ancient aqueducts in the Italian territory, and the evaluation of their present state; (ii) the updating of the state of the art on the matter: many publications on ancient aqueducts are available in the historical and archaeological literature, but they have never been properly collected and organized so far; (iii) encouraging new studies and explorations, in particular by cavers, regarding the ancient aqueducts (Fig. 6); (iv) safeguarding and exploitation of these unique works of historical and engineering hydraulic importance.

Since the Italian territory presents a huge amount of ancient hydraulic works, the database of the project includes all the aqueducts responding to these two time and space requirements: 1) the upper time limit of the aqueduct construction is considered to be the XVIII century; 2) the aqueduct must be at least 400 meters long.

Regarding the first requirement, the aqueducts are subdivided into three periods: i) Greek-Roman time (until 6^{th} century a.C.); ii) Byzantine-Medioeval time (7^{th} – 14^{th} century a.C.); and iii) Renaissance-Modern time (15^{th} – 18^{th} century a.C.).

In the first phase of the project, a specific form was implemented, in order to facilitate the collection of the main information about each aqueduct. The form consists of three parts: a) general data; b) technical data; c) personal data.

The general data include all the relevant information about name and location of the aqueduct (region, province, municipality), length (with indication of the percentage of subterranean course), and availability of plan and sections. In addition, indications of the present state of the structure, and the possible interventions that could be necessary for its re-utilization, are also listed. Eventually, the general data includes all the references to bibliography where the aqueduct has been dealt with.

The technical data of the form encompasses information about the geological and hydrological setting of the area where the aqueduct develops, with particular reference to geology of the spring area, and any likely change in geologic materials along the course of the aqueduct. They also include any known notice about age of utilization of the aqueduct. The personal data, eventually, refer to name, address and correspondence of the form's compiler, in order to have the possibility to contact him/her for further requests.

Fig. 5: Fontana Acqueduct in Velletri, Rome (photo C. Germani).
Fig. 5: acquedotto Fontana a Velletri, Roma (foto C. Germani).

Fig. 6: Orsini Odescalchi Aqueduct in Bracciano, Rome (photo C. Germani).
Fig. 6: acquedotto Orsini Odescalchi (Bracciano, Roma) (foto C. Germani).

A very important part of the project consisted in putting together, in a single bibliography, all the references about ancient underground aqueducts, that are often dispersed in many local or sectorial publications, journals or conference proceedings. A thorough work of bibliographical research, and a subsequent phase of cross-checking among the main literary sources, allowed to develop a list of over 1,000 publications. These were subdivided on a regional basis, and within each region they were in turn associated to each hydraulic work. The bibliography is continuously updated (for the first version see Parise, 2007a, b), and we are still working to collect additional information and references about the ancient underground aqueducts of Italy.
The first results of the Project were published in a dedicated special issue of the Journal Opera Ipogea in 2007, and then have been updated in further publications, both in journals and conference proceedings (Parise et al., 2009, 2013b, c; Parise, 2012b).
At the time we write (December 2014) an overall number of 140 forms have been compiled, with a regional distribution of the aqueducts covering the whole territory of Italy. This number, certainly not a definitive one, expresses the great potentiality of the Italian territory as regards the presence of ancient hydraulic engineering works.
The data correspond to 135 ancient aqueducts, with Latium hosting the highest number, counting 54 hydraulic works. Many other regions are also largely represented in the database: for instance, Marche, Campania and Apulia are present with more than 10 aqueducts each. A direct consequence of such a regional distribution is the presence of aqueducts in the different Italian provinces: Rome counts 28 aqueducts, and is followed at great distance by Ancona (7), Viterbo, Naples and L'Aquila (6), and by many other provinces. An interesting data that can be extracted by the database is represented by length of the aqueducts. As concern length of the hydraulic works, most of the identified aqueducts are in the range between 1,000 and 5,000 m, but the presence of hydraulic works with length over 30 km is also significant (at least 15 cases). Especially for the longest aqueducts, however, these preliminary data need to be carefully checked, since in many cases they derive exclusively from bibliographical sources.
Over four/fifth of the inventoried aqueducts (precisely, 82%) is of Greek-Roman age. Only one aqueduct has been catalogued as Byzantine-Medioeval, but

it likely follows an older (Roman?) course, not yet documented, however. The remaining (13%) is of Renaissance-Modern time. Some considerations have to be done about dating of the aqueducts: the date often comes from historical sources (for example, an ancient author indicates explicitly in the text the date of beginning, or end, of the work, together with the emperor's name); sometimes it is derived from the functionality of the aqueduct (for example, it provided the water supply to a Roman colony, thus it is a Roman aqueduct); in some case, it is just an hypothesis (for example, it is called Roman aqueduct, but actually no documentation which can prove the date is available).

Uses of the underground hydraulic works are quite differentiated: most of them were used to tap and transport water resources for towns, settlements and spa, but in some cases aqueducts were realized to provide drinkable water to individual *domus* or *villae*, military settlements, or for agricultural purposes.

Further activities have included the study of other types of hydraulic works, namely reclamation works and drainage tunnels (Galeazzi et al., 2012). In some cases, in fact, the waters were used to irrigate, while in others the hydraulic works drained waters from lakes.

There is no uniformity in the geological setting of the source areas of ancient aqueducts. In most of the cases, rocks of sedimentary origin (35%) crop out in the areas where the springs are located. These are followed by carbonate (31%) and volcanic rocks (30%), while a much lower percentages interest debris deposits (4%). Analyzing the geology of the area where the hydraulic works are located, and even the difficulties related to the presence of different types of rocks to dig the underground tunnel is a very interesting topic, worth to be thoroughly studied (Del Prete & Parise, 2013). More in general, it has to be noted that the deep knowledge the ancient populations had about hydrogeology, hydraulics and topography, in order to design, and correctly realize, underground aqueducts, is really astonishing.

The Project "The Map of Ancient Underground Aqueducts of Italy" is still in progress; the amount of sites to study, and where to collect further data, is actually enormous in a country as Italy. The efforts by the Italian Speleological Society have necessarily to be strictly linked to research centres and universities, in order to have the possibility to keep working on this subject. Aimed at further co-operations with foreign scholars and cavers, a systematic research about bibliographic references to ancient underground aqueducts outside of Italy has also started. The interest on the topic is in fact great even outside the Italian boundaries, and especially in the other countries of the Mediterranean Basin, where many other important ancient hydraulic engineering works have been built and used during the different epochs. This part of the project has so far resulted in a list of some hundreds of bibliographical references about underground aqueducts distributed all over the world (Parise, 2012b).

Underground aqueducts in Latium

The remarkable arcades of the aqueducts that characterize the Roman territory are among the most well-known and admired evidences of the building ability of ancient Romans, but they represent only a small portion of the whole and extremely complex network of transportation of hydric resources at Rome and surrounding areas. Actually, most of the aqueducts were (and they still are) designed and built as underground works (Fig. 7).

According to the historical sources, the first aqueduct (*Aqua Appia*) reached Rome in 312 B.C., thanks to the work by censor Appio Claudio Cieco. Its overall length, about 16 km, was developed entirely underground to the outskirts of Rome, also for safety reasons. At regular time intervals, other aqueducts followed, that are the object of a wide literature (see, among the others, Parker, 1876; Ashby, 1935; Judson & Kahane, 1963; Tölle Kastenbein, 1993; Coates Stephens, 1998).

The aqueducts at Rome are only the most known part of a reality that was widespread. Every urban settlement needs, as a matter of fact, an adequate supply of drinkable hydric resources in order to exist. In Latium, as well as in the other regions of Italy, and of the world as well, each town, village or hamlet has its own aqueduct that, from more or less far sources, brings the precious water to the public fountains and, more recently, to each and every house. The most remote and isolated settlements, and those located in arid or semi-arid areas, on the other hand, use for their water demand structures such as cisterns for collecting rain water, or direct taking from rivers and lakes.

In Latium, a high number of springs is located at the foothills of the Apennine Chain. From these karst areas the greatest part of the Roman aqueducts took their water.

Another important source of potable water is represented by the water tables within the chain of volcanic structures, elongated on the Thyrrenian Coast. In this case, discharge is usually lower than those of the Apennine springs, but the diffuse distribution of these minor aquifers in the territory is at the origin of the dense network of smaller aqueducts, directed to supply with water Roman villas in rural areas, Medieval settlements and Renaissance residences.

The working techniques have remained essentially the same for millennia: the modern aqueduct Peschiera-Capore, built in the '60s of last century, shows long stretches of low-slope channels, directly excavated into the tuff deposits, without any support and with free surface flow.

Evolution in the building materials and in the excavation techniques, however, deeply changed the overall structure of the aqueducts that, with time, have been progressively re-built and/or re-structured, abandoning old passages but keeping, at the same time, most of the path, as well as the springs and the final destinations, for geographical and geological reasons.

These progressive works caused the constant presence

Fig. 7: "Piantato" Aqueduct in Montecompatri, Rome (photo C. Germani).
Fig. 7: acquedotto del "Piantato" (Montecompatri, Roma) (foto C. Germani).

in the land of ancient hydraulic structures, typically abandoned and unknown, at a short distance from the modern conduits.
The research carried out in 2006, during the first phase of the Project (see the special issue of the journal *Opera Ipogea*, no. 1, 2007), allowed to put together the bibliographical references and information on 37 underground aqueducts in Latium. Since then, the work continued, and the number of inventoried structures has now arrived at 54 (Fig. 8). In addition, the numbering in the Register of Artificial Cavities was also updated and changed, in order to make it homogeneous with the classical numbering of the historical Roman aqueducts. Notwithstanding these efforts, we firmly believe that the overall number of underground aqueducts in the Latium region is still underrated. On the other hand, interested scholars are in very limited number, which explains the difficulty in obtaining further data on "new" structures.
The work should start from a systematic re-checking of the path followed by the ancient aqueducts, by using modern technologies. This is, however, a very expensive task in economic terms, and a time-consuming activity as well.
As a consequence, many ancient aqueducts are dismissed, or are destroyed due to abandonment or because of the urban expansion. Notwithstanding their undoubted remarkable historical importance, these hydraulic works are not duly safeguarded by the Authorities, for both lack of funds and will.
"There is still much to study, discover, excavate, measure, draw, survey, document, and understand, before that such evidence become definitively lost" (Pisani Sartorio, 1986).
Management of the Project "The Map of the Ancient Underground Aqueducts of Italy" is today associated to the Register of the Artificial Cavities of Latium region; activation of a public consultation of the database is scheduled in the next future.

Conclusions
The study and documentation of artificial cavities cover many different disciplines, and is also of interest as concerns the occurrence of instability problems in built-up areas where the memory of the presence of underground voids went lost with time (Parise & Gunn, 2007; De Waele et al., 2011; Parise & Lollino, 2011; Gutierrez et al., 2014). The cavities belonging to type A in the Classification of Artificial Cavities, that is Hydraulic underground works, are of great importance especially as regards the human history, the development of settlements and civilizations, and

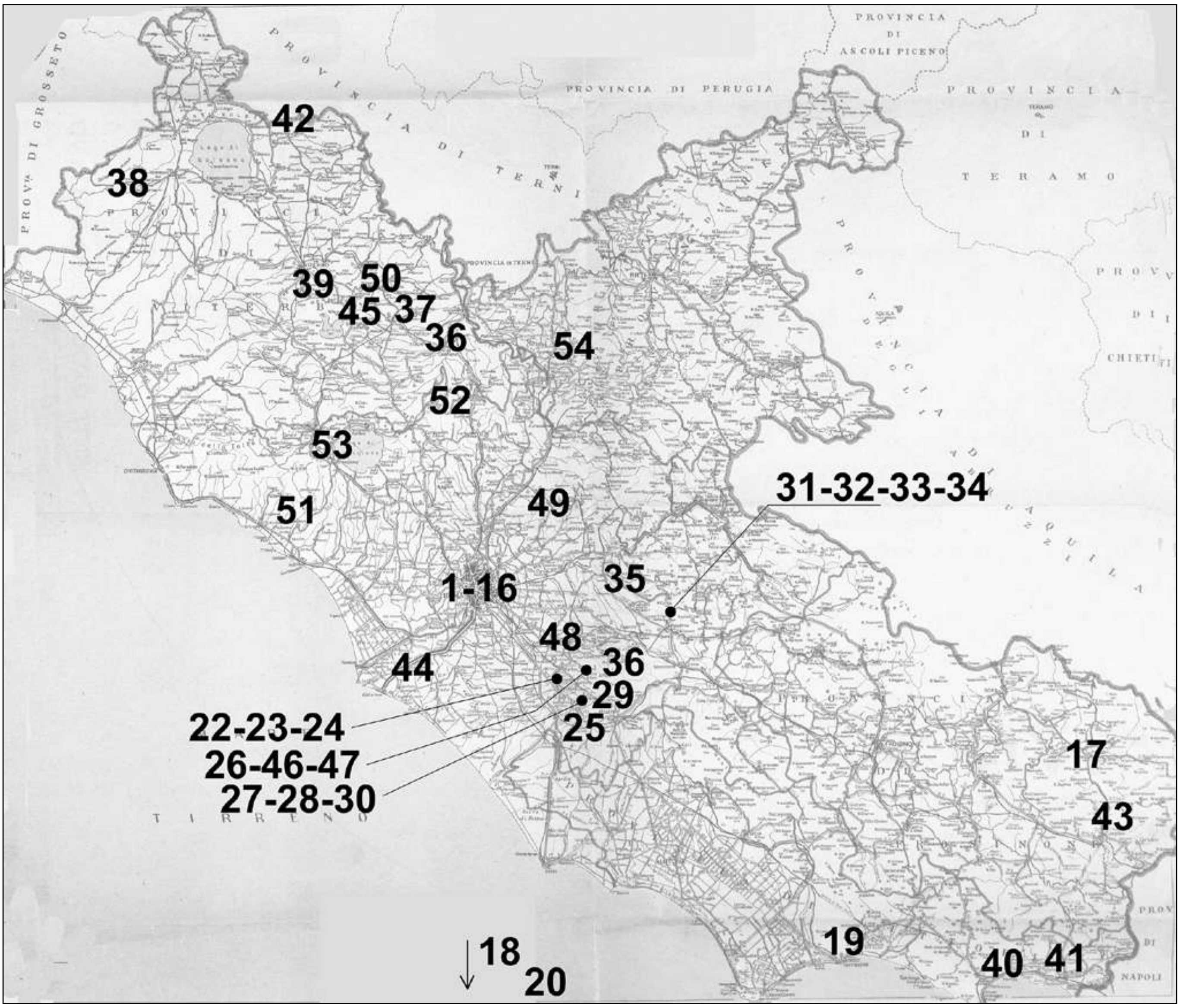

Fig. 8: distribution of ancient underground aqueducts in Latium (drawing: C. Germani). For Key see the Italian caption.

Fig. 8: distribuzione degli antichi acquedotti sotterranei del Lazio (elaborazione grafica: C. Germani). Legenda: 1) Acquedotto Appio; 2) Acquedotto Aniene Vecchio (Anio Vetus); 3) Acquedotto Marcio; 4) Aqua Tepula; 5) Acquedotto Giulio (Aqua Julia); 6) Acquedotto Vergine (Aqua Virgo); 7) Acquedotto Alsietino (Aqua Alsietina); 8) Acquedotto Claudio (Aqua Claudia); 9) Acquedotto Aniene Nuovo (Anio Novus); 10) Acquedotto Traiano (Aqua Traiana); 11) Acquedotto Alessandrino (Aqua Alexandrina); 12) Acquedotto Felice; 13) Acquedotto Paolo; 14) Acquedotto Pio-Marcio (acq. moderno); 15) Acquedotto Peschiera-Capore (acq. moderno); 16) Acquedotto Appio-Alessandrino (acq. moderno); 17) Acquedotto romano di Atina; 18) Acquedotto delle Forna; 19) Acquedotto di San Lorenzo dell'Amaseno; 20) Acquedotto di Ventotene; 21) Acquedotto sotto Ponzano (Grotta di Costantino); 22) Acquedotto del Malaffitto Alto; 23) Acquedotto del Malaffitto Basso; 24) Acquedotto delle Cento Bocche; 25) Acquedotto Caratti; 26) Cunicoli della fontana di Q. Cielo e M. Decumio; 27) Acquedotto delle Mole di Nemi (Facciate di Nemi); 28) Cunicoli di Vitellio; 29) Acquedotto di Fontana Tempesta (o Acq. Fontana); 30) Acquedotto di Fosso Tempesta; 31) Acquedotto di Palestrina (Cannucceta); 32) Acquedotto di Palestrina (Bulligа - F. Lucinetto); 33) Acquedotto di Palestrina (Fossatello or.); 34) Acquedotto di Palestrina (Fossatello occ.); 35) Gallerie di Ponte Terra; 36) Cunicoli dell'Acqua Sacra (Tempio di Giunone Curite); 37) Acquedotto di Ponte di Ponte; 38) Cunicoli idraulici sul Fiume Olpeta; 39) Acquedotto di (Mummio Nigro Valerio) Vegeto; 40) Acquedotto romano di Formia; 41) Acquedotto romano di Minturnae; 42) Acquedotto di Bagnoregio (Fontane secche); 43) Acquedotto romano di Cassino; 44) Acquedotto di Ostia Antica; 45) Acquedotto Farnesiano; 46) Acquedotto del Piantato; 47) Acquedotto di Camaldoli; 48) Acquedotto per Villa Aldobrandini; 49) Acquedotto di Mentana; 50) Acquedotto Ruspoli; 51) Acquedotto etrusco-romano di Cerveteri; 52) Acquedotto del Fosso della Mola di Magliano; 53) Acquedotto Bracciano; 54) Acquedotto di Poggio Catino.

all those aspects related to knowledge of the territory, in terms of geology, hydrogeology, hydraulics. In this sense, ancient populations were able to reach, through experience and hard works and studies, a very deep comprehension of the modality of flow of groundwater, and were successful in exploiting the hydric resources in a sustainable way, providing the later generations with a number of lessons that should be taken into the due account even today.

Our hope is that the efforts of the Italian project might raise interest on the topic of underground aqueducts even outside the Italian borders, and stimulate similar researches in other countries, starting from the Mediterranean area.

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