International Workshop
"Classification of the typologies of artificial cavities in the world"
Turin (Italy), 18-19-20 May 2012

The typological tree of artificial cavities: an SSI Commission contribution

By Carla Galeazzi [1, 2, 3]

Contact: carla.galeazzi3@alice.it

1 Egeria Centro Ricerche Sotterranee (*www.speleology.wordpress.com*)
2 UIS Commission of Speleology in Artificial Cavities
3 SSI Commission of Speleology in Artificial Cavities

The typological tree of artificial cavities: an SSI Commission contribution

The typological classification of artificial cavities we today use, is due to the work of many colleagues during last twenty-five years, whom I thank here because I cannot do with everyone personally:

Giulio Cappa

Roberto Bixio

Joep Orbons

Roberto Nini

Paolo Guglia

Vittorio Castellani

Grotte Caetani, Cisterna Latina (A. De Paolis)

Emissario Albano (V. Castellani)

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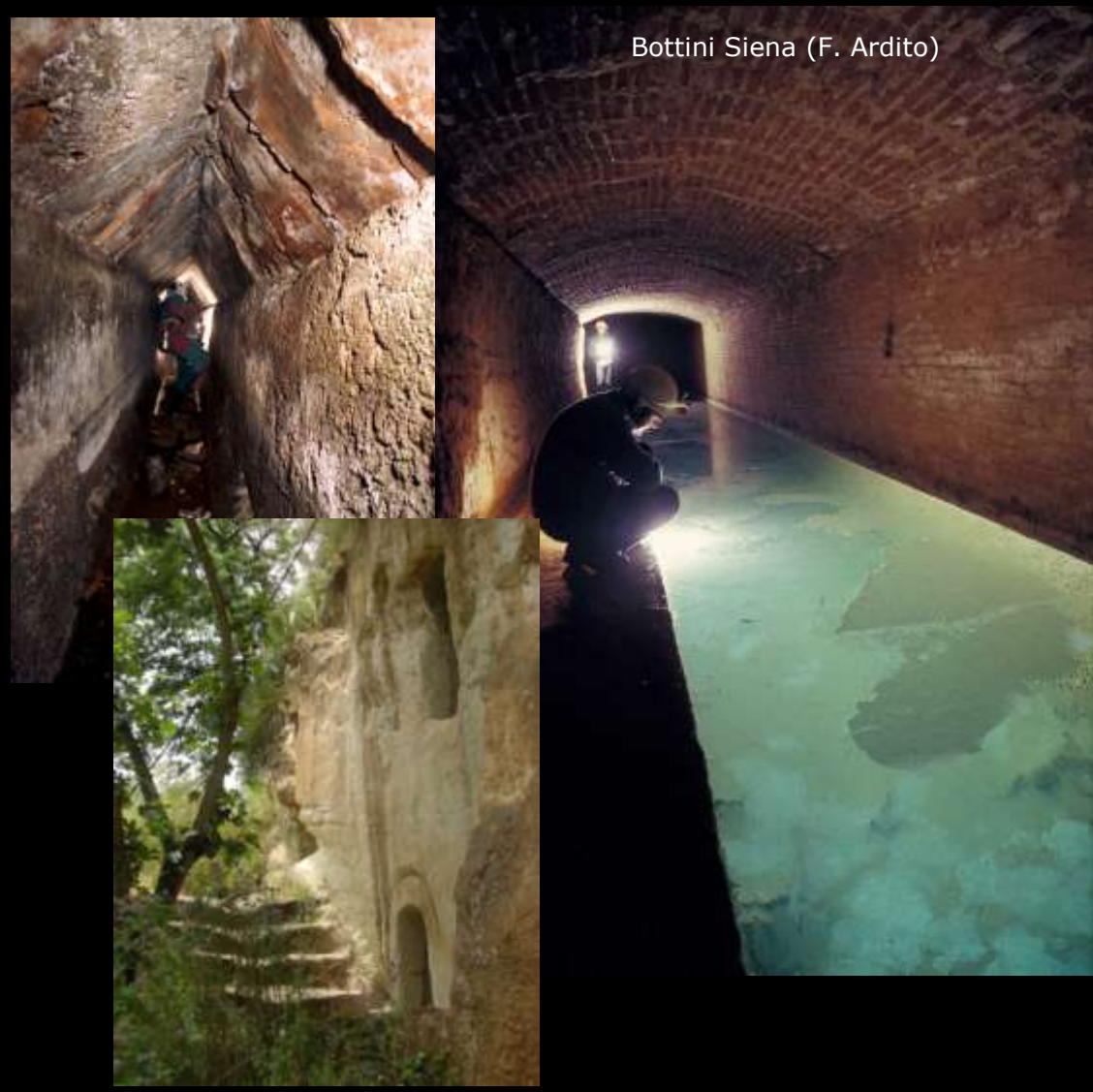
Concept of Artificial Cavities

Conventionally, artificial cavities are the underground works of historical and anthropological interest, man-made or readjusted by man for his needs (excavated, built underground or turned into underground structures by stratigraphic overlap) and natural caves if readjusted to human needs at least in part (for example, the natural caves used as shelters in the Alps during the First World War, the hermitages in natural shelters, etc.)



Bottini Siena (F. Ardito)

Motivation

The reasons why people very different, in different eras, dug the depths of the rock are to be found in the need to:

1. obtain water and / or minerals
2. exploit the natural thermal inertia of underground sites to survive in adverse weather conditions
3. overcome the shortage of timber for building and / or heating
4. bury the dead
5. find conditions of ascetic isolation

Albano, Roma C. Germani)

Matmatah , Tunisia (E. Besana)

disegno R.Bixio
per rivista Archeo

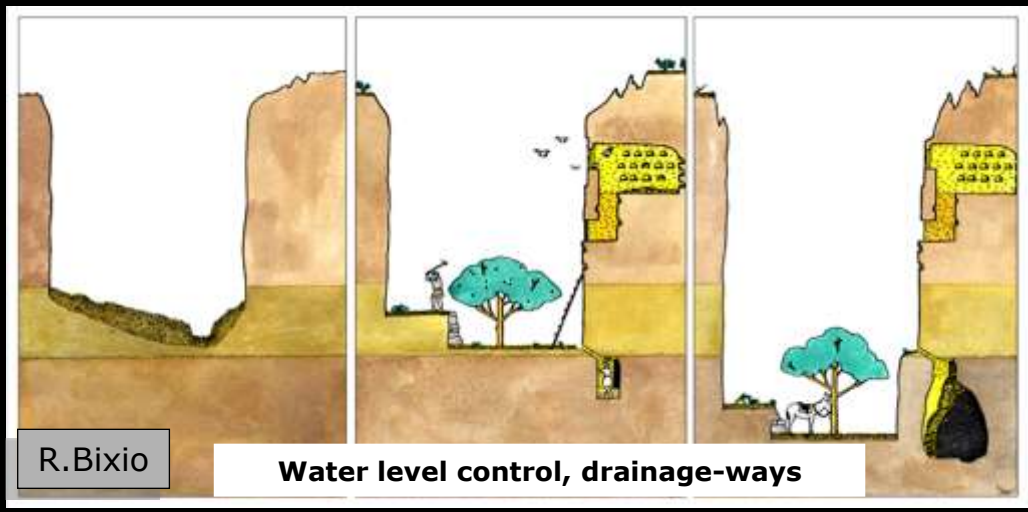
Eremo S. Giovanni a Majella (T. Dobosz)

Motivation

6. defend against raids, persecution, war
7. hide from justice
8. exploit the economy and / or ease of excavation of some types of rock compared to other techniques construction
9. take advantage from the shape of some rocky hills
10. Obtain free areas for productive activities

Filiktepe (G.Bologna)

Zelve, Turchia (R. Bixio)



To summarize, where climatic conditions or historical events required it, and the morphology and lithology were favourable, techniques of excavation or construction in negative (by subtraction) were developed, and they produced in the course of ages a large part of what we now call *artificial cavities*.

They are underground structures, spread all over the world, diversified by age, excavation technique and purpose, and of which *man is the speleo-genetic factor.*

Giordania (C. Germani)

Study and classification of artificial cavities

To ensure the proper investigation and cataloguing of the cavities of anthropogenic origin it would be crucial to identify:

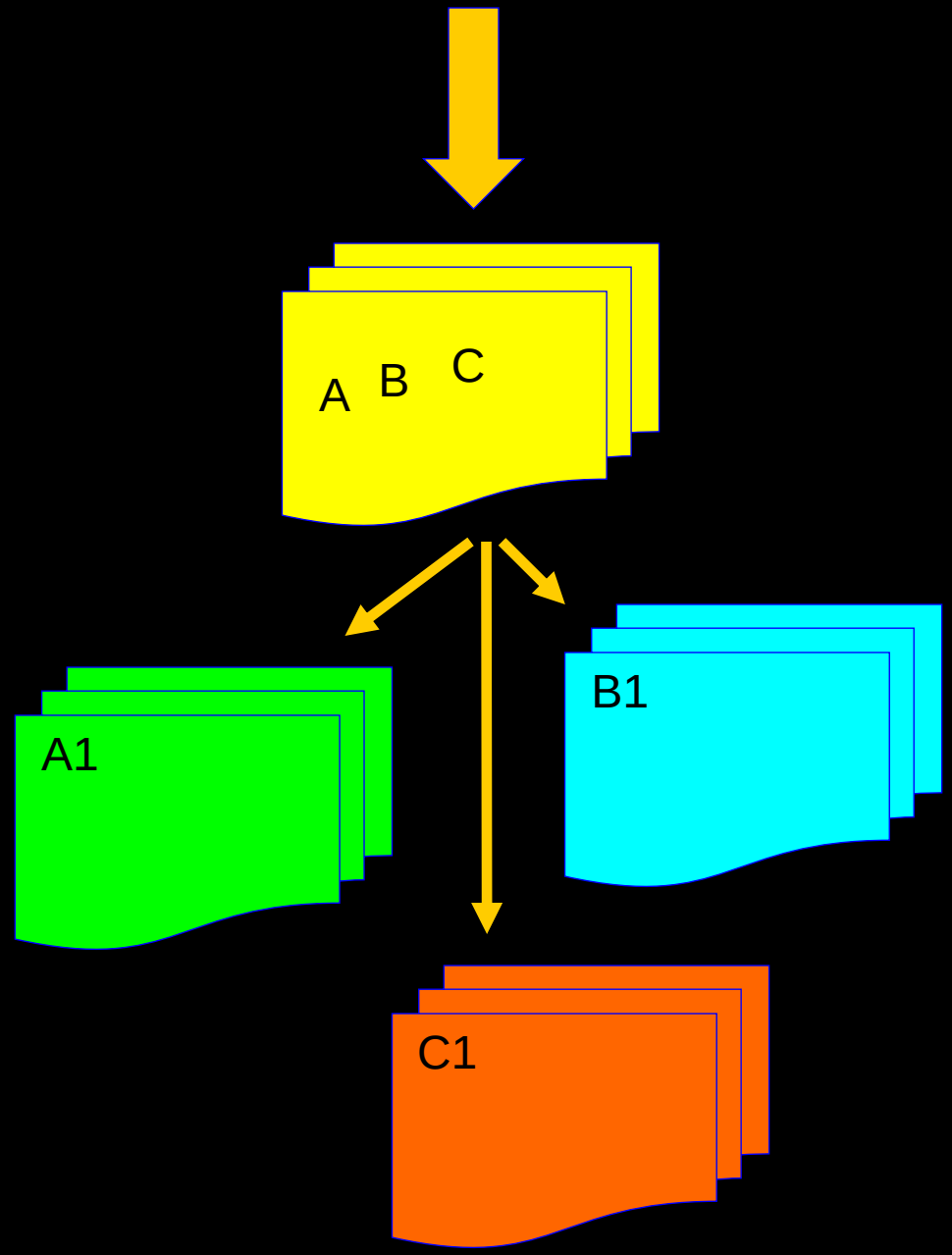
- the technique of construction;
- the function (or purpose);
- the time of excavation;
- the shape and development of the underground structure;
- the spatial correlation with the surrounding environment;
- the temporal correlation with historical events on general, regional and local scale.

Montelibretti, Roma (C. Galeazzi)

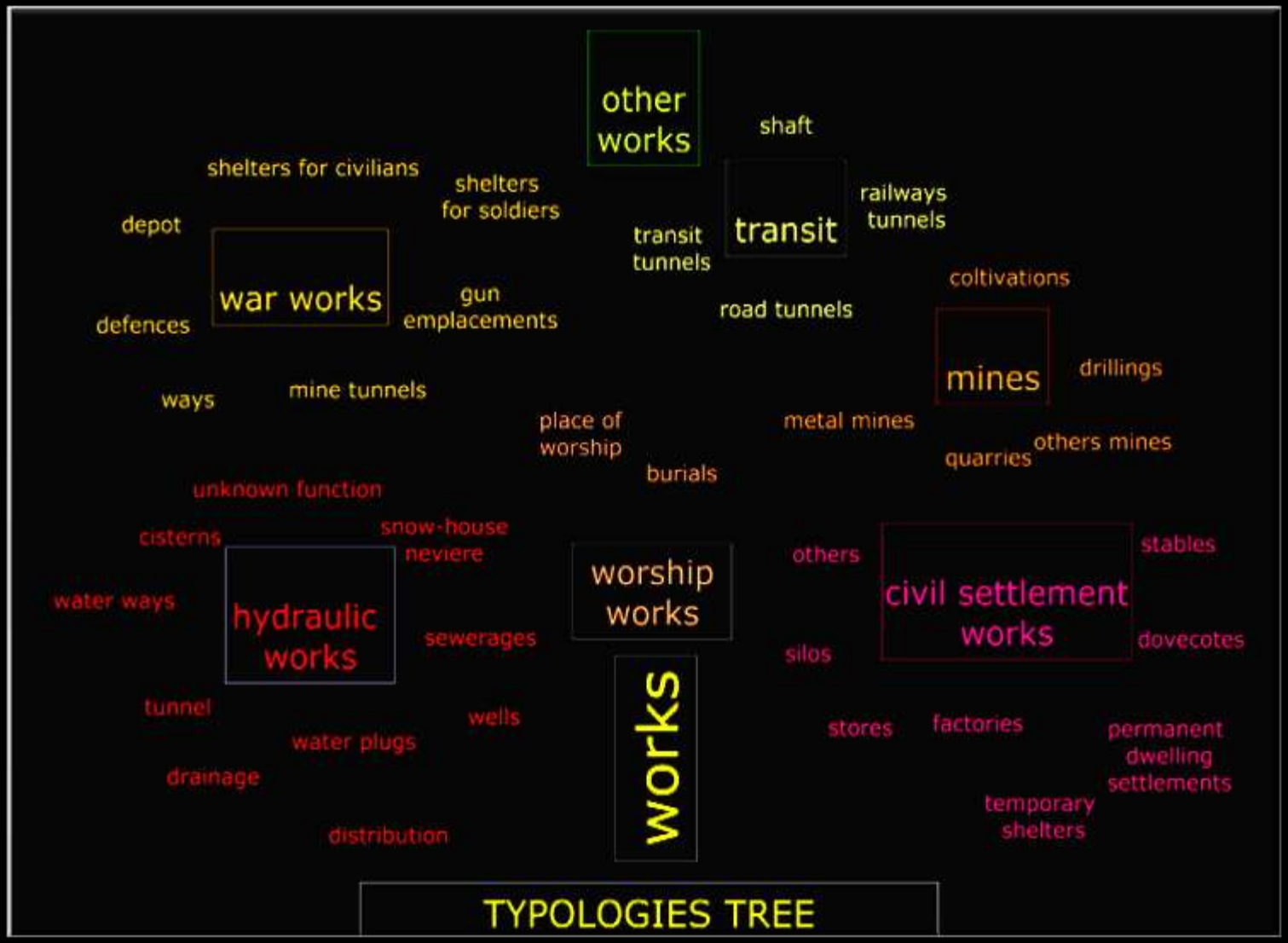
Typological tree

The variety of underground artificial structures is very large. Often different uses overlap in time.

Consequently, the classification chosen by the commission of artificial cavities of the Italian Speleological Society, to identify synthetically the nature of a cavity, is organized like a tree, based on seven main types, in turn divided into sub-types.



Typological tree



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Tree Types works

(Codes of the Italian Commission of Speleology in Artificial Cavities)

Type A – Hydraulic underground works (A.1 – A.10)

Type B – Hypogean civilian dwellings (B.1 – B.8)

Type C – Cult structures, veneration works (C.1 – C.2)

Type D – Military and War works (D.1 – D.7)

Type E – Mining works (E.1 – E.5)

Type F – Transit underground works (F.1 – F.4)

Type G – *Other works not included in the former categories*

You can find the specify of such sub-codes inside the paper document

Here we will see a general photographic view of most frequent underground works

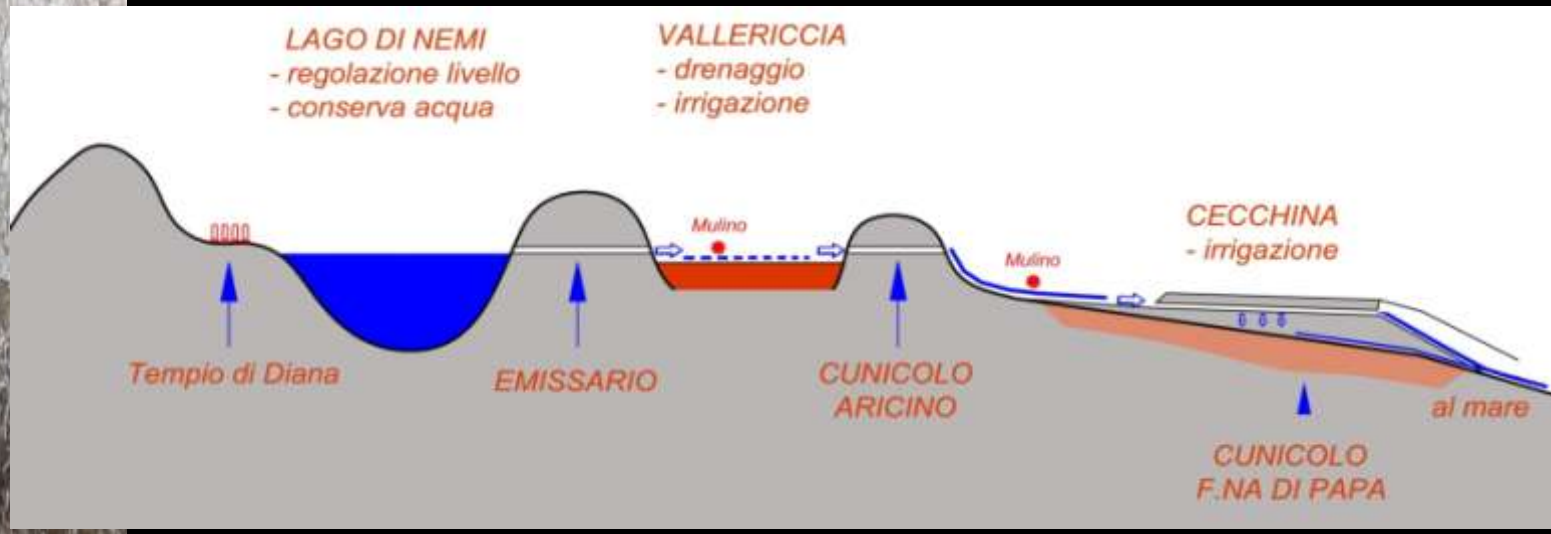
Type A – Hydraulic underground works

A.1 – Water level control, drainage-ways

Emissario Nemi (C.Germani)

Tunnels dug for the reclamation of marshlands and to stabilize the level of lakes (emissaries) and reservoirs.

Scheme of the function of ancient emissary of the Nemi Lake (Latium, VIII – VI century B.C.)



Emissaries

Fucino, Abruzzo (C.Germani)

Laghetto, Roma, Lazio (C.Germani)

Pian del Lago, Toscana (C.Germani)

Type A – Hydraulic underground works

A.2 – Underground stream interception structures

Tunnels and galleries designed to capture underground water veins or dripping waters. The work of interception can consist either of a simple duct cut into the rock, or of a complex system integrated with building works.

Cunicoli di captazione.
Albano, Roma (C.Germani)

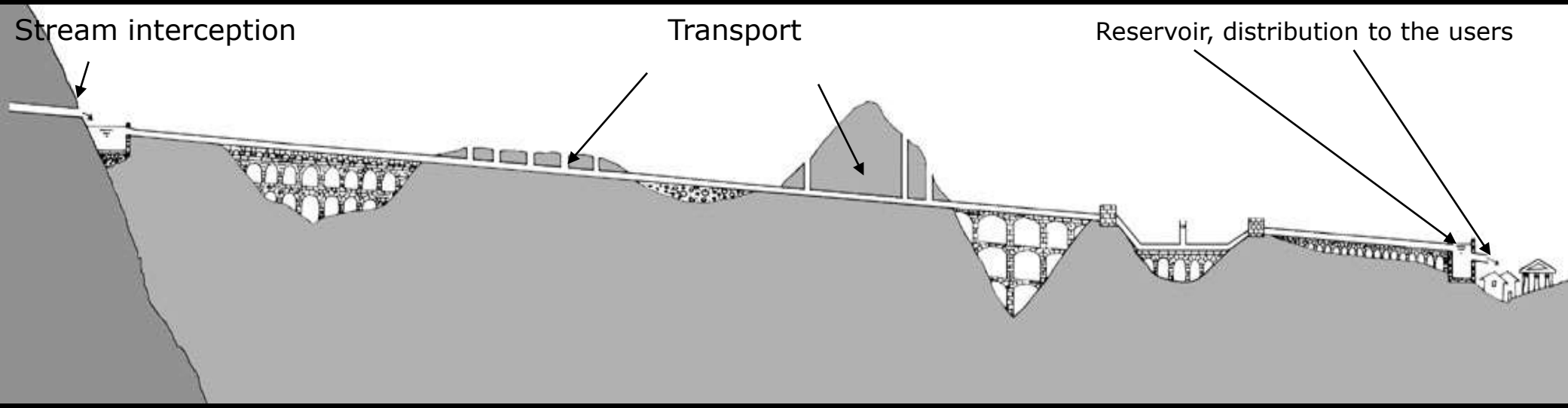
Gravina di Puglia (M.Traverso)

Captazione n.2 – Nemi, Roma (C.Germani)

Type A – Hydraulic underground works

A.3 – Underground water ducts: acqueducts

- Galleries and tunnels to carry water from the stream interceptions to the users.
- Deviations into galleries of water courses to allow the construction of bridges: the so-called *Ponti Terra* or *Ponti Sodi* (Etruscan technique).



Scheme of a Roman acqueduct. Grafica C. Germani (da Dolci, 1958, e da V. Castellani)

In Roman times the hydraulic technique, turning the knowledge previously acquired by the Etruscans and Greeks, reaches its highest peak. Long stretches of aqueducts were built underground.

Acqueducts

Roma, Acquedotto Claudio (C. Galeazzi)
Siena, schema distribuzione nei Bottini di Fonte Gaia (A. De Paolis)
Trieste, Acquedotto Teresiano (F. Ardito)

Type A – Hydraulic underground works

A.4 – Cisterns, water reservoirs

Underground spaces to store up water, usually completed with waterproofing of the walls.

Rieti, cisterna Villa di Assio (C. Galeazzi)

Albano, Roma, i cisternoni (G.Marchesi)

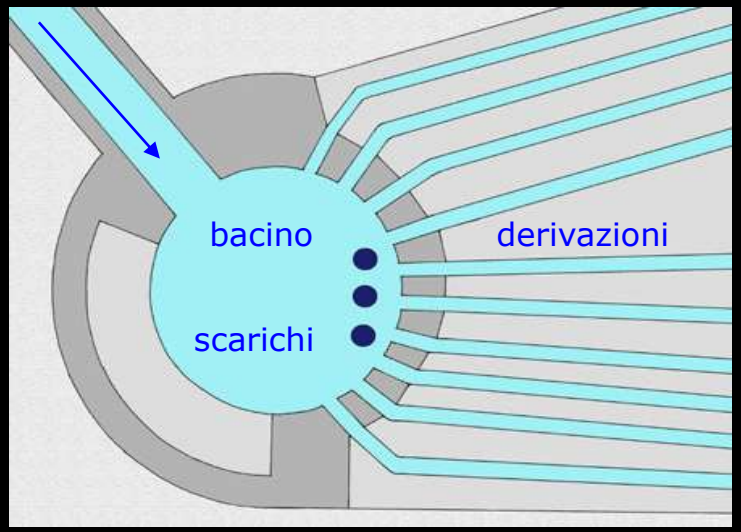
Type A – Hhydraulic underground works

A.6 – Hydraulic distribution works

Tanks or other underground rooms in which one (or more) ducts converge and from which other ducts go out to distribute water to the users (*castellum aquae*).

Gravina (M.Traverso)

Grafica Roberto Bixio



Gravina (G.Bologna)

Type A – Hhydraulic underground works

A.8 – Ship, boat canals

They are found mainly in central Europe... unfortunately not in Italy

Cotswold canal, Bristol, Gloucester, Inghilterra (foto J. Orbons)

Type B – Hypogean civilian dwellings

B.1 – Permanent dwellings

Long term settlements, cave dwellings, underground houses. Most of cave dwellings have been abandoned. In antiquity some sites have achieved the size and organization of real urban hypogean areas, often complemented by brickworks.

Cappadocia, Turchia (A. Del Bon)

Zungri, Calabria (C. Germani)

Type B – Hypogean civilian dwellings

B.2 – Temporary shelters

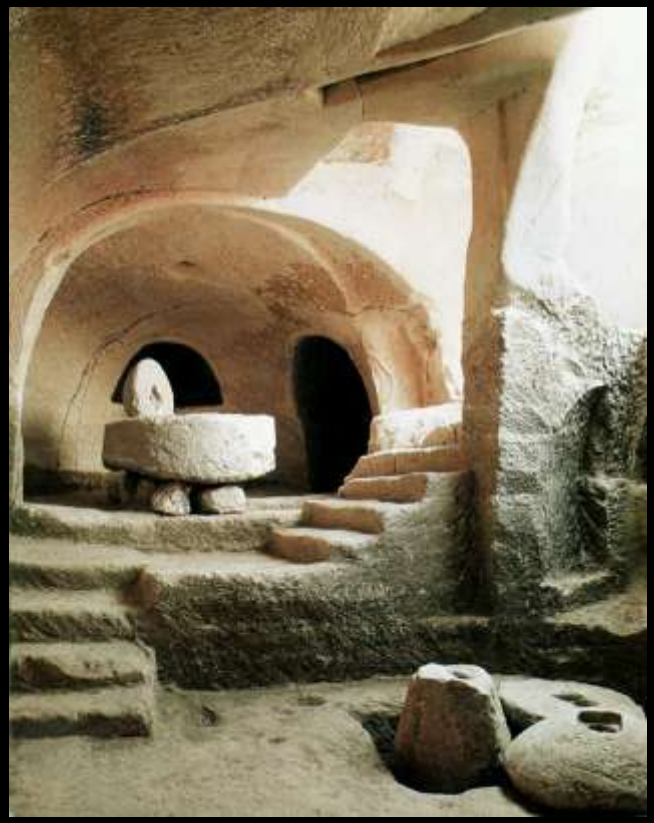
Seasonal settlements, shelters for shepherds during the transhumance, hiding-places of bandits, places of temporary detention.

Type B – Hypogean civilian dwellings

B.3 – Underground plants, factories

Rope makers caves, oil mills, factories, working places no more in use. The military factories are classified D.1.

M. S. Angelo, 30.12.1960, Foggia, Puglia, Italia (foto G. Cappa)



Maresha Excavations, 2003 (da Amos Kloner)

Type B – Hypogean civilian dwellings

B.5 – Underground silos

Cavities general accessed from above, carved into the rock and closed by a stone carefully worked, to guarantee the preservation of food from mice or humidity. Sometimes they are bell-shaped.

Ancient settlement of San Lorenzo, Lazio (foto C. Germani)

Eski Gümüş, Cappadocia, Turchia (foto M. Traverso)

Type B – Hypogean civilian dwellings

B.7 – Pigeon-houses

Dovecote or pigeon-house are synonyms to indicate rocky structures used for the housing of pigeons or similar birds.

Ancient settlement of San Lorenzo, Lazio (C. Germani)

Type B – Hypogean civilian dwellings

B.8 – Any other kind of civilian settlements

It is difficult to establish a complete list of all the types of settlements. Unusual or not understood works can be included here.

For example, the rocky apiaries represent a typology identified just recently (now included in B.6: shelters for animals of any size i.e. horses, chickens, other birds and bees).

Kizil Çukur, Cappadocia, Turchia (G. Bologna)

Cappadocia, Turchia (A. Del Bon)

Type C – Cult structures, veneration works

C.1 Nymphaeum, Mithraea, temples, sacred wells, shrines, monasteries, churches, chapels etc.

If the structures contain many burials are also classified in C.2. Conversely, if in a catacomb there are clear traces of the altar is also the type C.1.

Ancient settlement of San Lorenzo, Lazio (foto A. De Paolis)

Type C – Cult structures, veneration works

C.2 – Places of cult

Crypts, chamber tombs, complex systems such as funerary columbaria, catacombs, necropolis, Domus de Janas (Sardinia).

Crypta Ferrata, San Nilo Abbey, Roma (archive Egeria - Asso)

Colombarium Pomponio Hylas, Roma (dal web)

Type D – Military and war works

D.1 – Defensive works

Underground fortifications and their appurtenances.

Shawback Castle, Giordania (C. Germani)

(disegno R. Bixio)

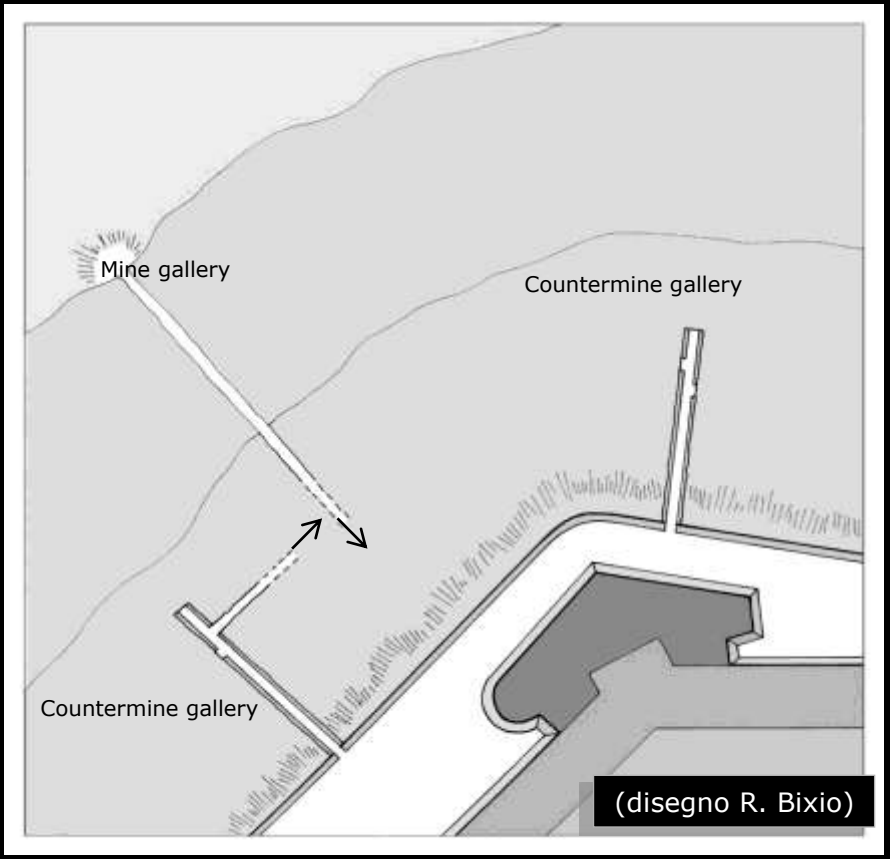
Type D – Military and war works

D.3 – Tunnels of mine and countermine

Military trenches with a specific role.

Mine galleries: tunnels dug by the attackers to reach and undermine the foundations of the walls of the defenders, or dug by the defenders to reach and undermine the artillery of the enemy.

Countermine galleries: tunnels dug by the defenders to intercept the mined tunnels and prevent the attack.



Type D – Military and war works

D.7 – War shelters for civilians

Underground places where the civilian population sought refuge during raids, invasion, shelling, aerial bombardment. They can consist of a single room or develop for many hundred meters.

Grotte Caetani (foto A. De Paolis)

Rifugio antiaereo Cagliari (foto C. Galeazzi)

Type E – Mining works

They are structures that can reach huge depths and developments.

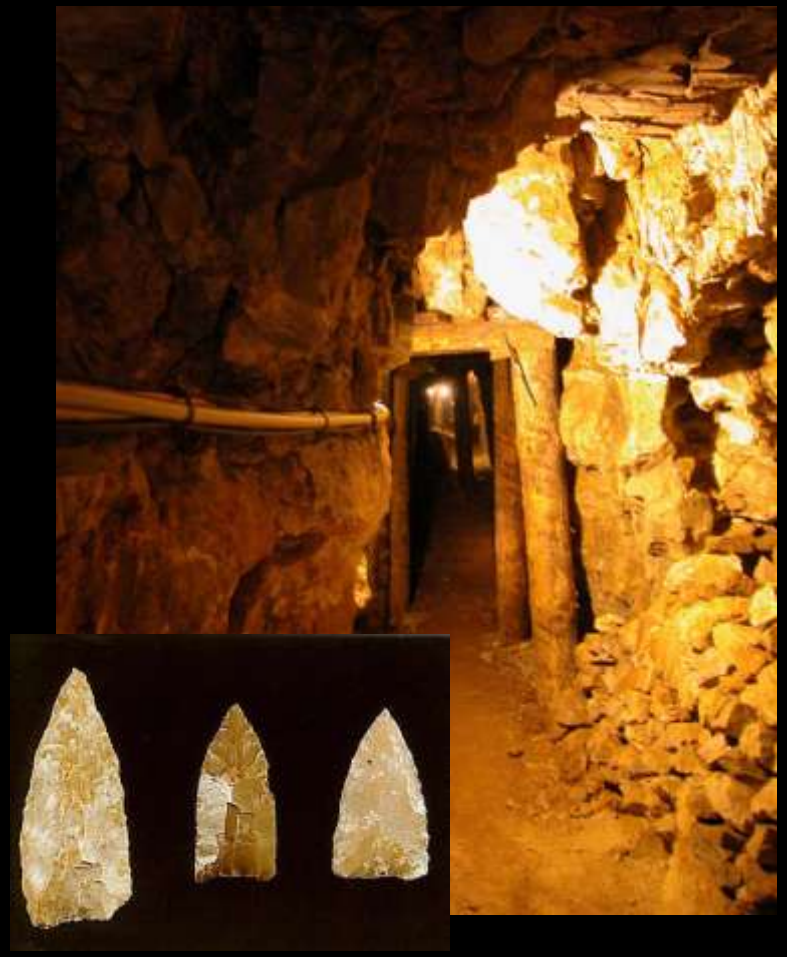
E.1 – Aggregates quarries (sandpits, pozzolana, limestone blocks, building stone or ornamental).

E.2 – Metal mines (mines of copper, iron, tin, lead, gold, etc.)

E.3 – Mining and quarrying of other substances (non-metallic): underground quarries of flint, alum, sulfur, coal, sand for glass, ochre, salt, ect.)

E.4 – Non-specific mining surveys: traces of excavation activities aimed at the identification of mineral deposits. They are, in general, exploratory tunnels of modest size.

Miniere Lombardia (Archivio L. Laureti)



Type E – Mining works

E.5 – Underground spaces to grow vegetables

In them are grown plant products, typically mushrooms and vegetables.

Roma, Lazio, Italia (C. Germani)

Type F – Transit underground works

F.1 – Tunnel for vehicles, pedestrian or horses
F.2 – Transit works, not military
F.3 – Railway tunnels, tramways or funicular (out of use)
F.4 – Not-hydraulic wells, shafts etc.

Transit work Ani, Turchia (foto R. Bixio)

Transit work Giordania (foto C. Germani)

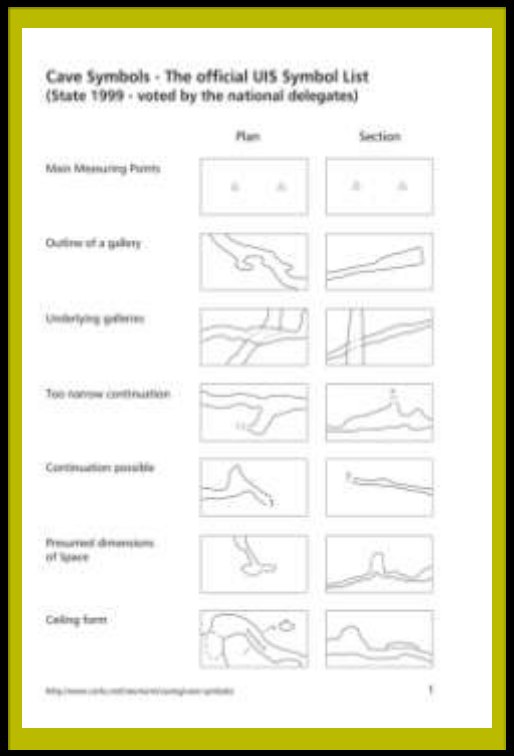
Type G – Other works not included in former categories

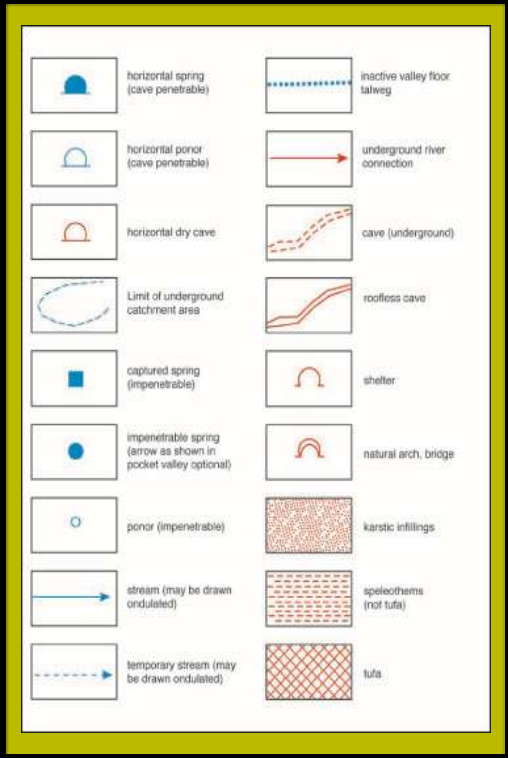
Certainly you cannot think to have well classified all structures: you need a generic category. For example, the wells that are not part of other undergrounds, structures with unknown function, ventilation wells, light wells, cavities for technical spaces, passages, wells for alignment... find space in this typology.

Light well, Grotte Caetani, Cisterna Latina, Lazio (A. De Paolis)

Proposal for adoption of standard symbols in surveying and mapping of artificial cavities.

Since many years UIS has been adopting schemes of reference both for the mapping of caves and for the indications relating to the karstic surface phenomena.





Similarly, it would be very important encode the most suitable graphic symbols to represent the artificial cavities, comparing and sharing those already in use in different Countries. In particular, it would be interesting to include the indication of artificial wells (water, light, ventilation wells), the magnetic north, the direction of excavation, the direction of water flow, etc.

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International dictionary of the most frequent terms in the description of artificial cavities

In order to complete this first general contribute, I remind you that some years ago, in 2001, Giulio Cappa and Alberta Felici developed a dictionary of the most frequent terms in the description of artificial cavities (initially proposed by Joep Orbons) in Italian, English, German and French languages.
You can find the contribution in the paper document at your disposal, to provide a basis for other further implementation.

... and sorry for my stammering English!!!

Thanks for your attention

CREDITS

Artificial Cavities Lessons no. 41, 42, 43
Didactic Project SSI-UIS 2009

Edited by Roberto Bixio and Carla Galeazzi

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