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THE SAN PATRIZIO WELL: AN ALTERNATIVE AND DEFENSIBLE SOLUTION TO THE ROMAN WATER SUPPLY SYSTEMS

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Presentation outlines

1. Water systems and geopolitical contest
2. Roman adduction systems
3. Pope Clemente VII and S. Patrizio well
4. Conclusions

Introduction

The knowledge of the development of water supply techniques is of the utmost importance because of the inventions that have contributed towards the progress of science and water engineering.

The highly advanced Roman waterways are amongst the greatest achievements of the ancient world: Roman aqueducts were very complex structures whose quality and technology remained unpaired for more than 1000 years after the fall of the Roman Empire

After the fall of the Roman Empire, it was preferred to supply towns with “local” solutions to ensure the water resource even in the case of siege. A significant example of this practice is the so-called St. Patrick's Well in Orvieto.

Afterwards, with the consolidation of a national political structure, the adoption of systems of water supply from distant springs was proposed again.

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Hydraulic works can be seen as an expression of the local political structure to which technological knowledge have always adapted….

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TODAY

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Roman Adduction systems

The first aqueduct was built in the year 312 bc By censor Appio Claudio.
It drew water from the springs east of the city, and it was about 11 miles long.

During the subsequent 600 years, ten more aqueducts were built.
The last one was completed in the 3rd century AD.

Appia	Rome, Italy	BC 312	16.6
Anio/Anio Vetus	Rome, Italy	BC 272-269	81.0
Marcia	Rome, Italy	BC 144-140	91.3
Tepula	Rome, Italy	BC 125	
Julia	Rome, Italy	BC 33 or 40	15.4
Virgo	Rome, Italy	BC 19	20.9
Alsietima	Rome, Italy	BC 2	32.8
Claudia	Rome, Italy	AD 38-52	68.7
Anio Novus	Rome, Italy	AD 38-52	86.9
Trajana	Rome, Italy	AD 109	57.0
Alexandrina	Rome, Italy	AD 226	22.0

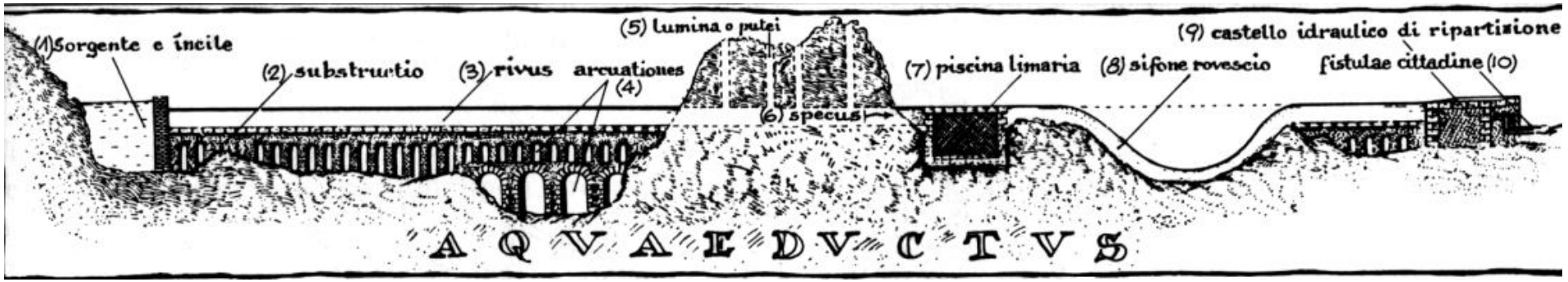
Roman Adduction systems

The longest system was the 132 km long Carthage aqueduct, built in aD 160 and accounted as one of the marvels of the world.

Name	*Construction*	*Location*	*Length*
Appia	**312 BC**	**Rome**	**16.6**
Marcia	**144 BC**	**Rome**	**91.3**
Carthage	**AD 160**	**Tunisia**	**132**
Gier	**AD 50**	**Lyon, france**	**86**

Roman Adduction systems

Section of a Roman aqueduct



:

(1) spring and inlet;
(2) bearing wall;
(3) open channel;
(4) arcades;
(5) shafts;
(6) underground channel;
(7) settling basin;
(8) reverse siphon;
(9) main reservoir;
(lO) water pipes

Roman Adduction systems

A supply system based on aqueducts, however, is highly vulnerable….

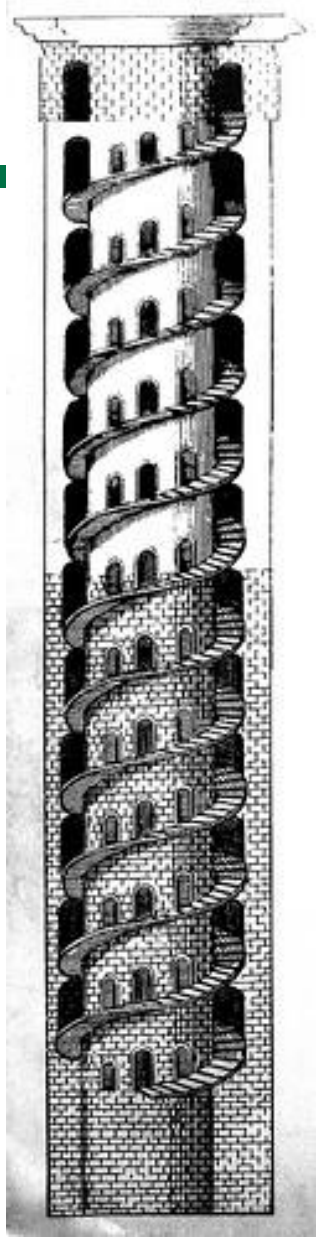
In order to defeat Rome you must take away its most valuable asset: water".

Key dates:

394 AD	Earthquake
410 AD	Invasion of visigoths
455 AD	Vandals of Genseric
476 AD	Heruli of Odacer
534 AD	Closure of outlets by Vitige King of the Goths

During the medieval period water was provided by the "acquarioli" who were people distributing filtered water taken from the Tiber River.

S. Patrizio well



As example of the close relationship between historic period and choice of appropriate engineering solution, the case of S. Patrizio well in Orvieto (Italy) is here presented.

The San Patrizio well is a 54 m deep well, dug into tufa rock of Orvieto city, Umbria Region from 1527 to 1537.

The well takes his name from the medieval legend that St. Patrick's cave in Ireland gave access down to Purgatory, thus indicating something very deep.

S. Patrizio well

The work was committed by pope Clement VII, after the “Sack of Rome” in 1527 of the Holy Roman Empire under Charles V

the Pope had sought refuge in the city and was concerned that there was not enough water for the area should the city fall under siege….

S. Patrizio well

The project and construction of the well was made by Sangallo the younger, an Italian architect active during the Renaissance.

He was borne in Florence, but he lived and worked in Rome for most of his life, having being employed by several popes.

After the Sack of Rome (1527), he moved from Rome working mainly as a military architect.

Among his works there are: the Rocca Paolina in Perugia and the fortifications of other cities, including Orvieto

S. Patrizio well

The city of Orvieto stands on top of a tuff hill, practically impregnable, inhabited since the 9th century BC by Etruscans.

The aquifer of St. Zeno was already known during Etruscan times, as evidenced by the remains of the ancient well of the cava, located on the opposite side of Orvieto platform respect to the case of study.

Excavation of well was preceded by a careful hydro-geological study to identify the most suitable site, analyzing the altimetry heights of the springs at the base of the Plateau and the Well of the Cava was then chosen.

S. Patrizio well

The project of Sangallo was inspired by the spiral staircase of the Villa Belvedere in the Vatican

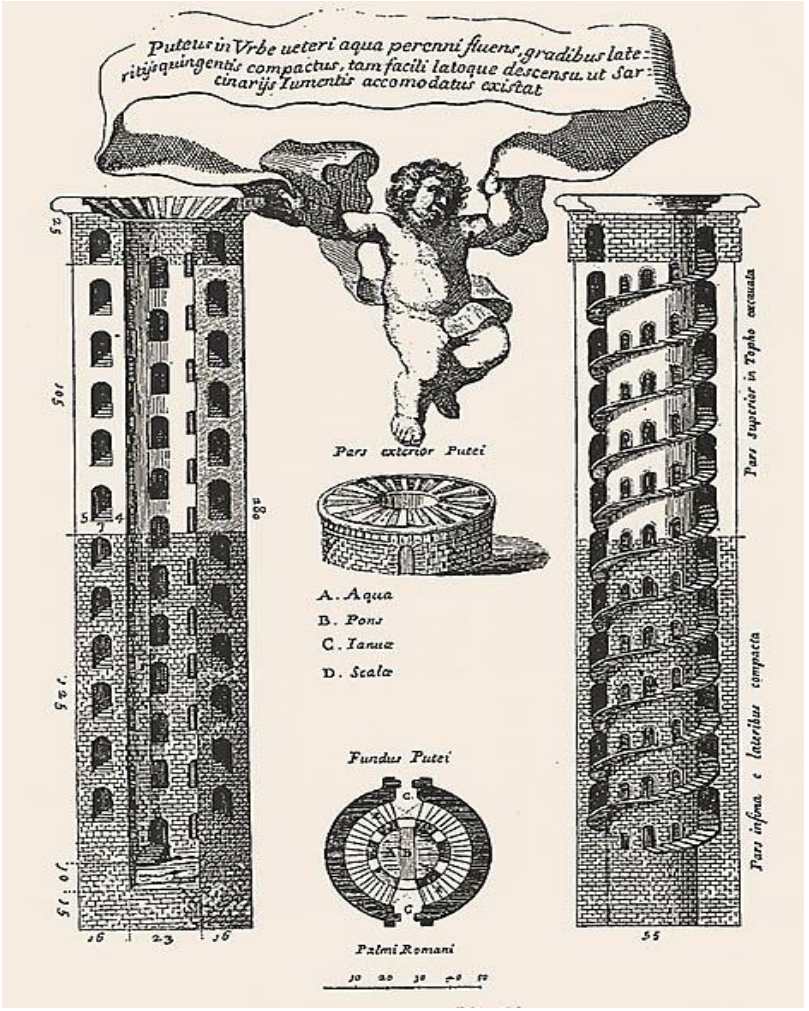
The same system architecture is also found in the royal stairway of Palazzo Farnese in Caprarola

He created an ingenious system of more than 200 helical steps (248) in order separate the entrance and exit pathways avoiding "traffic"

S. Patrizio well

It consists of a double helicoidal ramp that made it easy for beasts of burden to go back and forth.

The two spiral ramps are joined together by a bridge just above the water level, from which the mules were loaded up

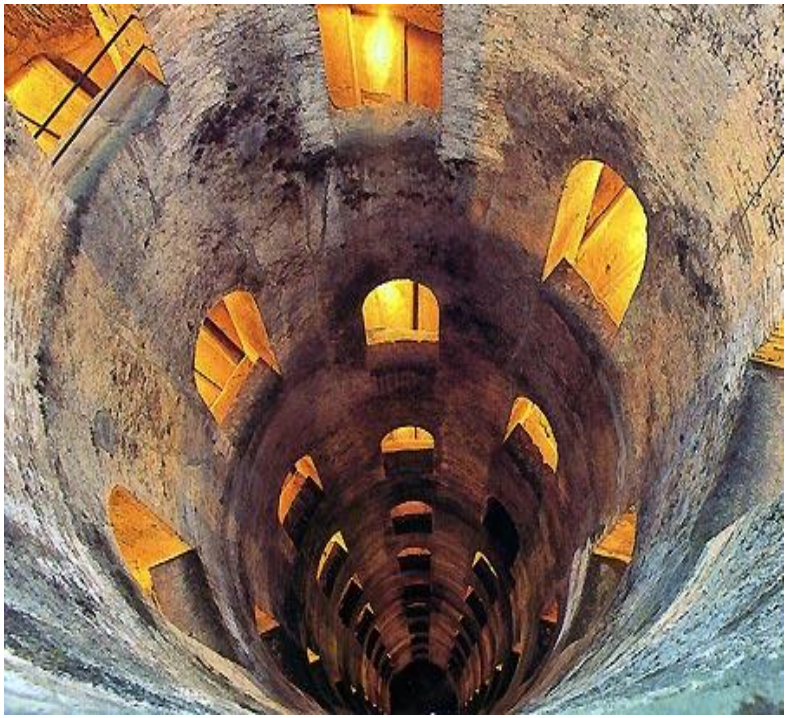


S. Patrizio well

The well has an external circumference of 12,21 m, is 54 m deep reaching 58 m including the outer drum.

The brick facing that appears at a certain point in the cylinder was built to ensure the solidity of the walls.

72 windows, called “finestroni”, allow a reasonable level of daylight to reach the spiral ramps, especially as the time taken to make the full descent allows the eyes to compensate for the diminishing light level



S. Patrizio well

The outside of the well is placed against the backdrop of the hills surrounding the cliff, like a wide and low cylindrical construction decorated by Paul III Farnese lilies.

Two openings diametrically opposed are built to allow entrance or people going down and exit of those coming up

S. Patrizio well

This work was finally finished in 1537, when Clement VII had already come to terms with Charles V and so the siege never occurred……

Conclusions

The water supply techniques adopted during the centuries is bound not only to the technological level and scientific competencies of hydraulic engineers, but also to the contingent socio-economic situation.

The case of a “War” thank: the S. Patrizio well as a local and defendable solution instead of the very large roman aqueducts is here discussed.
Its unique construction and impressive depth directly hint that war can often inspire innovation.

Thus, hydraulic works are an expression of the local political structure to which technological knowledge have always adapted.