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

LE PUITS DE SAINT PATRICK: UNE SOLUTION ALTERNATIVE ET DEFENDABLE AUX SYSTÈMES ROMAINS D'APPROVISIONNEMENT EN EAU

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ABSTRACT

Since Roman Empire times a well-developed scientific knowledge and engineering techniques were used to design and build up water adduction systems. The possible application of these skills, however, is strictly connected also to the territory, to social and political contest and to economic aspects. The magnificence of Roman Empire is expressed also through the construction of complex Aqueducts system all over the conquered territories. Given the vulnerability of water supplies mainly due to extension of aqueducts, after the fall of the Roman Empire, it was preferred to supply towns with "local" solutions (wells, cisterns…). This work presents an excursion on different approaches that have been applied to face the water supply problem and an extreme example of "War" reservoir is here presented: S. Patrick well.

The work, committed by pope Innocence VII, to Antonio Sangallo the Younger, represents a marvel of Renaissance Architecture showing that innovation can also be inspired by fear of Siege and War.

RÉSUMÉ

Depuis les temps de l'Empire romain des connaissances scientifiques et des techniques d'ingénierie bien développés ont été utilisés pour concevoir et construire des systèmes d'adduction d'eau. L'application possible de ces compétences, cependant, est aussi strictement liée au territoire, au contexte sociale et politique et aux aspects économiques. La magnificence de l'Empire romain est exprimée aussi à travers la construction d'un système complexe d'aqueducs partout dans les territoires conquis. En considérant la vulnérabilité de l'approvisionnement en eau, qui est principalement due à l'extension des aqueducs, après la chute de l'Empire romain, on a préféré approvisionner les villes avec des solutions «locales» (puits, citernes ...). Ce travail présente une excursion sur les différentes approches appliquées pour faire face au problème d'approvisionnement en eau et un exemple extrême de "guerre" réservoir est présenté: le puits de Saint Patrick.

Les travaux, confiés par le Pape Innocence VII, à Antonio Sangallo le Jeune, représente une merveille d'architecture de la Renaissance montrant aussi que l'innovation peut être inspirée par la peur de la guerre.

Keywords: Water supply , Roman aqueduct, S. Patrick well, S. Gallo the Younger

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1. 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. Each important town had its own water supply system based on gravity aqueducts capable of providing water even from very far springs.

Given the vulnerability of water supplies mainly due to extension of aqueducts, after the fall of the Roman Empire, it was preferred to supply towns with “local” solutions such as pumping from wells, even within the walls of the city in order to have defensible sources and 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.

Pope Clement VII returning from the sack of Rome, decided to build a deep well to provide water to the town of Orvieto (Umbria) in case of siege. The pit, 54 meters deep and 13 meters wide, reaches down to touch the waters of S. Zeno springs. The project is to be attributed to Sangallo the Younger, a genius in terms of architecture if we consider the complex structure of the well.

Afterwards, with the consolidation of a national political structure, the adoption of systems of water supply from distant springs was proposed again. It is also interesting to notice that a completely modern aqueduct for Rome was built only after World War II. That was an important water supply for the new districts, which were rapidly spreading out from the city center. Water was abducted to Rome by means of the the Peschiera aqueduct, whose first branch was completed in 1949, while a second one was opened in 1964 providing water from the springs located near Rieti (about 60 kilometers north-east of Rome) and reaching the city from the northwest.

Thus, the water supply techniques adopted is clearly bound to the contingent socio-economic situation and hydraulic works are an expression of the local political structure to which technological knowledge have always adapted.

2. Roman adduction systems

The construction of Aqueducts, during the Roman empire, represents one of the biggest expression of the Roman Civilization and technical knowledge: “The highest manifestation of the greatness of Rome" as written in 97 aD by Frontino in quality of "curator aquarum", in his essay " De aquae urbis Romae ductu” [1] .

The adduction systems, based on gravity, supplied and carried water from springs located many kilometers away[2] . (see table 1). 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. The longest system was the 132 km long Carthage aqueduct, built in aD 160 and accounted as one of the marvels of the world.

A supply system based on aqueducts, however, is highly vulnerable especially during war periods because it is impossible to guard all the network and this exposes the water resource to possible fraudulent contaminations: “In order to defeat Rome you must take away its most valuable asset: water”. In fact, along with the slow but inexorable fall of the Roman Empire began the gradual and systematic destruction of the aqueducts [3], due to the invasions of the Visigoths led by Alaric in 410 AD, the Vandals of Genseric in 455 AD and 476 AD the Heruli of Odoacer. Another phenomenon that contributed to the destruction of the aqueduct networks was the strong earthquake occurred in 394 AD. During the siege of Rome by Vitige King of the Goths (534 AD), the aqueducts were interrupted in several places and all outlets were closed. Because of that strategy, Rome, for nearly a thousand years, was left without its precious resource. During the medieval period water was provided by the "acquarioli" who were people distributing filtered water taken from the Tiber River.

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

Tab. 1 Characteristics of Roman aqueducts.

3. 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. This amazing masterpiece of hydraulic engineering was originally named Pozzo della Rocca ('Fortress Well'), as it is located close to Albornoz fortress, but its name was changed to Pozzo di San Patrizio ('St Patrick's Well') in the 19th century .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.

The work was committed by pope Clement VII, after the "Sack of Rome" in 1527 of the Holy Roman Empire under Charles V [4]. In fact, 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. 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 [5] and the fortifications of other cities, including Orvieto [6].

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. An inscription on the well says: 'QUOD NATURA MUNIMENTO INVIDERAT INDUSTRIA ADIECIT'.

The project of Sangallo , who was already working on the fortifications of the city, 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) and created an ingenious system of more than 200 helical steps (248) in order separate the entrance and exit pathways avoiding "traffic" . (Figure 1).

Figure 1 Spiral staicase in S. Patrick well, Orvieto, Italy

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 (Figure 2).

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 [7]. 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 .(Figure 2).

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 [8].

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

Figure 2: sight of “Finestroni” and of bridge

Figure 3 outside of S. Patrizio well and Farnese lily

4. 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.

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