

[ROSAPAT 12]



PRECIOUS WATER

Paths of Jordanian civilizations
as seen in the Italian archaeological excavations.
Proceedings of the International Conference
held in Amman, October 18th 2016

Edited by

LORENZO NIGRO - MICHELE NUCCIOTTI - ELISABETTA GALLO



ROME 2017

«LA SAPIENZA» EXPEDITION TO PALESTINE & JORDAN

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CHANGING WATER MANAGEMENT AND EXPLOITATION STRATEGIES AT AL-WU'AYRA (PETRA). A "LONGUE DURÉE" PERSPECTIVE THROUGH LIGHT ARCHAEOLOGY METHODOLOGY

Andrea Vanni Desideri - Guido Vannini*

The authors describe the modification of water management at the site of al-Wu'ayra (Petra) from Nabataean up to Crusader period according to the results achieved through the innovative and experimental procedures of Light Archaeology, by the Mission "Medieval Petra. Archaeology of the Crusader-Ayyubid settlements in Transjordan" of the University of Florence.

Keywords: Petra; al-Wu'ayra; water; light archaeology; Crusader

1. INTRODUCTION

As we know, water is a resource, in the right quantity. On the other hand, water can be a real problem when it is too much, as the 50th anniversary of the Florence flood reminds us, or when it becomes scarce and precious, as in the case of the site of al-Wu'ayra.

The site of al-Wu'ayra is located on the east of the ancient town area of Petra, corresponding to the oriental border of the Petra Archaeological Park, along the road from Wadi Musa to Beidha (fig. 1).

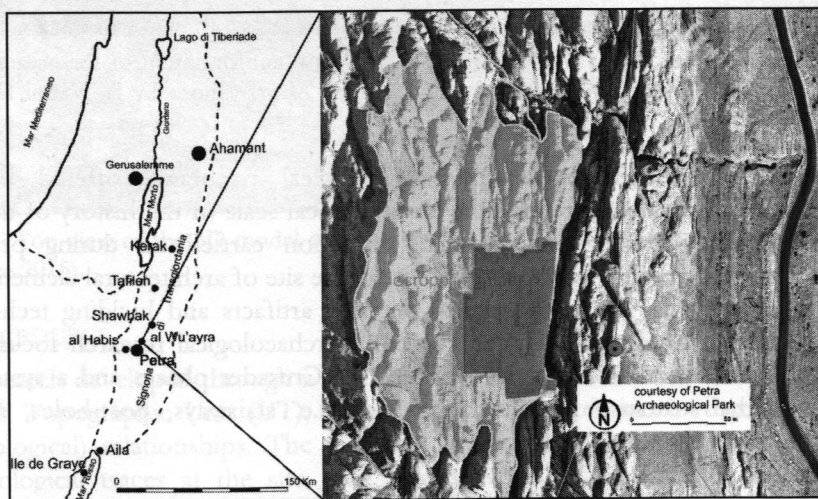


Fig. 1 - Location of the site of al-Wu'ayra and its surroundings (courtesy of the Petra Archaeological Park).

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From the first phases of the research carried out by the Mission “Medieval Petra. Archaeology of the Crusader-Ayyubid settlements in Transjordan” of the University of Florence on the medieval settlement dynamics in the area of Petra, the site of al-Wu’ayra was chosen as one of the most suitable and scientifically promising spot, where to investigate such a crucial period of the history of the entire region¹. In particular, the aim of the mission is to investigate the reasons, the forms and the heritage of the European occupation and, in a wider perspective, its historical significance in the moulding of ‘medieval’ and modern Transjordan².

The site of al-Wu’ayra, whose Arabic name means “place of difficult access”, is located in an area with a very particular geomorphological condition. A number of North-South faults moulded the bedrock in a series of sub-parallel ridges, smoothed by weathering and separated by more or less deep narrow wadis (fig. 2).



Fig. 2 - North view of al-Wu’ayra showing the geological conformation of the area and the surviving structures of the Crusader castle of *Li Vaux Moises* (photo by A. Vanni Desideri 2011).

As the research developed, the chronological panorama offered by the archaeological data, widely extended the chronological scale of the history of the site. The stratigraphic soundings and surface collection carried on during previous campaigns, not only pointed out the presence on the site of architectural elements and objects dating back to Nabataean times, but also artifacts and building techniques peculiar to Roman-Byzantine Petra. Since 2011, archaeological research focused on the extension and the characteristics of these pre-Crusader phases and a systematic mapping of the structures cut into the rock, i.e. stairways, post-holes, niches,

¹ The very first archaeological sondages at al-Wu’ayra were performed by R. Brown (1987).

² On the historical perspective, aims, methodology and results of the project, see: Vannini 2011; 2012; Vannini ed. 2007; Vannini - Nucciotti edd. 2009. The research at al-Wu’ayra is coordinated by A. Vanni Desideri and conducted on the field by S. Leporatti (University of Florence), D. Rose (Sapienza University of Rome). The surveys are conducted by R. Gabrielli (CNR, ITABC, Rome), P. Drap (CNRS, Marseille), F. Villani and M. Merlante (FT Studio).

platforms, channels, cisterns etc., was started in order to ascertain their chronology and function.

The aim is to consider such traces as clues to the different uses of the area, in order to understand how the landscape has been modified according to different needs and purposes throughout its history. This new step of research has been planned and performed with light archaeology methods, including low altitude 'aerial' photographs and 3D surveys (fig. 3). A methodology that integrates the architectural upstanding contexts (which, in the cases of Shawbak and, more recently, Kerak, has allowed a high degree of interpretation), with the landscape and environment stratigraphic analysis; as in this case, exemplary also from the methodological point of view.

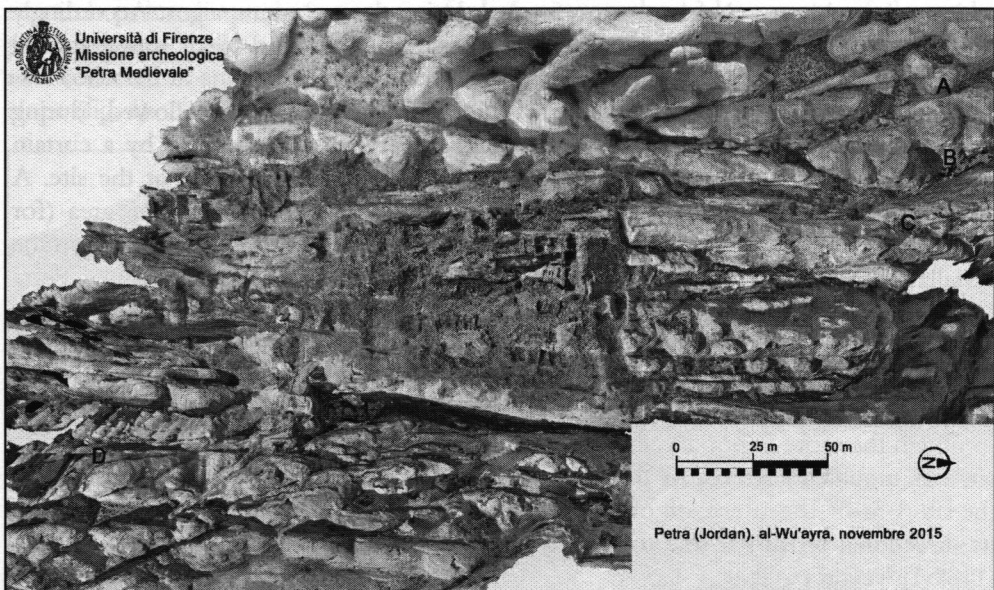


Fig. 3 - Top view of the 3D model of al-Wu'ayra (photo and processing by F. Villani and M. Merlante 2015).

2. PROCEDURES

Research developed through a first step including reconnaissance and registration of each Topographic Unit (UT), paying a particular attention to their physical (i.e. chronological) relationships. The mapping of rock cut traces, the most numerous archaeological traces at the site, was accomplished by means of a GIS platform specifically dedicated to their registration. The survey was then completed by 3D digital photogrammetry, obtained from surface as well as from low altitude aerial photographs in two different scale. A territorial survey for the comprehensive representation of the site was followed by a more detailed survey for single UT or groups of them. The latter was very useful especially for the comprehension of the

spatial, chronological and functional relationships between the different rock cut structures included in each UT. In such a way it was possible to ascertain the relative chronology of rock carvings and their features (tool marks, stone dressing techniques etc.). The 'absolute' chronology was reached through comparison with an already produced chrono-typology of all artificial traces (different kinds of building materials, stone dressing techniques, tool marks, masonry types etc.), on the basis of the stratigraphic sequences and artefact assemblages in the area³.

3. RESULTS

The chronological range from Nabataean/Roman to Late Islamic Periods has been confirmed by stratigraphic sondages as well as by surface collection of pottery sherds and erratic architectural elements, performed during the early campaigns. Accordingly the site revealed substantial modification of its functional and topographical organization.

The Nabataean horizon, possibly of funerary purposes, was followed, during Roman-Byzantine Period, by a probable military settlement, protected by a curtain wall, built up with limestone, a building material of new introduction at the site. A similar pre-Crusader occupation has been demonstrated elsewhere in the area (for instance at Shawbak/Najil). The subsequent desertion of the Roman-Byzantine installation, reflects the radical loss of urban and territorial directional role of Petra (7th-11th centuries CE).

Such a directional role was re-started and re-interpreted during the short Crusader Period (1100-1189 CE) by rearranging the whole installation. During this period a new building material appears, the fine 'blonde' sandstone easy to process and mainly used to obtain the more important and finely carved architectural elements and decorations, such as moulded cornices or the same apse of the church. The second desertion of the site, one of the aftermath of the defeat of Hattin, was the result of the transfer of its directional territorial role to the new Ayyubid-Mamluk capital-town of Shawbak (1189-16th century CE).

The late period of occupation (Middle-Late Islamic) shows at least three phases, beginning with the simple use of the surviving collapsed structures of the castle, without significant modifications, soon transformed by local dwellers into a quarry for building material, employed in the building up of a new 'endemic' use of the site⁴. Accordingly the use, management and exploitation of water underwent substantial modification somehow reflecting the intensity of human impact on the site, deduced from the quality of archaeological data⁵.

³ Vanni Desideri - Sassu 2014, 100-101, figs. 6, 8.

⁴ Vanni Desideri - Sassu 2014.

⁵ For a concise outline of landscape use and modification at al-Wu'ayra, see: Vanni Desideri - Vannini 2016.

3.1. The Nabataean phase

The chronology of the earliest phase at the site has been deduced through the synchrony of the typology of erratic architectural elements (capitals, column bases, column drums, decorative reliefs etc.) with stratigraphic (sondages) and typological (surface collection) contexts of pottery sherds and artefacts corresponding to a Nabataean horizon⁶.

The horizontal distribution of this evidence, both in term of finds and structures, indicates that whole surface of the later Crusader castle of al-Wu'ayra was occupied, maybe for sacred and/or funerary purposes, with an articulated topography, following the geological conformation of the site.

This phase shows the more constant and complicated connection with water. The research pointed out the presence of platforms on the highest spots of the rocks provided with shallow rock cut channels for the distribution of water (most probably rain collected in small cisterns). The longest channel runs for around 50 m towards a slope (fig. 4).

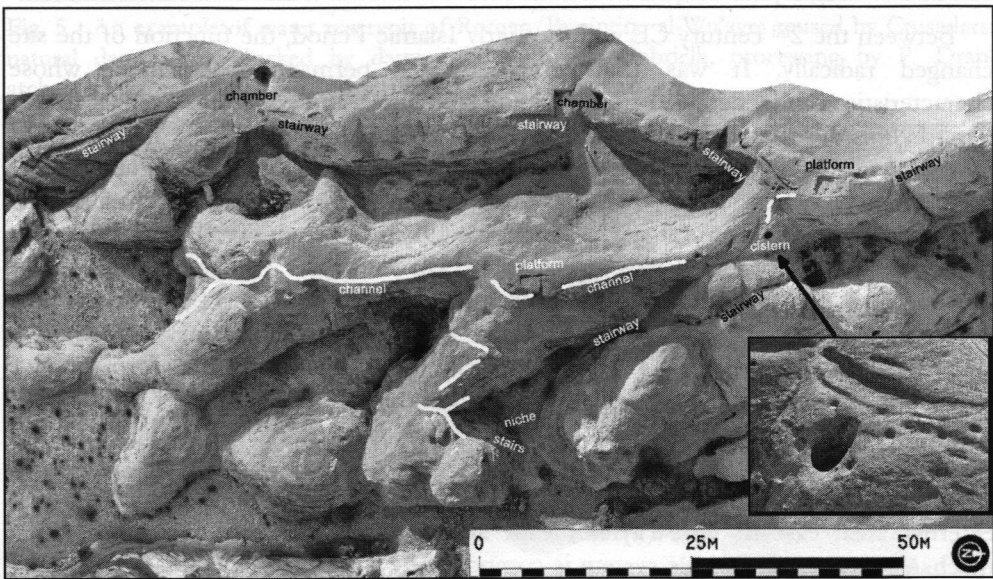


Fig. 4 - Example of Nabataean water management at al-Wu'ayra (photos by R. Gabrielli, processing by P. Drap, archaeological reading by S. Leporatti and A. Vanni Desideri).

At the moment, we have no plausible interpretation for such structures but it is almost clear that they were not intended for utilitarian purposes. The channels sometimes start close to small cylindrical water reservoirs with whom they apparently do not show physical connection. In this case it is possible that water was simply drawn from the reservoir and poured into the channels producing a weak flow rate

⁶ Vannini - Vanni Desideri 1995; Tonghini - Vanni Desideri 1998.

with no more than a symbolic function. Even if we have no indication of its final use, it is worth noting that some canals end with multiple courses simply flowing down the slope, sometimes close to rock cut stairs, horizontal post-holes, entrance of rock cut chamber cavities or rectangular niches.

The narrow northern wadis were arranged in complexes, sometimes protected by gates, provided with rock cut stairways leading to rock cut structures of various types, such as chambers and niches of possible funerary function.

During this phase the role of water seems strictly connected with activities performed close to these complexes, as demonstrated by the constant and close connection between tombs and water, which is provided by channels cut into the rock and collected in cisterns, too small and too dispersed to be intended for utilitarian use. Also the activities performed around the platforms located on the highest spots, mainly in the western part of the site, made use of water (possibly rain), collected into small rock cut cisterns.

3.2. The Roman-Byzantine phase

Between the 2nd century CE and the Early Islamic Period, the function of the site changed radically. It was transformed into a permanent settlement whose characteristics can be deduced from building techniques and structures peculiar to this period. For the first time in the history of the site, the inhabitants made use of limestone blocks obtained from a geological formation at the top of the mountain east of al-Wu'ayra. These were probably arranged in order to form a curtain wall. Identified for the first time at al-Wu'ayra in the 1998 campaign, this Roman-Byzantine phase was later recognized also at the castle ash-Shawbak⁷. Altogether with rough limestone blocks, nummulitic limestone seems to be peculiar to this phase and mainly used for finely carved architectural decoration, as the outline of openings.

During this period, the need for water supply produced the transformation of some natural depression into utilitarian structures, as in the case of two wadis, transformed by dams into basins for collecting rain, later on reused by the Crusaders (fig. 5).

But the most interesting hydraulic system of this phase is the one identified in the external area, east of al-Wu'ayra, meant at providing the operating power to a mechanic device. The whole system is composed by a net of rock cut canals drawing water from a small wadi running from the top of the mountain on the eastern outskirts of the site. The non-continuous seasonal flow rate appears to have been sufficiently strong during the past, judging from the several giant potholes produced into the bedrock. Downstream the water was then collected into two reservoirs obtained by blocking two natural depressions with a couple of dams (fig. 6).

⁷ Nucciotti 2007, 33; Vannini - Nucciotti 2012, 136-137.

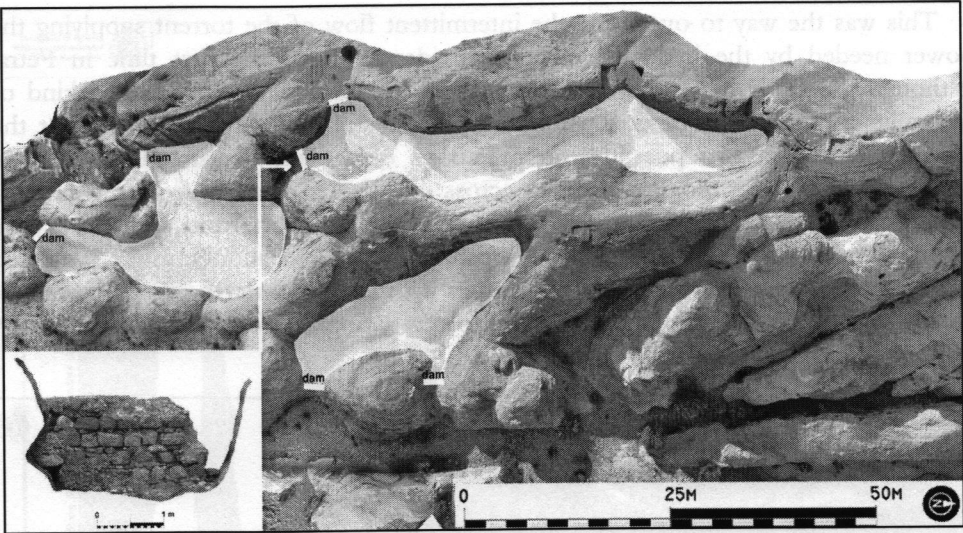


Fig. 5 - An example of water reservoir of Roman/Byzantine al-Wu'ayra reused by Crusaders: natural depressions blocked by dams (photos by R. Gabrielli, processing by P. Drap, archaeological reading by S. Leporatti and A. Vanni Desideri).

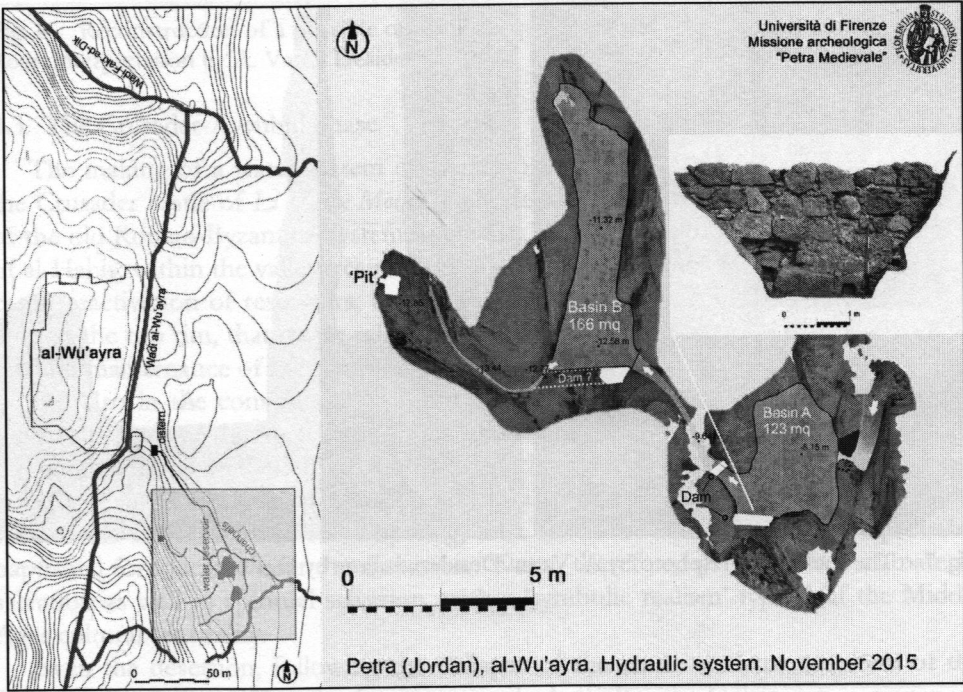


Fig. 6 - External water reservoirs and dam providing water to the hydraulic device of Roman/Byzantine al-Wu'ayra (photos, processing and archaeological reading by S. Leporatti, D. Rose and A. Vanni Desideri).

This was the way to overcome the intermittent flow of the torrent supplying the power needed by the hydraulic mechanism identified for the first time in Petra. Although the study it is not yet accomplished, the machine seems to be a kind of hydraulic counterweight device, whose function is still under study (fig. 7)⁸. At the moment there are two possible interpretations of the mechanism. The first one proposes a device for moving materials across the Wadi al-Wu'ayra from the external area (fig. 8). The second interpretation as a water mill, apart from some structural incongruence of our installation and its apparently strange location, must be evaluated more carefully⁹. Anyhow, it shows similarities with ancient water powered machines, mostly with models developed in the Hellenistic Period between the 3rd and the 2nd century BC and then spread in a later period.

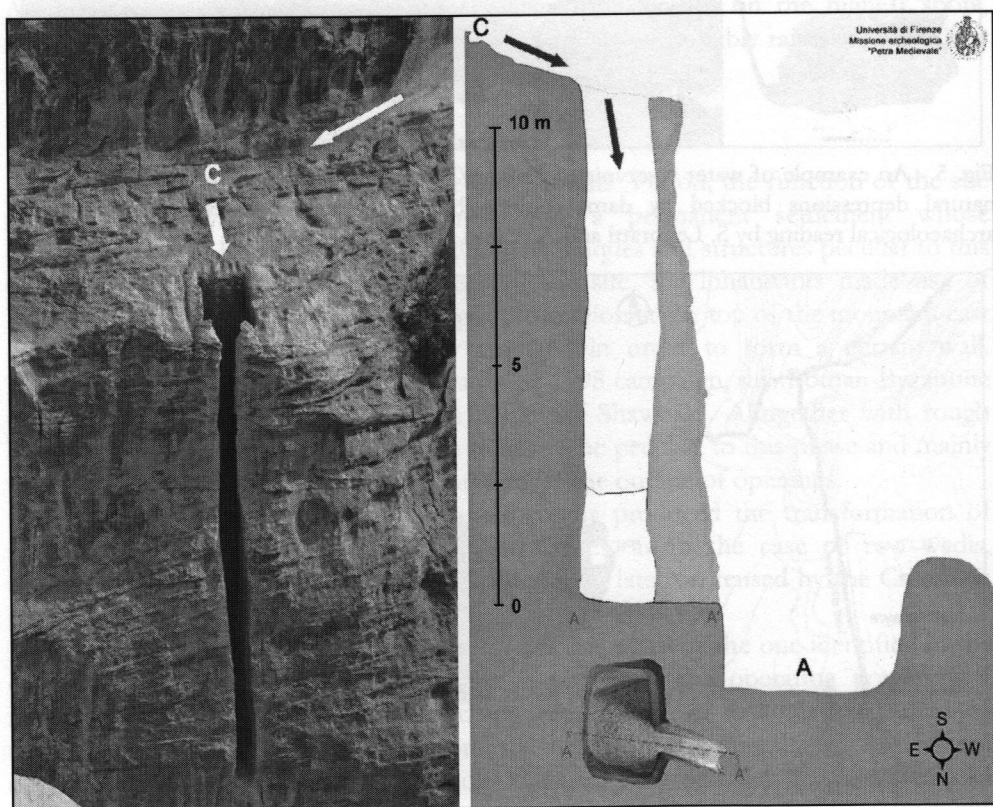


Fig. 7 - The rock cut 'pit' (photo by A. Vanni Desideri, survey by D. Rose).

⁸ A first report on this hydraulic system is provided by: Vanni Desideri - Leporatti 2014.

⁹ On water mills in Jordan, see: Greene 1995; McQuitty 1995; Rogan 1995; Kamash 2009, 231-243.

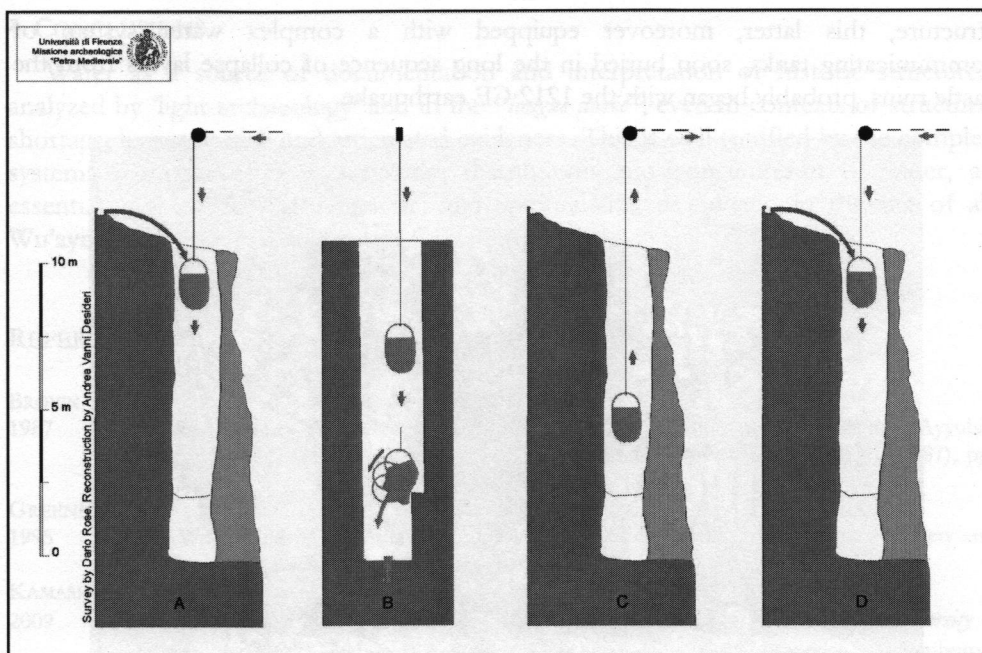


Fig. 8 - Reconstruction of a possible operating sequence of the hydraulic device (survey by D. Rose, interpretation by A. Vanni Desideri).

3.3. The Crusader-Ayyubid phase

The making of a water system calibrated on the possibilities and requirements of the Crusader castle of *Li Vaux Moises*, consisted in a recovery of sections and sectors of the old Roman-Byzantine system: segments of pipes, well attested also at the castle of al-Habis, within the valley; restoration of service tanks near the towers and, in many cases, reactivation of reservoirs, the largest of which shows alignments of post-holes around the top rim, that might relate to a wooden roofing or scaffolding probably for use and maintenance of the reservoir itself.

But also in the construction of impressive vaulted cisterns, like the one fronting the south ditch of the keep (fig. 9) and, above all, the monumental cistern set below the entire surface of the hall of the fortified church (fig. 10) – located at the summit point and as last defense of the keep – with a specific system of canals dug into the rock, both for filling and for emptying, and on direct connection with a probable baptismal font located near the *diakonikon*. Water, therefore, was perceived as material salvation as well as spiritual salvation, with a ‘symbolic realism’ typical of the Middle Ages cultural sensibility.

Even the desertion, following the collapse of the entire settlement system of the Crusader Lordship of Transjordan, a year and a half after the Hattin day, is evidenced by the very location of an Ayyubid metal workshop in the south ditch of the keep, which documents the entire, irreversible defunctionalization of the castle area: a

structure, this latter, moreover equipped with a complex water system of communicating tanks, soon buried in the long sequence of collapse layers from the castle ruins, probably began with the 1212 CE earthquake.

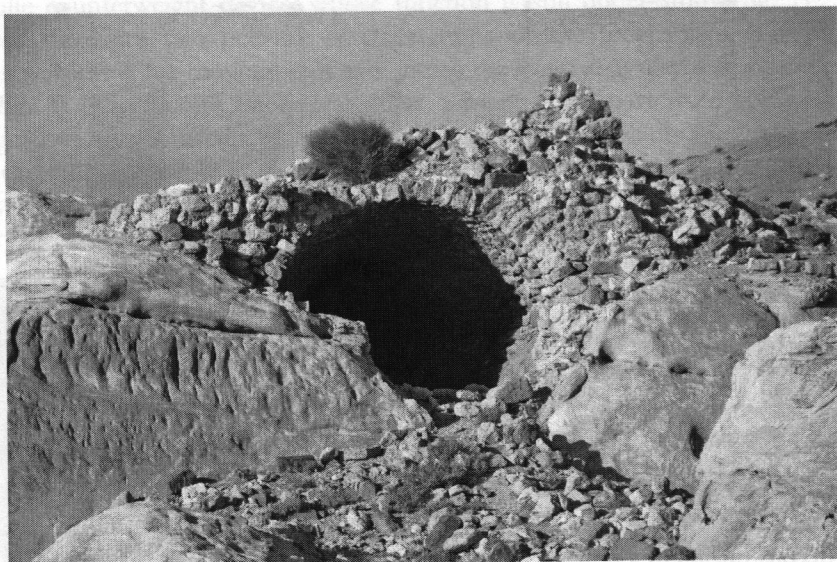


Fig. 9 - The southern cistern of the Crusader castle (photo by A. Vanni Desideri 2016).

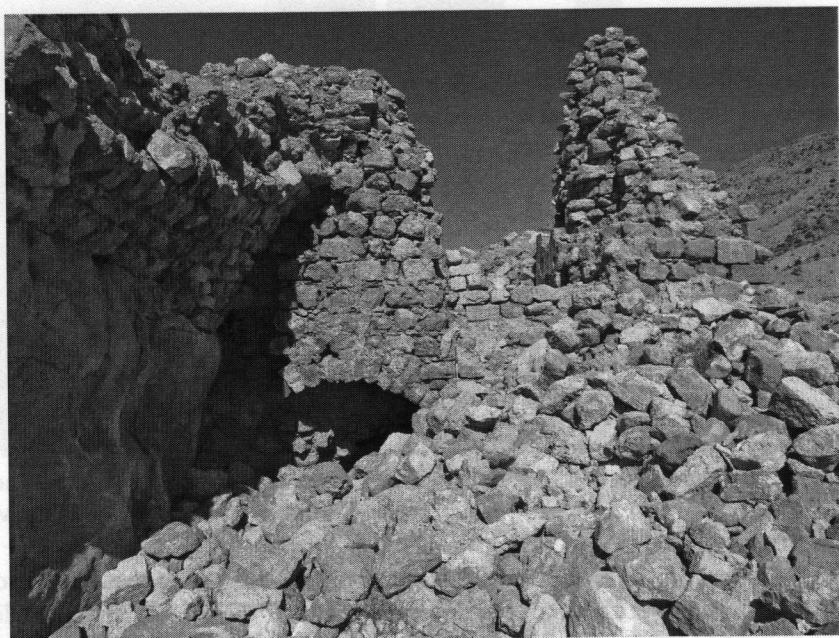


Fig. 10 - The entrance to the cistern underneath the church (photo by A. Vanni Desideri 2015).

4. CONCLUSIONS

Water as a source of documentation and interpretation of historic structures, analyzed by 'light archaeology' and in the "longue durée", even in contexts of structural shortage, leaves us rich and articulated evidences. This is well testified by the complex systems for collection, preservation, distribution and consumption of water, an essential element for both material and spiritual life, discovered in the site of al-Wu'ayra during the Nabataean and Crusader phases.

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