RE -DISCOVERY OF PALMYRA

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SUMMARY

Palmyra is a World Heritage site well renowned due to its ancient monuments. Recent studies have brought to light locally developed building techniques. This discovery is represented by the sequence of gradual changes and modifications in building techniques. Conservation and proper exposition of endangered at present architectural remains is cruccial for protection, not only magnificent monuments, but also intelectual values being utilized for their construction

1.

The great interest to ancient history and antiquities in Europe at the end of the 17th and 18th centuries was a result of both, the scientific tendencies of the Enlightment and desire to attain the unattainable. Those were a key factors in exploration of the Near and the Middle East resulting also in ancient sites research. Palmyra was one of destination in Orient. The site was famous because of a dramatic breakdown of Palmyrean rebellion by Aurelian in 273 AD and later Emperor's triumph in Rome, where Zenobia, the Queen of Palmyra had been brought in golden chains.

Discovery of Palmyra in the modern times has not been an easy task, due to the danger of desert tribes robbing foreign travellers. Therefore succesful journey of Mr. William Halifax and his companions from Aleppo to Palmyra in 1695 had been well received by European scholars and antiquarians. Mr. Halifax's impressive panorama of ruined town had soon been copied in numerous 18^{th} century books as an illustration of ancient city on the desert. Due to Robert Wood and James Dawkins expedition in 1753, and their complex description and

drawings of Palmyrean temples inscriptions and sculptures considerably magnified interest to the site. Next visitor, Mr. Cassas, completed numerous beautiful vistas of ruined monuments, where ancient buildings were inhabited by Beduins or ploundered by local robbers in search of sculptures. Cassas's representations of Palmyra opened the 19th century chapter of romantic voyages to the East to relive and contemplate with ruins grandeur of the ancient history. Lady Hester Stanhope and her followers considerably inreased the interest to the site. Numerous epigraphic studies completed in Palmyra shifted scientists' interest to town's important role as an ancient crossroad of intercultural exchange. The 20th century started with great archaeological expeditions, the German one before the I World War and the French during the period of the mandate. Since the 50ties excavations completed by Syrian, Swiss, Polish, Japanese missions exposed plenty of ancient buildings and provided a great deal of scientific materials. [1]

World wide fame of Palmyra causes thousands of tourist visits every year. The inclusion of Palmyra on the UNESCO's World Heritage List in 1980, considerably promoted the site as an obligatory point in travel agencies programs. Tourists coming to Palmyra can appreciate well preserved monuments, the Great Temple of Bel, temples of Allat, Bashamin, Nebo, public buildings – theater, Agora, Senate house, Baths, famous the Great Colonnade, Diocletian defence walls with remains of a legion camp in the Western quarter, numerous early christian churches and hundreds of underground and tower tombs on town necropolies. The museal collection is rich and full of priceless sculptures and archaeological objects. The number of building heritage, the high artistic quality of Palmyrene sculptures, as well as marvelous romantic views of ancient ruins on the desert create here a touristic paradise, still unspoiled, due to Syrian authorities strong policy forbiding modern development on the archaeological site.

2.

Palmyra was a unique city, where cultural influences of the East and the West crossed over. Hellenisation and Romanisation of the population during the 1st and the 2nd centuries AD influenced the intercultural change of a traditional style life, as well as resulted in mixture of oriental decoration and classical character of architecture. In general opinion, the replacement of architectural form from mud brick to stone architecture, occured rapidly in the 1st century AD. Here, cruccial was hire out a well experienced team of skilled masons for the Great Temple of Bel construction. The foreign builders brought to Palmyra not only classical forms of architecture, but also construction methods using stone for building. This developement influenced the local building trade causing a stone character of a new buildings against the old ones constructed in mud brick. The closer examination of Palmyrene monuments has brought to light the new evidence, which can confirm, that the change occured in a long period with very individual approach of local masons to building with stone.

Development of building techniques in Palmyra emerged in a few stages. The earliest examples are from the 2nd century BC. They had been constructed of mud brick, but its interesting feature was employement of arch, however in simple form. Up to the end of the 1st century BC for construction of important buildings, roughly dressed stone were used. Comparing tower tombs of this period with the later ones, of more elaborated structure, we can observe quick process of changes. The opening of a new quarry of a hard white limestone

was cruccial in this process. A hard limestone was necessary for construction of a Great Temple of Bel. [2] The bedding of this deposit due to its stratiform character enabled the limestone to be cut, both in ashlars and in large thin slabs. The possibility of a large slabs cutting became the main factor of further developments in Palmyra.

The early slabs of a hard limestone were employed in Palmyrene tower tombs. The walls of first towers were built with undressed stones, while from the end of the 1st century A.D. with ashlars, what resulted in perfectly vertical outer walls. The ceiling slabs occured in monuments dated to the middle of the 1st century. In this period slabs were rather short and did not exceed 1.5 m , what caused necessity of corbelling for their support. In latter monuments, the slabs reached up to 3 m in span, which allowed inner chambers to became more spacious and corbelling for supporting shorter slabs to be abandoned. The most spectacular change in Palmyrene building techniques was however the employement of thin slabs in wall costruction. From the middle of the 2nd century AD the construction of walls was modified. Size of stone blocks seemed to have been governed by the idea to retain the same weight of individual block, thus their length and width increased while their thickness diminished. Construction with bigger but thinner blocks caused the new technical solution to be used. The scaene frons in the theater consists of courses made of stone blocks set in pairs as stretchers. In latter extension of theater north wall, this solution was improved by use of mortar filling joining parallel blocks. Therefore, the wall became thinner about 20 cm. The crucial point of the development of art of building in Palmyra was use of large slabs (ca. 1 x 3,5 x 0,35 m) set vertically on edge and joined together without use of any clamps or dovels. Analyzing the size of slabs and ashlars one can suspect that average stone blocks of volume of about 1 cubic meter and weighting up to 3 tons were prefered in Palmyra. This observation would suggest the idea that Palmyrene masons had been limited rather by stone block weight than by its size. Resignation of cubic ashalrs in favor of long and thin slabs was presumably stimulated by some economic and technical advantages. It allowed to limit the number of construction elements needed for wall building. Reduction of stone dressing to an indispensable minimum permitted saving time and high skilled manpower. This new building system was very efficient and cheap due to the fact that slabs needed less time to be prepared and assembled. This appreciable development of „opus emplectum", its original and only used in Palmyra form allowed me to name it „opus Palmyrenum".[3] As a result of this new solution, the ordinary „opus emplectum" method was visually improved by giving the impression of large ashlar masonry. This new technique was employed in Palmyra in the beginning of the 3rd century AD for houses and shops construction. The idea of constructing with big blocks was also adopted for erecting of columns. In the 3rd century Palmyra, there were plenty of monolithic shafts, while the elder monuments had columns constructed with small drums. The Great Colonnade being built between the middle of the 2nd century untill the end of the 3rd century can be here a good example. Columns in earlier porticoes of the height 7,3 m were made of 7 to 8 drums, contrary to the 3rd century examples of the same hight made of 4 only. Possession of column's monolithic shafts, as well as long drums was possible due to the horizontal way of limestone querring. It is necessary to say that this way of stone block cutting, being vertically set in building, especialy in the case of column drums, shafts and wall's slabs, broke the fundamental principle of stone employement in building. In Palmyra, the variety of well preserved vaults and arches provide us a rare opportunity to study and form an opinion about transition and the development of local building trade.[4] The limited impact of Romans until the 2nd century create here a chance to evaluate the origins and establish the real level of local masons capabilities. The oldest arch construction in Palmyra was found in

in the 2nd century BC tomb. It was a simple stone construction over a narrow door opening, having rather a decorative character and not structural importance. The tomb was built of mud brick and we can only presume its roofing was constructed of mud brick as well. The next examples of vaults and arches are dated to the early 1st century. Apart of pitched stone corbelled vaults in Palmyrene tower tombs, there are domes and vaults being executed in very special manner. They seem to be a regular constructions, but after examination, the unusually low thickness and low quality of the soft limestone voussoires confirms their false character.The „slab" voussoires had specially rebated joints. By overlapping each other, they formed a kind of shuttering into which the lime mortar was poured, thereby constructing a monolithic solid structure. The largest construction of this kind spans up to 3,5 m. In latter monuments, rebated joints were used both, in stone vaults and arches. This technique ressembles the idea of dowelling or clamping being practised in construction of some early stone vaults. Another original feature presented in Palmyra were arches of crosseted voussoires having abnormal length. The size of the voussoires allowes the classification of the arch structural work as a corbelled construction. It should be mentioned, in some arches of the 1st and the 2nd centuries rebated joints were applied. In ordinary practice extravagant cutting of rebated joints and crosseted voussoires is carried out purely for the sake of appearance, but in Palmyra such features had presumably a structural meaning. It could assure the masons of the structural stability and durability of arches. It has become obvious that local builders knew perfectly the idea of arch construction, but they were afraid to introduce it in a regular form in a stone building. This is clearly visible in the side entrance to the Bel Temple constructed at the end of the 2nd century. Here, two arches of the same span were built, but differently implemented depending on their load bearing. The inner arch, between the columns of the temenos is constructed of regular voussoires, but the arch beneath in the temenos wall has both, crosseted voussoires and rebated joints. The construction of the famous Monumental Arch of span 6,9 m, built in the beginning of the 3rd century, from engineering point of view should not be recognized as an arch. [5] Its main and side arches were constructed as a structures of interacting crosseted voussoires mounted with rebated joints and locked with a large double beam acting as a key stone. The application of these solutions allow us recognize this structure construction as corbelled. Contrary to the 2nd century monuments, the arches of the 3rd century were rather bland. At that time at least eight large arches were constructed with use of regular voussoires. The development of the building trade which occured in Palmyra at the turn of the 2nd and the 3rd centuries can explain this dramatic change.

3.

The problem of arch building in Palmyra is a very interesting case, when compare it with numerous constructions erected at the same period in the nearby Hauran and towns of Decapolis, i.e. Gerasa, Bosra, Shahba, where the strong impact of Roman architects was present. At that sites, the employement of arch construction was not only limited to arches, vaults or domes, there were also relieving arches, flat arch lintels and „opus caementicium" structures, but in Palmyra such forms practically did not exist till the end of the 3rd century. In Palmyra, the long continuity of pre-arch forms and adoption of the simple arch structures built in stone confirms that local masons doubted their experience constructing the heavy stone arches. They were afraid to repeat the forms seen in other towns in Syria, however they utilised the structural idea of arch construction. Presumably their experience was different and was mainly based on constructing corbelled arches, mud brick vaults or light domes on a

wooden skeleton. The evidence of Palmyrene building heritage confirms the long lasting transition period and gradual abandonement of the local roots of building tradition. [6] Dramatic change in architecture of Palmyra at the begining of the 3rd century can be explained by the great development of the town and desire to have architectural forms proper to a capital city. The advantage of „opus Palmyrenum" looking like the „Grand Appareil" technique enabled Palmyra uphold its prestige. The volume of work done in town at that time can be comparable with other Middle Eastern cities – Gerasa, Apamea, Bosra, but Palmyra being situated on the desert had presumably much more bigger problems with building. Treeless Palmyra resembles problems of Hauran, but here they were solved in different way. The isolation of Palmyra in the desert was an important factor in an independent approach to architectural forms known from the other parts of the ancient world. The strucural analysis of Palmyrene buildings enables us to isolate the milestone examples and form their sequence of development. These monuments have an outstanding importance as examples of understanding a human approach towards building. The new investigation in the region, in Jerash, Hauran, as well as in ancient towns of Asia Minor confirm that adoption of the new trends coming from Rome owed plenty to innovative local architects and proper usage of locally available materials. [7] These were a main factors of bold architectural development in the region.

4.

The case of Palmyra architectural remnants has considerably broaded the issue of the Middle East cultural heritage protection, also to aspect of intelectual values ingeniously treasured in stone. However, the famous ruins of Palmyra seems to be eternal, but there are constant process of limestone deterioration, especially on remnants exposed after excavations. [8] The sequential of a limestone biological deterioration and stone expansion due to temperature oscilation, considerably endangers the state of decorated elements and causes block cracking. Despite frost resistance of the solid rock, a thin veins between layers subjects limestone to stratification. This form of stone destruction is caused by frost and big temperature oscillations normal in the desert climate. Additional factor of bigger rate of Palmyrene hard limestone deterioration is the way of limestone block setting in walls or columns. Blocks, and especially slabs set vertically expose veins in stone for water penetration, which accelerates stone flaking. Preservation works executed in Palmyra have left the mechanism of stone deterioration out of account, and have, therefore, not provided the answer to the protection of Palmyrene monuments. There were plenty conservation and restoration actions undertaken in Palmyra, but the efforts of the Syrian team of conservators do not cover the scale of problems in numerous ancient buildings. Important for protection of the Town's heritage is to formulate a wide programme of protective works including elaboration of conservation techniques acceptable in Palmyrene conditions, because a different conservation measures, ballanced according to the individual situation should be applied there. The unique complex of the West Necropolis (the famous Valley of Tombs) should have its own programme, including architectural documentation, because many of the preserved tombs have not yet been documented in modern way. Remains of ruined monumentss should be cleared and protected against progressive deterioration. There are still plenty of richly decorated blocks exposed for destruction. Measures to save them should be undertaken. The characteristic features of the Palmyrene landscape are columns and colonnnades, both those originally preserved and those newly re-erected. Their skyline forms a wonderful view, but columns alone are not able to create a three-dimensional image of town's monuments.

It would be difficult, or even impossible, to reconstruct the walls of buildings, but it would be highly recommended to anastylose them wherever possible. The additional benefit of such action would be the protection of stone masonry against deterioration, especially in newly excavated sites. Palmyra is a typical example of the way how architectural heritage is presented to visitors. Tourist guides emphasize only a great scale and beauty of Palmyra monuments. There is lack of posters or billboard planches informing about the construction method of temples or erection of houses. At present this important chapter confirming human creativity is neglected and hidden, being reserved only for scholars. The proper exposition of ancient ruins focused also on building technology aspects, should considerably increase the importance of these remains, till now being recognized because of their artistic value. The restoration works already completed, as well as future conservation activities in the town would protect the marvallous complex of ancient ruins, and would form for visitors a more attractive image of glorious Palmyra. The international assistance would be of a great importance in protection of this undisputable World Heritage site.

5. REFERENCES

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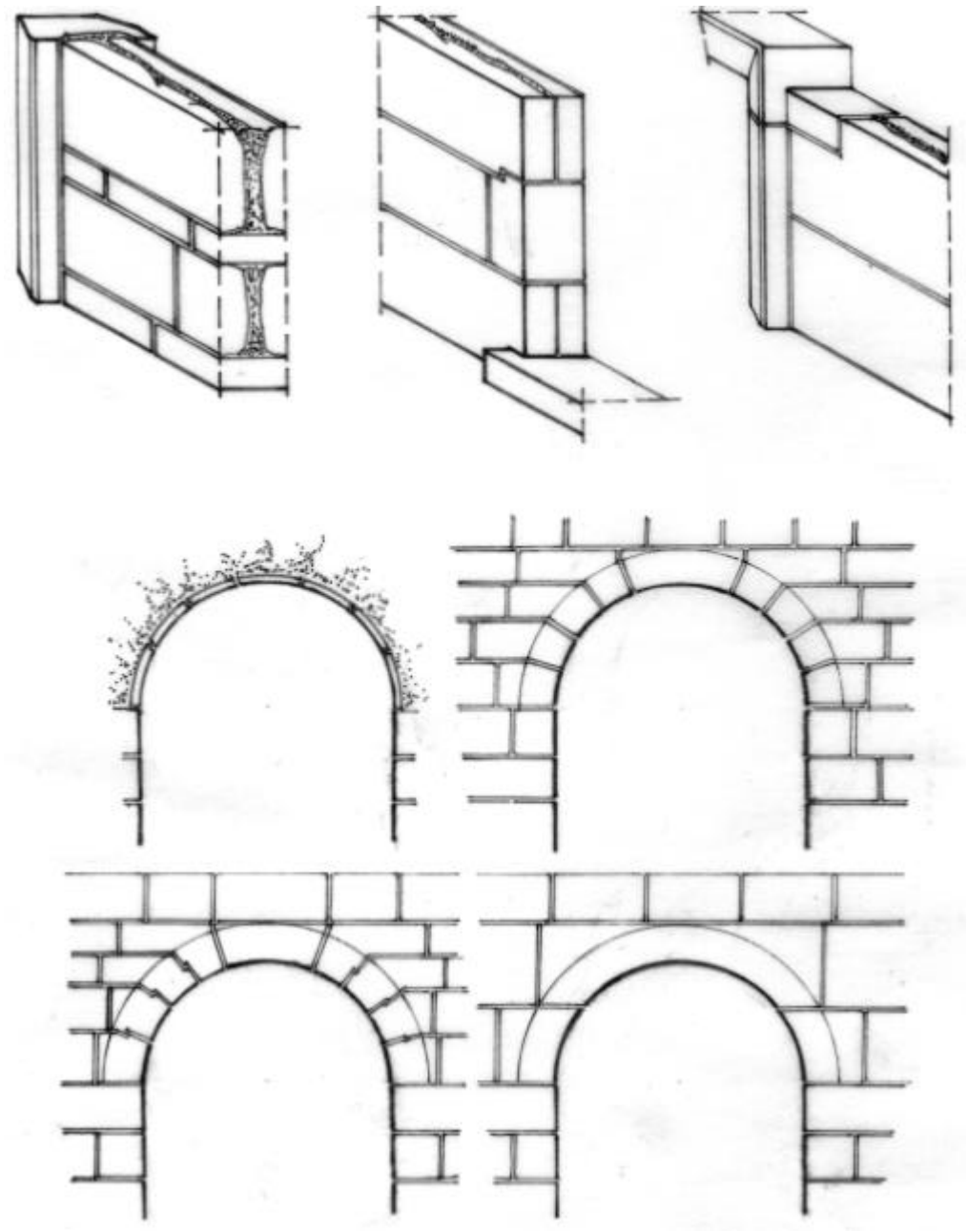

Solutions applied in building techniques in Palmyra for construction of walls, arches and vaults.