BUILDING TECHNOLOGY TRANSFER BETWEEN MALTA AND THE MIDDLE EAST: A TWO WAY PROCESS

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SUMMARY

A good knowledge of historic building techniques is essential for the correct conservation of monuments. The building technology transfer between the Maltese Islands and the Holy Land has a long history and, surprisingly, has been a two way process. Whereas Nabatean building technology of the 3rd century was imported into Malta during the Early Middle Ages, during the 19th century, Maltese building technology and expertise were exported to the Holy Land.

1. INTRODUCTION

The correct conservation of monuments demands a thorough knowledge of the building materials and techniques used. The evolution of building technology throughout the ages has been a gradual process and the influences of international cross currents should not be under estimated. Traditions in architecture generally evolve slowly as they are handed down from generation to generation. The rate of evolution is dependant on external influences such as political, social and economic factors. Innovations, which are constantly being imported, only take root when the local conditions are right for them to do so and then the results can be surprising. Similarly, ideas and technologies can be exported when conditions are right for a successful technology transfer. This paper will show how building technology transfer occurred between the Middle East and the Maltese Islands in both directions at different times which means that the conservation of monuments in both areas must take these factors into consideration.

2. 'NABATEAN' TECHNOLOGY

2.1 Petra

The Nabateans were a Semitic people who emerged from the Arabia desert to inhabit the Negev and ancient Edom in Transjordan from 3rd century BC to 7th century AD. Although they were nomads at first, they then turned into traders and lead caravans along the Spice Route, which was an ancient route for trade caravans bringing spices from Arabia to Mediterranean shore and lead from the Indian Ocean (through Yemen and Ethiopia) to the Mediterranean coastal cities of Gaza, Alexandria, Acco and Beirut. They brought back in return, industrial goods (pottery and copper utensils), which came from the northern Mediterranean areas of Cyprus, Anatolia and Crete. Their caravans were called "The Ships of the Desert". By the second century, they built cities along the caravan route and settled down to provide essential services for the caravans. Among these cities, the most famous is probably their capital city Petra, the rose coloured city in Jordan. The trade routes were a victim of geopolitics and although they managed to survive the conflicts between the Seleucids and the Ptolemeys, by the 8th century AD, the flourishing cities of the Nabateans were abandoned.

Among the more modest remains of the spectacular ruins of Petra, is a row of 2^{nd} century AD shops. The interesting feature about these small rectangular shops is the method of roof construction, which consists of a series of arches, which in turn, support stone roof slabs spanning the space between the arches. This building technology, although not apparently sophisticated, is dependent on an intimate knowledge of the properties of the stone used in construction. Stone materials are not known for their tensile properties and indeed the development of architecture may be said to depend on the ability to enclose space. Arches and vaults are the natural developments of this will to overcome this material deficiency. However the use of these stone slabs shows the inventiveness of these builders since if the span is too long or the stone slab too thick, then it will collapse under its own weight. Similar construction techniques are to be found in the excavations near Church of St. Anne in Jerusalem. [1]

2.2 Hauran

This technology, which may be called 'Nabatean', since apart from the Maltese Islands, it appears to be found only in areas known to have come under Nabatean influence, [2] evolved with time and the next development is to be found in the cities of the Hauran region.

The region of Hauran is situated in Southern Syria and North Jordan. These political divisions are recent since until the 20^{th} century the Hauran was regarded as a single region within the Ottoman Empire. It is sometimes known as the Geleb Druze. The chief characteristic of the architecture of the Hauran region is the extensive use of corbelling. Corbelling is the use of cantilevered ceiling and roof supports designed to carry stone or wooden beams. Although the techniques of barrel vaulting and the arch were known, corbelled ceiling supports avoided the erection of elaborate scaffolding and the cutting of finely dressed and precisely curved blocks. This was particularly important in this region where the prevalent building material is hard black basalt and trees are an extremely scarce resource. Corbels can hold a considerable load without cracking and are held in place by the weight of the walls of the floors above. [3] The length

length of the stone ceiling beams placed on the corbels was limited to about three metres. The result was a rather narrow room of indefinite length. To create larger halls, well-constructed arches five to ten metres in width were used. Almost every private house had one large room with an arched partition, while a number of churches used a row of these transverse partitions to create a large roofed space. It is probable that the arched partition in domestic buildings was used to create the principal sleeping alcove, which is a typical typological feature. [4]

What makes the use of corbels so special is that this indicates a sophisticated knowledge of material properties and a grasp of structural mechanics in the Roman period, which was only explained scientifically in the 19th century.

The maximum span which can be safely roofed over by a stone slab depends on the type of stone being used and the thickness of the slab. In any particular region, the stone most commonly used is generally the one most readily available, while the optimal thickness required for maximum span is readily arrived at by trail and error. At this point one is able to construct a roof made of simply supported slabs. The structure may be optimised further by restraining or fixing the ends of the stone slab, which increases the carrying capacity of the slabs considerably. However this also introduces several undesirable side effects since a small subsidence of the fixed ends will set up large stresses as will changes in temperature and changes in the loading. This results in cracking of the slabs followed by collapse of the roof. In modern constructions, using reinforced concrete, most of these objections can be obviated by employing the double cantilever construction in which breaks are introduced in the structure at the points of contraflexure. It is therefore amazing that the same principle was used by these ancient builders. Notwithstanding the limitations imposed by the material properties of stone, they managed to devise a system of construction which increased the allowable safe spans by about one third, which is no mean feat considering the relatively primitive technologies employed. The corbels were fixed by extending their length through the entire width of the double skinned walls of the building and held down by raising the height of the wall above them. [5]

Another typological element, which was extensively used in this region, is the exterior cantilevered stairway, in which treads were cantilevered along walls. Because of the narrowness of the rooms, the stairs usually were constructed on the outside, particularly in the courtyards of buildings.

The majority of walls are of a simple rubble-filled type. The two faces were built independently, of stones dressed only on the exterior. The interior space between the double-wall was filled with small stone chips and soil as construction progressed. It may be that this rubble was compacted and strengthened by the use of lime, but there is little evidence of this due to leaching of the fill by rainwater.

The two faces of such a wall were tied together only by ceiling corbels and stairway treads, which extend all the way through both faces. The combination of building blocks and rubble formed a solid mass, which remained very strong as long as the plaster joints retained the interior rubble. With the plaster gone, however, the rubble would dribble out over time, leaving a hollow core and therefore a much weaker wall.

Because doorways and windows act as weakening interruptions in the structure of the wall,

much greater attention was paid to the quality of frame construction. The result is that frequently doorways and windows have remained after the walls had collapsed around them. This was because carefully dressed blocks were used for lintels and doorposts, which made the The building system described above appears to have been transported as a whole to the Maltese Islands. Although there is no written evidence for when the system appeared on the Islands, the use of Arab technical terms, including several archaic ones, would indicate that the joints between the stones extremely tight and able to withstand much greater vertical force than the plaster-filled joints of the walls. [6]

2.3 Malta

The building system described above appears to have been transported as a whole to the Maltese Islands. Although there is no written evidence for when the system appeared on the Islands, the use of Arab technical terms, including several archaic ones, would indicate that the technological transfer occurred during the Arab period of 870 – 1091 A.D. The apparent abandonment of the islands, as described by the author Al-Himyari, during the period 870 – 1048, which was followed by a re-colonisation of the islands by the Arabs in 1048, would appear to narrow the gap. [7] Indeed the actual word for the corbel 'kileb' is considered to be an archaic word in the Maltese Islands and, as the author discovered, is only understood by the older generation of persons connected with old buildings in Jordan. The younger generation are less accustomed to the use of these archaic technical terms, which, however, describe architectural elements so precisely, and represent an important element of cultural heritage.

Like the Hauran region, the Maltese Islands lack timber but are blessed with a plentiful supply of good building stone, which in this case is also soft and easily worked. One fundamental problem for the historian is how the system with all its construction details, including the waterproofing of the roofs, intact managed to be transported to the islands. Similar corbelling roofing systems are not found in the neighbouring islands of Lampedusa or Pantelleria, nor are they to be found in Sicily. This is not to say that this building system was preserved in an un-modified form, because external influences, of which there were many on the Maltese Islands, affected local methods. An example is the use of clay roof tiles. These are not an indigenous material and seem to have been introduced from Sicily by the Angevins or Aragonese. The use of these clay roof tiles is most often recorded in the fortified town of Malta in which these foreigners settled and there is scant evidence of their use by the local population elsewhere. This may, in part, be due to the added expense of the material but certainly it is an undeniable fact that a pitched roof deprives the inhabitants of the house of the valuable roof terrace, so often used for sleeping in the hot summer months. As a result, the use of these clay roof tiles gradually faded away and eventually, even the sloping roof of the Cathedral Chapter Hall was covered in the local lime based mortar enriched with crushed pottery or pozzolana to make it waterproof.

The attitude of the Maltese masons to foreign influence was aptly described by Francesco Lapparelli who was sent to the islands in 1566 to design the new capital city, Valletta, and who also appreciated native skills in building especially in their reluctance to change tried and tested methods of construction. [8] The more professional trained architects, engineers or town-planners brought in by the Order of St. John to advise them on their building programmes very often learned from the vigorous building tradition which already existed on th

the islands and although the resulting buildings display a classical façade and plan, the construction techniques employed are traditional Maltese. Nothing shows this more than the persistence of stone roof slabs in Maltese buildings. Despite the introduction of timber beams and, later, iron beams, the use of thin stone slabs persevered until the advent of cheap reinforced concrete well into the 20th century. [9]

3. 'MALTESE' TECHNOLOGY

3.1 British expansion in the Mediterranean

The Crimean War began as a quarrel between Russian Orthodox and French Catholics over who had precedence at the Holy Places in Jerusalem and Nazareth. Tempers frayed, violence resulted and lives were lost. Tsar Nicholas I of Russia demanded the right to protect the Christian shrines in the Holy Land and in 1854 the Crimean War began in which the British and the French assisted the Turks. After a long and bloody conflict, in early 1856, Sevastapol fell and the war was brought to a conclusion by the Peace of Paris. As a result of the assistance afforded the Sultan permitted European missionaries to build religious houses in the Holy Land.

3.2 'Maltese' technology in the Holy Land

This newly found freedom to operate in previously uncertain territory, gave rise to a need for skilled stone workers familiar with the needs of the new missionary settlers. As part of an expansion campaign aimed at securing the route to India, the British had acquired the Maltese Islands during the Napoleonic wars and the building skills of the Maltese masons were soon noted by the British. Maltese expertise was employed in the building of the Royal palace of Corfu for the British Governor, Sir Thomas Maitland in 1834. [10] A few years later, in 1840, Major Harry Jones of the Royal Engineers had recorded those skills in a Memorandum in which he described the economy of means with which Maltese masons achieved their remarkable results. [11] At this time, Maltese masons were transported to the Holy Land to assist with the building of the new mission houses and it is recorded that the Anglican Church of Christ in Jerusalem was built in 1864 by Maltese masons. [12] The overwhelmingly Christian population of Bethlehem coupled with the presence of the Franciscan Friars, whose Maltese Friary has long had strong connections with the Holy Land could have induced the craftsmen to settle in Beit Jalla near Bethlehem. They stayed on to build several other churches and houses, brought their relatives over from Malta, and they established a flourishing practice and trained many Christian Arabs in their craft. [13] Indeed, the analysis of the houses in Bethlehem shows a turning point at around 1860 and this could well be ascribed to the arrival of these Maltese masons bringing back techniques which had all but been forgotten in the Holy Land. [14] Detailed analysis of the houses in Bethlehem, such as the so called Museum House, shows that such details as the wrought iron door furniture is identical to that found in 19th century Maltese examples. It is clear that the technology transfer was not merely limited to stone masons but must have included practically all the building trades. It would be interesting to analyse the present population of Beit Jalla in order to see whether there are any remnants of this original Maltese community.

4. CONCLUSION

The article has shown the existence of cultural links between two separate geographic locations, which was brought about by historic events. The restoration of the many monuments in both areas would certainly be enriched by a parallel study of the building techniques used in both localities. In this way common factors could be elicited and solutions to ever pressing conservation problems could be tackled on two fronts. Cooperation may yet result in a beneficial synergy.

5. REFERENCES

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