

Maltese stone

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A B S T R A C T

Malta Summer School is an event prepared by the Belgian organisation Xpeditions, which operates in the field of anthropological research. The heads of the project are Marc Vanlangendonck and Sam Janssen. The purpose of the event is to research areas connected with anthropology in a place where the group lives for a certain period.

The rich history of Malta testifies that over the centuries, or rather millennia, it has played an important strategic role as a defensible point in the middle of the Mediterranean. The remains of the Ggantija Temples can be seen today on the island of Gozo, which have a specific place in the development of the earliest sacral architecture. The underground temples and tombs hold a special place.

The next important period is the Renaissance. Valetta is one of the most important Renaissance towns, which, according to tradition, was planned in a mere six days. This period was followed by the Baroque. A well-known name from that time is Count Giovanni Battista Vertova, who was a mathematician and military engineer.

Contemporary architecture provides the last framework. Here it is worth mentioning as a curiosity the production of modular stone in quarries in a way that is characteristic only for this area. In addition to new buildings, vernacular architecture must also be mentioned, to which belong ginas or shelters, hides for bird hunters, beehives in walls, wells etc.

A R T I C L E I N F O

Keywords

Malta, Gozo, stone, temple, vernacular architecture, arch, corbelling, Baroque, Renaissance, quarry

Introduction

Malta Summer School is an event prepared by the Belgian organisation Xpeditions, which operates in the field of anthropological research. The heads of the project are Marc Vanlangendonck and Sam Janssen, and other members also take part. The aim of the event is to work in the field of anthropology in a relaxed atmosphere. This means, as well as excellent company, high temperatures, good food, attractive beaches and friendly locals.



Figure 1: Texture created in stone after a certain time because of external influences.



Figure 2: Method of transporting megalithic stones in the Neolithic.

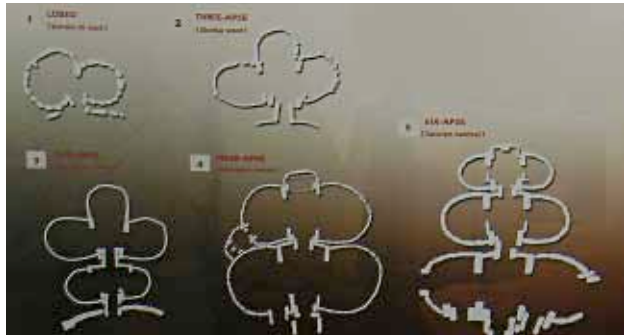


Figure 3: The development of the groundplan of Neolithic temples took place in five phases.



Figure 4: Photograph of a model of the temple of Ggantija from The Museum of Archaeology in Victoria - Gozo.

The Maltese islands lie in at the apparent junction of the European and African continents, one hundred kilometres from Sicily and approximately three hundred from the shores of Africa. It seems that without today's political division it would be difficult to decide to which major cultural space it depends. However, its rich history eloquently testifies that over the centuries, or rather millennia, it has played an important strategic role as a defensive point in the middle of the Mediterranean Sea. It would have provided a strong fortress for military conquerors who tried to advance into Europe and control of both the sea and the air space by southern Italy. Knights at the time of the Crusades relied on it in the same way, when they advanced from there towards Jerusalem. The Maltese Order of Knights or the Knights of St. John, which was founded in 1080, has left a very strong symbolic stamp, which is still in general use today. It is the Maltese Cross, which is found on the majority of coats-of-arms and even on the official flag of this state. The influence of the knightly order is reflected in the fact that the island is still today covered with churches, chapels and, not least, it also has a number of cathedrals, which are huge building complexes with encircling walls. The event that marks their last important victory occurred in 1565. After a famous »great siege« they succeeded, with a considerably smaller army, to defend the island from the Turks. They suffered considerable losses and a great many buildings were destroyed and burnt. Despite the small likelihood of victory, the Maltese restored the walls and buildings and had gradually to strengthen them.

On hearing the Maltese language, it is not difficult to recognise that it is reminiscent of Arabic. At the transitional period before Christ, from which there is similarly preserved an unbelievable large number of remains of temples and tombs for such a small area, the former prevailing influence of Europe was replaced, or at least mixed, with influences from the Arabic countries. This was also reflected in the architecture. The defences against the Turks and pirates dictated the construction of strategically planned towns, encircling walls and observation towers. A leap in time brings us to 1800, when Malta became a British colony and, approximately 140 years later, when it entered the Second World War. The island was heavily bombed from all sides. The Germans tried to build a base for their fleet, and the British defended »their« territory. The local population profited least from this, since a great deal of damage was done under the pressure of bombing from the air. Certainly the events around colonisation also brought new culture and so many Maltese today speak English.

Through all these turning points, from prehistory to today, and in all likelihood also tomorrow, something

can be found that links the people on this island and is an integral part of the cultural heritage. This is the material from which they build; something unique, which seems inexhaustible for use on the island itself and which creates the same colour of panoramic appearance through all periods. It is a rock of sedimentary origin, which is simple to work, sufficiently hard and pleasant to the touch. Two types of limestone are mainly used. The first is called Globerigina Limestone, and the other Lower Coralline Limestone. The subject of research is the use of this local stone for various types of architectural object on the island of Gozo. The field is very wide, whence also the division into three chapters, which, both chronologically and in terms of the characteristics of building, embrace the most characteristic features of builders of specific types of object at specific periods. First is described the original use of the stone in monoliths for the construction of shrines around three thousand years BC, then the use of the stone in the Baroque, which represented the strongest style on the island, the stamp of which is still visible today and, finally, the contemporary use of the stone, which is similarly specific for the mentioned area. With the latter is described the »life of the stone« - from the quarry to an honourable place in a wall, and finally ruin.

Neolithic architecture

Any material that has been newly discovered as suitable for use, was first used for enriching the spiritual level – thus for expressing culture. In addition to painting and sculptural work, the production of jewelry also belongs here. In the second phase, people devoted themselves to making tools and weapons, and only as a third did the building of objects have its turn. With objects, there was similarly a distinction between for the most part functional creations – those that provided a roof over their heads – and those which, in addition, contain a deeper meaning for a particular community. It is difficult to talk about temporal priorities, but a difference is certainly noticeable in the very dimensions of these objects. The remains of megalithic temples on Malta clearly illustrate a case of the latter.

They were created in the Neolithic. Their main construction elements are megaliths – stones of massive dimensions in one piece, such as is difficult to imagine for use in construction today. Because they represented a major task to transport and erect in the desired place, there had to be at least some sufficiently serious reason for their use. One is certainly that it was a sacral object and something that is superhuman deserves a building that man cannot build. Considerable organisation of work was required to erect



Figure 5: Schematic presentation of the ratio between a man and a megalith from Ggantija temple.

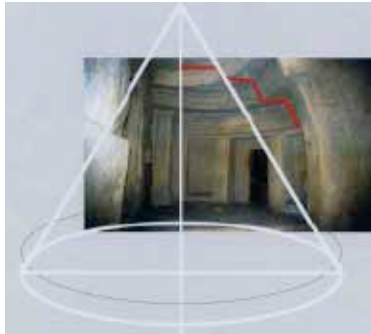


Figure 6: Photograph of the interior of the underground temple of Hypogeum and schematic presentation.

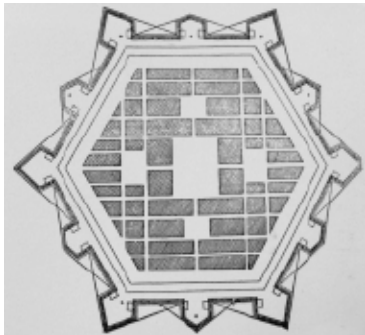


Figure 7: Catana's plan of an ideal town for the construction of Valetta.



Figure 8: Saw for vertically cutting stone and the rails along which it drives in order to cut accurately.

the stone blocks, which could measure up to six metres in length and weigh several thousand tons. In view of the fact that such things were built in ancient Egypt, here too, they probably used »machines from people«. Archeological finds there have included among other things small round stones, which probably served as bearings for reducing the friction during transport. Metal tools were unknown at that time. [Museum of Archaeology - Victoria, Gozo]

The technique of construction, therefore, is based on megaliths, and the intermediate space between them was packed with smaller stones and rubble. The principle of construction is similar as with the Cyclops walls from Mesopotamia – larger stones with rubble in the role of binding. This binding greatly differed from today's in its properties. It is suspected that the temples were covered with a roof. A possible explanation would be construction by the system of corbelling, but with such large spans, the roof would be too high, and so this is not very likely. There could have been partial covering, with an opening in the middle of the roof. Stones for covering in a single piece, because of their weight, do not enter into consideration and, in addition, the spans were too great. The megaliths are from local limestone.

Two temples, Ggantija

Location: Xaghra, Gozo

Period: Neolithic, circa 3600 BC

Purpose: honouring the goddess, the Fertility Mother, to which archeological finds of figurines and statues testify; they probably performed animal sacrifice. A legend circulates on the island that the temples were built by giants, since the word Ggantija means in translation »tower of giants«.

The building: it is a complex of two temples within a single shell. The southern is larger, with a more spacious apsidal chamber and was built first. Both have a clustered structure with five apsidal chambers connected by a common passage. Their entrances are oriented towards the southeast. The external circumference of the shrine and the walls of the external spaces consist of upright megaliths, measuring up to five metres in height. The space between the external and internal walls is packed with smaller stones and rubble. It can be concluded from the remains that the rough walls were covered by plaster. A smaller part of the temple cannot be viewed today from the inside because of renovation work; but major height differences in the paving between the individual rooms and the passage can be seen in the interior. This indicates that the apsidal chambers were also arranged in a hierarchical sense. The altar, which had the highest value, had to be placed in the apse concluded by the passage. Both types

of limestone are used as material – Globegirina Limestone in the interior part and Lower Coralline Limestone for the exterior.

Some common denominators can be extracted from all the temples that have been preserved, which represent the characteristics of this kind of building. The first is that the temples consist of two basic elements: an oval courtyard in front of the entrance and at least a partially covered structure in the shape of a D with massive external walls and a centrally erected entrance. Concavity is characteristic of the facade; so that it opens against the flank of a hill towards the south or southeast and the centrally positioned entrance has a rectangular shape. The development of temples that led to a shape such as Ggantija was in five steps. First was the courtyard, which was extended into a room of irregular shape. In the second step, in addition to the courtyard, three symmetrically placed apses were added. In the next phase, another pair of apses was added beside the main axis and it thus obtained the shape of a five leafed clover. The aforementioned three phases belong to the »period of Ggantija« between 3600 and 3200 BC. This was followed by the »period of Tarxien« between 3150 and 2500 BC. Thus the central apse was first lowered into a smaller niche, and then to the existing five-petaled form was added a pair of symmetrical apses by the main entrance.

Hypogeum

Location: Paola, Malta

Period: Neolithic, around 3600 BC.

The word »hypogeum« derives from the Greek and means »underground«. This is the main particularity of this shrine, which, in contrast to others, was dug into the ground. It was created in a number of phases, probably in relation to the spatial demands of people, the number of which increased. It raises the question of what forced these people to resort to the underground. One possible reason was religious persecution, since it was a sacred object, but it is difficult to conclude what happened so long ago. The shrine was discovered by chance in 1902, when they were digging a well for a residential house. They unexpectedly broke into it. In order to protect the remains of the shrine, there are strictly organised viewings of the object, which is under UNESCO protection today. Only 80 visitors are accepted a day, who are divided into small groups and guided by a guide or a radio receiver. It is therefore necessary to book in advance.

The difference between underground temples and those on the surface gives great outlet for building on Malta in the future. It is an important historical feature, which represents the identity of the island. Taking this



Figure 9: The saw for horizontal cutting of stone is used when the stone has already been cut vertically.



Figure 10: Saw with running band for final dressing of the stone blocks.



Figure 11: Running band which loads the dressed blocks onto the means of transport.



Figure 12: Measured dimensions of modular blocks and the ratio which appears in the block.



Figure 13: Schematic presentation of the process of creation of a wall.



Figure 14: Strengthening the corner of a wall by a system of covering.

into account as a basic guide, the use of contemporary technology opens countless opportunities of how to adapt old knowledge to the contemporary world.

Renaissance

Valletta is one of the most important Renaissance cities, which, according to tradition, was planned in a mere six days by the military engineer, Francesco Laparelli. Because of its exceptional erection, it survived the pressure of conquerors. It is also worth mentioning one of the most important architects in the history of Malta – Girolamo Cassarja - and his contribution to the shaping of this city. His successor was Lorenzo Gafa, designer of the cathedrals on Gozo and in Mdina. Other creators of Maltese cities were Romano Carapecchia, Mederico Blondel and Francois de Mondion. The majority of them drew their knowledge and inspiration from neighbouring Italy. [Hughes, Q., 1969]

Baroque

A famous name from that time is Count Giovanni Battista Vertova (1592-1647), a mathematician and military engineer. A rule with the Baroque style was that architecture is created without obstruction. Whence also the magnificent churches and cathedrals, including the cathedral with encircling walls in Victoria (Gozo) and in Mdina on Malta. Within the latter, people are buried below large marble slabs. It thus plays the role of a huge tomb. [de Lucca, D., 2001]

The churches are built from local stone, so their colour is yellowish. In order to create a richer appearance on the inside, the majority of the walls are covered with velvet textile. So a sharp contrast can be seen between the interior and exterior spaces; a contrast between yellowish and scarlet. In view of the fact that they are Catholic churches, a considerable number of them are covered by cupolas. This most reflects the historical influence of the Arab world. Because of their height, they can also be seen from far around.

Quarries

Quarries are known throughout the world, but not like those on Malta. Their particularity is the method of working the stone and the area that remains when the mountains of useable stone are exhausted. Malta, and above all Gozo, are scattered with these quarries, of which a large number are still active today. However, many locals don't know about them at all, or not where they are located. One of the reasons for this is the difficulty of access to the

terrain and their protection. Access to those not employed there is generally forbidden, but with strong determination this rule can be overcome. There is a problem, namely, of possible damage and the dust that rises with the sawing of the stone. This dust can also be dangerous for a camera.

The specificities of the stone, which is soft and easily worked, enable a special way of working it. So in principle the working is divided into three different saws. They thus simply lower the mass of yellow stone by layers and transform it into blocks of standard dimensions. The saws are made in such a way that they crawl along special rails, which can be moved. The saws press along these rails. The blade of the first saw turns in a vertical direction and cuts the level surface of the quarry like a cake into pieces; first only in a longitudinal direction to a specific width and then again transversely. The blade of the second saw turns in a horizontal direction. It thus slices the lower juncture of the stone and creates a block of the desired dimensions. Because these blocks are fairly robust and roughly cut, they are sent through a third machine. This guides the block along a running band through a system of three circular saws, which fine dress them. Two saws turn in a vertical direction and one in a horizontal. The blocks prepared like that are ready for use in building.

The dimensions of the blocks are 24/28/56 cm, or exactly 9/11/18". These measurements differ considerably from our standard which is used for a brick. The latter is made so that a builder can hold it in one hand. The weight is also suitable for this. The stone blocks are too heavy for one hand and also the dimensions do not allow this. They similarly use such blocks for roofs in combination with steel I girders, but these blocks are cut to smaller dimensions (14/28 cm). This means that they are 10 cm thinner than the wall blocks, but are considerably longer. Globegirina Limestone, which is also called Franka, is an almost ideal building stone. It has a uniform texture, is simple to work and resistant to the influence of weather. So it is also used as a facade stone without additional protection.

Walls

An outstanding part of the landscape. The walls are visible work of human hands in the middle of nature. It can be said that everyone notices them, even if they do not pay particular attention to the construction. On coming across such walls, I am always first struck by how much work has been invested in these long lines. Was it perhaps the work of a single man or of a group? The latter seems more likely, precisely because there must have existed the artisan skill or knowledge from formerly that has preserved these creations over so many years.



Figure 15: A girna by the road to Popeye Village.



Figure 16: Azure Window as an example of how the nature has formed a shape that people wanted to copy.



Figure 17: Lintels in the role of supporting elements that carry the roof.



Figure 18: Construction of an arch by the system of corbelling.



Figure 19: Typical example of the construction of an arch with a keystone.



Figure 20: Extremely slender arch with a wide span built without the use of binding and the forces.

On Malta, or Gozo, a series of different walls can be detected. Despite their external uniformity, which changed over time, the principle of building remains the same. Corners represent an eternal problem. They must therefore be strengthened more than other parts of the wall. If I draw a parallel with wood, a mass of different carpentry joints have been created for corners. The properties of wood allow this; it can be shaped to will. This possibility does not exist with stone. Stone never splits exactly along the line that one wishes. In addition, it does not support stretch forces. So it is necessary to find another solution, although the basic problem remains the same. Larger and heavier stones of more regular shape than those within a wall are normally placed at the corners. A firmly built corner, in which the stones lie as close as possible to each other and thus have greater surface contact, more easily resists the forces that are greatest at this point.

Another rule in building stone walls is that stones of more regular shape are laid on the external and internal sides of the wall, while the interior is packed with smaller stones, rubble and waste material, which is otherwise unusable. This method of building gives a wall constructional solidity, since it thus resists transverse forces and prevents it falling down. There is also an aesthetic contribution; all the visible surfaces are from fine stones.

And then to the question of the significance of building walls in wide open spaces. The first reason is certainly that it bounds the space for animals. There are not many of these animals today, but the walls nevertheless remain. The second reason may be that they circumscribe parcels of land and thus create boundaries between the owner and his neighbours. As the most important reason, I would mention the fact that people needed areas that were suitable for agricultural cultivation. Land that is littered with stones does not unfortunately allow this. So it was necessary to clean it and when the work was done, a mountain of unusable stones was immediately created. The question arose of how to get rid of these stones; and from here came the idea that it was better to build something useful and aesthetic than simply stack the stones somewhere where they would be in the way.

Vernacular architecture

The architecture with which the majority of the local population are confronted is only rarely mentioned in the professional literature. It is therefore often under-appreciated and in general unknown. These are creations of people without professional knowledge but with wisdom and experience which have passed from generation to generation. Such objects are built with careful thought

and, without special maintenance, successfully resist the teeth of time. Objects that can be placed in this category and that are found on Malta are girnas, beehives, wells and hides for hunters. [Juvanec, B., 2008]

A girna is a small shelter on the edge of farmland. It is normally made of stones that have been removed from the land in order for it to be suitable for cultivation. The stones are laid using a system of corbelling, which gives stability to the roof. They are intended for the storage of small tools and as shelter for the farmer in the event of bad weather. They are of various shapes, but for their most part the rule applies that more exposed ones are more attractive than those that are hidden. They are hidden, in fact, so that other people do not know about them.

A particularity of beehives is that they are built into stone walls. They are therefore very difficult to see and, at the same time, they are sufficiently functional. From the outside they are a hollowed out hole, in which containers are placed for honey, and from the inside a narrow passage with enough space for a person to change the containers. [Juvanec, B., 2006]

Arch

There are specific forms that appear in the architecture of an individual region more often than others. On Malta this is certainly the arch. The Azure Window is the best known, a unique example shaped by natural processes over the course of time. These processes would be fairly difficult to halt, so the window can be expected gradually to collapse. A clear difference in the thickness of the arch is already noticeable by comparing postcards from 30 years ago and photographs today. The simple mass of stone thus obtained a shape such as people wanted to copy. However, seen from a construction point of view, an arch without binding is difficult to execute. Development thus took place in three stages. The first was as with the Azure Window – a lintel. From a static point of view it is a bearing element on two supports. The only problem with erection is that the lintel must provide adequate, resisting both pressure and strain. The second approach that people made use of is a system of corbelling, which is laid with the aid of a triangle with a height of $\sqrt{3}/2$. Stones are laid one across another so that the combined centre of gravity of the two stones is before the end of the first stone. This enables the higher stones always to shift towards the interior.

The third element in building an arch is a boss or keystone. This is a stone which is set at the top of an arch and is larger and heavier than the others. With a suitable mastery of horizontal forces, this stone presses on the others and prevents their movement. [Stone shelter, <http://www.stoneshelter.org/stone/construction.htm>]



Figure 21: Arch from smaller stones without a keystone in the centre has poorer construction properties.



Figure 22: Detail of an arch that functions as a bearing construction for the roof.

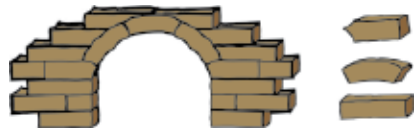


Figure 23: Schematic presentation of three types of modular stones and their positioning in a wall.



Figure 24: Course of building a residential object through various phases (2000, 2001, 2007).

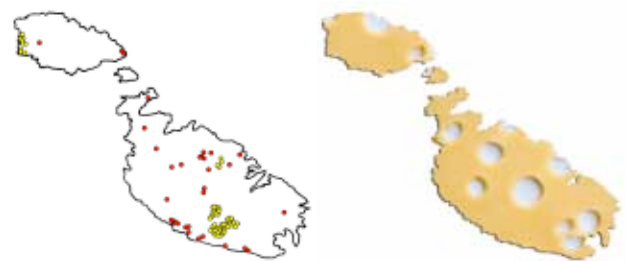


Figure 25: Quarries on Malta and caricatured possible scenario with excessive excavation of stone.

Our forebears also used arches in the building of aqueducts. This motif can be found on Gozo, where they built roadside walls with an appearance which is fairly reminiscent of an aqueduct. In contemporary building, precisely for the purpose of building arches three types of modular stones are made that enable the simple and speedy construction of an arch. In addition, the motif appears in contemporary concrete constructions, in which the execution using boarding presents no special problems and repetitions can be mass produced.

Some proposals

There should be enough local stone for local needs. The method of building with a material that they obtain on the spot and does not need transport is more rational and above all ecological. The question arises of what to do with the holes that remain from the exhausted quarries. In caricature terms, according to a black scenario, Malta would be reminiscent of a Swiss cheese. Models must be found that belong in the given situation and which conceal the created damage in as quality a way as possible. Some conceptual possibilities are enumerated below, which could be attractive and, at the same time, also functional. Their implementation could have long term consequences for Malta, so it is necessary to study each individually and judge the suitability of individual solutions.

Building a shopping centre

Objects such as shopping centres are normally built with little aesthetic consideration and without regard to the cultural and ethnographic values of an individual place. Their aim is to be as cheap as possible and for their enlargement to be envisaged in advance. So they not infrequently spoil the appearance of an individual place, since, in essence, they do not belong in any environment. Various zones and districts of towns are created that are intended only for such activities. On Malta, a solution exists of where to put such objects. A quarry pit would be a suitable location in view of the fact that it is big enough. The industrial appearance of the shopping centre would be hidden from at least one to three sides and it would give it a local touch.

Attractive tourist facilities

As with the erection of a shopping centre, a hotel or some facility intended for various tourist activities could be built. Since the stone in these places has the property of being simple to work, it could be done in a way that is rarely found elsewhere in the world. A facility within a former quarry could be linked to the sea by a special tunnel through

the surrounding stone, which would mean that guests of this hotel would have direct access to the beach. There is a possibility of hollowing special holes out of the stone to serve as bedrooms and this would represent a unique experience for visitors. Deeper excavation would also enable the construction of wine cellars, which could raise the level of viticulture, which is somewhat disregarded because of the climatic conditions.

Filling with sea water

If the stone from the quarry was only removed in a vertical direction, the hole would remain walled on all sides. Although the edge throughout the entire area is not on the same level, the possibility nevertheless exists of filling the hole with sea water. The intervention could also have an influence on climate change in an individual area, from the point of view of water circulation – evaporation and rainfall.

Planting the area

Planting the upper edge is the cheapest of the four interventions, which could bring back to life a recently dead area. Planting a belt of tree and shrubs in a specific order would create a more attractive appearance both from below and from the top of the quarry. Because the floor of the quarry has a significantly higher temperature than above, minor interventions would allow a forest of more exotic tree species to be created there. It would need to be considered how to ensure a sufficient quantity of water, but certainly this is an intervention that would create an oasis in the middle of the bare rock.

In three weeks on Gozo it was possible to see an enormous number of things. The reason is the cultural and historical richness of the island and the creations that have been preserved until today. In addition, it is all compressed into a relatively small area. Local public transport is a special experience. When I returned home, because of those buses I began to drive more slowly. In general, I would describe the Maltese as an extremely friendly and open nation – also to foreigners. Talking to a stranger is perfectly normal and so pleasant events happened one after another.

Conclusion

The Maltese island was presented briefly in all its richness, which is revealed to a visitor at every step. A matter was presented that is revealed only to a more careful observer; to those who examine phenomena that do not at the moment present a problem but will certainly become such in the future. Some conceptual solutions have been



Figure 26: The question arises of how to fill in a quality way the hole that remains when a quarry is exhausted.



Figure 27: A shopping centre is hidden within the walls of a quarry.



Figure 28: Hotel with a tunnel through the soft rock. Guests have direct access to the beach.

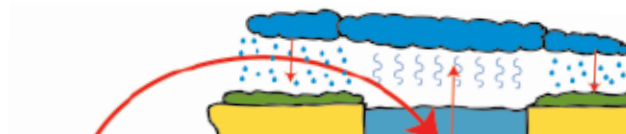


Figure 29: Filling the holes with sea water could have a long-term impact on climate change.



Figure 30: Planting the upper edge of a quarry with trees and shrubs.



Figure 31: Temperatures on the floor of the hole are higher than those above.

enumerated to which it is necessary to devote a great deal more attention than was possible in such a short time. The advantage of such a form of work as took place on Gozo is that people are gathered in one place with an interest in research and still better – they come from various fields of study. A number of different points of view are confronted and so conceptual solutions can be a great deal more integral than if dealt with by only one profession.

Notes - ful description of figures

Figure 1: Texture created in stone after a certain time because of external influences. Photograph of the exterior of the walls of the cathedral in Victoria.

Figure 2: Method of transporting megalithic stones in the Neolithic. The stone balls serve as bearings and reduce friction. [based on a poster in The Museum of Archaeology in Victoria – Gozo]

Figure 3: The development of the groundplan of Neolithic temples took place in five phases [based on a poster in The Museum of Archaeology in Victoria – Gozo]

Figure 4: Photograph of a model of the temple of Ggantija from The Museum of Archaeology in Victoria - Gozo, from which the cluster shape of the groundplan is evident.

Figure 5: Photograph of the temple of Ggantija from 3600 BC, and schematic presentation of the ratio between a man and a megalith from this temple.

Figure 6: Photograph of the interior of the underground temple of Hypogeum and schematic presentation. [Juvanec, B., 2001]

Figure 7: Catana's plan of an ideal town for the construction of Valetta [Hughes, Q., 1969]

Figure 8: Saw for vertically cutting stone and the rails along which it drives in order to cut accurately.

Figure 9: The saw for horizontal cutting of stone is used when the stone has already been cut vertically. The cut blocks are reminiscent of a piece of cake which is cut from the whole.

Figure 10: Saw with running band for final dressing of the stone blocks, which, when they are cut, are still of slightly irregular shape or with deformed edges. Two circular saws rotate in a vertical direction and one in the horizontal.

Figure 11: Running band which loads the dressed blocks onto the means of transport. The photographs were taken in the first quarry east of Dwejra Bay.

Figure 12: Measured dimensions of modular blocks and the ratio which appears in the block. [from Juvanec, B., 2001]

Figure 13: Schematic presentation of the process of creation of a wall. The rocks are removed from a field for it to be suitable for use. The pile of stones is in the way, so it is made into a wall.

Figure 14: Strengthening the corner of a wall by a system of covering. The wall beside the road that leads to Popeye Village is photographed.

Figure 15: Photograph of a girna by the road to Popeye Village. The ratio that appears within the shelter is shown. This is $1 : \sqrt{3}/2$, which is the ratio of corbelling. The measured width of the girna is 3.15 m, height 2.12 m and thickness of the wall 0.84 m. The door opening is 1.02 m high and 0.82 m wide.

Figure 16: Azure Window is a unique example of how the action of natural processes has formed a shape that people wanted to copy. Statically speaking, it is an arch – a bearing element on two supports.

Figure 17: Lintels in the role of supporting elements that carry the roof. [from Juvanec, B., 2001]

Figure 18: Construction of an arch by the system of corbelling. The girna is photographed on a ridge above the River Mistra close to Xemxija. [Juvanec, B., 2001]

Figure 19: Typical example of the construction of an arch with a keystone. The stone in the centre is larger and heavier, which enables a greater spread of forces and ensures constructional firmness without additional binding. The photo is a detail of a water channel along the flank of the Gordan hill with a lighthouse.

Figure 20: Extremely slender arch with a wide span built without the use of binding and the forces that operate in the construction. In the photograph is the approach to a house in Xaghra.

Figure 21: Arch from smaller stones without a keystone in the centre has poorer construction properties. Over time it has been damaged and a layer of binding had to be applied for the stones to remain in their place. The photograph is

from a hill with Stations of the Cross by Ghasra Church.

Figure 22: Detail of an arch that functions as a bearing construction for the roof [from Juvanec, B., 2001].

Figure 23: Schematic presentation of three types of modular stones and their positioning in a wall with an arch.

Figure 24: Course of building a residential object through various phases. The pictures are from 2000, 2001 and 2007. [Juvanec, B., 2001-2007]

Figure 25: Quarries on Malta. The yellow dots mark the location of soft stone and red hard [<http://www.mra.org.mt/Downloads/Publications/quarries.jpg>] and caricatured possible scenario with excessive excavation of stone. Malta will be reminiscent of a Swiss cheese.

Figure 26: The question arises of how to fill in a quality way the hole that remains when a quarry is exhausted.

Figure 27: A shopping centre is hidden within the walls of a quarry and, at the same time, gains the appearance of local buildings instead of an industrial form.

Figure 28: Hotel with a tunnel through the soft rock. Guests have direct access to the beach.

Figure 29: Filling the holes with sea water could have a long-term impact on climate change and contribute to making the place green.

Figure 30: Planting the upper edge of a quarry with trees and shrubs would be the simplest way of concealing the view of an emptied area.

Figure 31: Temperatures on the floor of the hole are higher than those above, which would allow the growth of exotic plants that thrive in a humid environment.

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