Cave formation of ghar dalam

Ghar Dalam is literally translated to be the ‘ Cave of Darkness’. It is found in the South-eastern part of the Maltese island and located in the north-east bank of Wied Dalam. The Cave is seen to be 144 meters deep and about 15. 5 meters above sea level. (Malta Heritage, 2008). A general view plan of the cave is seen in photo 1. The cave has yielded a number of discoveries that are of great significance, not only for the Maltese island but for the entire Mediterranean region. It sheds new light on what occurred during the Pleistocene period, when successive ice ages occurred in Europe around 180, 000 years ago.

Since the cave acted as a trap for material that was being washed down Wied Dalam, the layers that built up inside contributed to the cave deposits found in the cave today. The stratigraphy of this deposition provides important evidence about what animals where present in the Maltese island and how they evolved over time. Ghar Dalam is also seen to be of importance since it gives evidence of the first known human inheritance of the Maltese island. C: UsersKATRINADesktopbiologyEvolutionField trip 2-Ghar DalamPhotosDSCF1489. JPG

Stalacites and Stalagmitic sheets

A succession of water-borne deposits containing an extinct Pleistocene dwarf mammalian fauna

(and D) Deposits left by man- pottery dating back to 5, 200 B. C

Photo 1 – general plan of Ghar Dalam

Cave Formation of Ghar Dalam

Karst solution processes generally result in the formation caves and fissures. Fissures are usually the initial stages of the formation of the cave, which results from the action of water on sedimentary particles of calcium carbonate. Caves may be classified in relation to the water table. The three main types are phreatic, vadose and water table caves. Vadose caves are seen to lie above the water table, in the unsaturated vadose zone. Phretaic caves lie below the water table, where cavities and caverns are permanently filled with water. (Haggett, 2003)

Ghar Dalam is seen to be a phreatic cave that formed under forced flow pressure. Its presence is due to the phreatic tube formed below the bed of a stream flowing through Wied Dalam. It was seen that a stream cut into the bed, and thus penetrated the ceiling of the tunnel, and deposited its bed-load in the tunnel. Further down-cutting by the stream resulted in the formation of two caves. The larger of the cave is today known as Ghar Dalam. (Iowa Department Of Natural Resources, 2005)

Ground water is able to flow through the cracks or jointed areas within the rocks. This water, containing some degree of acidity due to the atmosphere, dissolves the calcium carbonate within the limestone as it flows through. The acidity can remain constant; however, it is most likely to increase due to carbon dioxide released from the vegetation. Thus more and more limestone is dissolved on its way down. The water eventually reaches the ceiling of the cave and thus may start to form a stalactite. These form cone shaped dripstones, as seen in photo 2. (Iowa Department Of Natural Resources, 2005) Photo 2- Stalactites on the Ceiling of cave C:

UsersKATRINADesktopbiologyEvolutionField trip 2- Ghar DalamPhotosDSCF1503. JPG

Stalagmites are formations that form from the ground up. This formation is due to the dripstones from the stalactites. These droplets hit the bottom of the cave and scatter. Stalagmite may be seen in photo 3. Algal species may form on the wet surface of the stalagmite thus resulting in the red, green coloration. C: UsersKATRINADesktopbiologyEvolutionField trip 2- Ghar DalamPhotosDSCF1501. JPG

Photo 3 – Stalagmites on floor of cave

Deposits

The stratigraphy sequence at Ghar Dalam, from oldest to newest, as seen in photo 3 below, is seen to be divided in: C: UsersKATRINADesktopbiologyEvolutionField trip 2- Ghar DalamPhotosDSCF1498. JPG

Detrital Clay layer

Hippopotamus layer

Pebble/ Boulder layer

Cervus or Red Deer Layer

Cultural layer

Photo 3- Rock layers found at Ghar Dalam

The Detrital Clay layer is seen to be the oldest layer and was suggested to have been present in the Late Pliocene/Early Pliocene and Late Pliocene. This layer is seen to be bone free, around 1. 7 m deep and found below a fossil rich layer. This fossil layer, seen in photo 4, is the Hippopotamus layer that runs about 1. 7 m in depth. This layer has yielded the remains of two species of hippopotami, Hippopotamus pentlandiI and Hippopotamus melitensis. The former being a dwarf species and the latter being even smaller. Also included in this layer were the fossils of two species of giant dormice Leithia cartei and Eliomys gollcheri, two or three species of pygmy elephants, five species of bats, a shrew and numerous bird species.(Hunt and Schembri, 1999) Photo 4 – Hippopotamus Layer C: UsersKATRINADesktopbiologyEvolutionField trip 2- Ghar DalamPhotosDSCF1507. JPG

The bone free layer, as seen in photo 5, is made up of pebbles and small boulders which has a depth of about 0. 34 meters is present on top of the Hippopotamus layer and according to Zammit Maempel (1989 , as cited in Hunt and Schembri 1999) this layer was present in the upper Pleistocene age. This layer is seen to have scarce presence of local fauna at the time. C: UsersKATRINADownloads188281_10150105602055686_564540685_7073407_5039151_n (1). jpg

Photo 5 – Pebble layer (taken by Sasha Dunlop on 12/03/2011)

Above this layer is the fourth layer, as seen in photo 6 and 7, with a depth of 1. 75 meters and filled with a series of fossiliferous layers. According to Savona, Ventura and Mifsud (1998, as cited in, Hunt and Schembri 1999),

this layer is referred to as the ‘ red earth layer’. This layer was proposed of being split into two layers, the ‘ Carnivora stage’ and the upper ‘ Cervus stage’. The former layer being part of the lower layer and containing carnivorous remains, while the latter forms part of the upper and contains a red earth layer. Besides the dwarf Red Der, Cervus elaphus, these layers also contain the remains of a small fox, Vulpes, a bear, Ursus arctos, a wolf, Canis lupus, together with a vole, bats and shrews. According to Despott (1918, as cited in) human artefacts and remains were also present in this layer. Two molar teeth showing a marked degree of fusion in the roots were also found. This is known as taurodontism. This discovery suggested that Neanderthal Men were present at this particular time; however, this was later proven that these belonged to Neolithic man. (Savona-Ventura, 1997) C: UsersKATRINADownloads198921_10150105602325686_564540685_7073412_7771521_n. jpg

Photo 6 – Deer layer (taken by Sasha Dunlop on 12/03/2011)

C: UsersKATRINADesktopbiologyEvolutionField trip 2- Ghar DalamPhotosDSCF1480. JPG

Photo 7 – Breccia layer now found in the Museum

A thin Calcareous layer 0. 06 m thick is seen to separate the Deer layer from the uppermost cultural layer. This layer is composed of volcanic ash deposits resent in manly localities around Malta. The uppermost cultural layer, having a depth of 0. 75 meters and about 7000 years old has more of an archaeological rather than paleontological importance. Human remains and many cultural artefacts, including pottery, shard, flints, obsidian tools and

ornaments, as seen in photos 8 and 9), were found in this layer. (Hunt and Schembri 1999)C: UsersKATRINADownloads189056_10150105601020686_564540685_7073380_1133115_n. jpg

Photo 8 and 9 – tools and Pottery remains found in the uppermost cultural layerC: UsersKATRINADownloads189056_10150105601020686_564540685_7073380_1133115_n. jpg

In the upper layer, however, remains of domestic animals were also found. For example the Black rat, Rattus rattus, the brown rat, Rattus norvegicus, the house mouse, Mus musculus, together with bats, hedgehogs , shrews, cats, dogs, pigs sheet and goats.

Ice Age

During the Ice age the sea level was seen to decrease by about 120-130 meters. This was due to the evaporation of sea water, as snow fell on land and formed continental ice sheets. The low water level during the glacial period thus allowed animals that were unable to swim to colonise the Maltese island from Sicily. (Borg , 2007)

Animals that colonised the small Maltese island evolved exceedingly rapidly and resulted in isolated development. This was due to a phenomenon known as the founder effect. Due to the small size of the Maltese island, food was scarce and many of the predators of these animals were absent. This was seen to cause dwarfism of any animals since they did not need their large size for defence and could maintain their life will less food intake.

Also gigantism was also seen to occur with some animals. This was due to the fact that originally the animal adopted a smaller size to be able to hide from their predators. However, due to their absence the smaller animals were able to adopt a larger size, and maybe even become predators to other smaller animals.

The Maltese dwarf hippopotamus, Hippopotamus melitensis, was seen to be derived from the Siculo-Maltese species, Hippopotamus pentlandi which was in turn seen to be evolved from another hippopotamus species found around Europe in Pleistocene times, Hippopotamus amphibious (as seen in photo6) . Dwarfism was also seen in the Maltese elephant, Elephas, which alas also seen to closely related to the Sicilian elephant. According to Zammit Maemplel and De Bruijin, (1982, as cited), the giant dormouse, Leithia melitensis occurred on both Malta and Sicily. (Hunt and Schembri, 1999)C: UsersKATRINADesktopbiologyEvolutionField trip 2- Ghar DalamPhotosDSCF1516. JPG

Photo 10 – Skull of Hippopotamus amphibious

Conclusion

By studying the different biota, environment and biogeography of Ghar Dalam one is able to understand the evolutionary processes that occurred in the Maltese island. This thus depicts how different species in the Maltese island adapted to certain stresses in the environment. Some of these stresses being the isolation on a small island. Also, the stratigraphy of the rocks gives us a chronological order of the species present in the Island via the bones and other remains left fossilised into the rock.