

E. the thickness of Tarawan formation in Gabel Tarawan was ~ 90 m but its thickness in "6.5022'1. 1.39.

this area was 2:3 m ,This is an indication that the center of the basin was at Gabel Tarawan, and by moving away from it we reach the edges of the basin. Tufa is found on the scarp or on plateau , we had an example of it on the scarp. Tufa is a fresh water limestone. There are channels in the tufa that express the presence of creatures that used to live in it, such as crabs. These are considered as trace fossils that indicate that the ancient environment in which they lived was a shallow marine environment. There are also Y-shaped channels in which crabs lived. The lateral succession of layers indicating the presence of geological structures such as faults is significant. The Esna Shale serves as a marker bed that can provide information about the type of faults present in the area. By following the Esna Shale, it has been determined that natural faults are prevalent in the region. The fault direction is noted as being Northeast to Southwest NE – SW. Observations show that the layers were inclined on the scarp in an eastward direction. Additionally, a major normal fault with a North to South (N–S) direction has been identified, This fault runs parallel to the Tarawan – Dakhla fault, suggesting a significant tectonic activity in the region. The layers were inclined to each other and also to the fault, forming fault drag. When the hugging wall is inclined to the fault, forming a monocline fold. 2.2.1.4. Kurkur formation Karstification phenomenon formation is formed by the presence of acidic rainfall , carbonate rock such as highly fracture limestone, and groundwater level. The process of karst formation typically begins with rainwater absorbing carbon dioxide from the atmosphere and soil, creating a weak carbonic acid. This mildly acidic water then percolates through the soil and limestone (which contains calcite) dissolving the mineral and widening fractures within the rock. The dissolution of calcite by carbonic acid is a key process in the development of karst topography, and it is what creates the characteristic features of karst landscapes such as underground caves and sinkholes. The karst feature occurs at the water table due to the presence of a continuous supply of carbon dioxide. the level of the water table can influence the formation of speleothems in caves and karst landscapes. When there is continuous presence of acid rain, the acidity of the water can affect the dissolution and deposition of minerals in caves, leading to the formation of these structures. Speleothems, such as stalactites and stalagmites, are formed when mineral-rich water flows through caves, depositing the minerals as it moves. The water table plays a role in this process as it determines the level at which water can percolate through the rock and flow into the cave system. These speleothems are a result of the slow and continuous deposition of minerals over long periods of time. The presence of coarse-grained or recrystalline limestone indicates that there was enough space for the grains to grow in size. This can happen when there is enough space within the rock for the individual mineral grains to grow and rearrange themselves. This typically occurs when the original sedimentary grains are subjected to high temperatures and pressures, allowing them to recrystallize and form larger grains. The sources of carbon dioxide are Atmospheric air, Biological source (vegetation cover), Deep reducing environment that reduces sulfate and nitrogen and produces carbon dioxide. Marine environment deposits: Fresh limestone "deep marine " , Meteoric water environment deposits: Tufa , travertine ,playa , recrystalline limestone , speleothems.Fossils like (Gastropoda ,Bivalvia ,Echinodermata ,Echinolamps, Echinochorys ovata) Dakhla shale formation: It's dark, greenish shale with thin layer of gypsum, contains of *Osteria overwegi* fossil which belongs to

upper Maastrichtian (here there are K/T boundary). West Al-Zaiat area West El Zaiat area is located at Latitude: 25°21'21.163"N and longitude: 29°27'10.058"E In the West El Zaiat area, there are two distinct units in the geological formation: The first unit is Lower Unit; This unit comprises lenses of shale and claystone containing minerals such as glauconite, iron, limonite, and gypsum. E. Quseir formation (forms the floor of Dakhla area), The largest thickness of the Quseir variegated shale is in the Dakhla region, which is divided into two members: The first member is Lower unit (not member) "red color", Environment consists of continental, and Fluvial deposits (lower fluvial member). The second member is Upper unit (Hendawy member) "green color". While they share some similarities, there are distinct differences between tufa and travertine: Tufa: Formation: Tufa is formed by the precipitation of calcium carbonate from ambient temperature water bodies, such as freshwater springs, streams, and lakes. Esna Formation: Esna shale is a calcareous shale means that it contains a high percentage of CaCO₃ because it is an open marine environment and contains a large percentage of oxygen even if it have an organic matter, all of them will be oxidized, but Dakhla is not oxidized because it is formed in a reducing environment And the organic matter is preserved, not oxidized. In summary, tufa is formed from ambient-temperature water bodies and has a porous, spongy texture, while travertine is formed from hot springs or geothermally heated water and has a denser, compact texture 2.2. 1.5. In this case, the presence of cross bedding in the sandstone layers of the upper unit in the West El Zaiat area points towards a dynamic environment with active sediment transport and deposition, likely influenced by currents, winds, or waves. 1.2. The Kurkur Formation overlies the Dakhla Shale Formation Dakhla shale has a sharp contact with kurkur formation, Dakhla shale formation is classified into three units; The first unit is Upper member (Paleocene), The second unit is Middle member (marked with *Ostrea Overwegi* – Upper Cretaceous), The third unit is Lower member (black shale, dark gray shale, and red shale – Maastrichtian). Tufa and travertine are both types of limestone rock formations that are formed by the precipitation of calcium carbonate, often associated with water bodies such as hot springs, rivers, and lakes. Conditions: Travertine formation is often associated with geothermal regions where the interaction of heated mineral-rich water with the atmosphere leads to the deposition of travertine coatings and terraces. Gabel Tarawan stratigraphic consist of Tarawan formation; it's Paleocene sediments, shallow marine environment, consist of carbonates limestone rocks. In Naqb Assiut area, the contact between the Esna Shale and Thebes is characterized by an irregular surface that is gravel and contains phosphate deposits. There are two types of carbonate rocks in the region – marine carbonate represented by Eocene limestone (Thebes formation) and freshwater carbonate represented by tufa deposits. The high-pressure, carbonate-oversaturated water precipitates tufa deposits in various shapes when it exits through fractures and joints in the rock layer. Cross bedding, as observed in the upper unit, can be generated by various processes such as water currents, wind (contributing to the formation of sand dunes or barchans), or wave action. Also, the phosphate layers are less thick than those found in Abu Tartur, Phosphate layers are characterized by; granular in size, ranges from 0.5 m to 1 m, vertebrae remains as well as marl or black shale layers. Gabel Tarawan Located north of El-kharga town at Latitude 25°29'9.26 N and Longitude 30°33'39.27 E. Mainly composed from Tarawan formation, Dakhla formation. Qarn Jinnah Lithology is Nubian sandstone that consists of 5 units: Tarif (fluvial sandstone),

