

Geological exploration for the Friendship Project East Aswan, Egypt

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Abstract: This work represents a part of the social, economic, planning and engineering studies required for the development of 250 houses at Aswan for the Egyptian-Danish friendship. This area covers 250 Feddans and lies between latitudes 24° 06' 24" & 24° 05' 20"N and longitudes 32° 55' 12" & 32° 56' 30"E.

The exploration of the site was to assess the feasibility of the project, to plan and design appropriate foundations and to draw up bills of quantity for excavation. Information such as: the sequence of stratigraphy of the rocks and soils; the nature and thickness of superficial deposits; the frequency and orientation of joints; location of faults; the ground water conditions; the presence of economic deposits and the suitability of local rocks and soils to be used as construction materials were obtained during this study.

Résumé: ce projet fait part des études sociales, économiques, polytechniques, et planificatrices nécessaires à l'établissement de 250 maisons à j'Est d'Aswan, selon le traité d'amitié conclu entre l'Égypte et le Danemark. Ces maisons seront édifiées sur une superficie de 250 feddans entre les diamètres 24° 06' 24" & 24° 05' 20" au Nord et 32° 55' 12" & 32° 56' 30" à l'Est.

L'exploration du site aidera sans doute à évaluer les études de conjonctures économiques du point de vue planification et meilleur dessin bases. Elle aidera également à préciser le coût et la longueur de percement dans les pierres. Des études ont été établies pour explorer la nature du sol et des pierres pour préciser la nature de celles-ci et évaluer la nature et la densité des sédimentations sur le sol. On a également précisé la direction des démarcations et les lieux de coupure ainsi que le taux telluriques. Comme on a précisé les fournitures économiques sur le site et la valeur des pierres existantes et qui peuvent être employées dans la construction.

Keywords: Berms, clay, foundation, mudstone, sandstone, site investigation.

INTRODUCTION

The main objective of geological exploration of an engineering site is the answer to the following question - what rocks and soils are present, and how are they distributed under the site?

McLean & Gribble (1979), stated that good professional practice in the exploration of an engineering site is described in the British Standard Code of Practice CP2001 Site Investigations. Dumbleton & West (1976) recommended a good procedure, which describes the search through records, maps and other literature relevant to the geology of the area under exploration. The exploration of a site assessing the feasibility of a project to plan and design appropriate foundations, and reduce the costs of excavated rocks. Blyth & De Freitas (2001) stated that satisfactory design and construction of an engineering structure can be accomplished only when the character of the soil or rock on which, or within which, it is to be built is known.

In the present work the following items are studied for the site under consideration:

- Rock and soils are presented, including the sequence of strata, the nature and thickness of superficial deposits and the presence of igneous intrusions.
- How these rocks are distributed over, and under, the site (their structure).
- The presence of joints in the different rock masses and the location of any faults, the presence and extent, of any weathering of the rocks and particularly of any soluble rocks such as limestone.
- The ground water conditions, including the position of the water table, and whether the ground water contains noxious substances in solution such as sulphates, which may affect cement with which it comes into contact.
- The presence of economic deposits, which may have been extracted by mining or quarrying. The suitability of local rocks and soils especially those to be excavated as construction materials.

CLIMATE

The daily maximum temperature is above 40°C during the months of June, July and August and is just below 40°C during the months of May and September. These five months therefore constitute the hottest months of the year. Desert conditions are prevailing over the district - in winter-time it is cold and summer time it is extremely hot. The difference in temperature between day and night is always great throughout the year. The rainfall over this district is very scarce as in many desert regions. Several years may pass without any rain at all but when it does occur it may be very heavy rendering the wadies to flow as streams or even torrents.

TOPOGRAPHY

The topography of the area is an extensive plateau varying in level from 150m above sea level adjacent to the Nile valley and increasing in level towards the East to reach 200 meters above sea level. The Nile valley level in Aswan district is roughly 100 meters above sea level and the area under investigation consists of irregular hills separated by some drainage lines (Khors). The main route starts from the valley and ascends the slope to the plateau surface crossing the site from north to south.

GEOLOGICAL FORMATION

The generalized geological map (Figure 1), shows the geological formations underlying the district, these comprise metamorphic and igneous rocks of Precambrian age, sandstone and clay of the Nubian Sandstone series of Upper Cretaceous age [divided into lower, middle, and upper groups] and ancient gravels, sands, river sands and Nile mud of Pleistocene and Recent ages. The strata forming the selected site belong to the lower group of the Nubian Sandstone series. This group of strata overlies the Precambrian igneous and metamorphic rocks with thickness ranges of between 35 and 40 meters. Generally, conglomerates, pebble beds and kaolinitic clays and sandstones are characteristic features of this group but they are not necessary found everywhere. Grits may be met with sandstones of various grain sizes and clays are common. Clayey sandstone is occasionally found but sandy clays are not so common. Prospecting boreholes indicated more details about the stratigraphy in the site. These borings show that there are various alternating strata of clayey siltstone, sandy siltstone, claystone and sandstone. Layers of silty clay, sometimes included between rock layers may have high swelling potential.

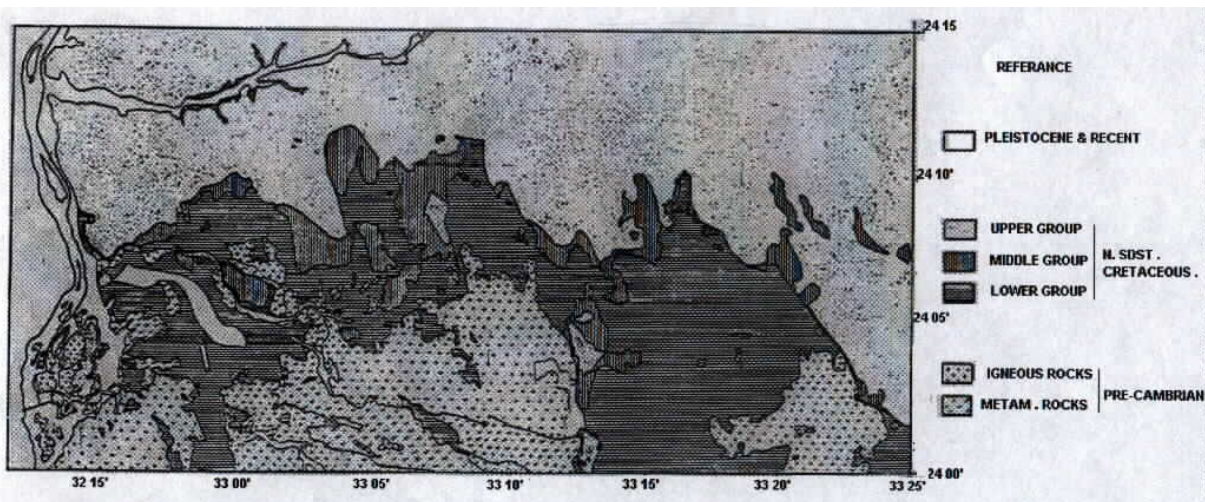


Figure 1. General geological map of the district of Aswan.

GEOLOGICAL STRUCTURE

Nubian sandstone strata have more or less a tabular structure; these strata are either horizontal or inclined at small angles, the dip ranging between 3 and 10 degrees mainly towards the north and north-west.

FISSURES AND JOINTS

Joints are observed in the site especially on the edge of the plateau. The prospecting boreholes indicated that some rock layers contain small cavities and fissures.

FAULTS

There are many faults in east Aswan district. These faults are far from the selected site. The nearest faults to the site are two minor faults about one kilometer from the north-west corner of the site. These two faults are of normal type and orientated south to north with length ranges of 1 to 1.2 km. These two faults have no effect on the project construction.

ROCK PROPERTIES

Twelve borehole positions were selected. Mechanical borings were carried out. The properties and thickness of different rock layers were determined. Complete quantitative values for the site rock properties are given in Table 1.

ECONOMIC MINERAL DEPOSITS

Besides the oolitic iron, the economic mineral deposits known in the district of East Aswan are barytes, clays, kaolin, quartz and talc.

ORNAMENTAL ROCKS

Ornamental rocks in the district are granites and granodiorites.

Table.1. Site rocks geotechnical properties

Rock	Thickness (m)	Density (gr/cm ³)	Compressive Strength (MPa)	Internal friction degree	Shear strength (MPa)	Cohesion (MPa)
Yellow friable clay	1.4	2.2	8.27	18	5.2	3.3
Laminated clayey sandstone	0.5	2.08	25.1	25	6.7	3.5
Yellowish clay	6	1.8	1.86	22.8	7	4.2
Brown medium to coarse grained sandstone	4.1	1.87	31.7	22	8	5.3
Kaolinitic clayey sandstone	3	2.0	18	19	9	4

CONSTRUCTIONAL ROCKS

Sandstones are quite common in Aswan district. They vary in colour, grain size and consolidation. All the temples in Upper Egypt are built from sandstone. At present, sandstone is quarried to a certain extent in Aswan district for building purposes or irrigation construction and works.

CONCLUSION

- Topographically the site consists of irregular hills and it needs considerable work in leveling, in case of cut and fill, the stability of rock slopes must be taken into consideration.
- The selected site free of faults and there is no danger effect on project construction. In case of extension of the site area care from the near faults taken into consideration.
- Sandstone covers the area near the site and may be used as a construction material for the project.
- A safety berm must be left between the edge of the plateau and structures of the project; the width of this berm depends upon the properties of rock, the degree of fissures, and the slope of plateau edge.
- Precautions must be done to prevent the leakage of drinking and drainage water to the swelled rocks.

REFERENCES

- BLYTH, F.G.H. & DE FREITAS, M.H. 2001. *A Geology for Engineers*, Butterworth-Heinemann, London.
- DUMBLETON M.J. & WEST, G. 1976. Preliminary source Of Information For Site Investigation In Britain, Road Research Laboratory, Report LR 403. Department of the Environment. H.M. Stationery Office, London.
- McLEAN, A.C. & GRIBBLE, C.D. 1979. *Geology For Civil Engineers*, George Allen & Unwin, London.