CONTRIBUTIONS TO THE MINERALOGY OF EGYPTIAN BLACK SANDS

BY

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N O T E

The present thesis is submitted to Ain Shams University in partial fulfillment of the requirements for the Degree of Master of Science in Geology.

Besides the research work materialized in this thesis, the candidate has attended eight post-graduate courses for one year in the following topics :

1- Geological maps
2- Laboratory Geological methods
3- Geochemistry
4- Photogeology
5- Igneous petrology
6- Sedimentary petrology
7- Metamorphic petrology
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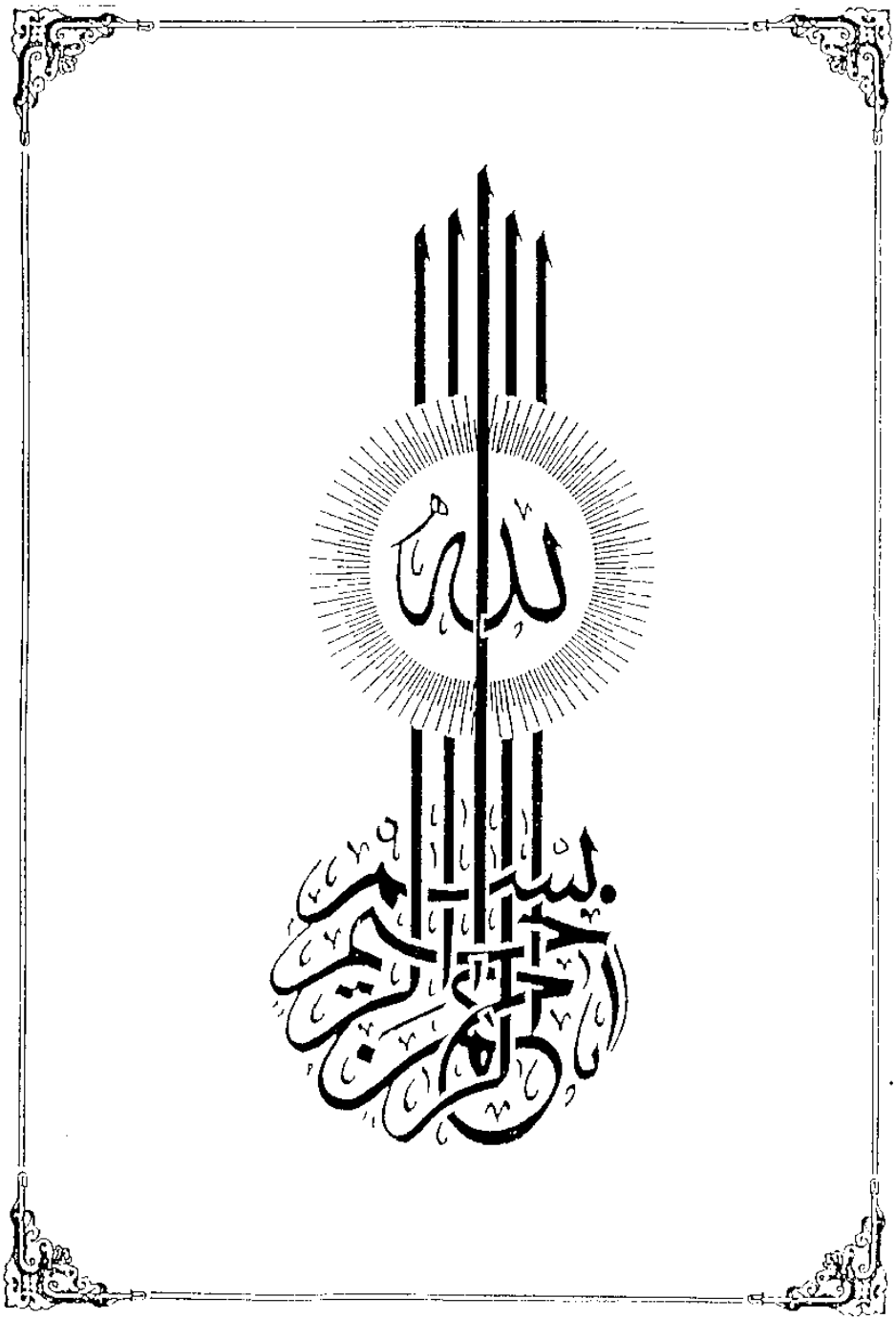

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A B S T R A C T

The present study has been carried out to determine the different textural and mineralogical characteristics of the beach sand sediments (the so called diluted black sands) along the Nile Delta coast between Rosetta and Dameitta, and to describe in detail the properties of quartz and some heavy minerals (zircon, amphiboles, pyroxenes) and their distribution. A comparison between the deltaic beach sediments and both of Nile sediments and sands is also carried out. The results obtained are used to explain the process of formation of the diluted black sand deposited along the Nile Delta coast.

Detailed study of the grain size analysis of both beach sands and Nile sediments and of various related statistical parameters (e.g. Mean Size; Mz, Inclusive Graphic Standard Deviation; σ_I, Inclusive Graphic Skewness; SK_I and Inclusive Graphic Kurtosis, K_G') are carried out. These revealed that the beach sands were derived from Nile sediments through hydrodynamic processes that resulted in removal of silt and clay fractions as well as causing better sorting of the sand fraction.

The main heavy minerals encountered are the opaque minerals (essentially magnetite and ilmenite), amphiboles, pyroxenes, epidote, garnet, zircon, rutile, monazite and staurolite. The distribution of various grain sizes of heavy minerals is discussed in detail and revealed a marked variation both along the shore line and normal to it.

The relationship between amphiboles, opaque minerals and pyroxenes for beach sands, Nile sediments and Nile sands indicates that the beach sands of the Nile Delta are mainly Nile sediments that were subjected to selective sorting action of waves and wind along the beach.

Opaque minerals express a strong negative correlation with either pyroxenes or amphiboles, meanwhile pyroxenes and amphiboles are positively correlated. These relationships are

due to depositional and sorting selectivity between the different minerals. Such selective processes are controlled by the specific gravity of the mineral concerned and by the size and shape of its particles.

The shape analysis study of quartz grains indicates that the coarser the grains the better the roundness they are, and that the roundness decreases eastward from Rosetta particularly for fine and very fine grain sizes due to the action of the eastward currents. The quartz grains in all size classes in the backshore sediments are more rounded than those in the foreshore sediments, this is due to the hydrodynamic and sorting effects of waves. The roundness of quartz grains in the dunes at Baltim does not differ markedly from those in the nearby backshore.

Although the study indicates that undulatory quartz grains are generally less abundant at Rosetta than at Baltim and Gamasa, yet their is no significant trend in the distribution of polycrystalline quartz grains neither along the shoreline nor perpendicular to it.

Dimensional measurements of the separated zircons revealed that their grain size varies proportionally with elongation and inversely with both length and breadth. In Baltim, the elongation of zircon is found to increase from the foreshore area back to the coastal dunes.

Microscopic examination together with X-ray diffraction and chemical analyses for the separated amphiboles and pyroxenes indicate that the former are mainly magnesiohornblende with some oxyhornblende, and that the latter are essentially augite with subordinate hypersthene.

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This research work
was carried out in the
Earth Sciences Laboratory
National Research Center,
Cairo, Egypt.

CHAPTER 1

INTRODUCTION

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INTRODUCTION

Black sands are known to occur along the shores of the Nile Delta especially at the Nile outpourings near Rosetta and Damietta. The sands have been described as "black" due to the presence of different proportions of dark heavy minerals.

The black sands of Rosetta were briefly described by Shukri (1945) and Hilmy (1951). The first detailed studies of these sands were carried out by Higazy and Naguib (1958), Rittmann and Nakhla (1958) and Nakhla (1958); Higazy and Naguib (1958) described the geological and radiometric surveys carried out along the Mediterranean beach of the Nile Delta. They pointed out that there are two modes of occurrence of black sands. The first is the "concentrated ore" which is very dark in colour and contains from 70 to 90 per cent heavy minerals. The second which is called the "diluted ore" constitutes most of the sand deposits along the beaches of the Delta and contains up to 40 per cent of the dark heavy minerals. Higazy and Naguib estimated the amount of the heavy minerals present in the black sands to be not less than 25 million tonnes. The main economic minerals encountered are ilmenite, magnetite, zircon, rutile, monazite and garnet. The same authors discussed the mechanism of deposition of the black sands and pointed out that they were derived from