Ain Shams University
Faculty of Science
Geology Department

Impact of Weathering Grade on the Petrological and Engineering Properties of Some Egyptian Metavlocanics for Utilization as Concrete Aggregate.

By

Mohammed Mostafa Mohamed Abdel Fattah
(B.Sc. in Geology)
Faculty of Science-Ain Shams University

A Thesis

Submitted in Partial Fulfillment of the Requirements
For
The Degree of Master of Science in Geology

Department of Geology
Faculty of Science
Ain Shams University
2017

Supervisors

Prof. Dr. Baher Abdel-Hamid El Kalioubi
Professor of Geology
Geology Department, Faculty of Science,
Ain Shams University.

Prof. Dr. Ali Ismail Mohamed Ismail
Professor of Engineering Geology ,
Geological Sciences Department,
National Research Centre, Dokki, Cairo.

Dr. Abdel Monem Mohamed Soltan
Associate professor of applied Geology
Geology Department, Faculty of Sciences,
Ain Shams University

Ain Shams University
Faculty of Science
Geology Department

APPROVAL SHEET

M.Sc. thesis

Name: **Mohammed Mostafa Mohamed Abdel Fattah**

Title: **Impact of Weathering Grade on the Petrological and Engineering Properties of Some Egyptian Metavlocanics for Utilization as Concrete Aggregate**

Supervisors

1- Prof. Dr. Baher Abdel-Hamid El Kalioubi

Professor of Geology, Geology Department, Faculty of Sciences, Ain Shams University.

2- Prof. Dr. Ali Isamil Mohamed Isamil

Professor of Engineering - Geology, Geology Science Department, National Research Center, Dokki, Cairo

3- Abdel Monem Mohamed Soltan

Associate professor of applied Geology, Geology Department, Faculty of Sciences, Ain Shams University.

Head of Geology Department

Prof. Dr. Abel Mohsen Mohamed Morsi

Note

The present thesis is submitted by Mohamed Mostafa to Faculty of Science, Ain Shams University in partial fulfillment of the requirement for the degree of Master of Science in Geology. Beside the research work materialized in this thesis, the candidate has attended postgraduate courses covering the following topics:

1. Field Geology.

2. Statistical Geology.

3. Sedimentation.

4. Sedimentary Rocks.

5. Igneous Rocks.

6. Metamorphic Rocks.

7. Mineralogy.

8. Geochemistry.

9. Advanced crystallography.

10. Ore petrology.

11. Lab techniques.

12. English.

She has successfully passed the final examinations of these courses.

Head of Geology Department

Prof. Dr. Abel Mohsen Mohamed Morsi

ABSTRACT

Concrete plays a great role in the security and safety to maintain human life. It is composed of cement and rock aggregates. The latter components are naturally formed in geological environment and they affected by the weathering conditions surrounding them.

The mutual interaction between the cement, as a binding material, and the metavolcanic concrete aggregates, as natural aggregates, affects the engineering characteristics of the concrete blocks. Such interaction is mainly affected by physical characteristics, aggregate mineralogy, petrography, chemistry, pore system and weathering process.

This research proposal is aiming mainly to integrate both the mineralogiocal and petrographical characteristics of the different types of metavolcanic rocks and their engineering characteristics to be used as concrete aggregates. Such study will endeavour the classification of Egyptian metavolcanic rocks engineering wise.

This research will focus in details, on the metavolcanic aggregates pore systems and mineral/petrographic characteristics. It relate these data sets to the geotechnical criteria of both the individual aggregates and the formulated concrete blocks. It also consider the reaction zones between the binding material, cement, and the metavolcanic aggregates to explain the possible mineral transformations and their positive/negative impacts.

There is a priority for promoting and fostering economic development of territories outside the Nile valley, especially in the areas around the Red Sea. Most of these areas are surrounded by mountains and vallies composed mainly of hard rocks and filled with metavolcanics and Wadi deposits, respectively. Therefore, detailed studies are important to investigate how far would the metavolcanic rocks can help as unconventional natural concrete aggregates. Metavolcanics represent a group of regionally metamorphosed volcanic rocks and their pyroclastic and tuff equivalents. In Egypt, metavolcanics are found in different locations in Southern and Central Eastern Desert.

The metavolcanics rock aggregates were used in this study classified into basic, intermediate, intermediate-acidic and acidic rocks. Such differentiation induces variation in the mineral and chemical compositions, petrography, physical characteristics and pore system. These characteristics would affect the suitability of the different metavolcanics as concrete aggregates. In this research, the selected areas are located in the Southern and Central Eastern Desert. The Southern Eastern Desert are Shadli area El Sukkari in Idfu Marsa Alam and Central Eastern Desert embraces two location Ambagi area and Sid areas and

ACKNOWLEDGEMENTS

First thanks to God for all who guided me to bring forth this work. Second, thanks to my supervisors and colleagues during my researches at Geology Department, Faculty of Science, Ain shams University that have brought forth many interesting experiences. I would like to thank my academic supervisor **Prof. Dr. Baher Abd El- Hamid El Kalioubi,** professor of geology, Geology Department, Faculty of Science; Ain shams. for his guidance during the field works, kind help and facilities during the planning for this research, providing valuable data on Egyptian Basement rocks, rich discussions and thorough reviewing the present work. My special gratitude and appreciation to my academic supervisor **Prof. Dr. Ali Ismail Mohamed Ismail,** Professor of Engineering Geology, Geological Sciences Department, National Research Center , El Dokki, Egypt, for his continuous help, continuous encouragement, discussing critical technical data of the thesis. The author wishes to express his thanks and extreme appreciation to **Prof. Dr. Abdel Monem Mohamed Abdel Monem**, Geology Department, Faculty of Science; Ain shams University, Egypt for supervising this thesis, continuous help and critical discussion. I would like to express my sincere thankfulness to my family who has always been helpful of my motivation in life and they have given me the motivation and encouragement and got me back on path when times were intractable.

CONTENT

Title Page

CHAPTER III: GEOLOGY AND PETROGRAPHY

CHAPTER IV: GEOCHEMISTRY OF METAVOLCANICS

CHAPTER V: GEOENGINERING PROPERTIES OF THE METAVOLCANICS AGGREGATES

CHAPTER VI: GEOENGINERING PROPERTIES OF CONCRETE

LIST OF FIGURES