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**Geochemistry of some Egyptian nepheline syenites and their
utilization in glass ceramics.**

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Note

The present thesis is submitted by Ahmed Mohamed Yahya 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:

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2. Statistical Geology.
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5. Igneous Rocks.
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ABSTRACT

Glass-ceramics plays a great role in the security and safety to maintain human life. It is composed of raw materials and chemical additives. The first components are naturally created in geological environment and they might influenced by the weathering conditions surrounding them. One of the important natural source for glass-ceramics is the alkaline rocks widespread in the alkaline intrusions.

Abu Khruq ring complex is the type locality of the upper Cretaceous alkaline intrusions related to the alkaline province of the Southern Eastern Desert. It comprises concentric rings of syenitic rocks ranging in composition from quartz-rich syenite at the outer ring, through alkali feldspar syenite to nepheline syenite in the center.

The mutual interaction between components of raw materials and chemical additives through different temperatures of heat treatment affects the physical, chemistry and mineralogical characteristics of the resulted glass-ceramic.

This research article is aiming essentially to integrate both the mineralogical and petrographical characteristics of the different types of syenitic rocks and their chemical characteristics to be used as raw materials induced through glass ceramic.

Petrographical and chemical investigations were achieved to define the mineral composition and geochemical characteristics of the various rock present.

The syenitic rocks have a considerable value of Al_2O_3 (12.8 – 17.3 wt. %) and total alkalis are above 8.5 wt. %. They show slight decrease of Na_2O and enrichment of SiO_2 toward outer ring. According to geochemical characteristics, the different types of syenitic rocks might indicate development of magma from deep crustal source of mixed material from the mantle placed in within plate tectonic setting.

Sintered glass-ceramics were prepared from the syenitic rock specifically nepheline syenite and quartz syenite rocks with soda-lime-silica glass. Boric acid was added to the glass batches to decrease the melting point and the viscosity of the glass melt. MgF_2 and CaF_2 were added to the glass batches as nucleation catalysts. Crystalline phases are nepheline, augite, xonotlite and fluoride which were developed in the specimens after sintering process. Scattered minor skeletal crystal of nepheline phase was formed in boron-free and containing specimens. However, the addition of MgF_2 improve sintering of augitic pyroxene, whereas CaF_2 enhance the formation of xonotlite and fluoride. All the specimens have nano and micro size rods of crystalline phases which were developed in glassy matrix.

The microhardness, density, chemical resistance and thermal expansion were achieved to define characteristics of the glass-ceramic product. The microhardness and densities values are between ~ 400 to 600 kg/mm^2 and ~ 2.10 to 2.52 g/cm^3 respectively. Also, chemical resistance were achieved by acidic and neutral condition, glass-ceramic specimens gave a good durability at neutral condition while boron-free and –containing specimens showed good resistance than MgF_2 and CaF_2 bearing specimens at acidic solution. Thermal expansion values are between 11.9 to $1.75 \times 10^{-7} \text{ }^\circ\text{C}^{-1}$.

Finally, this study throw light on the importance of the syenitic rocks can help as a natural source of alkalis and aluminum that can be used improve glass-ceramics building materials.

Key words: Glass-ceramics, Syenitic rocks, nepheline, Augite and Xonotlite.

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