USE OF MAIRÍ GRANITE RESIDUE FOR THE DEVELOPMENT OF CERAMIC COMPOSITIONS TO OBTAIN CERAMIC BLOCKS

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1. ABSTRACT

The Jacobina Mountains constitute an important metallogenic province in the State of Bahia, enclosing a series of mineral deposits. It comprises a geotectonic structure 220 kilometers long, in the north/south direction, the result of the amalgamation of sedimentary basins of the Jacobina Group (GJ) and the Mairí Complex (CM), and meta-vulcansedimentary of the Novo Mundo Greenstone Belt (GSBMN). The proposal of this work was the use of granite from the Mairí Complex, which exhibited the presence of a mineral association composed of quartz + feldspar + plagioclase + mica, which relates to the gray coloration of the rocks, present in the gold region hosted by the green quartzites and conglomerates of the Jacobina Mountains, for clay body compositions for the production of ceramic blocks. In this work four groups of samples were prepared with 10, 20, 30% residue of mairí granite and a group with the standard body composition. The raw materials used were characterized by DRX and FRX. The specimens were compacted in a uniaxial press and dried at 100° C for 24 hours and sintered at 850°C, 950°C and 1000°C on a 60 minutes plateau, with a heating rate of 5° C/min. After firing, the three-point flexural strength test, linear shrinkage test, water absorption, apparent porosity, loss on ignition and apparent specific mass were performed. Microstructural characterization of the samples was performed by scanning electron microscopy (SEM). In general, the formulations presented adequate physicochemical properties for the production of coverings, and it is possible to substitute the use of conventional raw materials for residues. The formulations with percentages higher than 10% of residue of mairí granite presented the best results, it being possible to use them for the production of ceramic blocks. In addition, the adoption of the alternative of using these residues will not only reduce the environmental impact, but also add value to the final product.

2. INTRODUCTION

This research was carried out in the vicinity of Jacobina - BA, in the Jacoferro mine. This exhibits the characterization of a rocky material of igneous origin resulting from the geological processes of the Mairi Complex, through the analysis of its physical and mineralogical characteristics.

The Jacobina Mountains constitute an important metallogenetic province of the State of Bahia, enclosing a series of mineral deposits. The rocky material used in this work is represented by the Mairí Granite presenting a mineral association composed by quartz + feldspar + plagioclase + mica, which relates to the gray coloration of the rocks [1], [3] and [4].

The results presented here refer to the analysis of the incorporation of granite into the ceramic composition for the production of ceramic blocks. In this study four groups of 10, 20 and 30% granite samples were prepared, and one group with the standard composition. The standard composition used in this research was the Miguel Calmon deposit clay. The proposal of this work is to take advantage of granite residues from the Jacobina-Ba region, specifically Serra Mairí, generated in the mineral exploration process for the production of ceramic blocks.

3. EXPERIMENTAL APPROACH AND MATERIALS

Deposit clay from Miguel Calmon

Chemical composition of the most important elements found in the clay used in this work, are represented by the minerals: Quartz (SiO_2); Kaolinite ($Al_2Si_2O_5(OH)_4$), and Halloysite ($Al_2O_3.SiO_2.nH_2O$), Figure 1(A).

Mineral residue

The results of the x-ray fluorescence and x-ray diffraction characterization of the mairí granite residue used in this work indicated the presence of quartz (SiO_2), albite ($NaAlSi_3O_8$) and mica represented by muscovite $KAl_2(Si_3AlO_{10})(OH,F)$, Figure 1(B).

Sample Preparation

In this work, Miguel Calmon clay (Bahia, Brazil) and mineral residue from the exploitation of mairí granite from Jacobina region (Bahia, Brazil) were used. The three formulations were prepared with a mineral residue of 10, 20 and 30%.

Sintering

The sintering temperatures used were 850°C, 950°C and 1000°C, with a heating rate of 10 ° C / min for 60 minutes. The furnace used was a Mufla type, JUNG brand, model 0713. Figure 2 shows the compressed and sintered samples.

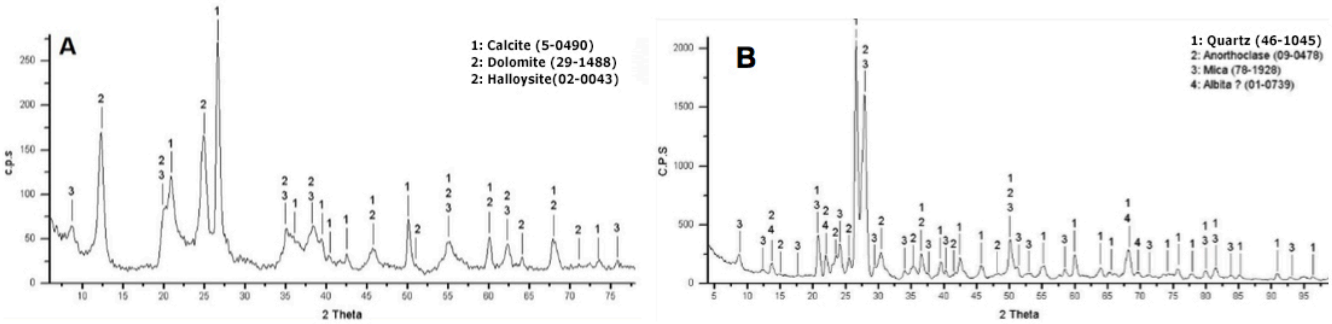

***Figure 1**: X-ray diffraction of (A) clay and (B) mineral residue.*

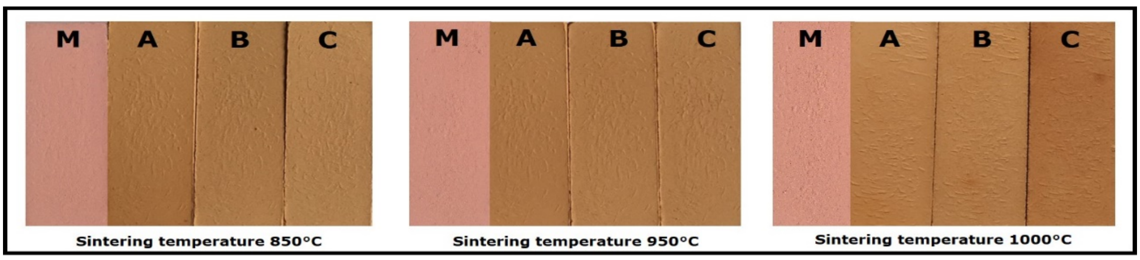

***Figure 2:** Photos of the test specimens of the formulations studied at a) 850°C, b) 950°C and c) 1000°C, with a heating rate of 10°C / min, for 1 hour.*

4. RESULTS AND DISCUSSIONS

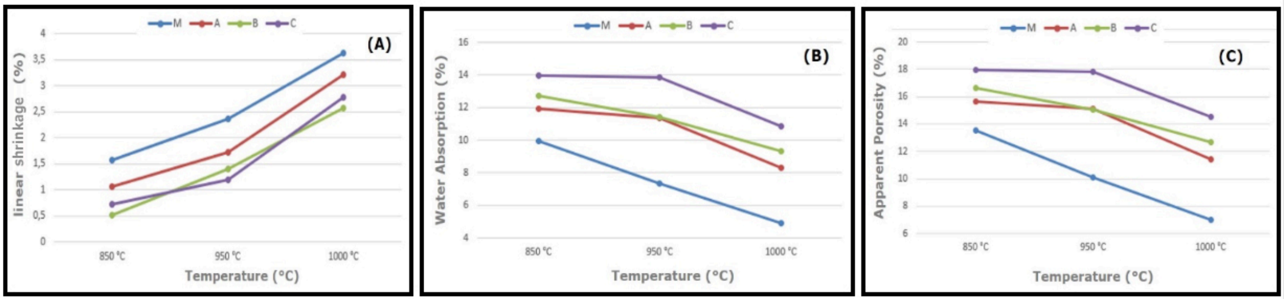

Figure 3: *Technological tests of the studied samples.*

5. CONCLUSIONS

High additions of mineral residue provide a reduction in the mechanical strength of the final product and hamper the conventional production process. From the results obtained it was possible to verify that the formulations presented satisfactory results, in which there were some values suggested by ABNT NBR 7.171 - Masonry Ceramic Block – Specifications [2] and [3]. However, the incorporation of the granite residue from Serra Mairí in the ceramic composition presented satisfactory results, it being the formulations with residual contents in the range between 10 and 20% that presented the best results. On meeting the technical specifications, it indicated the possibility of various applications in ceramic bodies. The characterization results induce the technical feasibility of the use of mairí granite residues in ceramics for the production of ceramic blocks, due to the physicochemical characteristics of the residues resembling that of the conventional raw materials: that is, they contain aluminosilicates (SiO_2 and Al_2O_3) in the composition, it being possible to substitute the raw materials quartz and feldspar. The results encouraged the use of mairí granite residues in the development of ceramic products in particular for ceramic blocks. This will bring benefits such as the possibility of minimizing/mitigating the environmental impact caused by the indiscriminate disposal of this material, as well as reducing the cost of final products and diversifying the range of raw materials for the ceramic industry.

6. REFERENCES

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