



Universidade do Minho
Escola de Engenharia

Semana da Escola de Engenharia October 24 - 27, 2011

CHARACTERIZATION OF THE SCHIST IN THE PORTUGUESE TRADICIONAL CONSTRUCTIONS

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KEYWORDS

Schist, characterization, traditional constructions.

ABSTRACT

Among the traditional Portuguese architectural heritage, there are many buildings in schist masonry, from North to South of the country, varying the buildings typology and use, the constructive techniques and even the type of schist, which may have quite different physical and mechanical properties depending on the extraction location. The present study intends to characterize the properties of the schist from three different regions in Portugal. The main results obtained in the characterization laboratory tests are presented and a comparison is made between the properties of the schist from these three regions.

INTRODUCTION

Within the broad traditional Portuguese architectural heritage, traditional schist masonry buildings are spread over several regions from North to South, varying the typology, construction methods and even the schist material itself, which, depending on the area where it is extracted, may have very different properties and characteristics. According to Boeri (1995), natural stones when used in construction have its behavior strongly related to its natural characteristics. Furthermore, Ribeiro et al. (2008) state that this type of construction is closely linked to nature, which holds its roots and where it is raised, resulting in a symbiosis between nature and human workmanship.

SCHIST CHARACTERIZATION

To obtain good results from the application in the constructions, the stones must have several requirements directly related to the intended use of the building. Understand that the properties of the rocks

derived from the physical and chemical characteristics of the materials that they are made and the geometric characteristics of the structures is essential for a perfect analysis and understanding of the schist constructions. Taking into account the representativeness of the traditional schist constructions in the regions of Minho, Beiras e Trás-os-Montes, the following laboratory tests were performed for the samples from the three regions: axial compression test, Schmidt hammer test, point load test, capillarity and atmospheric water absorption test, salt crystallization test and ultrasounds test. All the tests followed the existing rules.

For a better analysis, the distinction between regions is carried out corresponding different colors to each region. Therefore, the blue color is referred to the region of Minho, the red color to the region of Trás-os-Montes and the green color to the region of Beiras. The tests were performed in both directions of the anisotropy plane of the rock, i.e. parallel and normal directions.

Regarding the results obtained from the mechanical tests, it can be observed that the schist from the Beiras regions is the hardest material, and point load index increases with the mechanical compressive stress (see Figure 1).

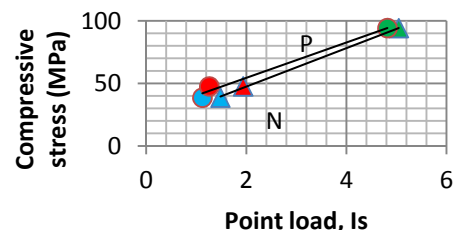


Figure 1: Compressive stress and point load index.

Comparing the results from the compressive stress test with the results obtained in the ultrasound test, one can observe that the material from the Beiras region has



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higher quality than the other regions tested. It is also confirmed that the best quality material gets the higher wave speed in the ultrasound test (see figure 2).

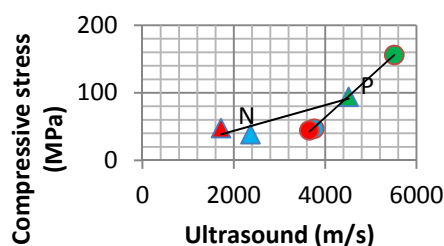


Figure 2: Compressive stress and ultrasound.

Being the biggest wave velocity registered in compact materials, as seen in the Figure 2, the results from the atmospheric water absorption must be less for the same compact materials. This is the case for the schist from the Beiras region as it can be seen in Figure 3.

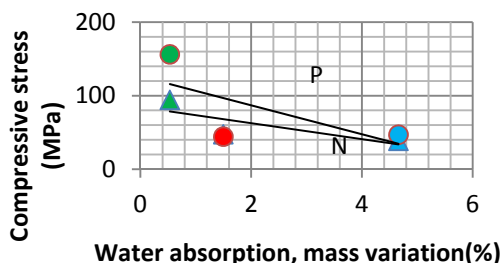


Figure 3: Compressive stress and atmospheric water absorption.

The mass variation in the salt crystallization tests presents the higher results of gains or losses for the regions of Minho and Tras-os-Montes and the schist from the region of Beiras registers the lower mass variation (see Figure 4).

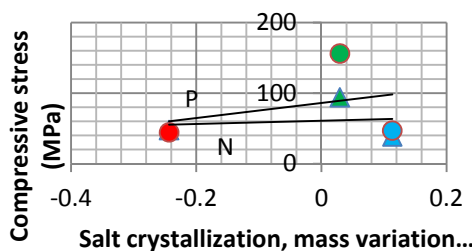


Figure 4: Compressive stress and salt crystallization.

Regarding the results obtained from the capillarity water absorption tests, schist from the region of Beiras gets the lower results in the order of 720 g/m^2 in the normal direction and 425 g/m^2 in the parallel direction compared to the region of Minho where were obtained 2400 g/m^2 for the normal direction and 4200 g/m^2 for the parallel direction or the region of Trás-os-Montes where were obtained 1550 g/m^2 for the normal direction and 1900 g/m^2 for de parallel direction.

FINAL CONSIDERATIONS

The traditional schist constructions have greater predominance in the Beiras region, this fact is related, not only with abundance of material in the soil, but also with the quality of the schist, as seen in performed tests. The performed laboratory tests confirmed that the schist from the Beiras region is the hardest material and it has higher quality than the schist from the other regions tested. In all the performed tests the schist from Beiras region obtains best results than the schist's from de Minho and Trás-os-Montes regions.

Future work involves the study of the types of schist constructions in others Portuguese regions, as well as to characterize the schist as a construction material and the mechanical characteristics of schist structures.

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AUTHORS' BIOGRAPHIES



RICARDO S. BARROS was born in Paços de Ferreira, Portugal in 1980. He graduated in 2005 on a 5-years course of Civil Engineering obtained at University Fernando Pessoa. In 2007 he ended a MSc in seismic improvement, restoration and consolidation of historical buildings

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