

THE ANÇÃ LIMESTONES COIMBRA, PORTUGAL

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Introduction

Ançã is located in the Lusitanian Basin (western Meso-Cenozoic sedimentary basin), in the municipality of Cantanhede, close to Coimbra, Portugal. This constitutes the northernmost Dogger (Bajocian) limestone sequence in Portugal.

The use of the Ançã limestones is documented since the Roman occupation of the Iberian Peninsula. It was used for the construction of houses, palaces, churches, fine sculptures, carving, paving and for the production of lime.

These limestones vary from white and very soft varieties, with very high porosity used for sculpture and carving, to white and hard varieties used for masonry and to produce aggregates, and to white to bluish with low porosity and high strength mainly used for paving.

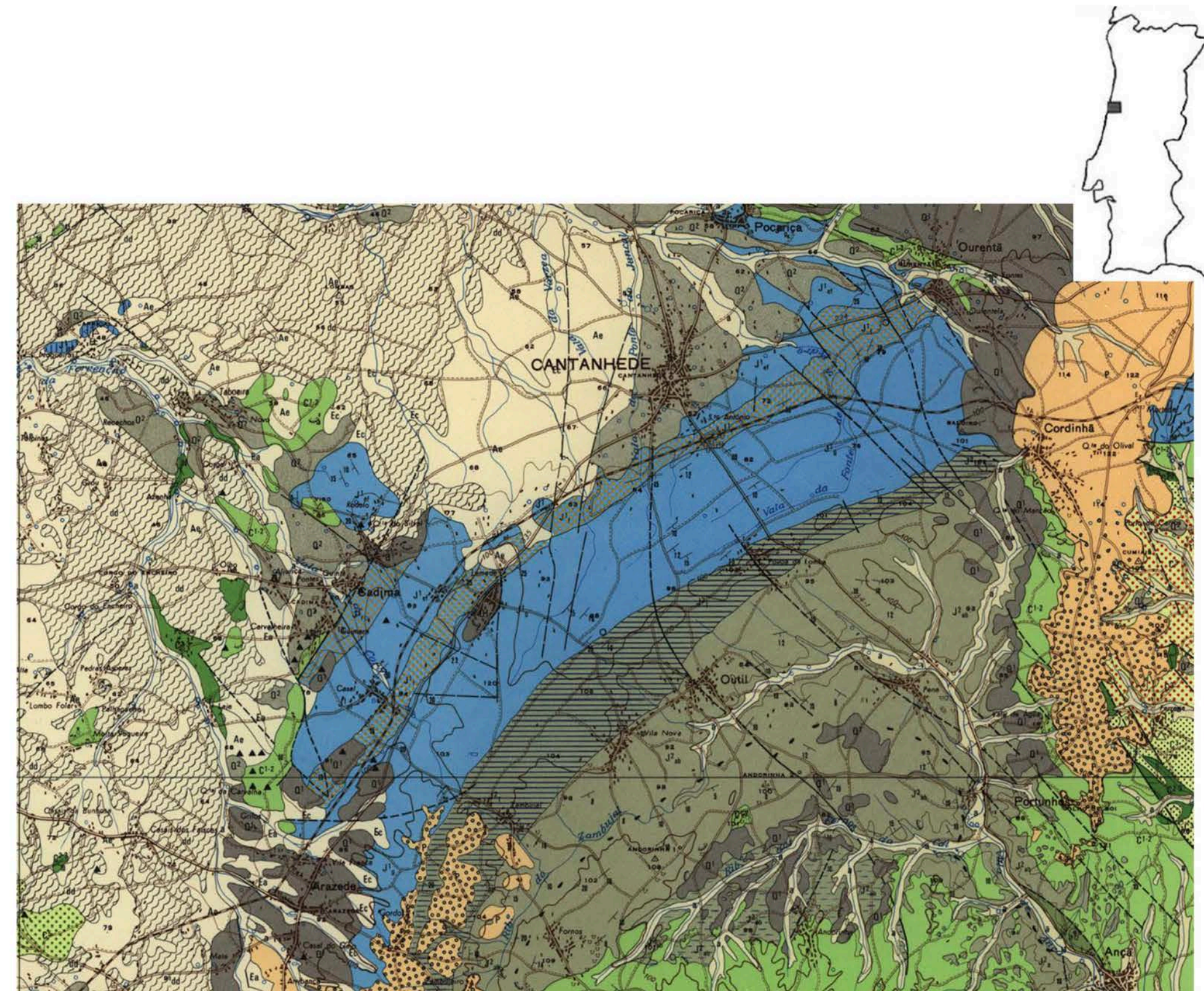


Fig. 1. Geological map of the Ançã limestone area (Barbosa, 2008)

Results

The softer and whiter variety is worldwide known as Ançã Stone (Pedra de Ançã) exhibiting beautiful characteristics with a very white colour and an uniform fine texture.

It became famous after being largely used by Coimbra most famous Renaissance sculptors like João de Ruão and Nicolau de Chanterenne. The Pedra de Ançã was used mainly in the region of Coimbra, but also in several other places in Portugal, in Santiago de Compostela, Spain, and Brazil.

Some examples of heritage in Coimbra using the “Pedra de Ançã” are the renaissance portal of the Saint Cross Church (Fig. 2), the tombs of the first two Portuguese kings located in this church, the altar of the Saint Cross Church or of the Old Cathedral Porta Especiosa (Fig. 3), or in sculptures at the University of Coimbra.

The less porous varieties of the Ançã limestones (< 20 % porosity) were mainly used for masonry, paving and production of lime. The royal Palace of Buçaco is a remarkable masonry building constructed at the end of the XIX century with the less porous varieties of the Ançã limestones.



Fig. 2. Portal of the Saint Cross Church in Coimbra.



Fig. 3. Portal (Porta Especiosa) of the old Cathedral of Coimbra.

Most of the traditional quarries are abandoned and those still in activity are mainly used to produce crushed aggregates, limestone blocks for paving produced in a quite artisanal way, and more rarely for sculpture.

The identification and characterization of the variability of the Ançã limestones, as well as the inventory of the existing quarries and outcrops are necessary to preserve this unique resource, im-

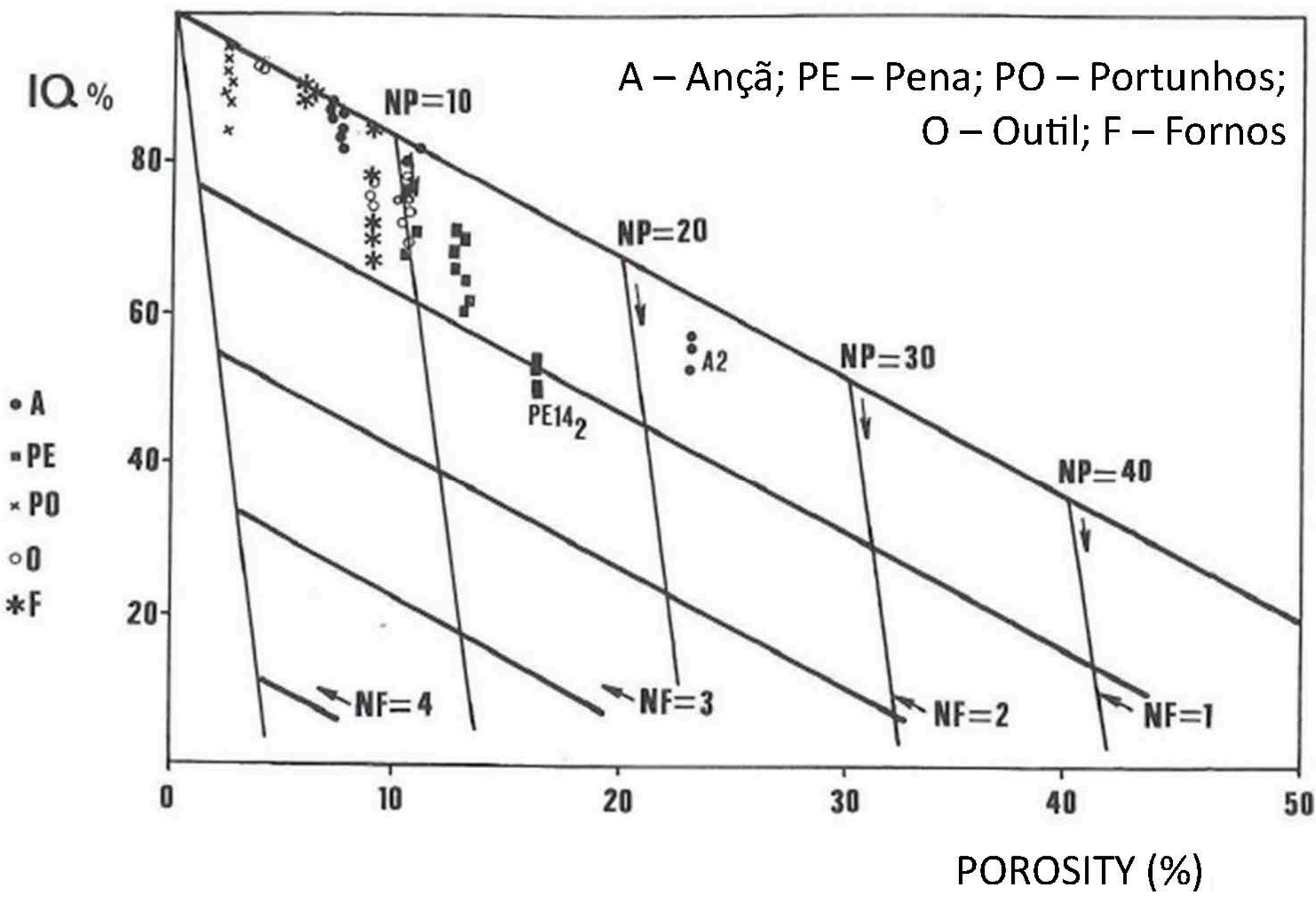


Fig. 4. Separation of pore porosity and fissure porosity based on the Index of quality (IQ) and porosity (n) using the graph proposed by Tourenq et al. (1974) and the data of Trindade (1994).

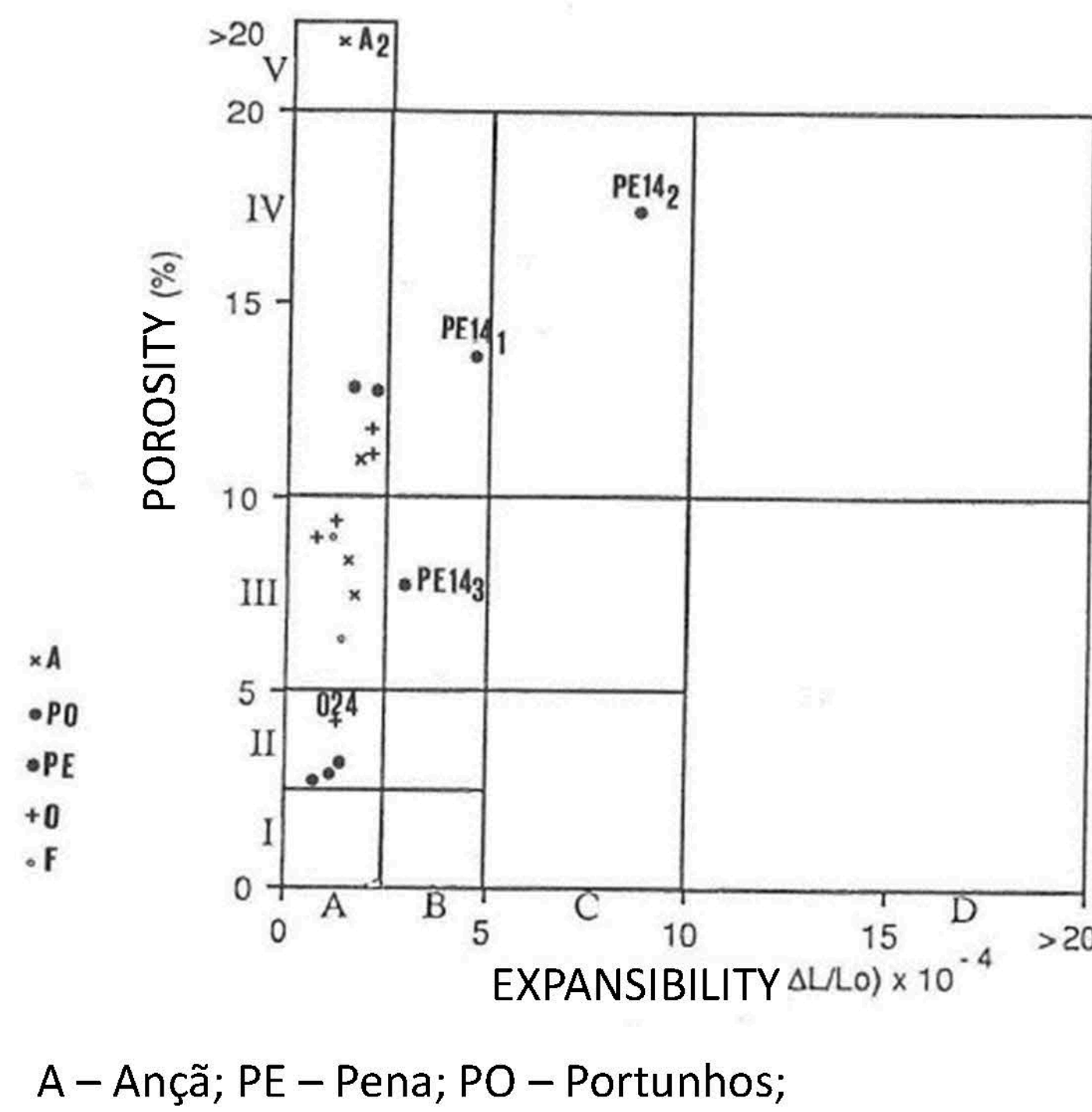


Fig. 5. Classification of limestone rocks from the area of Ançã, using the graph of Delgado Rodrigues (1988) and the data of Trindade (1994).

portant for the preservation and rehabilitation of several monuments and artwork, in Coimbra, classified as UNESCO Word Heritage, where Ançã limestones, including the Pedra de Ançã, were extensively used.

Several varieties were already identified: A – Ançã; PE – Pena; PO – Portunhos; O – Outil; F – Fornos. The Typical values for Ançã limestone is presented in Table 1.

Table 1. Typical values for Ançã Limestone

Unit weight (g/cm ³)	1.92—1.99
Solids Unit weight (g/cm ³)	2.71
Porosity (%)	26—29
Capilarity coefficient (g/cm ² .min ^{0.5})	16
Ultrasound velocity (m/s)	3200

The white Ançã limestone is quite prone to deteriorate when exposed to atmospheric agents and to soluble salts (Fig. 6), mainly due to its high porosity. Deteriorated surfaces needing treatment constitute difficult conservation problems, especially when consolidation and protection treatments are required.



Fig. 6. Typical aspect of Ançã limestone:
- unweathered (Top);
- Weathered (right).

Research works were done to determine the best treatment procedures in order to preserve this beautiful but very weatherable rock material (e.g.: Ferreira Pinto and Delgado Rodrigues 2014, Delgado Rodrigues and Ferreira Pinto, 2015).

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Acknowledgements

The financial support of FCT-MEC through national funds and, when applicable, co-financed by FEDER in the ambit of the partnership PT2020, through the research project, UID/Multi/00073/2013 of the Geosciences Center is acknowledged.