







Abstract

Palaeozoic calcitic marbles are found in the Estremoz Anticline, Ossa-Morena Zone (Southern Branch of the European Variscides in Portugal). The 40 km NW-SE structure present outcrops continuity and intense mining activity since the Roman Period (fourth century BC). The structure has a Precambrian core and the younger rocks aged Devonian Period. The marbles occupy an intermediate stratigraphic position in the Cambrian age Volcano Sedimentary Sequence. The Variscan Orogeny performed twice with different intensities under ductile and brittle tension fields. The Alpine Cycle also acts and causes more fracturing of the marbles. These show spatial-temporal continuity of the deformation where a complete Wilson Cycle can be described. The geological features imprint the marbles beautiful aesthetic patterns that are highlighted when used as Dimension Stone.

Nowadays most of the quarries are placed in the counties of Borba and Vila Viçosa. This last city claims for itself the "Capital of the Marble" title and named the marble as "White Gold".

The marbles exhibit physical properties (Table 1) allowing fabrication of structural and decorative elements. In the Roman period, pieces of art made with Estremoz Marbles were exported abroad and can be found in Museums and Archaeological Sites throughout Europe and North Africa countries.

During the maritime expansion, altars, stairways, columns, statues, etc., were carried as ballast in the holds of ships. At the destination the Portuguese had built monuments which can now be found in South America and Africa countries.

The Modern Dimension Stone Industry Global Market allows Portuguese Marbles to be present all over Recent studies based on U–Pb geochronology of detrital/inherited and igneous zircons from sedimentary and igneous rocks of the Ossa-Morena Zone have the World. Notice that every variety of marble has enough reserves to sustain the mining activity for reinforced that SW Iberia reflects the geodynamic evolution of the North-Gondwana margin during the late Ediacaran to early Cambrian times (Chichorro et al., several hundreds of years. 2008; Linnemann et al., 2008; Pereira et al., 2008, 2011, 2012; Sánchez-García et al., 2008; Solá et al., 2008)

The Alentejo hallmark whitewashed houses are a landscape that can only have been developed by the The following data present new U–Pb dating of zircons of the stratigraphic sequences of the Estremoz Anticline that is a major Variscan structure of the Ossaavailability of marbles to produce quicklime. The marble based built heritage is very rich and is always Morena Zone (Portugal). Figures 1 to 3 in: Pereira et al., 2012. Fig. 4 - Google Earth image (© 2007), with the location of the main towns in the region and Geology in present. The countryside is marked by intense mining activity living side by side with rural industries, Moreira, J. & Vintém, C. (1997). namely wheat fields, groves, orchards and vineyards; therefore the region has unique characteristics 1 - Map of Iberia with major tectono-stratigraphic zones (adapted from Julivert, 1987); Map showing the localities where the Neoproterozoic and Cambrian rocks are preserved in the allowing the development of integrated industrial tourism routes, promoting sustainable development Ossa-Morena Zone (Adapted from Pereira et al., 2006); Simplified geological map (Adapted from Gonçalves, 1972) and cross section of the Estremoz Anticline (Sample locations of industrial, scientific and technological culture opportunities. used for U–Pb analyses).

Table 1 - Physical properties and carbonated composition of Portuguese and foreign marbles. (Data: http://www.stoneexpozone.com/; http://rop.ineti.pt/rop/; http://www.natursteinonline.de)

Portuguese Marbles											
Туре	Localization	Compression Breaking Load kg/c㎡	Compression Breaking Load after Freezing Test kg/cm ²	Bending Strength kg/cm²	Volumetric Weight kg/m ³	Water Absorption at N.P. Conditions %	Apparent Porosity %	Thermal Linear Expansion Coefficient 10 ⁶ per °C	Abrasion Test mm	Impact test: minimum fall height cm	Carbona Compos
Branco Estatuária	Vila Viçosa, Pardais, Lagoa	788	895	208	2709	0,08	0,23	9,9	2,8	65-70	98% ca 54% Ca 43% C0
Branco	Vila Viçosa, Bencatel, Vigária	967	933	208	2713	0,07	0,17	12,6	2,1	45-50	99% ca 55% Ca 44% C0
Branco Rosado	Estremoz, Sta. Maria, Cerca de Sto. António	970	950	243	2718	0,07	0,20	7,3	2,0	50	94% Ca 55% Ca 44% C0
Crème Venado	Borba, S. Tiago de Rio de Moinhos, Herdade do Mouro	990	863	238	2713	0,05	0,15	11,1	2,6	60	99% Ca 54% Ca 43% C0
Rosa Aurora	Vila Viçosa, Bencatel, Santos	872	950	179	2717	0,06	0,16	7,3	3,7	50-55	99%Ca 54% Ca 43% C0
Ruivina Escuro	Borba, S. Tiago de Rio de Moinhos, Ruivina	930	952	270	2715	0,05	0,14	5,4	2,6	45-50	99% Ca 55% Ca 43% C0
Ruivina da Fonte da Moura	Vila ViçosaPardais, Fonte da Moura	863	977	256	2703	0,10	0,28	14,8	2,0	55	95% Ca 54% Ca 43% C0
				Wor	ldwide I	Marbles					
Afyon Tiger Skin	Turkey	648	447	65	2710	0,1	0,2		6,66		99,6%c
Afyon White	Turkey	701	590	151	2730	0,1	0,2		0,51		95,2%c
Bianco Carrara Unito C	Italy	1209	1181	174	2688	1,6		7,2	4,72	73,8	55%Ca 44% C0
Calacatta Bianco	Italy	844	959		2674	1,5		10,3		71	
Greek Cipolino	Greece	965		155	2705	0,11			8,55		43% Ca
Imperial Pink	Brazil	1199	1182	184	2732	0,06	0,17	8	3,31	46	96% ca
Mystique Dark	China	833		83,8	2693	0,08					
Salome	Turkey	1019	1019	174	2730	0,1	0,4		0,37		78,9%
Thassos Saliara Snow White vein	Greece	971		185	2880	0,68			0,35		45,9% (33,8% (19,9%
Villa Gray	China	898		75,6	2820	0,17					





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gradients. The clear pink, white and cream are the most valuable and appreciated varieties.

Figures 6 and 7 represent the same mosaic and so show evident marble translucency.

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Marble Variety

of César Valério (Fig. 8).



Geology and Stratigraphy

2 - Stratigraphy of the Ossa-Morena Zone and of the Estremoz Anticline (Adapted from Gonçalves, 1972 and Sánchez-García et al., 2010).

3-CL imaging of representative zircons with analytical sites and their resulting ages indicated, of samples: 3A - ETZ-32 (Greywacke of the Mares Formation- Serie Negra Succession; Late Neoproterozoic). 3B - ETZ-32 (Greywacke of the Mares Formation - Serie Negra Succession; Late Neoproterozoic). 3C - ETZ-1 (Rhyolite from the Volcano – Sedimentary Complex of Estremoz; Late Cambrian) and 3D - Outcrop of these rhyolithe. 4 - Detailed geology of the Estremoz Anticline. The Volcano-Sedimentary Complex is represented in blue. Dark blue represents the grey and dark blue marbles (commercially named

«Ruivina»), light blue represents all others varieties of «Estremoz Marbles».



Landscape in the southern terminus of the Estremoz anticline



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Built Stone Heritage

The marble has been primarily used as a are many examples of structural element utilisation. The examples showed Castle Tower (Fig.10) and the Church of Santa have marble walls (Fig. 12).



Concluding Remarks

In few words it is impossible to cover all the examples and applications where the marble has been used. Therefore must be noted that the intrinsic physical properties, versatility of colors and patterns and *know-how* of the companies, allow each end user to be held by a single piece of exceptional quality.



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