CHECKLIST FOR
“GLOBAL HERITAGE STONE RESOURCE” DESIGNATION
(Revised October 2014)

Formal Name for this proposed “Global Heritage Stone Resource”:
Mármores de Estremoz; Estremoz Marble;

Origin of Name (optional):
The name came from the nearest and bigger city of the quarries where, in the beginning of the XX Century, the modern age exploitation of marbles as dimension stone has acquired sufficient importance to constitute itself as a pole of local development and simultaneously begin to be exported (Figs. 1 and 2).

Fig. 1 – Marmoz’s Estremoz quarry in 1901. This quarry still exists and has about 100 m deep. Is located at the east entrance of the city and very close the graveyard. The photo was provided by Marmoz – Companhia Industrial de Mármores de Estremoz Lda.

Fig. 2 – This picture shows a very large block (3,41 m x 1,50 m x 1,32 m) ready to be loaded on the railroad from Vila Viçosa to Lisbon. This is for sure a quiet unusual size block in the twenties of the XX Century and was quarried in the Herdade da Vigária SOLUBEMA’s quarries (Sociedade Luso-Belga de Mármores S.A.; other of the oldest companies in the region). This photo was provided by the SOLUBEMA, S.A. company.
Nowadays the counties of Borba and Vila Viçosa, situated Southeast of Estremoz, have over 90% of marble production and the name Estremoz Marble (Mármores de Estremoz) is often change by Portuguese Marbles (Mármores de Portugal).

**Stratigraphic (or Geological) Name:**

Estremoz Volcano – Sedimentary – Carbonate Complex (Complexo Vulcano – Sedimentar – Carbonatado de Estremoz)

The Estremoz Anticline extends NW – SE from 42 kms since Sousel to Alandroal and is a major structure in the Ossa – Morena Zone (Iberian Variscan Belt, Portugal). An Upper Precambrian siliciclastic sequence is found in the core and, in discordance a Lower Cambrian to Ordovician (?)Volcano – Sedimentary – Carbonate sequence has formed (Pereira et al., 2012). In the bottom the carbonates are essentially dolomitic, without any interest as dimension stone, since they are intensely fractured. In the upper part of the sequence the calcitic marbles are interbedded with basic volcanic rocks. The thick marble beds occurs in the Southern part of the anticline in the “Marble Triangle” (Estremoz – Borba – Vila Viçosa) (Lopes, 2004).

**Commercial Designations:**

List of the principal commercial name and additional commercial names that are used to market the designated stone:

- Azul Lagoa (Lagoa Blue)
- Branco (White)
- Branco anilado (White Indigo)
- Branco com vergadas (White with streaks)
- Branco corrente (Regular White)
- Branco de Cabanas (Cabanasa’s White)
- Branco do Olival Grande (Olival Grande’s White)
- Branco estatuária (Statuary White)
- Branco levemente venado (White slightly veined)
- Branco rosado (Pink White)
- Branco venado da Cruz dos Meninos (Cruz dos Meninos’s white veined)
- Branco venado da Fonte da Moura (Fonte da Moura’s white Veined)
- Branco venado da Lagoa (Lagoa’s white veined)
- Branco venado do Poço Bravo (Poço Bravo’s white veined)
- Branco cinzento claro com bandas (Light gray with streaks)
- Creme (Cream)
- Creme do Mouro (Mouro’s Cream)
- Creme rosado (Pink Cream)
- Creme rosado da Fonte da Moura (Fonte da Moura’s Pink Cream)
- Creme venado (Cream veiny)
- Creme venado da Lagoa (Lagoa Cream Veined)
- Marinela (Marinela)
- Pele de Tigre (Tiger Skin)
- Rosa (Pink)
- Rosa aurora (Aurora pink)
- Rosa claro (Light pink)
- Rosa com venado esverdeado (Pink with greenish veins)
- Rosa de Rosal (Rosal Pink)
- Rosa Portugal (Portugal Pink)
- Rosal rosa puro (Rosal Pure Pink)
- Rosa venado da Lagoa (Lagoa’s Pink Veined)
- Rosa venado da Maroteira (Maroteira’s Pink Veined)
Rosa venado de cinzento (Pink with grey veins)
Rosa venado de cinzento e acastanhado (Pink with grey and brown veins)
Rosa venado de São Marcos (São Marcos Pink Veined)

Rosa venado do Olival da Encostinha
( Olival da Encostinha’s Pink Veined)
Rosa venado do Poço Bravo (Poço Bravo Pink Veined)
Ruivina de Fonte da Moura (Fonte da Moura Ruivina’s – dark blue)
Ruivina escuro (Dark Ruivina’s)

Other Names:
For any variety is frequent the use of the term “pedra mármore” (marble stone).

Inappropriate Use of Names
Sometimes, and not always innocently and for commercial purposes, some varieties are called “Carrara Marble”. The same happens with limestones many times confused with marbles (it must be remember that “marble” is the usual name for any kind of dimension stone that shine after polishing).

Area of Occurrence:
As pointed before, all the active quarries are in the Southern part of the Estremoz anticline (Fig. 3). In the past other some small quarries occurs near Sousel (White and Cream varieties), NW of Estremoz (mainly white with veins) and NW of Alandroal (Ruivina Dark variety).

Fig. 3 – Google Earth map with Estremoz Anticline structure from Sousel to Alandroal. The active quarries corresponds to the white dots near Estremoz, Borba, Bencatel and Vila Viçosa.
Principal Location of Extraction Sites:

The principal extraction sites are located in the counties of Estremoz, Borba and Vila Viçosa, as follows:

**Estremoz:**
- Cerca de Santo António,
- Santa Maria and
- Cruz dos Meninos;

**Borba:**
- São Tiago Rio de Moinhos,
- Salgadas,
- Ruivina,
- Poço Bravo,
- Mouro,
- Encostinha and
- Carrascal;

**Vila Viçosa:**
- Herdade da Vigária,
- Monte d’El Rei,
- Cabanas,
- Lagoa,
- Texugo,
- Maroteira,
- Olival Grande,
- Monte da Lagoa,
- São Marcos and
- Fonte da Moura.

Production Details:

The mean rate of recovery in the quarries is about 10 – 12%. In some cases could be low as 3,5% or exceptionally high as 35 – 40%. This range highly depends on the geotechnical behaviour of the masses and the geology that controls the complex structures originated in two ductile and three fragile deformation phases. Despite that the regional deformation behaviour of the rocks is well known, the production is highly controlled by local geological conditions, hence detailed geological mapping and fracturing study is always mandatory to increase the rate recovery. Sometimes this marks the difference to keep the production enough to sustain the quarry open.

The statistics marble data are often together with other stones (several kinds of limestones, travertine and gypsum) so, a detailed analysis of the National Institute of Statistics (INE) data available online has been done to separate the marble values. The results are express on table 1 and Figs. 4 and 5.
Table 1 – Marble Production Details (2000 – 2016). Particularly interesting is the value per ton of exported raw material that more than duplicate its value in this period. Final data from 2000 to 2014, provisional 2015 and preliminary 2016. Last update of this data: February 09, 2017; Table drawn on February 25, 2017; http://www.ine.pt.

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<th>Exports (kg) of marbles (Combined Nomenclature - NC8)</th>
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Fig. 4 – Portuguese marble exportation in quantity and value from 2000 to 2016. Final data from 2000 to 2014, provisional 2015 and preliminary 2016. Last update of this data: February 09, 2017; Table drawn on February 25, 2017.

Manufacturing information:

Primary stone processing is done in, or nearby, the 67 active quarries (block dimensioning). In the “Marble Triangle” there are about thirty medium – big processing plants that transform the blocks into slabs and tiles. Small and micro factories are 174 in Alentejo’s, half of them in the Estremoz region (Fig. 6). Other processing centres are located in Pêro
Pinheiro (150 km away; northwest of Lisbon) and in the Maciço Calcário Estremenho (200 km away, in Leira and Santaréém districts, about 150 km North of Lisbon).

Fig. 5 – Portuguese marble exportation in value per ton from 2000 to 2016. Final data from 2000 to 2014, provisional 2015 and preliminary 2016. Last update of this data: February 09, 2017; Table drawn on February 25, 2017; http://www.ine.pt

Fig. 6 – On the left, location of the Estremoz Anticline in Portugal; in the middle, coats of arms of the counties (from North to South: Sousel, Estremoz, Borba, Vila Viçosa and Alandroal) and relative percentage of dimension stones companies in the Estremoz anticline per county.

Geological Age and Geological Setting:
Recent studies based on U–Pb geochronology of detrital/inherited and igneous zircons from sedimentary and igneous rocks of the Ossa-Morena Zone have reinforced that SW Iberia reflects the geodynamic evolution of the North-Gondwana margin during the late Ediacaran to early Cambrian times (Chichorro et al., 2008; Linnemann et al., 2008; Pereira et al., 2008, 2011, 2012; Sánchez-García et al., 2008; Solá et al., 2008).
Fig. 7 – Estremoz anticline geological map over Google Earth image. This detailed geology of the Estremoz Anticline shows the Volcano-Sedimentary Complex represented in blue. The dark blue colour represents the grey and dark blue marbles (commercially named «Ruivina»), light blue represents all others varieties of «Estremoz Marbles». Geology adapted from Vintém et al. (1997).

The following data presents U–Pb dating of zircons of the stratigraphic sequences of the Estremoz Anticline, itself a major Variscan structure of the Ossa-Morena Zone (Portugal).

Fig. 8 – Map of Iberia with major tectonostratigraphic zones (adapted from Julivert, 1987); Map showing the localities where the Neoproterozoic and Cambrian rocks are preserved in the 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 used for U–Pb analyses). Adapted from Pereira et al., 2012.
Fig. 9 – Stratigraphy of the Ossa-Morena Zone and of the Estremoz Anticline (Adapted from Gonçalves, 1972 and Sánchez-García et al., 2010) with location of samples dated in the work of Pereira et al., (2012): ETZ-32 Greywacke of the Mares Formation - Serie Negra Succession; Late Neoproterozoic); ETZ-30 Arkosic sandstone at the bottom of the Lower Cambrian Dolomitic Formation and ETZ-1 Rhyolite from the Late Cambrian Volcano – Sedimentary Complex of Estremoz. After Pereira et al., (2012).

Fig. 10 – Upper left, outcrop of Lower Cambrian arkosic sandstone (detail in bottom right). On the left, cathode luminescence images of representative zircons with analytical sites and their resulting ages indicated, of samples ETZ-32 Greywacke of the Mares Formation – Serie Negra Succession, Late Neoproterozoic and ETZ-30 arkosic sandstone at the bottom of the Lower Cambrian Dolomitic Formation (Adapted from Pereira et al., 2012.).
Fig. 11 – Outcrop and some details of the ETZ-1 – Rhyolite from the Volcano – Sedimentary Complex of Estremoz; Late Cambrian. Notice that in this case the ages determined in the Zircons all fit in the same range, they are new crystallized and not inherited from previous rocks, which makes this dating very precise and crucial importance for consolidation of the regional stratigraphy. Cathode luminescence image adapted from Pereira et al. (2012).

The study from Devi et al. (2013) analysing the Sr isotope ratio also points to the Cambrian age of the Estremoz Marbles. More important than the age is that this ratio is so constant that can be used to distinguishing between marbles from other provenance (Fig. 12).

Fig. 12 – Box-and-Whiskers plots of the 87Sr/86Sr isotope ratios of the Estremoz marbles compared with the main classical marbles and the main Hispanic marbles. Sample size for each area is indicated in brackets. As seen in this study, even when applied to works of art or masonry, the Portuguese marbles can be easily distinguished from others with similar colours and patterns. After Taelman, D. et al. (2013) (Estremoz); Brilha, et al. (2005), Gärtner, et al. (2011), Pentia, et al. (2002) (Mediterranean marbles); and Morbidelli, et al. (2007) (other Hispanic marbles).
Petrographic Name and Characteristics:
The Estremoz Marbles corresponds to a medium to fine, rarely coarse grain, calcitic marble with granoblastic texture (despite that crystal preferred orientation is almost always present, Fig. 13). A milonitic texture is often present and occasionally nematoblastic texture can be found in more heterogeneous (noncommercial) varieties.

Mineralogical composition: Calcite (98 – 100%), others: quartz, dolomite, sericite, muscovite, fuchsite, biotite, chlorite, amphibole, k-feldspar, plagioclase, sphene, zircon, apatite, pyrite, magnetite, ilmenite, graphite.

There’s a close relationship between the occurrence of mafic volcanic green layers and the pink colour in the marble. This is due to the enclosure of Mn in the calcite crystal lattice, in very small amounts (ppm) which confers the pink colour without forming another mineral (rhodocrosite) (Fig. 14).

Always on the top of the stratigraphic sequence a dark blue carbon carrying marble is found. This is a variety knowing as “Ruivina” (which is the name of the place South of Borba where first was quarried). Sometimes thick layers of carbon are found and there a notice that many years ago one of them was exploited as coal mine.

A particular breccia texture, caused by hydraulic fracturing, only occurs in a quarry near Estremoz. The veins are filled with brown calcite (Fe bearing calcite, not siderite!) and the rock matrix is blue; when polished gives the enjoyable sense of “gold over blue” (Fig. 15).

In the forties of the XX Century, this stone was used in the Maputo’s Cathedral inner coating (Fig. 16).

Fig. 13 – Two caption of Estremoz marble thin sections obtained along stretching lineation and perpendicular to the macroscopic preferred crystal orientation (foliation). The subedric quartz crystals between calcite have two and sometimes three phase inclusions which enable the metamorphic deformation temperature. As a particular note, the quarrymen knows this orientation as “currume” and they take this in attention while cutting the stone.
Fig. 14 – Office building in the Infante Santo Avenue, Lisbon, coated with Estremoz pink with green stripe marble, showing the close relationship between the basic volcanic layers (quartz, chlorite and amphibole with calcite layers) and the pink color of the marble. Notice also the cut in “open book” to generate attractive geometric patterns.

Fig. 15 – Marble block in Marinela’s quarry (Estremoz) and Maputo Cathedral coated with Marinela Estremoz marble variety. The Cathedral designed by the Architect Marcial Freitas e Costa in 1936 and built in 1944.
Primary Colour(s) and Aesthetics of Stone

White, pink, cream, light green, light and dark blue, or grey are the main colours of the Estremoz Marble (Fig. 16). All these colours, in several intensities, may be present with or without streaks, stains or veins.

Fig. 16 – Tiles representing some of the color natural diversity of the most important Estremoz Marble varieties. From left to right: Ruivina, Tiger Skin, Pink with streaks, Portugal Pink, Cream, Light Cream and White. Notice the transparency of the White tile.

Natural Variability:

The great number of commercial names reflects the possible variety that naturally occurs. In fact, Pereira (1987) define seventeen extraction localities where at the surface marble is distinguish from each other. At the time he didn´t pointed any particular reason for that but now we can discuss a structural model that fully explain these differences (see Lopes, 2004 for more details). In a few words… at the beginning it must be considered two ductile non coeval deformation phases, these originated deformation patterns that often can be observed in the quarries (Fig. 17). Then, at the end of the second phase, a NNW-SSE sub vertical transpression system occurs and disrupt the vertical limbs of the second phase folds. Much later, in Jurassic times, an ENE-WSE vertical fracturing system, perpendicular to the second phase axial planes, reacts as a dip slip system faults and, related with North Atlantic opening, also open spaces where basaltic magma erupts and divide once more the regional structure. The dykes are locally known as “Cabo Real” and every quarrymen knows that “after each dyke the marble always changes!”
Fig. 17 – Two meters width pink with streaks slab marble showing interference patterns.

**Technical Properties:**

The Estremoz Marbles Technical Properties were summarized after several catalogues and Manuals referred in the bibliography; the numbers after each property refers to maximum and minimum obtained values.

- **Abrasion Resistance (mm):** 2.0 – 3.7
- **Bending Strength (kg/cm²):** 179 – 270
- **Compression Breaking Load (kg/cm²):** 788 – 990
- **Compression Breaking Load after Freezing Test (kg/cm²):** 863 – 977
- **Compressive Strength – Dry (MPa):** 788 – 1150 kg/cm²
- **Density (kg/m³) (real and apparent):** 2703 – 2718
- **Flexural Strength – Dry (MPa):** 179 – 270 kg/cm²
- **Impact test: minimum fall height (cm):** 45 – 70
- **Open Porosity (%):** 0.14 – 0.28
- **Slip Resistance in Dry Conditions, Polish Material (SRV):** 34
- **Slip Resistance in Dry Conditions, Sawn Material (SRV):** 78
- **Slip Resistance in Wet Conditions, Polish Material (SRV):** 4
- **Slip Resistance in Wet Conditions, Sawn Material (SRV):** 55
- **Thermal Expansion Coefficient (10⁻⁶ per °C):** 5.4 – 14.8
- **Thermal Shock Resistance, mass variation (%):** 0.01
- **Thermal Shock Resistance, modulo variation (%):** 35.4
- **Water Absorption at N.P. Conditions (%):** 0.05 – 0.1

**Suitability:**

The Estremoz Marble are suitable for any utilisation, interior and exterior, for example: cut building blocks, sculpting stone, monuments, polished decorative use, fine art design objects, technological objects, stairs and wall coating, etc.

Particularly in the Herdade da Vigária, statuary quality big size blocks are occasionally extracted. By request, special blocks can be supplied for high quality sculpting stone. Anyway, since the Roman Period these marbles are used in sculpture; all around the World, especially in the Portuguese spoken countries, is frequent to find sculptures made of this stone.
**Vulnerability and Maintenance of Supply:**
The estimated reserves are sufficient for long term exploitation.

Records of trial drilling during the last three decades confirm the existence of marble dimension stone quality to at least 400 meters depth. Although some quarries reach more than 100 in depth, these are exceptions, the maximum deep reached was 150 meters but the normal deep extraction must be 50 meters.

Considering that only 30% of the 27 km² that the marbles occupy are explored, that the yields rate is around 10% that any quarry goes to 100 m depth and an average 400,000 tons / year production we can find that there is marble for more 550 Years of continuous exploitation. Of course that would be more expensive and dangerous each day...

Some varieties, like Marinela or some light green marbles not mentioned, are rare and exist only in very limited areas. Since these were used in historic buildings, should be preserved. Anyway there’s no organized policy to preserve any variety of marble but, some companies are doing it for itself and consumer protection. It must be noted that these stone doesn’t weathering easily, for instance, blocks quarried more than one century ago and parked in Nature only exhibit a submillimetre thick patina, easily removed so the marble can be used anytime.

**Historic Use, Geographic Area of Utilisation, Commercial Diffusion:**
The oldest evidence of use of these marbles dates to the year of 370 BC. The archaeological find of a tombstone, ordered by the Carthaginian captain Maarbal during a trip from Faro to Elvas, was discovered by Father Espanca in Terena (Alandroal).

In the 1st century AD, during the Roman Period, systematic quarrying in the Estremoz anticline began. The marbles were widely used as structural and decorative features of buildings that today are important architectural monuments, e.g. the Roman Temple in Évora, the Roman Theatre in Mérida (Spain), etc. In the Middle Ages, marbles were used for the construction of palaces, castles and other buildings. From the 15th Century the marbles began to have a more prominent use, both nationally and internationally, having been transported by Portuguese explorers to Africa, India, Macau and Brazil. During the next few centuries, the marbles were used for ornamental purposes and they appear inlaid with various polychromatic materials in several national and international monuments such as the Jerónimos Monastery (Portugal); Escorial Monastery (Spain); several monuments in Rome (Italy); Louvre, Notre Dame and Versailles (France). In the 20th century, with the introduction of new exploitation and manufacturing technologies and especially in the 70’s with the opening up of the Portuguese economy, the marble industry took a step forward and, since then, marble has been exported worldwide. But only in the late decades of the 20th century did the marble dimension stone industry of Portugal achieve international importance such that Portuguese marbles are now used worldwide.

Globally, more than 90% of the production is to exportation. Reporting to the year 2015, the National Institute of Statistics refers that 30% of the production is still exported in blocks, 20% in slabs and 50% as final products. The 119 M€ marble were exported to 102
countries. According to ASSIMAGRA, Marble Barometer Project consulted online August 22, 2017 (http://www.assimagra.pt/barometro/), and Newsletter distributed August 16, 2017, the accumulated Dimension Stone Portuguese Exports increases from 172 723 221 € in June 2016 to 179 812 539 € in 2017 (4%), being that the Marble Estremoz corresponds to more or less to the half of this value and accompanied the general trend. So, owing to the global commercial trade, Estremoz Marble can be found all over the World and increases his importance each day.

**Buildings etc:**

The capitels and base of the columns of the Roman Temple in Évora, the columns of the Roman Theatre in Mérida (Spain), the Altar-Mor of the Jerónimos Monastery (Lisbon, Portugal), some applications in the Escorial Monastery (Spain), Louvre, Notre Dame and Versailles (France), are some of iconic uses of the Estremoz Marbles. Nevertheless, the list of the significant buildings, monuments, sculptures is so extensive that, simply cannot be possible to right in this proposal.

When you want to make tribute to important people, remembering a historical event, etc., often these special words are written in marble tiles. Also the extensive use as a tombstone is a way to pay homage to missing loved ones through a noble stone.

“Constituting a symbol of economic strength, good taste and distinction, it can be say that there will be no virtually place in Portugal where marble Estremoz has not, somehow, been used in both small works of art or utilitarian objects as public monuments and private homes. Surely, there will be hundreds of thousands of buildings with Estremoz marbles on it. Historically documented this usage dates back to the IV century BC (Alarcão & Tavares, 1989, Justino & Coutinho, 1990; Cabral et al., 1992) and extends to our days where, due to the global commercial trade, can be found all over the World.

On the "SIPA" webpage (Information System for Architectural Heritage which is a system of information and documentation of Portuguese architectural, urban and landscape heritage of Portuguese origin managed by the Institute for Housing and Urban Renewal, IP – IHRU, http://www.monumentos.pt), 179 national monuments are referenced where Estremoz marble was been used. By itself, this fact constitutes an indicator of the marble importance in the History of Portugal and certifies its value as Global Heritage Stone Resource to be preserved. This long term intense use must be necessarily associated to quality standards, the only way to justify the demand that has been targeted for more than 25 centuries, otherwise would have been deprecated.

In fact, the research made on August 22, 2017 return 200 references that could be find here: http://www.monumentos.gov.pt/Site/APP_PagesUser/SIPASearch.aspx?id=0c69a68e-2a18-4788-9300-11ff2619a4d2 (just right “mármore” on the search box). Of these we highlight some iconic monuments where the Estremoz Marble were used, not only but mainly, as ornamental function: Church of Santa Engrácia / National Pantheon (Lisbon); D. Manuel Palace (Évora); National Palace of Queluz (Lisboa); Steps of the Via Sacra (Évora, Vila Viçosa and Borba); Cristo-Rei Sanctuary (Almada); Évora, Vila Viçosa, Estremoz, Alandroal, etc. Town Hall; Vila Viçosa Paço Ducal and Castle; Cathedral of Évora; Cathedral of Estremoz; Several fountains in Vila Viçosa, Estremoz, Évora and Borba; University of Évora (Colégio do Espírito Santo), etc.
Related Heritage Issues

There’s a Marble Museum at Vila Viçosa where all issues related to marble, from the geology to modern techniques of processing and application, are comprehensively explain. Including a fully operational 1:50 quarry model, where main operations of marble extraction are explain in short movies. In Estremoz the “Centro de Ciência Viva” develops leisure and teaching activities around the marble subject. Is the only Centre of Science in Iberian Peninsula fully dedicated to Geology and guided visits to quarries and dimension stones plant processing are one of the most required activities for the schools.

For whom interested is also possible to book field trips during from half a day to three days in: http://www.spira.pt/en/cultural-and-nature-touring/tones-of-marble-route/40.

Some companies found in his quarries testimonies of roman exploration, part of it can be visited inside the Vila Viçosa Castle where is also the Archaeology Museum that houses a rich number of pieces from different times. Among these, a valuable spoil of roman pieces found in the region stand out, together with archaeological artefacts belonging to the personal collection of King Luis I.

The A. Mocho Lda quarry (Monte da Lagoa, Vila Viçosa) is referred in page 84 of the book “Geological Heritage, geosites to visit in Portugal” (Brilha and Pereira, 2012) since is one of the better and biggest two phase interference folding pattern in the Variscan fold-belt in Portugal (Fig. 18)

Fig. 18 – Refolded layers of the Estremoz Volcano – Sedimentary Complex that. As long as can be seeing, multiply by six the original stratigraphic sequence thick. A. Mocho Lda quarry, Monte da Lagoa, Vila Viçosa.
Other Designations

There’s no need any other designation for the Estremoz Marble, maybe: Global Ornamental Estremoz Marble from Portugal.

Related Dimension Stones

In Alentejo’s region, the Cambrian Volcano Sedimentary Complex (CVSC) can be found from Campo Maior (in the North) to Vila Verde de Ficalho (in the South). The straight distance between these points is 130 km, corresponding the width of Ossa-Morena Zone. This CVSC was formed while Rheic Ocean was open in Lower Palaeozoic, at maximum open of this ocean, the two mentioned points could be as far as 2000 km. In Late Devonian, the closure of the Rheic Ocean gave origin of the Variscan Orogeny and different sections of the CVSC where sink to different deeps and distinguishing metamorphic conditions. So, similar carbonate rocks gave origin to marbles with texture, mineralogy a chemical composition so different. All of them were exploited in the past, also from the Roman Period, until the end of the XX Century. Nowadays, there’s only one active quarry in Vila Verde de Ficalho; the other localities whose inactive quarries are still found are: Escoural, Viana do Alentejo, Serpa, Trigaches (Figs. 19 and 20).

Fig. 19 – Representation of other Ossa-Morena Zone Portuguese marbles. Clockwise from upper left: Escoural, Viana do Alentejo (Sampaio), Viana do Alentejo (Herdade das Perdizes), Vila Verde de Ficalho, Trigaches and Serpa. The images were obtained online in: http://rop.lneg.pt/rop/ August 22, 2017.
Fig. 20 – Thin sections of Ossa-Morena Zone Portuguese Marbles. Notice that all the pictures are at the same scale. In the samples from Estremoz there’s a size homogeneity that isn’t true when considering the other locations.

Each one of this stone as distinguishing features that allows to the expert to easily recognize is provenance. Since that are geologically related and, in several aspects, the same history regarding the human use, in the future, when defined the rules, all the Alentejo’s and Spanish Extremadura’s Marbles can be propose as a “Global Heritage Stone Province”.

**Principal Literature related to the Designated Stone:**


Henriques, Paulo; Carvalho, Jorge M. F.; Falé, Patrícia; Luís, Gabriel - Estudos geológicos aplicados à indústria extractiva de mármores no Anticlinal de Estremoz: o caso do Núcleo de Pardais. In: Comunicações Geológicas, Tomo 93 (2006), p. 159-184


Images:

[Image of Roman Temple, Évora]
Roman Theatre, Merida (Spain)

Jeronimos Monastery, Lisbon
Versailles, France. Some white and pink marbles are suspected to come from Estremoz.
In situ testimonies of Roman quarrying activity, Marmoz Lda quarry, Lagoa – Vila Viçosa.

Mediatéque, Paris – France
Underground station, Moscow – Russia.

Private house, USA.
Private house, Borba – Portugal.

“Son of the Sun”, sculpture in Rosa Portugal by César Valério (finishing the piece).
“Bonsai”, Sculpture by César Valério, Vila Viçosa, Portugal

The same pink marble tile observed in direct light and backlit.

Vila Viçosa Ducal Palace
Park of blocks, Vigária – Vila Viçosa.

Inactive quarry, Pardais – Vila Viçosa

Sports activities in inactive quarry, Olival Grande – Vila Viçosa.
120 meters deep quarry, Fonte da Moura – Vila Viçosa.

Eziquiel Francisco Alves Lda quarry, Bencatel – Vila Viçosa
Tower of the Estremoz Castle and interior of Santa Maria Church, also inside the Castle. In both cases the marble was used as a structural element supporting the buildings.

Calcite crystals, Encostinha – Borba. The major crystal in the center has 5 cm width.
Roman Temple, Évora.

Detail of the marble in the column of the Roman Temple, Évora.
Rear of the altar-mor, Sé Cathedral of Évora
Magratex Lda quarry, Cruz dos Meninos, Estremoz.
Masters students in architecture visiting the quarries of Fonte de Moura - Vila Viçosa.

Any other items:
Activities regarding Geoheritage; Geotourism; Leisure; Archaeology; Music; Theater; Sports; Exhibitions; Wildlife Protection, Thematic Field Trips; Geocaching; etc. All of them already performed in the quarries or nearby!

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