

Creme de Fátima

Creme Casal, Faticreme



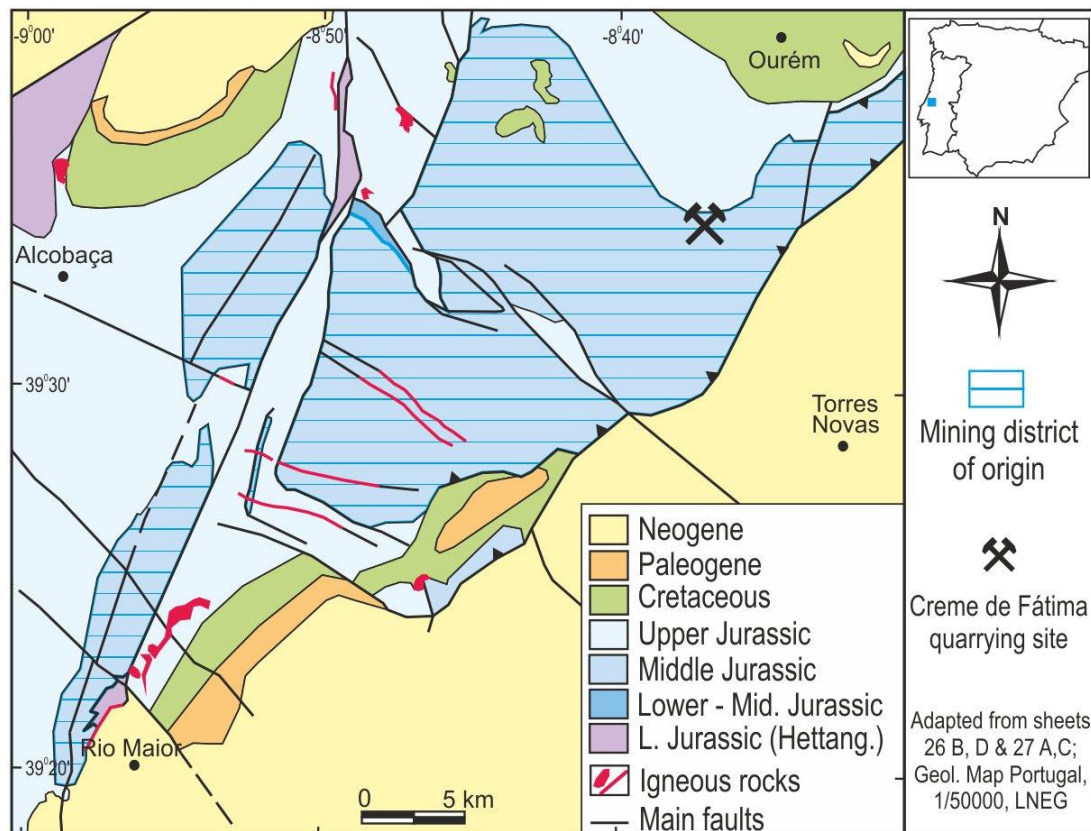
Short description:

Beige coloured limestone, clastic, fine to coarse grain.

Commodity	Lithology	Typical colour	Place of origin			
			Country	District	Municipality	Place
Commercial Limestone	Limestone	Beige	Portugal	Santarém	Ourém	Casal Farto and Boleiros



Geological setting



Geology:

The Maciço Calcário Estremenho (MCE) is a morphostructural unit of the Lusitanian Basin in Portugal, which has been uplifted during the alpine orogeny. Jurassic limestones partially covered by Cretaceous sandstones and Pliocene sand patches are the main rocks of the MCE.

MCE is a mining district of several ornamental limestone varieties, in which the Santo António - Candeeiros Formation of Bathonian - Callovian age stands out.

The Pé da Pedreira Member (upper Bathonian age) is part of this formation and consists of massive beds of limestones, which are characterized by meter-scale cross-stratification sets. Ornamental varieties extracted from this unit have a direct correspondence to these cross-stratification sets, or even to individual beds with uniform sedimentary lamination.

Creme de Fátima is a medium to coarse-grained clastic limestone facies of the Pé da Pedreira Member. During the processing stage, the final cut of the blocks is made parallel to the sedimentary lamination.

Production:

The production of ornamental stones in MCE started in the 1970s. The introduction of advanced technologies and machineries in the late-1980s led to a strong development of the exploitations, which continues today in large contiguous quarries. This was favoured by the fact that the productive unit corresponds to a massive subhorizontal limestone body, which in the Fátima region is about 100 m thick, and not intensely affected by fractures, allowing to obtain very large commercial blocks.

Geological age: Middle Jurassic / upper Bathonian

Geological unit: Santo António - Candeeiros Formation / Pé da Pedreira Member

Application, use and heritage



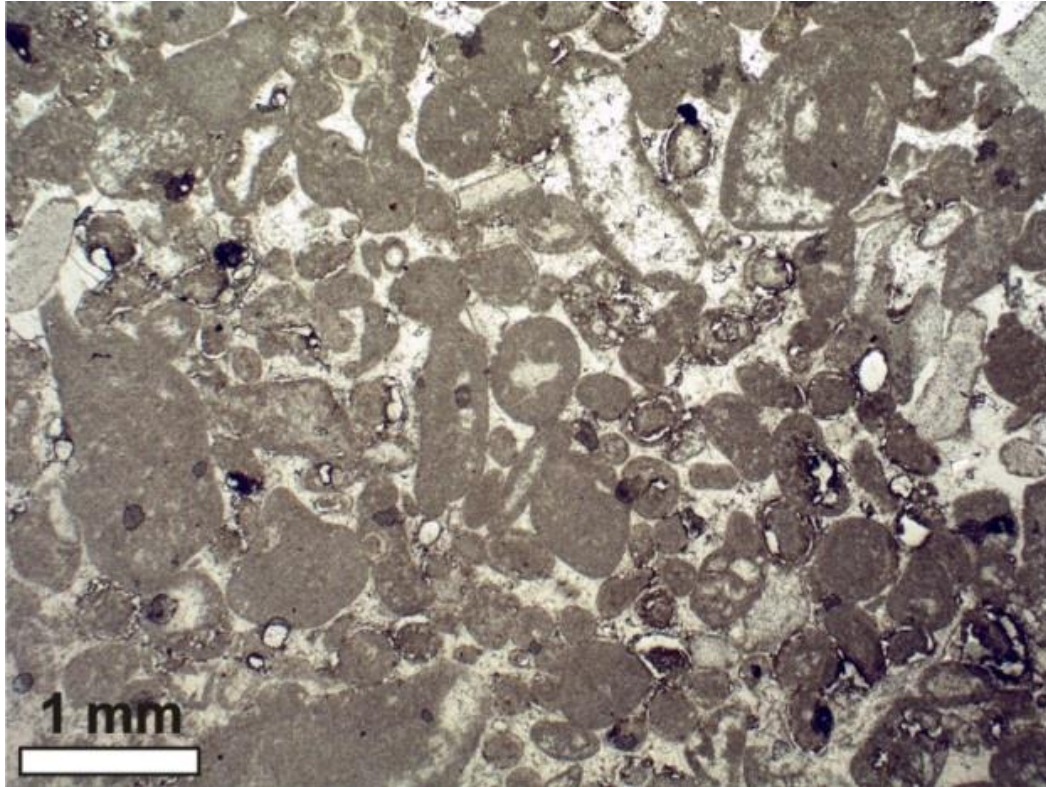
Timothy Rollins, CC BY-SA 3.0 <<http://creativecommons.org/licenses/by-sa/3.0/>>, via Wikimedia Commons

Description:

Oklahoma City Oklahoma Temple, USA



Petrography



Description:

Thin section microphotograph of Creme de Fátima obtained parallel to the sedimentary lamination. It corresponds to a pelbiointrasparite with a grainstone depositional texture.

Source of information:

Geological Survey of Portugal (LNEG - Laboratório Nacional de Energia e Geologia, IP).

Mineral composition

Calcite (%)	Opaque rusty spots (%)				
~100	vest.*				

* vestiges (traces)

Source of information:

Geological survey of Portugal (Laboratório Nacional de Energia e Geologia, IP)

Physical properties

Apparent density (EN 1936) kg/m ³	Open porosity (EN 1936) % vol	Water absorption at atmospheric pressure (EN 13755) % wt	Uniaxial Compressive strength (EN 1926) MPa	Flexural strength under concentrated load (EN 12372) MPa
2410	9.3	4.3	108	13.7

Real density (EN 1936) kg/m ³	Total porosity (EN 1936) % vol	Water absorption coefficient by capillary (EN 1925) (g/m ² x s ^{0,5})	Flexural strength under constant moment (EN 13161) MPa
—	—	31.2 (C ₁)	—

Frost resistance (EN 12371)				
Technological Test (Test A)				Identification Test (Test B): Number of cycles completed prior to stone failure
Flexural strength (EN 12372) after freeze-thaw cycling, MPa	Number of cycles	Uniaxial compressive strength (EN 1926) after freeze-thaw cycling, MPa	Number of cycles	
3.5	48	—	—	—

Resistance to ageing by thermal shock (EN 14066)			
Change in dynamic modulus of elasticity (increase: +; decrease: -) %	Change in open porosity (increase: +; decrease: -) %	Change in ultrasound pulse velocity (increase: +; decrease: -) %	Change in flexural strength under conc. load (increase: +; decrease: -) %
—	—	—	—

Abrasion resistance (EN 14157)			Resistance to salt crystallisation (EN 12370)	Breaking load at dowel hole (EN 13364)	
Method A - Wide Wheel Abrasion Test, mm	Method B - Böhme Abrasion Test, mm ³	Method C - Amsler Abrasion Test, mm	Change in mass (increase: +; decrease: -), %	Breaking load, N	Thickness of the test specimens, mm
21.5	—	—	—	2900	30.5

Slip resistance by means of the pendulum tester (EN 14231 / CEN/TS 16165)			Rupture energy (EN 14158), Joule	Thermal Conductivity (EN 1745), W/m·K
Tested surface finish	Slip Resistance Value — SRV			
	Dry test condition	Wet test condition		
honed	70	57	4	—

Source of information:

Geological survey of Portugal (Laboratório Nacional de Energia e Geologia, IP)

Chemical properties

Main elements (%)

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MnO	MgO	CaO	Na ₂ O	K ₂ O	P ₂ O ₅	TiO ₂	SO ₃	LOI
< 0.86	< 0.22	0.04	< 0.02	0.37	55.68	< 0.20	< 0.03	< 0.03	< 0.04	—	43.92

Trace elements (ppm)

V	Cr	Mn	Co	Ni	Cu	Zn	As
< 5	6	—	< 5	< 7	< 6	< 6	—
Sr	Cd	Ba	Pb	Be	Rb	Bi	U
304	—	8	< 6	—	< 3	—	< 6
Sc	Y	Th	Sb	Ta	Nb	Zr	Sn
< 7	7	< 5	—	< 6	< 3	< 3	< 6
Ag	B	Mo	W	Ga	Ge	Se	Cs
—	—	—	< 6	< 5	< 5	—	—
Tl	Hf						
—	< 7						

REE (ppm)

La	Ce	Pr	Nd	Sm	Eu	Gd	Tb
< 5	16	—	8	—	—	—	—
Dy	Ho	Er	Tm	Yb	Lu		
—	—	—	—	—	—		

Methods applied:

Determination of the main elements, trace elements and REE: X-Ray Fluorescence.

Source of information:

Geological survey of Portugal (Laboratório Nacional de Energia e Geologia, IP)

Sources of more information

Type of information	Name of provider	URL
This data sheet:	Geological survey of Portugal (Laboratório Nacional de Energia e Geologia, IP)	www.lneg.pt https://rop.lneg.pt/rop/index_en.php
Non-commercial directory:	Primeira Pedra	http://www.primeirapedra.com/en/stones/creme-de-fatima/
	Naturstein	https://www.naturalstone-online.com/index.php?id=360&user_dnsaeng_pi1%5BsteinID%5D=6093
Commercial directory:		
Scientific publication:	Environmental Earth Sciences	https://doi.org/10.1007/s12665-018-7382-x
Other publication:		

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