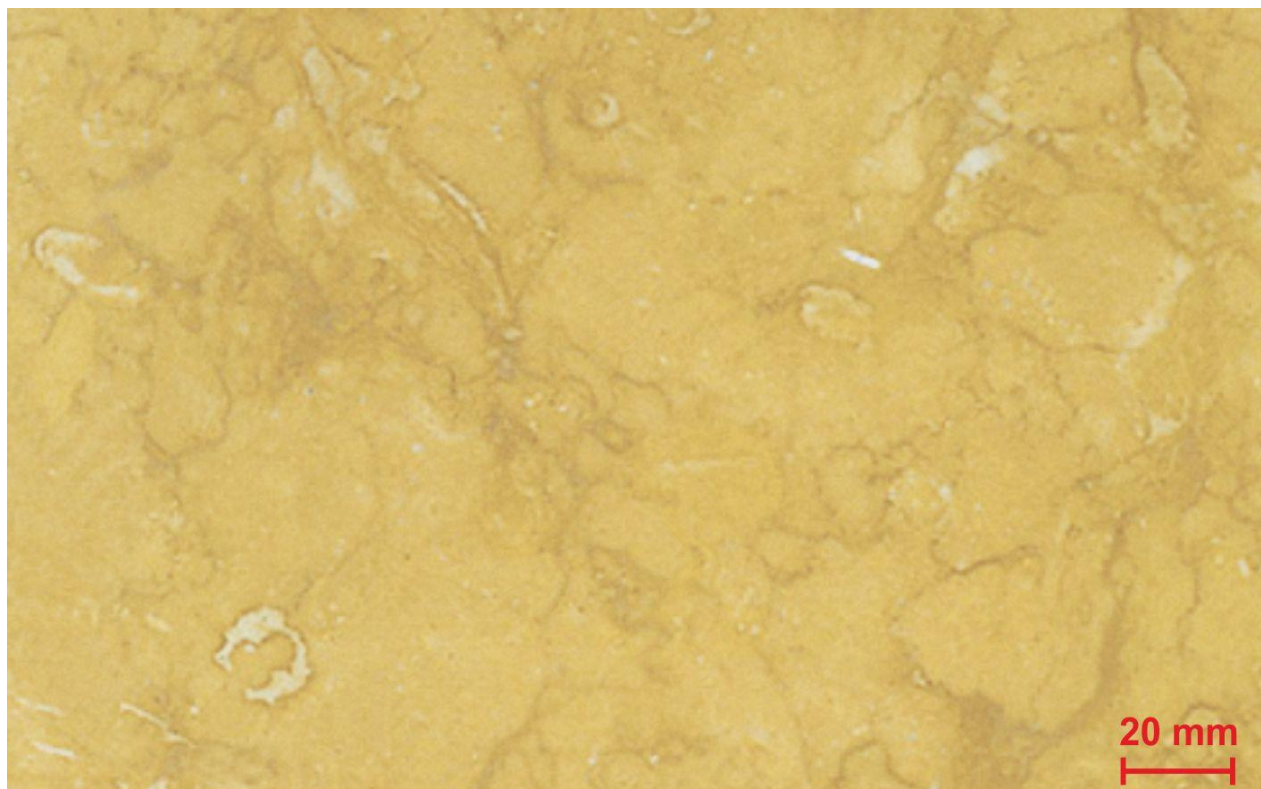


Amarelo de Negrais

Lioz Gold



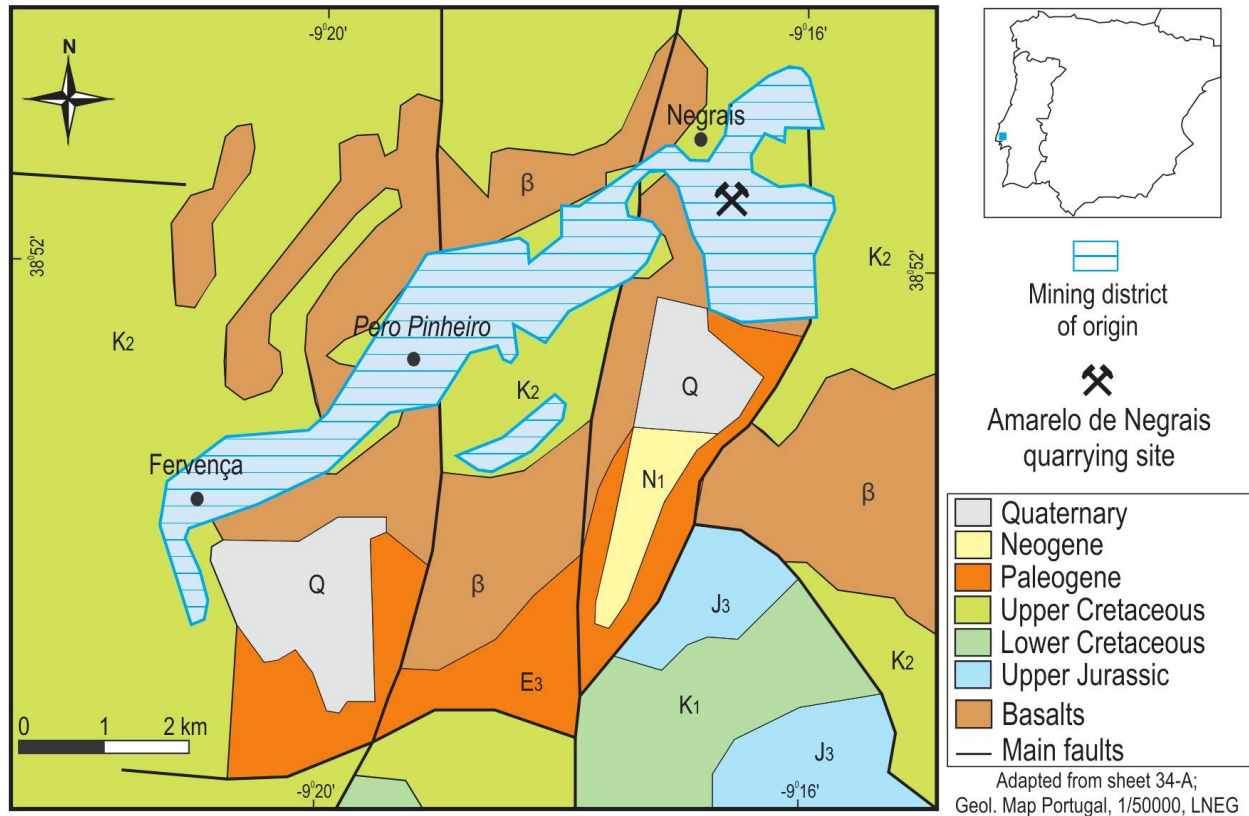
Short description:

Yellow fossiliferous limestone.

Commodity	Lithology	Typical colour	Place of origin			
			Country	District	Municipality	Place
Commercial Limestone	Limestone	Yellow	Portugal	Lisboa	Sintra	Negrais



Geological setting



Geology:

During the mid-Cretaceous (Albian - Turonian), a rim-shelf carbonate platform set up over larger areas of the in the Western Iberian margin. Reef and lagoonal limestones with coral and rudist units of middle Turonian age occur in the region of Lisbon and are overlain by basaltic rocks. The outcropping area of these reef units (Bica Formation), and part of the basaltic tuffs that overlap them, corresponds to a mining district of provenance for some ornamental stone varieties widely used in Portugal and, particularly, in the Lisbon region.

One of the best-known ornamental variety is called Amarelo de Negrais, which is a yellow coloured micritic fossiliferous limestone often rich in large rudist and bivalve fossils.

Production:

Amarelo de Negrais, like other varieties from this mining district, has been exploited in the Lisbon region since its occupation by the Romans and was intensively used in its reconstruction after the 1755 earthquake.

Modern exploitation reached its peak during the 60s and 70s of the last century in the Pero Pinheiro region, near Sintra. Currently only a few quarries near Negrais are operating, greatly constrained by urban expansion.

The sedimentary beds are not very thick and fracturing is relatively intense, so the extracted blocks are small and medium in size. The final cut is made parallel to the bedding plane.

Geological age: Cretaceous / Turonian

Geological unit: Bica Formation



Application, use and heritage

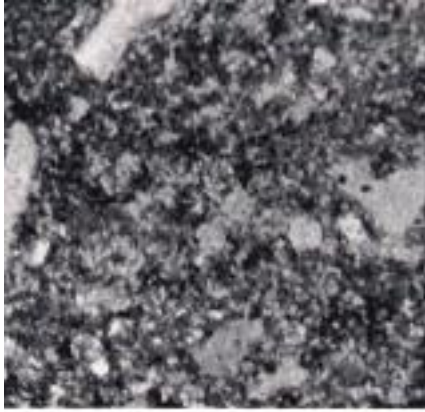
Amarelo de Negrais is very appreciated for its yellow color. It is widely used in countertops and decorative pieces, but also in coverings, as a contrasting element with other stone varieties. It was widely used for the construction of buildings and churches in the region of Lisbon, particularly for its reconstruction after the 1755 earthquake. Like other stones from the same region, it was used for the construction of several monuments in Brazil, as it was also used as ballast of freight boats during the seventeenth and eighteenth centuries.



Amarelo de Negrais combined with other stone varieties in the floor of the Basilica of the Mafra National Palace, Portugal.



Petrography



Thin section parallel to bedding.



Thin section perpendicular to bedding.

Description:

Sparitic biointraclastic limestone.

Obs.: not representative of the framestone texture as seen by the naked-eye.

Source of information:

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

Mineral composition

Calcite (%)	Dolomite (%)	Quartz and iron oxides (%)			
~94	~6	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
2670	1.2	0.4	141	13.9

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
—	—	—	—

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	
—	—	110	25	—

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
—	—	2.8	—	—	—

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		
—	—	—	5	—

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
1.59	0.25	0.37	vest.	1.29	53.02	0.07	0.02	—	0.00	—	43.22

Trace elements (ppm)

V	Cr	Mn	Co	Ni	Cu	Zn	As
Sr	Cd	Ba	Pb	Be	Rb	Bi	U
Sc	Y	Th	Sb	Ta	Nb	Zr	Sn
Ag	B	Mo	W	Ga	Ge	Se	Cs
Tl							

REE (ppm)

La	Ce	Pr	Nd	Sm	Eu	Gd	Tb
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/amarelo-de-negrais/
	Stone by Portugal	https://stonebyportugal.com/stone/amarelo-de-negrais/?lang=en
Commercial directory:		
Scientific publication:	Geoheritage	https://doi.org/10.1007/s12371-017-0267-7
Other publication:		

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Version / date:	V1 / 13/09/2021	