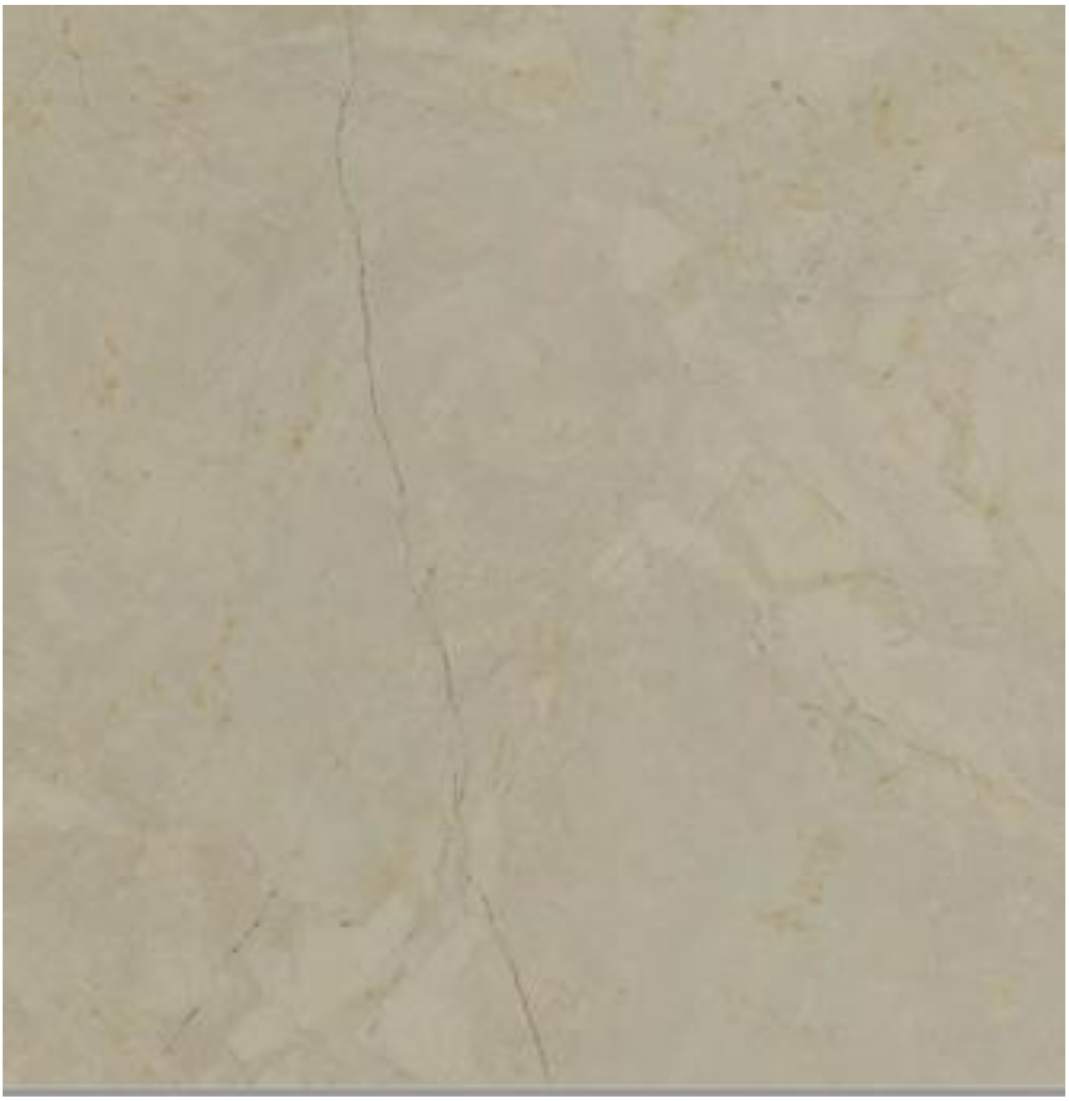
BRONZETTO DI TRANI

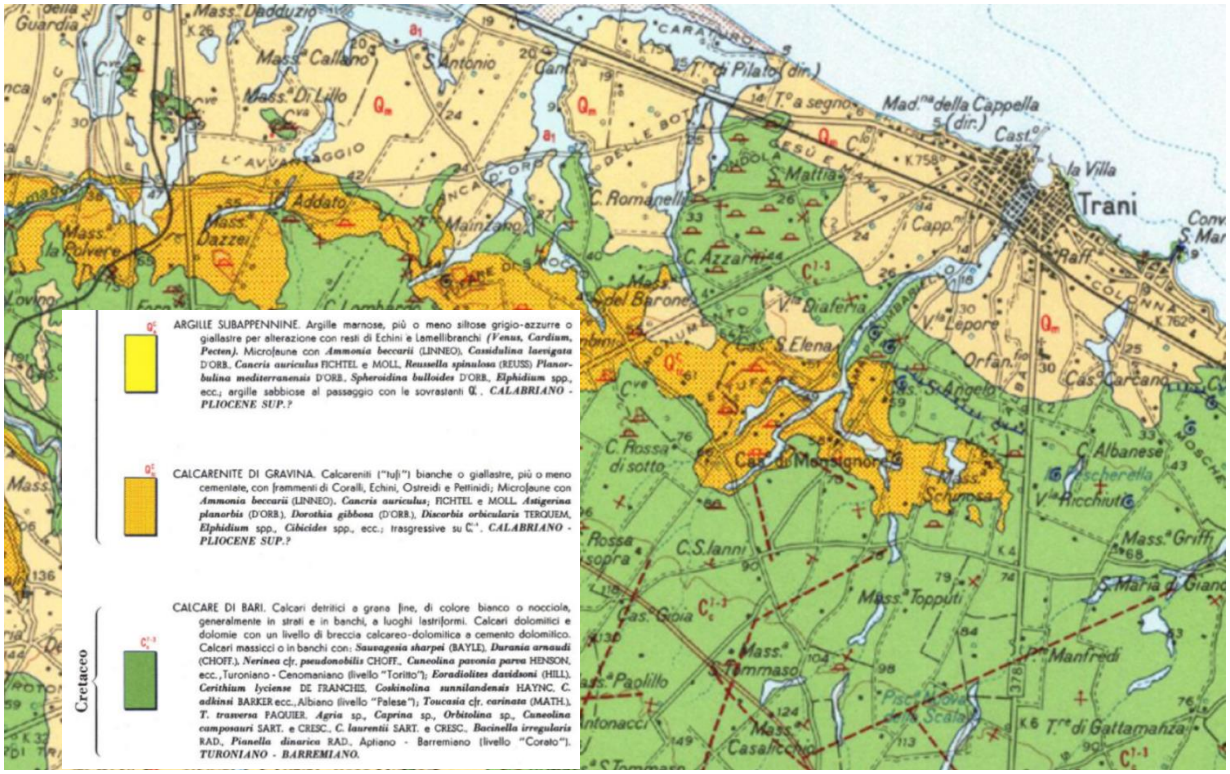
Pietra di Trani



Pelmicritic limestone with algal lamina and pellet lamina; drying cavities occluded by sparites; fine grain sparitic cement

Commodity (vocabulary)	Lithology (vocabulary)	Typical colour (code list)	Place of origin			
			Country	Province	Municipality	Village
Commercial limestone	Limestone	Beige	Italy	Trani (BAT)	Trani	Trani

Geological setting



Geology:

The area is mainly characterized by cretaceous limestone, mildly tectonized, belonging to the Apula platform (Mesozoic carbonate platform). This constitutes the substrate of the entire Murgian region, on which Pleistocene foredeep units (Gravina calcarenite and sub-Apennine clays) lies in stratigraphic unconformity, representing the transgressive portion of the cycle of the Bradanica Fossa on the margins of the Apulian Foreland. The Bronzetto di Trani represents a variety of the Trani Stone belonging to the formation of the Bari Limestone, consisting of white and light gray microfossils in layers of decimeter and metric thickness of lithofacies with a predominantly sustained mud texture (mudstone / wackestone) and subordinately sustained grain (packstone / grainstone) occasionally affected by meteoric diagenesis and / or pedogenesis with frequent intercalation of dolomitic limestone and gray dolomite. The general attitude of the layers of the Bari Limestone is that of a monocline, complicated by faults and folds, which plunges towards the southern quadrants; the overall thickness, in the mapped area, is 470 m.

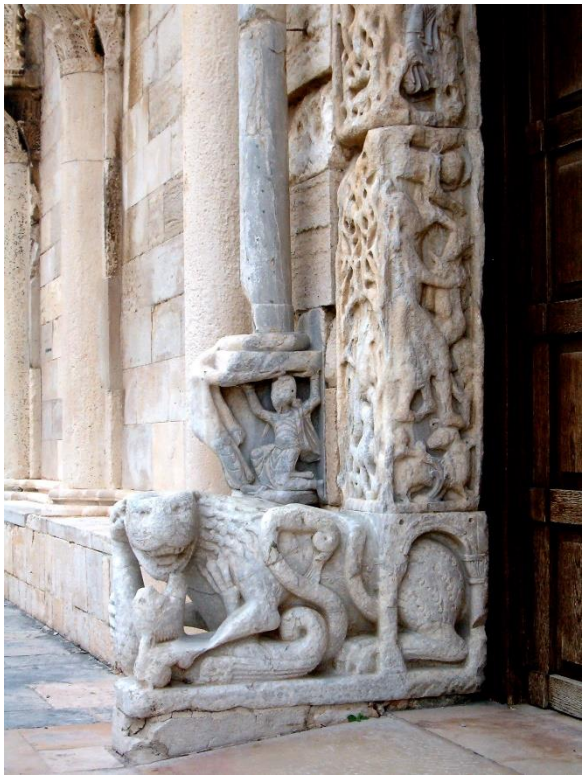
Production:

The Trani Stone Basin extends across the municipalities of Trani, Andria, Bisceglie, Corato, Ruvo, Minervino Murge and Canosa (historically the largest deposit of Apulian limestone, at least up until the end of 1980s). This stone is found everywhere in the historic centers of the central Apulia, from the high plateau of the Murges right up to the initial slopes of the Valle d'Itria. The entire quarrying basin has gone through periods of extraordinary growth, creating craftsmen, specialized stonemasons and entrepreneurs who have become an asset to entire Region. Many of today's interests go beyond quarrying to concentrate on processing are on processing these materials and marketing finished products for public buildings and private residences. Many of the Apulia stone processing companies are concentrated in this basin (approximately 40% of the total) and have modernized their production processes over the last few years, with new sawing machines and new stone modeling technologies.

Geological age: Cretaceous/Mesozoic era Cenomanian

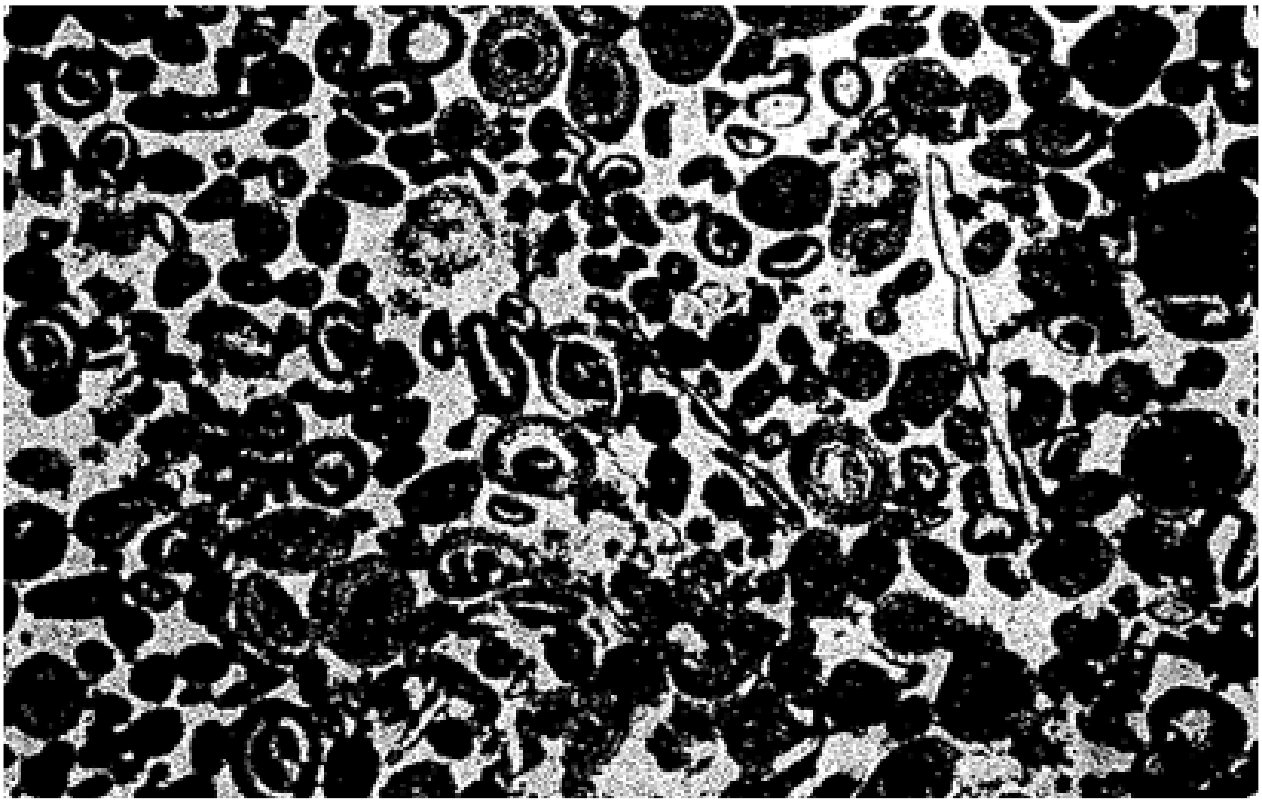
Geological unit: Formazione del Calcari di Bari

Application, use and heritage



Trani Cathedral, column in Pietra di Trani

Petrography



Description:

Pelmicritic limestone with algal lamina and pellet lamina; Clastic structure. The main mineralogical component is calcite (over 99 %), less than 1 % the insoluble residue, composed occasionally by iron oxide, rutile, clay mineral, and silicate (phyllosilicate, garnet).

Source of information:

- "La pietra di Trani" B. RADINA (AGI - RIG n. 5 del 1955) https://associazionegeotecnica.it/wp-content/uploads/2011/09/geot_1956_5_206.pdf
- MARMI ITALIANI - GUIDA TECNICA (ICE) Fratelli VALLARDI EDITORI 1982
- http://www.elmarstone.com/cava-di-trani/
- http://www.gaverini.it/it-IT/le_nostre_pietre/pietra_di_trani/PT
- "Tecniche geologiche tradizionalinella ricerca di nuovi giacimenti di pietre ornamentali in Puglia" A. REINA & L. BUTTIGLIONE (Geologi e Territorio n° 1 / 2 - 2005 pagg. 29-40 Ordine Regionale dei Geologi – Puglia)
- ATLANTE CONTEMPORANEO DEI MARMI E DELLE PIETRE DI PUGLIA – Regione Puglia D. POTENZA https://www.assoarchitetti.it/doc/atlante_marmi_pietre.pdf

Mineral composition

Calcite (%)	Fe oxyde (%)	Clay mineral (%)	Rutile (%)	Silicates (%)	Mineral 6 (%)	Mineral 7 (%)
> 99	**AM**	**AM**	**AM**	**AM**		

MM=main minerals, SM = Subordinate minerals, AM=accessory minerals

Source of information:

- "La pietra di Trani" B. RADINA (AGI - RIG n. 5 del 1955) https://associazionegeotecnica.it/wp-content/uploads/2011/09/geot_1956_5_206.pdf
- "Ricerche sedimentologiche sulla "Pietra di Trani" E. LUPERTO, 1957 Istituto di Mineralogia dell'Università di Bari.
- "Compact limestones as historical building material: properties of the Tarni Stone (Apulia, southern Italy) and preliminary study for self cleaning treatments" A. CALIA, L. MATERA and M. LETTIERI. 12th International Congress on Deterioration and Conservation of Stone – Columbia University, New York, 2012

Physical properties

Apparent density (RD 2232-2234 1939) kg/m3	**Open porosity (RD 2232-2234 1939) % vol**	**Water absorption at atmospheric pressure (EN 13755) % wt**	**Uniaxial Compressive strength (EN 1926) MPa**	**Flexural strength under concentrated load (EN 12372) MPa**
2650	**2,6**	**0,54**	**175,00**	**18,18**

Real density (EN 1936) kg/m3	**Total porosity (EN 1936) % vol**	**Water absorption coefficient by capillary (EN 1925) (g/m2 x s0,5)**	**Flexural strength under constant moment (EN 13161) MPa**
2715			

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	
13,62		**0,54**		

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, cm^3 / $50cm^2$	Method C - Amsler Abrasion Test, mm	Change in mass (increase: +; decrease: -), %	Breaking load, N	Thickness of the test specimens, mm

Slip resistance by means of the pendulum tester (EN 14231 / CEN/TS 16165)			**Rupture energy (EN 14158), Joule**	**Thermal Conductivity (RD 2232-2234 1939), mm/m °C**
Tested surface finish	Slip Resistance Value — SRV			
	Dry test condition	Wet test condition		
				0,0037

Source of information:

- http://www.gaverini.it/it-IT/le_nostre_pietre/pietra_di_trani/PT
- ATLANTE CONTEMPORANEO DEI MARMI E DELLE PIETRE DI PUGLIA – Regione Puglia D. POTENZA https://www.assoarchitetti.it/doc/atlante_marmi_pietre.pdf

- "La pietra di Trani" B. RADINA (AGI - RIG n. 5 del 1955) https://associazionegeotecnica.it/wp-content/uploads/2011/09/geot_1956_5_206.pdf

Chemical properties

Main elements

SiO_2 (%)	Al_2O_3 (%)	Fe_2O_3 (%)	TiO_2 (%)	MgO (%)	CaO (%)	Na_2O (%)	K_2O (%)	MnO (%)	P_2O_5 (%)	SO_3 (%)	CO_2	H_2O	LOI (%)
<1	<1	<1	<1	<0,1	55	<0,1	<1	<1	<0,1		43	<1	

Trace elements

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

REE

La (ppm)	Ce (ppm)	Pr (ppm)	Nd (ppm)	Sm (ppm)	Eu (ppm)	Gd (ppm)	Tb (ppm)
Dy (ppm)	Ho (ppm)	Er (ppm)	Tm (ppm)	Yb (ppm)	Lu (ppm)		

Methods applied and source of information:

- https://www.tranigoldstone.it/IT/scheda-tecnica#:~:text=La%20pietra%20di%20Trani%20%C3%A8,colorazione%20havana%20beige%20con%20stiloliti.&text=Calcare%20pelmitritico%20con%20bioclasti%3B%20prevalgono,Alghe%20calcaree%2C%20Ostracodi%2C%20Foraminiferi.
- BORGHI M, MASI U., TUCCI P. & VIZZINI G. (1996) “Chemiostratigraphy of the Upper part of the “Calcare di Bari” (Upper Cretaceous) from Polignano (Apulia, southern Italy)” in vol. TERRANES OF SERBIA pgg 241-246. Simposio di Beograd-Brezovica, 23-27 Settembre 1996.

Sources of more information

Type of information	Name of provider	URL
This data sheet	Geological Survey of Italy -ISPRA	http://sgi.isprambiente.it/geologia100k/mostra_foglio.aspx?numero_foglio=177
Non-commercial directory	Geological Science Department - University Roma Tre, Italithos 2000 Regione Puglia	http://www.italithos.uniroma3.it/scheda8.php?ID=377 https://www.assoarchitetti.it/doc/atlante_marmi_pietre.pdf
Commercial directory		https://www.tranigoldstone.it/IT/ http://www.gaverini.it/it-IT/le_nostre_pietre/pietra_di_trani/PT http://www.elmarstone.com/cava-di-trani/
Scientific publication		"Compact limestones as historical building material: properties of the Tarni Stone (Apulia, southern Italy) and preliminary study for self cleaning treatments" A. CALIA, L. MATERA and M. LETTIERI. 12th International Congress on Deterioration and Conservation of Stone – Columbia University, New York, 2012 "La pietra di Trani" B. RADINA (AGI - RIG n. 5 del 1955) https://associazionegeotecnica.it/wp-content/uploads/2011/09/geot_1956_5_206.pdf
Other publication		BORGHI M, MASI U., TUCCI P. & VIZZINI G. (1996) "Chemiostratigraphy of the Upper part of the "Calcare di Bari" (Upper Cretaceous) from Polignano (Apulia, southern Italy)"

Compiled by:	Geological survey of Italy – ISPRA website http://portalesgi.isprambiente.it/	ISPRA Istituto Superiore per la Protezione e la Ricerca Ambientale Sistema Nazionale per la Protezione dell'Ambiente