

Untersberg

Untersberger Marmor

Salzburger Untersberger

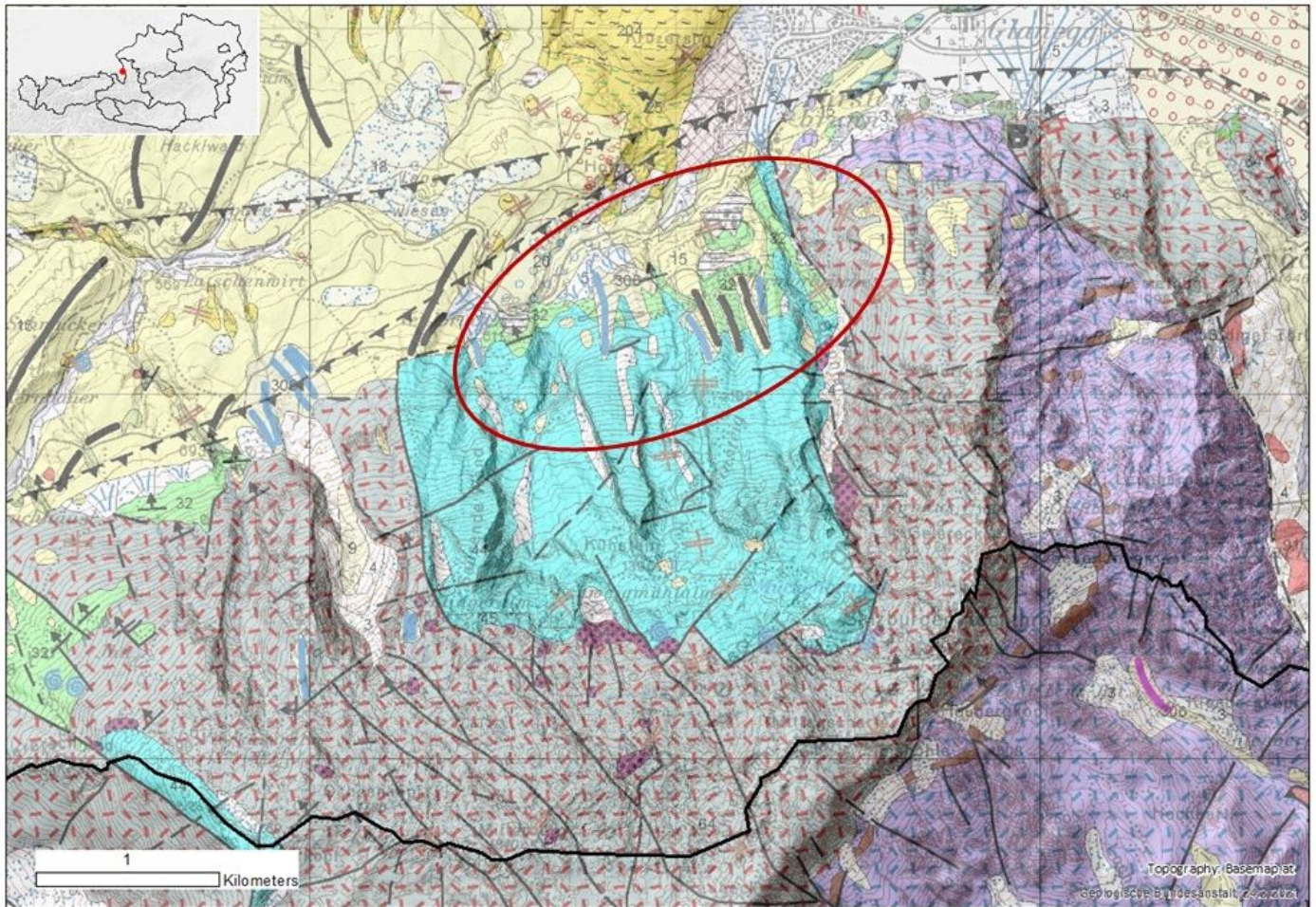


3 cm

Short description: fine- to medium-grained, very dense and weathering-resistant breccia limestone in colour varieties from light beige to reddish and yellowish

Commodity (vocabulary)	Lithology (vocabulary)	Typical colour (code list)	Place of origin			
			Country	County / District / Province	Municipality / Community	Place/town / Village
Commercial Limestone	Limestone	Beige	Austria	Salzburg-Umgebung / Salzburg	Grödig Großgmain	Fürstenbrunn Veitlbruch

Geological setting



Geology: The Untersberg marble (light green signature on the map) occurs not far from the village of Fürstenbrunn, southwest of the city of Salzburg. What now is known as Untersberg marble originally was a conglomerate with components of calcareous rocks, which were mainly formed by debris flows in the area of a steep coast. The presence of fossils – mostly rudists, corals, red algae, bryozoans or foraminifera - is also characteristic. Subsequent diagenesis has consolidated the sediments to such an extent that the boundaries between components and matrix are hardly recognisable. In the basal areas, bauxite and ore grains often occur, giving the rock a speckled appearance (“trout marble”) or a certain red, pink or yellow colour. Towards the top this bauxitic pigmentation decreases significantly and the rock becomes whiter.

Production: The main quarrying area is on the northern slope of the Untersberg west of Fürstenbrunn (red marking). There are indications that quarrying activities already took place in Roman times. The rock was then used more intensively from the 16th and 17th centuries onwards.

Geological age: Upper Cretaceous (Coniacian to Santonian)

Geological unit: Untersberger Marmor; Gosau Group (URI: <http://resource.geolba.ac.at/GeologicUnit/549>)

Application, use and heritage

Description: Untersberg marble was used as building and ornamental stone in numerous sacral and secular buildings throughout Austria and Central Europe. Although it was exploited since Roman times it is characteristic for the epochs of Renaissance, Baroque and later on (maybe due to innovated hardened chisel). Examples of use are found in the city of Salzburg (façade of the Salzburg Cathedral, Chapter Fountain and Residence Fountain, figures, stairs and balustrades in Mirabell Palace and the Mirabell Gardens) or in Vienna (Parliament, Opera House, Holy Trinity Column/Plague Column, balustrade of Albertina bastion). Furthermore, the stone was widely used for bases of monuments and for funeral monuments. During the 19th century the land belonged to Bavaria and quarry activities were directed to equip Munich, where the Wittelsbach fountain in the Residence is a famous example.

Petrography

Description:

Source of information:

Mineral composition

If no accurate number, use MM=main minerals, SM = Subordinate minerals, AM=accessory minerals

Mineral 1 (%)	Mineral 2 (%)	Mineral 3 (%)	Mineral 4 (%)	Mineral 5 (%)	Mineral 6 (%)	Mineral 7 (%)
Mineral 8 (%)	Mineral n (%)					

Source of information:

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

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	

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 (EN 1745), W/m·K
Tested surface finish	Slip Resistance Value — SRV			
	Dry test condition	Wet test condition		

Source of information:

Chemical properties

Main elements

SiO ₂ (%)	Al ₂ O ₃ (%)	Fe ₂ O ₃ (%)	TiO ₂ (%)	MgO (%)	CaO (%)	Na ₂ O (%)	K ₂ O (%)	MnO (%)	P ₂ O ₅ (%)	SO ₃ (%)	LOI (%)
2,01	0,21	0,14	0,02	0,60	53,0	0,06	0,03	0,01	0,27	0,08	43,2

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: average value from 3 samples; analysis of major and minor elements: energy-dispersive X-ray fluorescence analysis; gravimetric determination of the loss on ignition; Geological Survey of Austria (GBA)

Sources of more information

Type of information	Name of provider	URL
This data sheet	Geological Survey of Austria (GBA)	https://www.geologie.ac.at
Non-commercial directory		
Commercial directory		
Scientific publication		
Other publication		

Kieslinger, A. (1963): Die nutzbaren Gesteine Salzburgs.- Mitteilungen der Gesellschaft für Salzburger Landeskunde: Ergänzungsband, xi+435 S., Bergland-Buch, Salzburg.

Kryza, R., Uhlir, C.F., Kryza, G., Striskiene, E. & Höck, V. (2011): Tales about stone: Salzburg Limestones - "Royal marbles" in Poland and Lithuania.- Przegląd Geologiczny, vol. 59, nr 2, pp. 1-7.

Moshhammer, B., Uhlir, C., Rohatsch, A. & Unterwurzacher, M. (2015): Adnet 'Marble', Untersberg 'Marble' and Leitha Limestone. Best Examples expressing Austria's Physical Cultural Heritage.- In: Lollino, G. et al. (eds.): Engineering Geology for Society and Territory - Volume 5.- Springer, 1, pp. 253-257.

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Uhlir, C.F., Kryza, R. & Höck, V. (2010): Salzburg building and ornamental stones - tradition and present.- Przegląd Geologiczny, vol. 58, nr 6, pp. 472-479.

Picture of stone surfaces: Source: Kieslinger-Archive, Geological Survey of Austria, Wien

Geological map: Pavlik, W. (2009): GEOFAST Provisorische Geologische Karte der Republik Österreich 1:50.000 Blatt 93 Bad Reichenhall.- 1 Bl., Geologische Bundesanstalt, Wien.

Topographic map: Basemap.at (<https://basemap.at>)

Compiled by:	Geological Survey of Austria (GBA) https://www.geologie.ac.at	 Geologische Bundesanstalt
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