

Sölk

Sölker Marmor

Gumpeneckmarmor

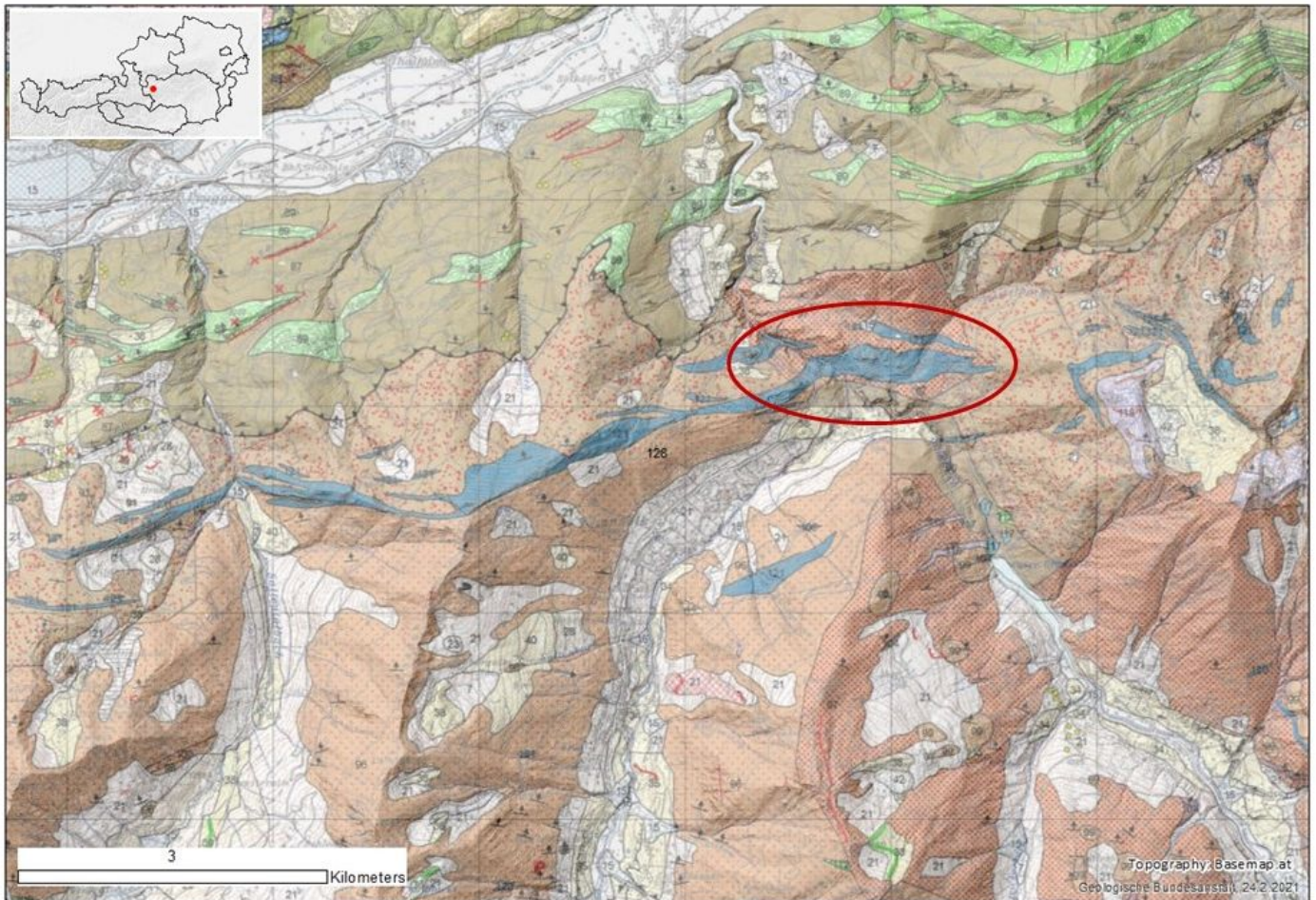


4 cm

Short description: coarse-grained, partly mica-bearing, vividly coloured calcareous marble of predominantly white/light colours with pink and grey-green streaks

Commodity (vocabulary)	Lithology (vocabulary)	Typical colour (code list)	Place of origin			
			Country	County / District / Province	Municipality / Community	Place/town / Village
Commercial Marble	Marble	Pink	Austria	Liezen / Steiermark (Styria)	Kleinsölk Großsölk	Großsölk Vorderwald Reith

Geological setting



Geology: The Sölk Marble (blue signature on the map – includes also the dolomitic Gumpeneck Marble) is exposed in Styria south of the Enns Valley over a length of about 15 km as a narrow west-east striking band together with the Gumpeneck Marble and is folded within a mica schist unit (Wölzer Micaschist).

Production: The main quarrying area is located near the village of Großsölk (red marking), giving the rock its name. At the Weiße Wand in the Walchen Valley (next valley to the east, outside of map) another exposure is mined for white calcium carbonate industrial filler.

Geological age: 350 Ma (Devonian); Permian metamorphosis of higher green schist at low pressures and similar Eoalpine metamorphosis (84-100 Ma)

Geological unit: Sölk-Gumpeneck-Marmor; Sölk and Gumpeneck Marble Lithodem; Wölz Complex (URI: <http://resource.geolba.ac.at/GeologicUnit/220>); tectonic unit: Koralle-Wölz Nappe System (URI: <http://resource.geolba.ac.at/tectonicunit/156>)

Application, use and heritage

Description: Due to its vivid colouring and high quality, Sölk marble is a popular ornamental stone. It is used, for example, for facade claddings and floor slabs, as terrace slabs, for garden design, as step slabs, in hydraulic engineering, for funeral monuments, sculptures and fountains or plates in infrared heating systems. Some of the material is also crushed and used as high-grade chippings and plaster. The pronounced quartz-content of the coloured varieties causes rather quick wearing out of the sawing machines.

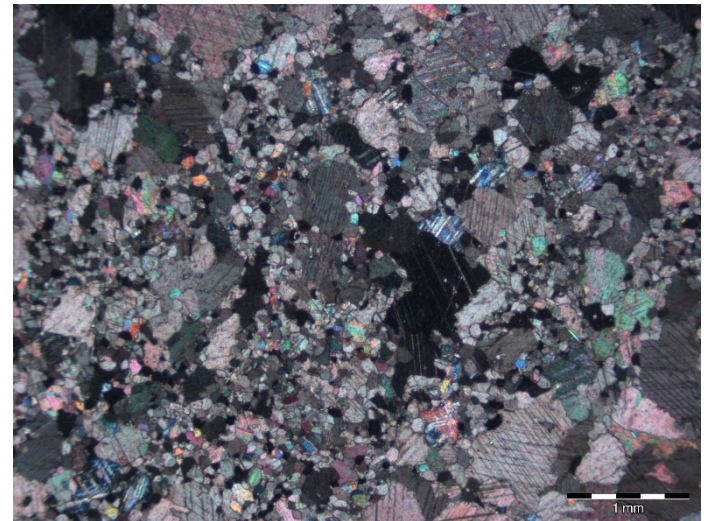
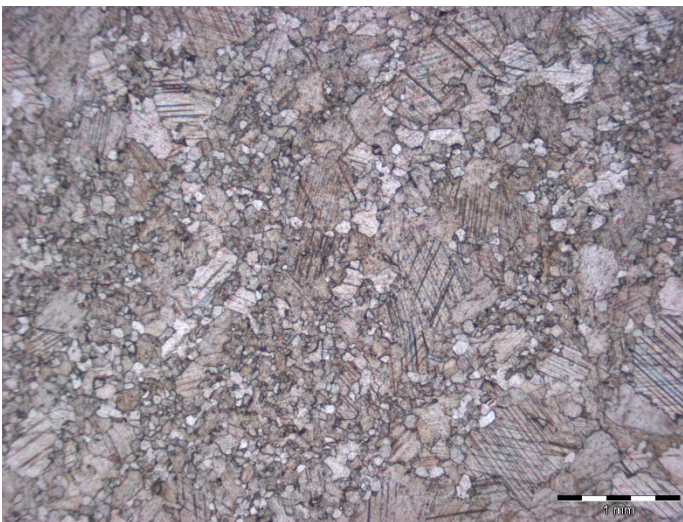
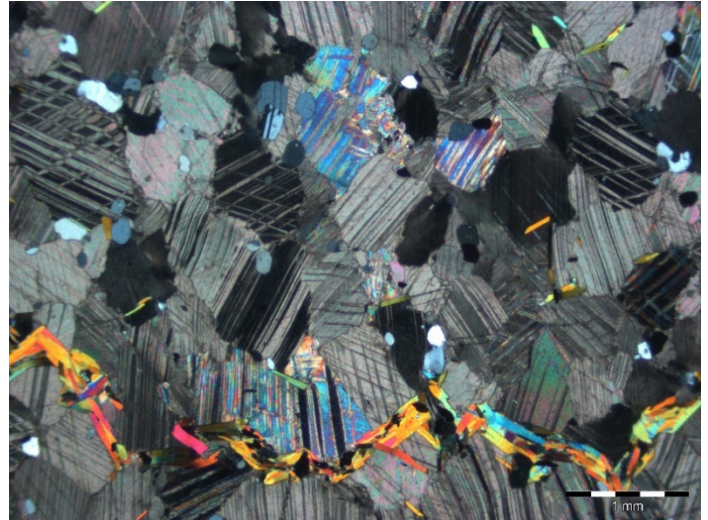
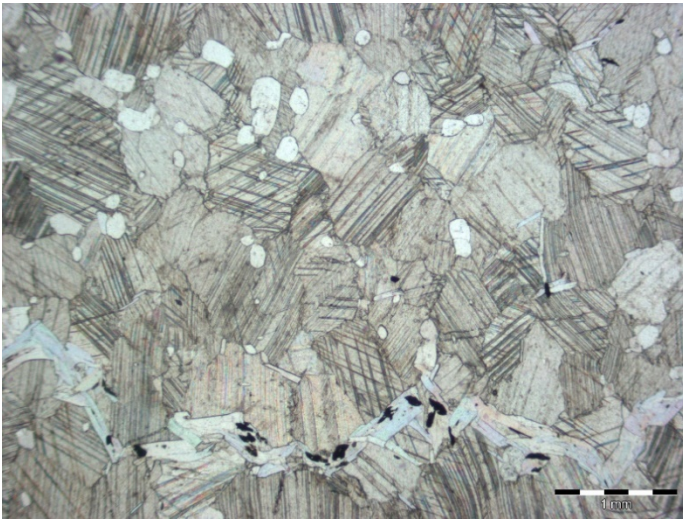


Description: These Sölk marble slabs (each 100x56x2 cm) not only radiate charming patterns but function technically as infrared thermal elements for natural stone heatings.



Description: Sölk marble is still used for sculptural works today. The sculpture "Panta Rhei - alles fließt" (Panta Rhei - everything flows) (2011) by the Austrian artist Klaus Schrefler, weighing over 500 kg, is located in front of the main building of the University of Graz. It is meant to symbolise connectedness, sustainability and intercultural cooperation.

Petrography



Description: The coloured marble type shows fine-, medium and coarse grained layered calcites. Silicate minerals are characteristic for the coloured zones and occur intermingled or as layers (quartz, micaschist). They comprise quartz, feldspar, mica, accessory ores, clinozoisite, chlorite, garnet, apatite and zirconium. They can show protomylonitic deformation with shear zones but also textures with subgrains as well as homogeneously granoblastic texture and different stages in twin lamellae. Dolomite crystals interspersed, in patches or outweighing are always fine grained. Microscopic images (left only plane and right with crossed polarized light) of typical Sölk Marble (coarser calcite grains, interspersed small quartz and white mica, silicate layer with mica, chlorite and titanite minerals) and a transition into Gumpeneck marble from Walchen with larger calcite and small dolomite crystals and very rare siliceous content.

Source of information: Geological Survey of Austria (GBA)

Mineral composition

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

Calcite (%)	Quartz	Feldspar	Muscovite	Rutile	Magnetite	Phlogopite
>> 90	SM	SM	AM	AM	AM	AM

Source of information: Geological Survey of Austria (GBA)

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 (%)
1,81	0,35	0,16	0,02	0,75	54,2	0,05	0,12	0,01	0,07	< 0,1	41,47

Trace elements

V (ppm)	Cr (ppm)	Mn (ppm)	Co (ppm)	Ni (ppm)	Cu (ppm)	Zn (ppm)	As (ppm)
< 15	16		< 5	< 5	6	5	0,21
Sr (ppm)	Cd (ppm)	Ba (ppm)	Pb (ppm)	Be (ppm)	Rb (ppm)	Bi (ppm)	U (ppm)
	< 0,8		18				
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)
< 0,8		< 5					
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 5 samples; analysis of major, minor and selected trace 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		

Lelkes-Felvari, G., Lobitzer, H & Moshhammer, B. (1999): Beiträge zur Petrologie, Geochemie und Weißmetrik des Sölker und Gumpeneck-Marmors (Niedere Tauern, Steiermark) – Contributions to the petrology, geochemistry and colorimetry (whiteness) of the Sölk/Gumpeneck marbles (Niedere Tauern, Styria).- Geologie ohne Grenzen: Festschrift 150 Jahre Geologische Bundesanstalt, Teil I, S. 213-228, Wien.

Moshhammer, B. & Lobitzer, H. (2000): Weißmetrik und Geochemie ausgewählter österreichischer Kalkstein- und Marmor-Vorkommen.- Mitteilungen Österreichische Geologische Gesellschaft, 91 (1998), S. 63-77, Wien.

Puhr, B. J. (2012): Metamorphic evolution and geochemistry of metacarbonate rocks of the Austroalpine Basement (Eastern Alps).- Dissertation Karl-Franzens-Universität Graz, 149 pp., Graz.

Picture of stone surfaces: Source: Werbegemeinschaft der Steinmetzmeister im Rahmen der österreichischen Bundesinnung unter Mitarbeit der Landesinnungen Wien, Niederösterreich, Oberösterreich und Steiermark (Ed., 1994): Naturstein II.- Natursteinkatalog, 96 Bl., Wien.

Geological map: Kreuss, O. (2021): GEOFAST Provisorische Geologische Karte der Republik Österreich 1:50.000 Blatt 128 Gröbming.- 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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