Salla

Salla Marmor

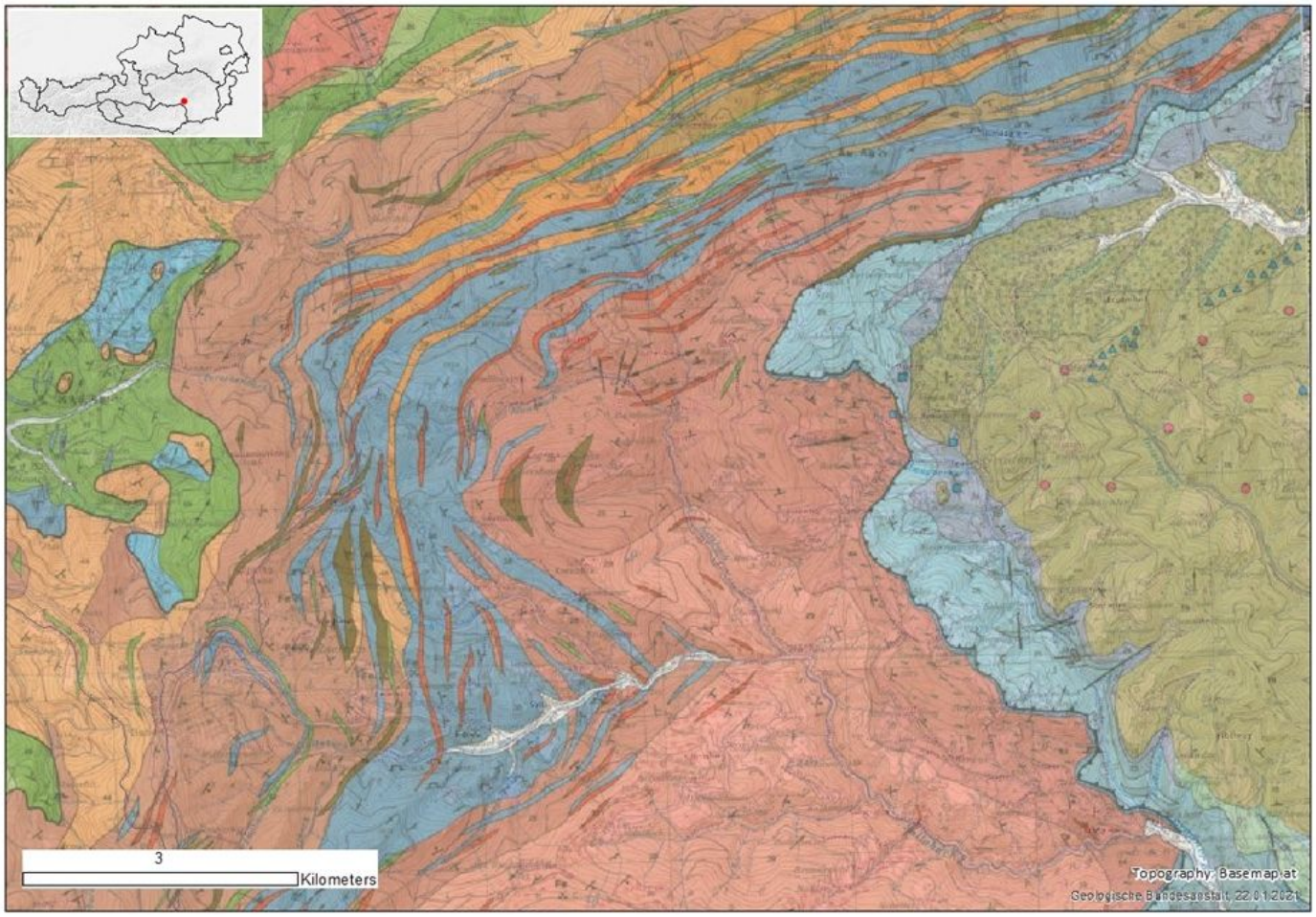
Kainachtal Marmor

3 cm

Short description: very light grey, fine- to medium-grained, recrystallized marble

Commodity (vocabulary)	Lithology (vocabulary)	Typical colour (code list)	Place of origin			
			Country	County / District / Province	Municipality / Community	Place/town / Village
Commercial Marble	Marble	Grey	Austria	Voitsberg / Steiermark (Styria)	Maria Lankowitz Kainach bei Voitsberg	Salla Oswaldgraben Gallmannsegg

Geological setting



Geology: The Salla Marmor (dark blue signature on the map) forms a 50-400 m thick marble sequence within the mica schist sequences of the Koralpe Wölz Crystalline (Styria). The spectrum of marbles in this area ranges from pure white to banded to grey and grey-blue types; higher silicate content or stronger pyrite and graphite guidance cause silicate marbles or carbonate schists to occur. Dolomite marbles are rare.

Production: The main quarrying area is located in the immediate vicinity of the name-giving village of Salla. Other important quarries are located to the north and northeast in the same geological unit up to the Kainach valley. Therefore they are also known as Kainachtal marble. A total of about 20 quarries are known. The building and ornamental stone industry has practically vanished. Impure marbles are used for crushed stone. The filler industry, however, has been very active and aims at the white marble parts of the deposits even in some underground mines as the dip of the Rappold Complex is rather steep.

Geological age: Devonian; Permian metamorphosis under amphibolite-facies conditions at lower pressures and Eoalpine metamorphosis under amphibolite-facies conditions

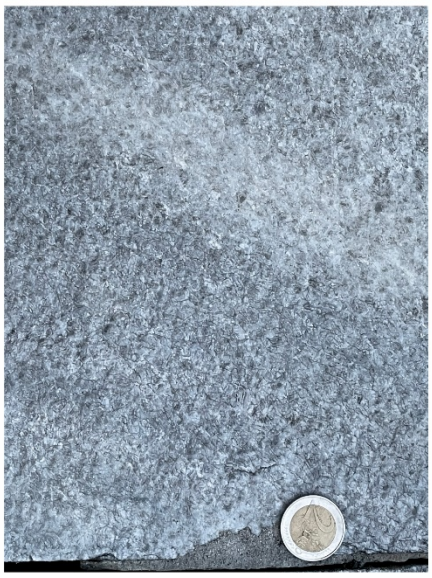
Geological unit: Salla Marmor, Kainachtaler Marmor, marbles of the Almhaus Serie, Bretstein Marble Lithodem; Rappold Complex; tectonic unit: Koralpe-Wölz Nappe System (URI: http://resource.geolba.ac.at/tectonicunit/156)

Application, use and heritage

Description: Salla marble has been quarried since Roman times. The Romans preferred the pure white type. Mainly the light grey patterned types are used as wall stones, bridge stones, floor and wall slabs, window sills, grave monuments and tomb stones, while the pure white types are also used as calcium carbonate filler in the paper, paint, plastics and chemical industries. The marble can be found on numerous historical buildings in Graz (Graz University of Technology, Theater am Stadtpark, Herz-Jesu-Kirche, Leonhardskirche), in Styria and in Vienna.

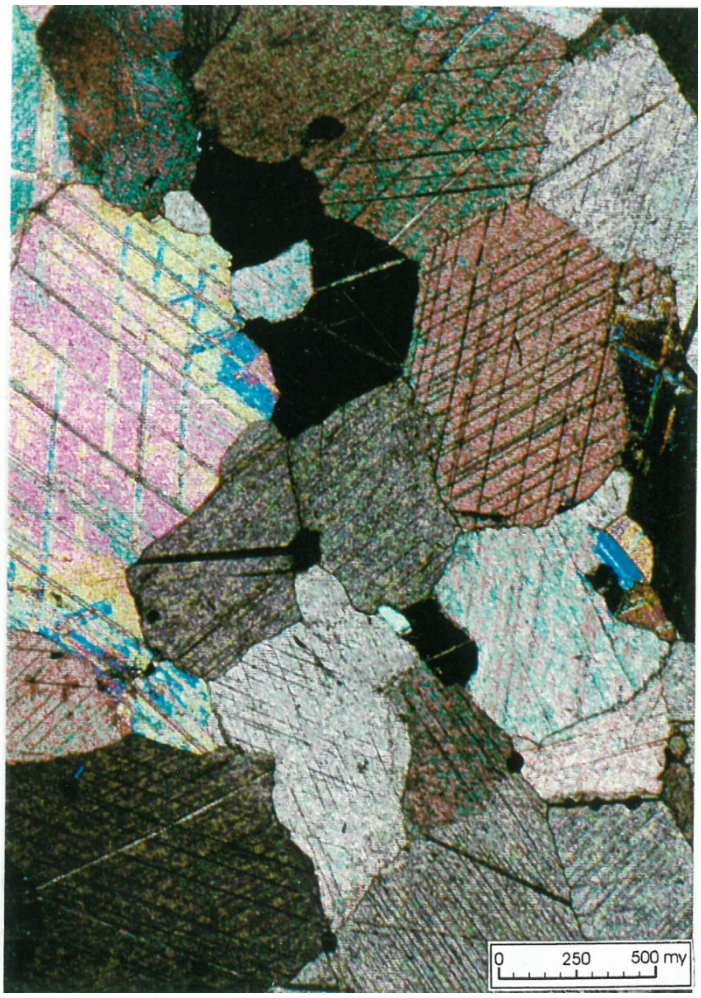
Description: The stairs leading from the first to the second floor in the Natural History and in the Cultural History Museum in Vienna are made of beautifully white and very delicately banded Kainachtal marble which was regarded a good match for a white Carrara marble when built in the late 1880ies (photographs: Alice Schumacher, Natural History Museum Vienna). Despite the small surficial scratches the surface is still very smooth and tight.

Application, use and heritage


Description: In the exterior of the central building from 1895 on the main campus of the Karl Franzens University in Graz, Salla marble was used for the two candelabras, whose pedestals are partially soiled by atmospheric pollution, the railings and pillars of the side entrance ramps and the façade cladding of the buttresses as well as the door frames. The grey, bluish-shaded light marble is medium to coarse-grained depending on its recrystallisation. Very fine rhombohedral crystals are dolomite. The grey sections are due to darker, blurred crystal cores. The cobblestone pavement and the stairs are made of granite.

Petrography



Description: The grey, light grey and white banded and folded marbles show well developed even and smooth cleavage planes. The grey colour is caused by dispersed graphite. A fresh surface of the rock produces a smell from hydrogene sulfate inclusions. The photomicrograph of the pure calcitic marble shows homogeneous, medium sized graines that are well crystallized with even boundaries, triple junctions, and twin lamellae from just slight tectonic deformation.

Source of information: Geological Survey of Austria (GBA)

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/m3	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/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

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_2O_3 (%)	Fe_2O_3 (%)	TiO_2 (%)	MgO (%)	CaO (%)	Na_2O (%)	K_2O (%)	MnO (%)	P_2O_5 (%)	SO_3 (%)	LOI (%)
54,4	0,37	0,09	0,03	0,7	54,4	0,03	0,21	0,01	0,23	0,11	43,29

Trace elements

V (ppm)	Cr (ppm)	Mn (ppm)	Co (ppm)	Ni (ppm)	Cu (ppm)	Zn (ppm)	As (ppm)
< 15	16		5	8	9	10	0,5
Sr (ppm)	Cd (ppm)	Ba (ppm)	Pb (ppm)	Be (ppm)	Rb (ppm)	Bi (ppm)	U (ppm)
	< 0,8		20				
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 16 samples (main elements) respectively 5 samples (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		

Becker, L.P. (1980): Erläuterungen zur Geologischen Karte der Republik Österreich 1:50.000 Blatt 162 Köflach.- 57 S., 18 Abb., 2 Blg., Geologische Bundesanstalt, Wien.

Kieslinger, A. (1972): Die Steine der Wiener Ringstraße. Aufnahmen von E. Mejchar.- Franz Steiner Verlag GmbH., 665 S., 358 Abb., Wiesbaden.

Lasnik, E. (2002): Gewinnung und Verwendung des Marmors in der Region im 19. und 20. Jahrhundert.- Tagungsband Köflacher Karbonattage, 19. u. 20. Sept. 2002, 3 S., Köflach.

Moshammer, 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: Kieslinger-Archive, Geological Survey of Austria, Wien

Geological map: Becker, L.P. (1979): Geologische Karte der Republik Österreich 1:50.000 Blatt 162 Köflach.- 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