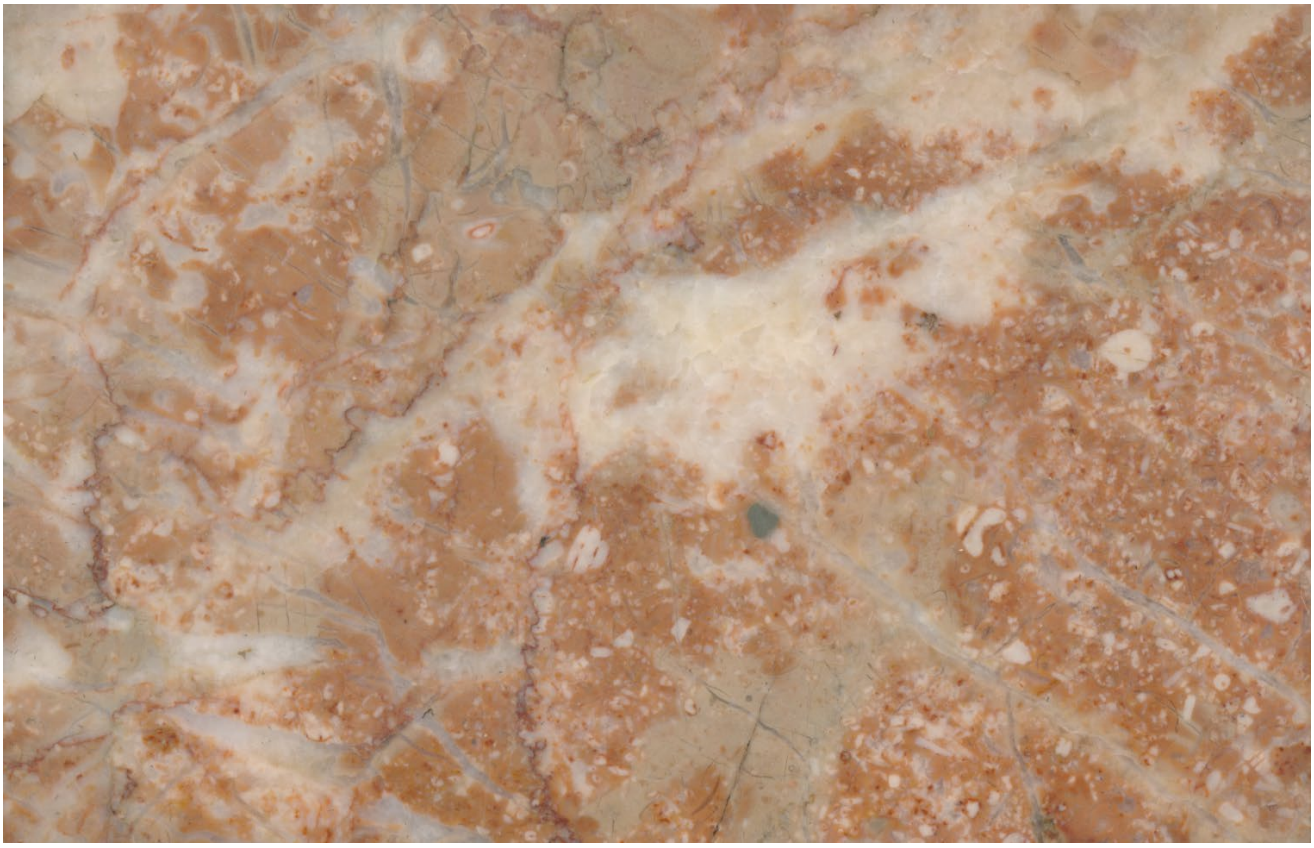
Kramsach

Kramsacher/Hagenauer Marmor

Tiroler Rot

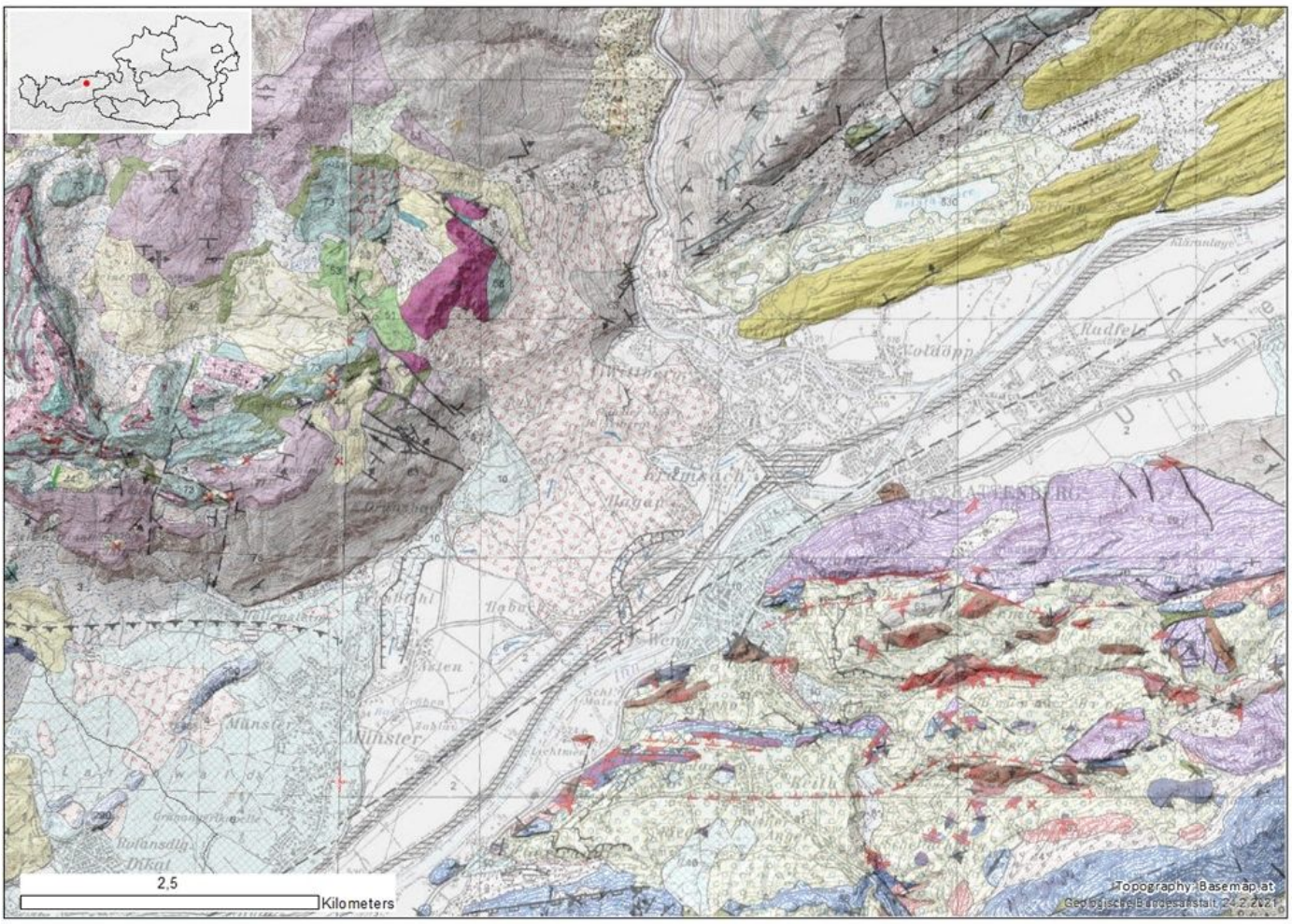


3 cm

Short description: red, fossil-rich Oberrhät reef limestone; the material also includes various Liassic limestones (red limestones with white crinoid ossicles, grey limestones) and Liassic breccias (mostly light-coloured limestone blocks in red calcareous matrix)

Commodity (vocabulary)	Lithology (vocabulary)	Typical colour (code list)	Place of origin			
			Country	County / District / Province	Municipality / Community	Place/town / Village
Commercial Limestone	Limestone (breccia)	Red	Austria	Kufstein / Tirol (Tyrol)	Kramsach	Kramsach Hagau

Geological setting



Geology: Kramsach marble is extracted from blocks of the Pletzach rock avalanche (light grey signature with red triangles on the map), which extends over an area of about 5 km² from the Pletzachkogel to the Inn valley (Tyrol). The rock avalanche deposit contains different types of limestone and breccias. The red limestones and Lias breccias, which only make up part of the rock avalanche material, are referred to as Kramsach marble in the true sense of the word.

Production: The quarrying area is restricted to the rock avalanche area. Since the 15th century at the latest, selected blocks have been quarried regularly. In the 20th century, the area began to be quarried more extensively and rock qualities that were not suitable for decorative purposes were also exploited. Currently, preference is again being given to environmentally friendly and resource-conserving use.

Geological age: Age of the rock avalanche: postglacial; age of the rock avalanche blocks: Triassic (Rhaetian) to Jurassic (Liassic)

Geological unit: various limestones of the Northern Calcareous Alps

Application, use and heritage

Description: The rock avalanche area has been used as a quarry since at least the Middle Ages. The Romanesque castle Schloss Lichtwert, for example, was built from Jurassic limestone blocks from Kramsach. The material was used on a large scale as building stone during the heyday of the Schwaz silver mining industry. Examples of this period are the churches of Rattenberg (from 1473) and St. Leonhard near Kundl (around 1480). The "red marble" on the Golden Roof in Innsbruck is made of Kramsach marble. However, the material was also popular in the Bavarian region. In the 19th century, it was used in industrial and transport buildings, for example for numerous railway bridges over the Inn. After the World War II, the blocks were quarried on a large scale for use in hydraulic and road construction.

Description: In Innsbruck Cathedral, the red “Kramsach marble” was used for the column facing and, together with white marble and black limestone, for the design of the floors.

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/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 (%)
4,85	0,31	0,2	< 0,01	0,81	51,1	0,04	0,08	0,01	0,2	< 0,1	41,0

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		

Patzelt, G. (2012): Die Bergstürze vom Pletzachkogel, Kramsach, Tirol.- Jahrbuch der Geologischen Bundesanstalt, 152, S. 25-28, Wien.

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

Geological map: Kreuss, O. (2008): GEOFAST Provisorische Geologische Karte der Republik Österreich 1:50.000 Blatt 120 Wörgl.- 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