



Standard: EN 12407

PETROGRAPHIC ANALYSIS

Client:	Bettazza Graniti SA		
Project:	Natural stone testing - Boschetto scuro		
Product:	Modular tiles of natural stone - SN EN 12057		
Quarry:	Boschetto, Cevio (TI), Svizzera		
Name of the stone:	Boschetto scuro		
EN 12440 denomination:	MAGGIAGRANIT		
Sampling:	Carried out by the client	Date of testing:	07.09.2015
Delivery:	Carried out by the client on 13.07.2015	Technician:	Dott. Geol. B. Cecchin

1. Macroscopic description of the handsample

General description Foliated, fined-grained rock. The dominant colour of the rock is black and white. The rock has a gneissic structure and is characterized by closely-spaced levels of quartz and feldspars alternated by thin levels of dark mica.

2. Microscopic description of the sample

Orientation of the thin section: parallel to lineation and perpendicular to foliation

2.1 Texture and structure

General description The granoblastic matrix of the rock is composed of inequigranular grains of quartz and feldspars with minor epidotes and other accessory minerals. Schistosity is formed by aligned thin flakes of green-brown biotite

Microfractures: Not present.

2.2 Mineralogical composition, grain size and microstructure

General description The rock is mainly composed of feldspars (~40%, more plagioclase than K-feldspar) and quartz (30-35%), characterized by undulatory extinction. Minor quantity of biotite (10-15%), epidote and clinozoisite (5-10%) and accessory minerals (<5%) such as apatite, opaque minerals, zircon, and relics of pyroxenes/amphiboles are also present in the rock.

Weathering degree of the thin section Slightly weathered.

2.3 Definizione petrografica proposta

Proposed petrographic definition Protolite: sedimentary origin
Facies: greenschist - amphibolite
Rock name: **fine-grained paragneiss with epidote**



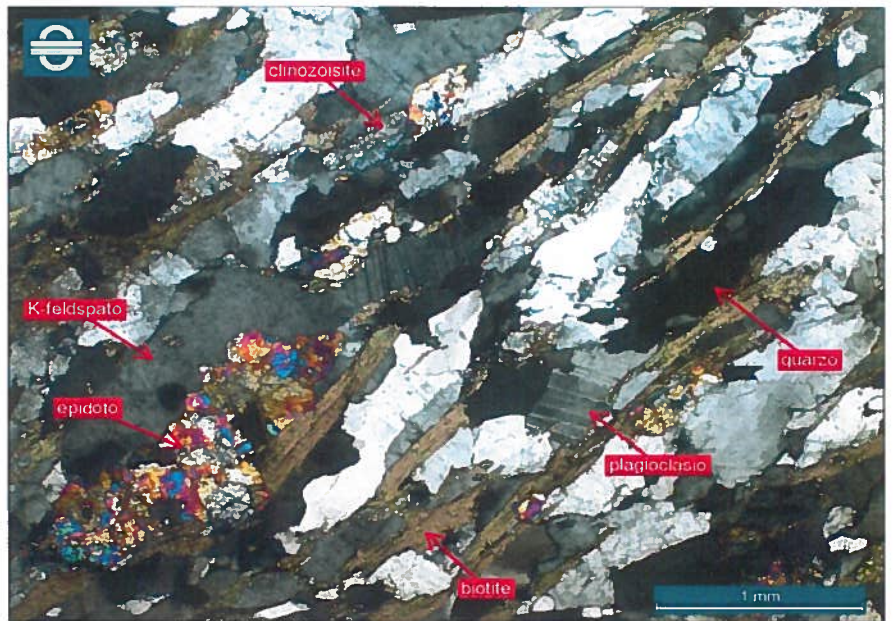
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Product: Modular tiles of natural stone - SN EN 12057
Quarry: Boschetto scuro

Image A

The major minerals that make up the rock are all easily recognizable in the XPL image. Several feldspars and quartz crystals show white-grey-black colours. Among feldspars, plagioclase grains are recognizable by polysynthetic twinning. Biotite flakes show high interference colours. In the lower left corner, a cluster of small crystals of epidotes characterized by brilliant interference colours and high relief can be seen. In the top part of the image grain of clinzoisite, with distinctive yellow-blue colours and moderate high relief is visible.

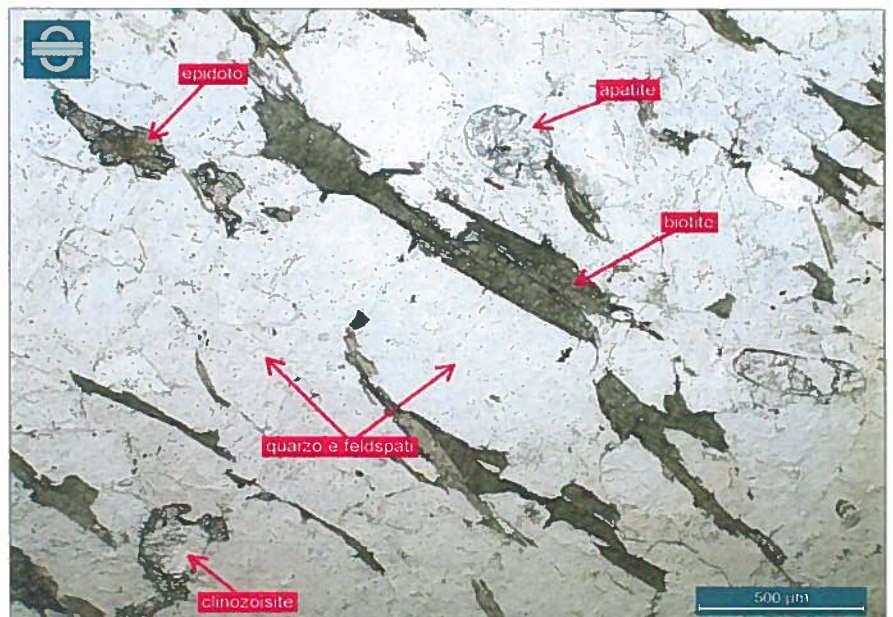


Magnification: 25x

Illumination: XPL

Image B

In the PPL image is possible to observe the strong pleochroism of biotite. Colours include a characteristic dark green leaning to brown. On the left side of the image, two high-relief grains of epidote (top) and clinzoisite (bottom) are visible. On the top right side of the image, are located two grains of apatite, characterized by a slightly higher relief than that of the rock matrix around them (mainly composed of quartz and feldspars).



Magnification: 40x

Illumination: PPL

Grancia, 16.09.2015 General Manager: Dott. M. Di Tommaso

IMM section: physical and mechanical testing on rocks



(Method statement: RO-10)

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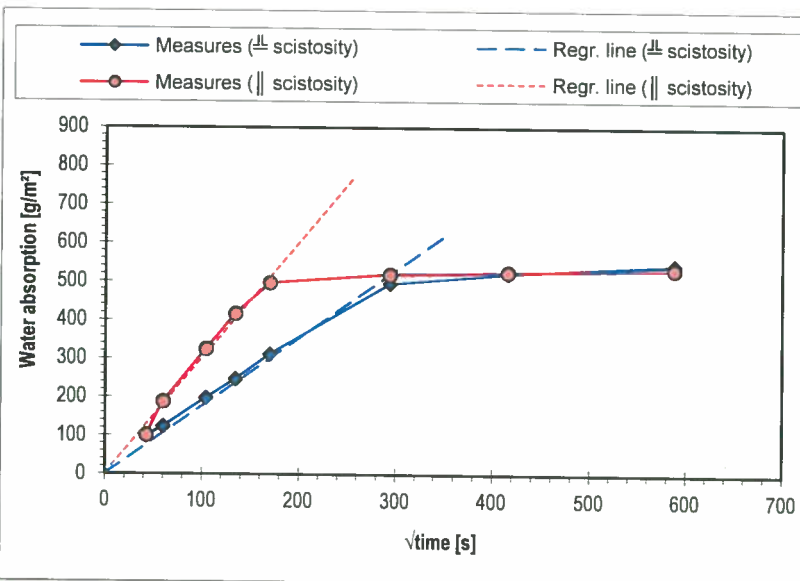
Standard: SN EN 1925, SN EN 12057



WATER ABSORPTION COEFFICIENT BY CAPILLARITY

Client:	Bettazza Graniti SA
Project:	Natural stone testing - Boschetto scuro
Product:	Modular tiles of natural stone
Quarry:	Boschetto, Cevio (TI), Svizzera
Name of the stone:	Boschetto scuro
EN 12440 denomination:	MAGGIAGRANIT
Petrographic description:	Paragneiss
Sampling:	Carried out by the client
Delivery:	13.07.2015
Date of testing:	04.08.2015 ÷ 07.08.2015
Nominal sizes:	Prisms: L = 70 mm; W = 70 mm; H = 70 mm
Technician:	Geol. B. Cecchin

Orientation	Perpendicular to schistosity		Parallel to schistosity		
	Time	Δm [g]	Absorp. [g/m ²]	Δm [g]	Absorp. [g/m ²]
	0.5 h	0.5	98.7	0.5	101.4
	1 h	0.6	123.4	0.9	188.2
	3 h	1.0	197.9	1.6	324.9
	5 h	1.2	247.2	2.1	416.8
	8 h	1.6	312.0	2.5	496.8
	24 h	2.5	496.5	2.6	520.1
	48 h	2.6	522.9	2.6	526.4
	96 h	2.7	545.6	2.7	534.1



The above values are the mean value of 6 measurements

Water absorption coefficient by capillarity, perpendicular to schistosity: $C1 = 1.8 \text{ g/m}^2 \cdot \sqrt{s}$

Water absorption coefficient by capillarity, parallel to schistosity: $C2 = 3.0 \text{ g/m}^2 \cdot \sqrt{s}$

Notes:

Grancia, 16.09.2015 General Manager: **Dott. M. Di Tommaso**

Settore IMM: prove su pietre naturali



(Procedura interna: PN-09)

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Standard: SN EN 13755, SN EN 12057

WATER ABSORPTION AT ATMOSPHERIC PRESSURE

Client:	Bettazza Graniti SA
Project:	Natural stone testing - Boschetto scuro
Product:	Modular tiles of natural stone
Quarry:	Boschetto, Cevio (TI), Svizzera
Name of the stone:	Boschetto scuro
EN 12440 denomination:	MAGGIAGRANIT
Petrographic description:	Paragneiss
Sampling:	Carried out by the client
Delivery:	13.07.2015
Date of testing:	20.07.2015 ÷ 25.07.2015
Nominal sizes:	Prisms: L = 70 mm; W = 70 mm; H = 70 mm
Technician:	Geol. B. Cecchin

Id.	Dry mass m_d [g]	Wet mass m_s [g]	Water absorption A_b [%]
1	971.6	974.4	0.3
2	969.3	972.1	0.3
3	974.8	977.8	0.3
4	962.9	965.7	0.3
5	967.3	970.2	0.3
6	971.5	974.3	0.3
Mean and STD: 0.3 ± 0.01 %			

Notes:

Grancia, 16.09.2015 General Manager: Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali



(Procedura interna: PN-08)

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Standard: SN EN 1936, SN EN 12057



APPARENT DENSITY AND OPEN POROSITY

Client: Bettazza Graniti SA
Project: Natural stone testing - Boschetto scuro
Product: Modular tiles of natural stone
Quarry: Boschetto, Cevio (TI), Svizzera

Name of the stone: Boschetto scuro
EN 12440 denomination: MAGGIAGRANIT
Petrographic description: Paragneiss

Sampling: Carried out by the client
Delivery: 13.07.2015
Date of testing: 21.07.2015
Nominal sizes: Prisms: L = 70 mm; W = 70 mm; H = 70 mm
Technician: Geol. B. Cecchin

Apparent density and open porosity					
Id.	Wet mass in water m_h [g]	Wet mass in air m_s [g]	Dry mass m_d [g]	Apparent density ρ_b [t/m ³]	Open porosity ρ_o [%]
7	618.1	972.1	969.2	2.733	0.8%
8	622.7	979.2	976.3	2.734	0.8%
9	616.7	969.7	967.0	2.734	0.8%
10	618.2	972.5	969.7	2.732	0.8%
11	614.5	967.0	964.1	2.730	0.8%
12	617.7	972.2	969.0	2.729	0.9%
Mean and STD				2.732 ± 0.002	0.8 ± 0.04 %

Notes:

Grancia, 16.09.2015 General Manager: Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali

(Procedura interna: PN-10)





Standard: SN EN 14231, SN EN 12057

SLIP RESISTANCE

Client: Bettazza Graniti SA

Project: Natural stone testing - Boschetto scuro

Product: Modular tiles of natural stone

Quarry: Boschetto, Cevio (TI), Svizzera

Name of the stone: Boschetto scuro

EN 12440 denomination: MAGGIAGRANIT

Petrographic description: Paragneiss

Sampling: Carried out by the client

Delivery: 13.07.2015

Date of testing: 08.09.2015

Nominal sizes: Prisms: L = 150 mm; W = 100 mm; H = 20 mm

Reference stone: Quartz-dolerite type TRL

Rubber slider width: 76 mm

Test length: 126 mm

Calculation of results: SRV mean value of 5 measurements in two opposite directions

Technician: Geol. B. Cecchin

	Id.	1+6	1+6	1+6						
	Surface finish	flamed	honed	polished						
Dry test	Specimen 1	98	97	53						
	Specimen 2	94	74	53						
	Specimen 3	87	76	57						
	Specimen 4	91	74	60						
	Specimen 5	106	79	62						
	Specimen 6	95	78	58						
	Mean	95	79	57						
Wet test	Specimen 1	65	60	25						
	Specimen 2	68	56	25						
	Specimen 3	68	53	26						
	Specimen 4	67	57	34						
	Specimen 5	67	61	33						
	Specimen 6	65	49	28						
	Mean	67	56	29						

Notes:

Grancia, 16.09.2015 General Manager: Dott. M. Di Tommaso
 Settore IMM: prove su pietre naturali



(Procedura interna: PN-07)

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Standard: SN EN 12372, SN EN 12057



FLEXURAL STRENGTH

Client: Bettazza Graniti SA
Project: Natural stone testing - Boschetto scuro
Product: Modular tiles of natural stone
Quarry: Boschetto, Cevio (TI), Svizzera

Name of the stone: Boschetto scuro
EN 12440 denomination: MAGGIAGRANIT
Petrographic description: Paragneiss

Sampling: Carried out by the client
Delivery: 13.07.2015
Date of testing: 20.08.2015
Nominal sizes: Prisms: L = 300 mm; W = 100 mm; H = 50 mm
Test setup: Center-point loading
Load direction: Perpendicular to schistosity
Load rate: 0.250 MPa/s
Supports spacing: 250 mm
Technician: Geol. B. Cecchin

Initial Type Test					
Id.	L / W / H [mm]	M [g]	ρ [t/m ³]	F [kN]	R _t [MPa]
1	300.7/100.7/52.5	4339.4	2.733	17.76	24.0
2	301.0/100.4/52.4	4280.6	2.706	16.63	22.7
3	301.0/100.3/51.9	4256.2	2.714	16.00	22.2
4	301.5/100.7/52.9	4360.4	2.717	18.55	24.7
5	300.9/100.7/53.1	4343.3	2.702	18.74	24.8
6	301.9/100.2/51.7	4252.9	2.719	17.00	23.8
7	301.3/100.3/51.9	4275.8	2.729	17.57	24.4
9	300.7/100.3/52.3	4268.8	2.704	17.34	23.7
10	300.0/100.3/51.9	4261.6	2.729	17.24	23.9
12	300.3/100.7/53.1	4331.1	2.701	18.30	24.2

Type Test	Mean and STD	Strength: $R_{ti,m} = 23.8 \pm 0.8$ MPa	Density: $\rho_{i,m} = 2.715 \pm 0.012$ t/m ³
		Lower expected values	Strength: $R_{ti,min} = 22.1$ MPa

Notes:

Grancia, 16.09.2015 General Manager: Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali

(Procedure Interne: PN-04, PN-05)



Standard: SN EN 12372, SN EN 12371, SN EN 12057



FROST RESISTANCE BY FLEXURAL STRENGTH

Client:	Bettazza Graniti SA
Project:	Natural stone testing - Boschetto scuro
Product:	Modular tiles of natural stone
Quarry:	Boschetto, Cevio (TI), Svizzera
Name of the stone:	Boschetto scuro
EN 12440 denomination:	MAGGIAGRANIT
Petrographic description:	Paragneiss
Sampling:	Carried out by the client
Delivery:	13.07.2015
Number of cycles:	56 cycles (21.08.2015 ÷ 11.11.2015)
Date of testing:	18.11.2015
Nominal sizes:	Prisms: L = 300 mm; W = 100 mm; H = 50 mm
Test setup:	Center-point loading
Load direction:	Perpendicular to schistosity
Load rate:	0.250 MPa/s
Supports spacing:	250 mm
Technician:	Geol. B. Cecchin

Initial Type Test						Test after freeze/thaw cycles (56 cycles)					
Id.	L / W / H [mm]	M [g]	ρ [t/m ³]	F [kN]	R _t [MPa]	Id.	L / W / H [mm]	M [g]	ρ [t/m ³]	F [kN]	R _t [MPa]
1	300.7/100.7/52.5	4339.4	2.733	17.76	24.0	1	300.0/100.4/52.3	4254.0	2.702	18.47	25.2
2	301.0/100.4/52.4	4280.6	2.706	16.63	22.7	2	300.0/100.8/52.4	4345.0	2.745	17.32	23.5
3	301.0/100.3/51.9	4256.2	2.714	16.00	22.2	3	300.0/100.3/51.8	4235.0	2.720	17.78	24.8
4	301.5/100.7/52.9	4360.4	2.717	18.55	24.7	4	300.0/100.5/52.7	4293.0	2.700	15.30	20.5
5	300.9/100.7/53.1	4343.3	2.702	18.74	24.8	5	300.0/100.2/51.7	4239.0	2.728	15.11	21.2
6	301.9/100.2/51.7	4252.9	2.719	17.00	23.8	6	300.0/100.3/52.4	4285.0	2.715	17.92	24.3
7	301.3/100.3/51.9	4275.8	2.729	17.57	24.4	7	300.0/100.8/53.0	4364.0	2.722	15.99	21.2
9	300.7/100.3/52.3	4268.8	2.704	17.34	23.7	8	300.0/100.9/53.3	4349.0	2.694	18.21	23.8
10	300.0/100.3/51.9	4261.6	2.729	17.24	23.9	10	300.0/100.9/52.5	4331.0	2.722	17.53	23.6
12	300.3/100.7/53.1	4331.1	2.701	18.30	24.2	11	300.0/100.2/51.7	4214.0	2.710	15.86	22.2

Type Test	Mean and STD	Strength: $R_{t,m} = 23.8 \pm 0.8$ MPa	Density: $\rho_{i,m} = 2.715 \pm 0.012$ t/m ³
	Lower expected values	Strength: $R_{t,min} = 22.1$ MPa	
After freeze/thaw	Mean and STD	Strength: $R_{t,m} = 23.0 \pm 1.7$ MPa	Density: $\rho_{i,m} = 2.716 \pm 0.015$ t/m ³
	Lower expected values	Strength: $R_{t,min} = 19.7$ MPa	$\Delta R_{t,min} = -10.8\%$

Notes:

Grancia, 20.11.2015 General Manager: Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali

(Procedure interne: PN-04, PN-05)

Standard: EN 14157:2005; EN 12057:2005

ABRASION RESISTANCE

Client: Bettazza Graniti SA

Project: Certification of natural stone - Boschetto scuro

Product: Natural stone products - Modular Tiles for flooring and stairs

EN 12440 denomination: MAGGIAGRANIT

Name of the stone: Boschetto scuro

Petrographic description: Paragneiss

Quarry: Boschetto, Cevio (TI), Switzerland

Sampling: Carried out by client

Delivery: 31.07.2015

Date of testing: 17.08.2015

Nominal Sizes: Prisms: L = 150 mm; W = 100 mm; H = 20 mm

Test Method: Wide Wheel

Abrasive: Corindone according with FEPA 42 F:1984

Test Orientation: Parallel to schistosity

Tested Surface condition: Dry Surface

Calibration Value: 20.5 mm

Technician: F. Protti

Id.	Groove [mm]
A1	19.0
A2	19.0
A3	19.0
A4	18.0
A5	18.0
A6	19.0

Mean and standard deviation: 18.5 ± 0.5 mm

Higher expected value (Eh): 19.5 mm

Notes:

Crevoladossola, 18.08.2015

General Manager

Sector CSL: natural stone test methods



(Procedura interna: PN-20)

The results obtained are referred only to the tested samples. Only the paper document printed and signed has legal value.