



Standard: SN EN 12372, SN EN 12058



## FLEXURAL STRENGTH

**Client:** Elio Sangiorgio SA Industria del granito

**Project:** Natural stone testing - Lodrino Gneiss

**Product:** Slabs of natural stone for floors and stairs

**Quarry:** Elio Sangiorgio SA

**Name of the stone:** Lodrino Gneiss

**EN 12440 denomination:** LODRINOGRANIT

**Petrographic description:** Orthogneiss

**Sampling:** Carried out by the client

**Delivery:** --

**Date of testing:** 03.03.2014

**Nominal sizes:** Prisms: L = 300 mm; W = 100 mm; H = 50 mm

**Test setup:** Center-point loading

**Load direction:** Perpendicular to scistosity

**Load rate:** 0.250 MPa/s

**Supports spacing:** 250 mm

**Operator:** Geol. B. Cecchin

Initial Type Test					
Id.	L / W / H [mm]	M [g]	$\rho$ [t/m <sup>3</sup> ]	F [kN]	R <sub>t</sub> [MPa]
1	300.1/100.1/50.2	4021.0	2.666	11.11	16.5
3	300.4/99.9/50.7	4042.0	2.657	10.77	15.7
4	299.9/100.3/49.6	3986.0	2.672	10.68	16.2
6	300.8/100.4/49.9	4007.0	2.659	10.57	15.8
7	300.6/100.2/50.0	4024.0	2.672	10.88	16.3
8	300.0/100.4/49.9	4005.0	2.665	11.01	16.5
9	300.0/100.2/49.7	3986.0	2.668	10.86	16.5
10	300.1/100.1/50.3	4019.0	2.660	11.58	17.1
11	300.4/100.2/49.5	3977.0	2.669	10.94	16.7
12	300.2/100.0/50.4	4043.0	2.672	10.92	16.1

Type Test	Mean and STD	Strength: $R_{ti,m} = 16.4 \pm 0.4$ MPa	Density: $\rho_{i,m} = 2.666 \pm 0.006$ t/m <sup>3</sup>
		Lower expected values	Strength: $R_{ti,min} = 15.5$ MPa

Notes:

Grancia, 20.02.2017

General Manager Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali

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

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Standard: SN EN 12372, SN EN 12371, SN EN 12058



## FROST RESISTANCE BY FLEXURAL STRENGTH

**Client:** Elio Sangiorgio SA Industria del granito

**Project:** Natural stone testing - Lodrino Gneiss

**Product:** Slabs of natural stone for floors and stairs

**Quarry:** Elio Sangiorgio SA

**Name of the stone:** Lodrino Gneiss

**EN 12440 denomination:** LODRINOGRANIT

**Petrographic description:** Orthogneiss

**Sampling:** Carried out by the client

**Delivery:** --

**Number of cycles:** 56 cycles (03.03.2014 ÷ 06.06.2014)

**Date of testing:** 16.06.2014

**Nominal sizes:** Prisms: L = 300 mm; W = 100 mm; H = 50 mm

**Test setup:** Center-point loading

**Load direction:** Perpendicular to scistosity

**Load rate:** 0.250 MPa/s

**Supports spacing:** 250 mm

**Operator:** Geol. B. Cecchin

Initial Type Test					
Id.	L / W / H [mm]	M [g]	$\rho$ [t/m <sup>3</sup> ]	F [kN]	R <sub>t</sub> [MPa]
1	300.1/100.1/50.2	4021.0	2.666	11.11	16.5
3	300.4/99.9/50.7	4042.0	2.657	10.77	15.7
4	299.9/100.3/49.6	3986.0	2.672	10.68	16.2
6	300.8/100.4/49.9	4007.0	2.659	10.57	15.8
7	300.6/100.2/50.0	4024.0	2.672	10.88	16.3
8	300.0/100.4/49.9	4005.0	2.665	11.01	16.5
9	300.0/100.2/49.7	3986.0	2.668	10.86	16.5
10	300.1/100.1/50.3	4019.0	2.660	11.58	17.1
11	300.4/100.2/49.5	3977.0	2.669	10.94	16.7
12	300.2/100.0/50.4	4043.0	2.672	10.92	16.1

Test after freeze/thaw cycles (56 cycles)					
Id.	L / W / H [mm]	M [g]	$\rho$ [t/m <sup>3</sup> ]	F [kN]	R <sub>t</sub> [MPa]
1	300.4/100.3/49.6	3980.0	2.663	11.14	16.9
2	300.4/99.5/50.8	4027.0	2.652	10.70	15.6
3	300.5/100.2/50.5	4040.0	2.657	10.37	15.2
4	299.9/100.2/49.6	3980.0	2.670	10.66	16.2
5	300.4/99.5/50.6	4030.0	2.665	11.23	16.5
6	300.1/100.2/49.8	3986.0	2.662	11.07	16.7
7	300.4/100.2/50.0	4020.0	2.671	11.02	16.5
8	300.1/100.3/49.7	3988.0	2.666	10.99	16.6
10	301.0/100.3/49.7	3987.0	2.657	10.64	16.1
12	300.3/100.1/50.6	4047.0	2.661	10.71	15.7

Type Test	Mean and STD	Strength: $R_{t,m} = 16.4 \pm 0.4$ MPa	Density: $\rho_{l,m} = 2.666 \pm 0.006$ t/m <sup>3</sup>
	Lower expected values	Strength: $R_{t,min} = 15.5$ MPa	
After freeze/thaw	Mean and STD	Strength: $R_{t,m} = 16.2 \pm 0.6$ MPa	Density: $\rho_{l,m} = 2.662 \pm 0.006$ t/m <sup>3</sup>
	Lower expected values	Strength: $R_{t,min} = 15.1$ MPa	$\Delta R_{t,min} = -2.8\%$

Notes:

Grancia, 20.02.2017 General Manager: Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali

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



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Test Certificate

**RFP4001F.2**

Standard: SN EN 12372, SN EN 12058



## FLEXURAL STRENGTH

**Client:** Elio Sangiorgio SA Industria del granito

**Project:** Natural stone testing - Lodrino Gneiss

**Product:** Slabs of natural stone for floors and stairs

**Quarry:** Elio Sangiorgio SA

**Name of the stone:** Lodrino Gneiss

**EN 12440 denomination:** LODRINOGRANIT

**Petrographic description:** Orthogneiss

**Sampling:** Carried out by the client

**Delivery:** 17.01.2014

**Date of testing:** 03.03.2014

**Nominal sizes:** Prisms: L = 300 mm; W = 100 mm; H = 50 mm

**Test setup:** Center-point loading

**Load direction:** Perpendicular to the edge of schistosity planes

**Load rate:** 0.250 MPa/s

**Supports spacing:** 250 mm

**Operator:** Geol. B. Cecchin

Initial Type Test					
Id.	L / W / H [mm]	M [g]	$\rho$ [t/m <sup>3</sup> ]	F [kN]	R <sub>t</sub> [MPa]
2	300.4/100.5/50.7	4075.0	2.662	9.33	13.5
3	300.5/100.4/49.7	4009.0	2.674	9.21	13.9
4	300.3/100.3/49.8	4000.0	2.667	8.92	13.4
5	300.1/100.4/50.6	4074.0	2.672	9.46	13.8
6	300.4/100.5/50.0	4021.0	2.664	9.66	14.4
7	300.2/100.3/49.9	4002.0	2.664	9.85	14.8
8	300.0/100.5/50.8	4077.0	2.662	9.43	13.6
9	300.3/100.2/50.5	4063.0	2.674	9.35	13.7
10	300.3/100.4/50.0	4001.0	2.654	9.28	13.9
11	300.1/100.2/50.5	4057.0	2.672	9.38	13.8

Type Test	Mean and STD	Strength: $R_{t,m} = 13.9 \pm 0.4$ MPa	Density: $\rho_{i,m} = 2.666 \pm 0.006$ t/m <sup>3</sup>
	Lower expected values	Strength: $R_{t,min} = 13.1$ MPa	

Notes:

Grancia, 20.02.2017

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 12058



## FROST RESISTANCE BY FLEXURAL STRENGTH

**Client:** Elio Sangiorgio SA Industria del granito

**Project:** Natural stone testing - Lodrino Gneiss

**Product:** Slabs of natural stone for floors and stairs

**Quarry:** Elio Sangiorgio SA

**Name of the stone:** Lodrino Gneiss

**EN 12440 denomination:** LODRINOGRANIT

**Petrographic description:** Orthogneiss

**Sampling:** Carried out by the client

**Delivery:** 17.01.2014

**Number of cycles:** 56 cycles (03.03.2014 ÷ 06.06.2014)

**Date of testing:** 16.06.2014

**Nominal sizes:** Prisms: L = 300 mm; W = 100 mm; H = 50 mm

**Test setup:** Center-point loading

**Load direction:** Perpendicular to the edge of schistosity planes

**Load rate:** 0.250 MPa/s

**Supports spacing:** 250 mm

**Operator:** Geol. B. Cecchin

Initial Type Test					
Id.	L / W / H [mm]	M [g]	$\rho$ [t/m <sup>3</sup> ]	F [kN]	R <sub>t</sub> [MPa]
2	300.4/100.5/50.7	4075.0	2.662	9.33	13.5
3	300.5/100.4/49.7	4009.0	2.674	9.21	13.9
4	300.3/100.3/49.8	4000.0	2.667	8.92	13.4
5	300.1/100.4/50.6	4074.0	2.672	9.46	13.8
6	300.4/100.5/50.0	4021.0	2.664	9.66	14.4
7	300.2/100.3/49.9	4002.0	2.664	9.85	14.8
8	300.0/100.5/50.8	4077.0	2.662	9.43	13.6
9	300.3/100.2/50.5	4063.0	2.674	9.35	13.7
10	300.3/100.4/50.0	4001.0	2.654	9.28	13.9
11	300.1/100.2/50.5	4057.0	2.672	9.38	13.8

Test after freeze/thaw cycles (56 cycles)					
Id.	L / W / H [mm]	M [g]	$\rho$ [t/m <sup>3</sup> ]	F [kN]	R <sub>t</sub> [MPa]
1	300.5/100.4/50.4	4052.0	2.665	10.10	14.9
2	300.5/100.2/50.6	4049.0	2.658	10.06	14.7
4	300.7/100.4/50.5	4045.0	2.653	9.73	14.2
5	300.4/100.3/50.6	4061.0	2.664	10.07	14.7
6	300.5/100.3/50.6	4057.0	2.660	10.13	14.8
7	300.5/100.5/50.4	4055.0	2.664	9.94	14.6
8	300.2/100.2/50.4	4042.0	2.666	9.85	14.5
9	301.4/100.4/50.6	4076.0	2.662	10.08	14.7
11	300.4/100.4/50.3	4043.0	2.665	9.75	14.4
12	300.2/100.4/50.3	4042.0	2.666	9.88	14.6

Type Test	Mean and STD	Strength: $R_{t,m} = 13.9 \pm 0.4$ MPa	Density: $\rho_{l,m} = 2.666 \pm 0.006$ t/m <sup>3</sup>
	Lower expected values	Strength: $R_{t,min} = 13.1$ MPa	
After freeze/thaw	Mean and STD	Strength: $R_{t,m} = 14.6 \pm 0.2$ MPa	Density: $\rho_{l,m} = 2.662 \pm 0.004$ t/m <sup>3</sup>
	Lower expected values	Strength: $R_{t,min} = 14.2$ MPa	$\Delta R_{t,min} = 8.9\%$

Notes:

Grancia, 20.02.2017

General Manager: Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali

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



Standard: SN EN 14231, SN EN 12058

## SLIP RESISTANCE

**Client:** Elio Sangiorgio SA Industria del granito

**Project:** Natural stone testing - Lodrino Gneiss

**Product:** Slabs of natural stone for floors and stairs

**Quarry:** Elio Sangiorgio SA

**Name of the stone:** Lodrino Gneiss

**EN 12440 denomination:** LODRINOGRANIT

**Petrographic description:** Orthogneiss

**Sampling:** Carried out by the client

**Date of testing:** 20.02.2014

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

**Rubber slider width:** 76 mm

**Surface finish:** Blasted

**Delivery:** --

**Operator:** Geol. B. Cecchin

**Reference stone:** Quartz-dolerite type TRL

**Test length:** 126 mm

		Test direction	Measured values					Mean
Dry test	Specimen 1	Forward	94	95	95	94	96	95
		Backward	95	94	95	95	96	
	Specimen 2	Forward	90	90	91	90	92	92
		Backward	93	94	93	94	94	
	Specimen 3	Forward	93	95	95	94	94	94
		Backward	93	94	95	95	96	
	Specimen 4	Forward	95	94	95	95	95	96
		Backward	96	96	97	96	98	
	Specimen 5	Forward	93	94	95	95	95	96
		Backward	97	98	98	97	98	
	Specimen 6	Forward	96	98	98	98	98	97
		Backward	96	96	97	97	98	
<b>Mean</b>							<b>95</b>	
Wet test	Specimen 1	Forward	78	79	77	77	77	77
		Backward	77	77	75	76	76	
	Specimen 2	Forward	80	79	79	79	79	79
		Backward	79	80	79	79	79	
	Specimen 3	Forward	80	79	80	80	80	79
		Backward	80	78	79	80	80	
	Specimen 4	Forward	80	80	79	80	80	80
		Backward	80	80	80	81	81	
	Specimen 5	Forward	79	77	77	78	78	79
		Backward	81	80	80	80	80	
	Specimen 6	Forward	83	82	81	81	81	82
		Backward	84	82	83	83	83	
<b>Mean</b>							<b>80</b>	

Notes:

Grancia, 20.02.2017

General Manager: **Dot. M. Di Tommaso**

Settore IMM: prove su pietre naturali

(Procedura interna: PN-07)

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Standard: SN EN 13755, SN EN 12058



**WATER ABSORPTION AT ATMOSPHERIC PRESSURE**

**Client:** Elio Sangiorgio SA Industria del granito

**Project:** Natural stone testing - Lodrino Gneiss

**Product:** Slabs of natural stone for floors and stairs

**Quarry:** Elio Sangiorgio SA

**Name of the stone:** Lodrino Gneiss

**EN 12440 denomination:** LODRINOGRANIT

**Petrographic description:** Orthogneiss

**Sampling:** Carried out by the client

**Delivery:** --

**Date of testing:** 19.02.2014 ÷ 26.02.2014

**Nominal sizes:** Prisms: L = 70 mm; W = 70 mm; H = 70 mm

**Operator:** Geol. B. Cecchin

Id.	Dry mass $m_d$ [g]	Wet mass $m_s$ [g]	Water absorption $A_b$ [%]
1	923.7	926.2	0.3
2	916.2	918.7	0.3
3	919.0	921.5	0.3
4	927.3	929.8	0.3
5	918.5	921.0	0.3
6	923.5	925.9	0.3
<b>Mean and STD: 0.3 ± 0.00 %</b>			

Notes:

Grancia, 22.02.2017 General Manager: Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali



(Procedura interna: PN-08)

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Standard: SN EN 1925, SN EN 12058



## WATER ABSORPTION COEFFICIENT BY CAPILLARITY

**Client:** Elio Sangiorgio SA Industria del granito

**Project:** Natural stone testing - Lodrino Gneiss

**Product:** Slabs of natural stone for floors and stairs

**Quarry:** Elio Sangiorgio SA

**Name of the stone:** Lodrino Gneiss

**EN 12440 denomination:** LODRINOGRANIT

**Petrographic description:** Orthogneiss

**Sampling:** Carried out by the client

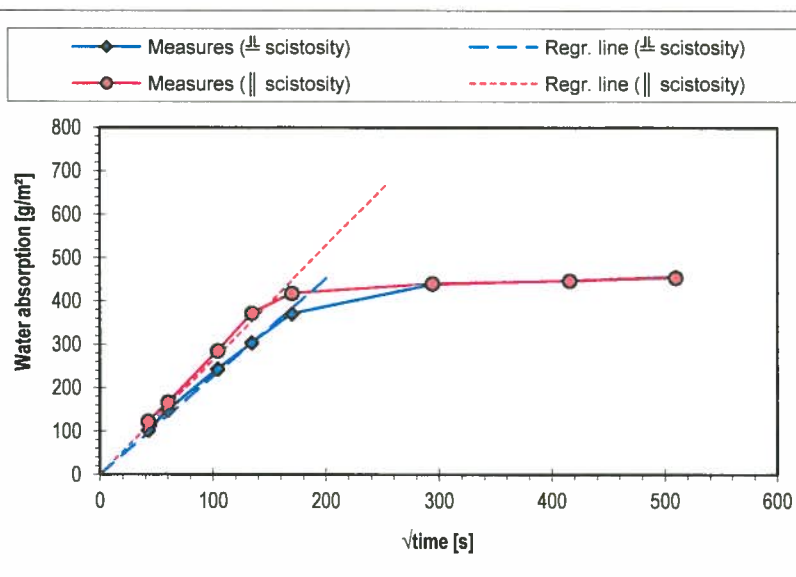
**Delivery:** --

**Date of testing:** 05.03.2014 ÷ 14.03.2014

**Nominal sizes:** Prisms: L = 70 mm; W = 70 mm; H = 70 mm

**Operator:** Geol. B. Cecchin

Orientation	Perpendicular to scistosity		Parallel to scistosity		
	Time	$\Delta m$ [g]	Absorp. [g/m <sup>2</sup> ]	$\Delta m$ [g]	Absorp. [g/m <sup>2</sup> ]
	0.5 h	0.5	101.7	0.6	122.8
	1 h	0.7	148.8	0.8	166.9
	3 h	1.2	243.4	1.4	285.3
	5 h	1.5	303.5	1.8	372.2
	8 h	1.8	370.6	2.1	417.7
	24 h	2.2	439.1	2.2	440.5
	48 h	2.2	447.6	2.2	447.3
	72 h	2.2	456.4	2.2	454.2



The above values are the mean value of 6 measurements

**Water absorption coefficient by capillarity, perpendicular to scistosity:  $C_1 = 2.3 \text{ g/m}^2 \cdot \sqrt{s}$**

**Water absorption coefficient by capillarity, parallel to scistosity:  $C_2 = 2.6 \text{ g/m}^2 \cdot \sqrt{s}$**

Notes:

Grancia, 22.02.2017

General Manager: Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali



(Procedura interna: PN-09)

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Test Certificate

**MVP4001F**

Standard: SN EN 1936, SN EN 12058



## APPARENT DENSITY AND OPEN POROSITY

**Client:** Elio Sangiorgio SA Industria del granito

**Project:** Natural stone testing - Lodrino Gneiss

**Product:** Slabs of natural stone for floors and stairs

**Quarry:** Elio Sangiorgio SA

**Name of the stone:** Lodrino Gneiss

**EN 12440 denomination:** LODRINOGRANIT

**Petrographic description:** Orthogneiss

**Sampling:** Carried out by the client

**Delivery:** --

**Date of testing:** 04.02.2014

**Nominal sizes:** Prisms: L = 70 mm; W = 70 mm; H = 70 mm

**Operator:** 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 $\rho_b$ [t/m <sup>3</sup> ]	Open porosity $\rho_o$ [%]
1	575.8	918.3	915.8	2.669	0.7%
2	575.9	918.6	916.0	2.668	0.8%
3	581.7	928.4	925.9	2.666	0.7%
4	576.6	919.8	917.2	2.668	0.8%
5	579.3	924.4	922.0	2.667	0.7%
6	583.0	930.3	927.9	2.667	0.7%
<b>Mean and STD</b>				<b>2.667 ± 0.001</b>	<b>0.7 ± 0.03 %</b>

Notes:

Grancia, 22.02.2017 General Manager: Dott. M. Di Tommaso

Settore IMM: prove su pietre naturali

(Procedura interna: PN-10)





Standard: EN 12407

## PETROGRAPHIC ANALYSIS

<b>Client:</b>	Elio Sangiorgio SA Industria del granito		
<b>Project:</b>	Natural stone testing - Gneiss di Lodrino		
<b>Product:</b>	Slabs of natural stone for floors and stairs - SN EN 12058		
<b>Quarry:</b>	Cava Elio Sangiorgio SA		
<b>Name of the stone:</b>	Gneiss di Lodrino		
<b>EN 12440 denomination:</b>	LODRINOGRANIT		
<b>Sampling:</b>	Carried out by the client	<b>Date of testing:</b>	19.02.2017
<b>Delivery:</b>	Carried out by the client	<b>Operator:</b>	Dott. Geol. B. Cecchin

### 1. Macroscopic description of the handsample

General description	White-black, medium-to-fine grained rock, characterized by moderate schistosity due to the preferential orientation of mica plates. Texture is typical of gneiss characterized by a granoblastic matrix made of feldspars and quartz crystals combined with numerous thin and discontinuous layers of biotite with minor muscovite.
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### 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 texture of the rock is typical of gneiss characterized by a granoblastic matrix made of prismatic, crystals of K-feldspar, plagioclase and quartz of different grain sizes and thin, discontinuous and slightly wavy layers made of biotite with minor muscovite.
Microfractures:	Not present.

#### 2.2 Mineralogical composition, grain size and microstructure

General description	The rock is mainly composed of the following minerals: K-feldspar (~ 50%), plagioclase (~ 20%), and quartz (~ 12%). Feldspars are easily recognized by the typical sub-idiomorphic prismatic grain shape and by the twinning. Quartz grains are usually found in interstitial positions and are characterized by irregular shape, lobed edges and undulose extinction. Biotite crystals (~ 15%) shows strong pleochroism (brown), muscovite flakes (~ 3%), clear at PPL, and are characterized by bright interference colors. Rare accessory minerals are also present.
Weathering degree of the thin section	Fresh, not weathered

#### 2.3 Definizione petrografica proposta

Proposed petrographic definition	Protolite: igneous rock Facies: greenschists Rock name: <b>orthogneiss</b>
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Standard: EN 12407

## PETROGRAPHIC ANALYSIS

**Client:** Elio Sangiorgio SA Industria del granito  
**Project:** Natural stone testing - Gneiss di Lodrino  
**Product:** Slabs of natural stone for floors and stairs - SN EN 12058  
**Quarry:** Gneiss di Lodrino

### Image A

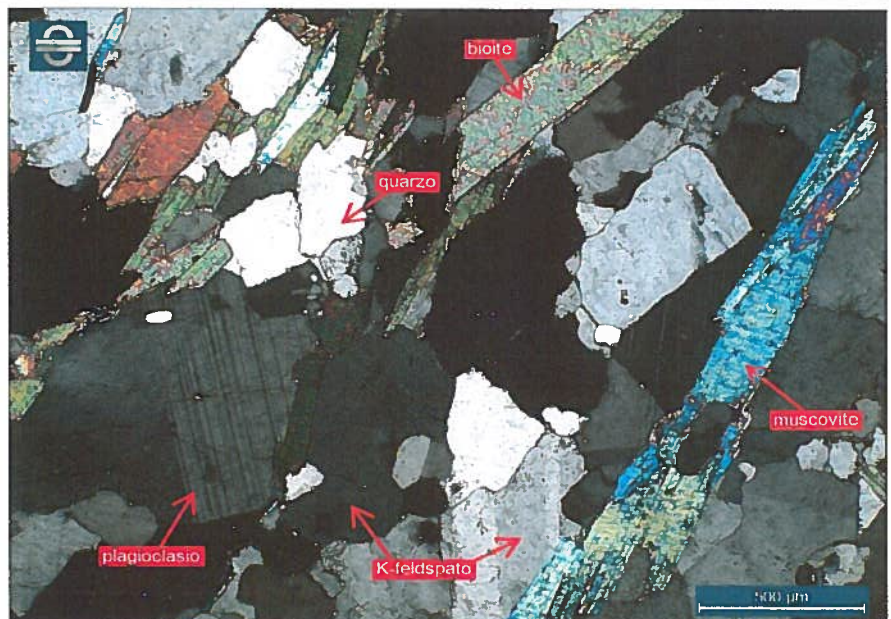
The image shows the gneissic texture of the rock characterized by a granoblastic matrix made of subidiomorphic, prismatic crystals of K-feldspar and plagioclase, accompanied by minor quartz. Quartz is recognizable by the irregular shape, typically lobed edges, and undulose extinction. Plagioclase is characterized by frequent polysynthetic twinning. In K-feldspar crystals are sometimes visible small perthite lamellae and in some cases also simple twinning. Rock schistosity is due to the presence of mica flakes of biotite and muscovite.



Magnification: 25x Illumination: PPL

### Image B

In the higher magnification image is possible to observe the main minerals of the rock sample. The most part of the image is occupied by prismatic K-feldspar grains. Plagioclase crystals can be distinguished from them thanks to polysynthetic twinning. Quartz is characterized by the irregular, lobed edges, and undulose extinction. Mica flakes are characterized by high-order interference colors: pink-green for biotite (on the left top side), light blue for muscovite (right side).



Magnification: 40x Illumination: PPL

Grancia, 22.02.2017 General Manager: Dott. M. Di Tommaso

IMM section: physical and mechanical testing on rocks

(Method statement: RO-10)

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