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Soapstone Catalogue of the Linnajavri Area,  
Hamarøy Municipality, Nordland County

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Tittel: Soapstone Catalogue of the Linnajavri Area, Hamarøy Municipality, Nordland County				
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Fylke: Nordland		Kommune: Hamarøy		
Kartblad (M=1:250.000) Sulitjelma		Kartbladnr. og -navn (M=1:50.000) 2230.3 Linnajavri		
Forekomstens navn og koordinater: 23 deposits		Sidetall: 65	Pris: Kr. 335,-	
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Sammendrag:				
<p>A very short background information and description of the soapstone deposits in the Linnajavri area are presented. The main focus is to present a catalogue for the soapstone types by photos and scanned slabs. The intension is to inform dimension stone companies of a possible future resource.</p> <p>The conclusion is: <i>In the bodies of soapstone in the Linnajavri area several types of soapstone are located, with different texture and decorative structures. Most of the reserves of soapstone are grey to light grey in color.</i></p>				
Emneord: Dimension Stone	Soapstone		Soapstone catalogue	

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<b><u>Deposit</u></b>	<b><u>No.</u></b>	<b><u>Slab number</u></b>	
<b><u>Northern area:</u></b>			
Boarta	1	B3-02	12
Klebervann	3	9-01, 11-01, 11-01	13-15
Njaskas 985	3	NV2-02, NV1-02, NV1-02	16-18
Kvitfjell NV	3	H1-00, B41-05, B42-05	19-21
Kvitfjell SØ	2	13-01, KV-02	22-23
Cohkul	2	Ck-02, Ck-02	24-25
Kleberlia	3	17-01, 15-01, 17-01	26-28
Helikoptergangen	2	H3-00, H4-00	29-30
Grensegangen	1	G-02	31
<b><u>Southern area:</u></b>			
Kleberflåget	4	8-01, 6-01, 7-01, B40-05	32-35
Vakkerdalen	2	B35-05, B34-05	36-37
Hatten	2	B32-05, B33-05	38-39
Klebergryta nedre	3	02-01, 04-01, 03-01	40-42
Klebergryta øvre	3	01-01, B30-05, B28-05	43-45
Nåva	1	B29-05	46
Kleberbotn	3	B26-05, B24-05, B25-05	47-49
Kleberbreen	2	B21-05, B23-05	50-51
Rido 1248	3	B17-05, B18-05, B19-05	52-54
Rido 1192 V	2	B15-05, B15-05	55-56
Rido 1192Ø	3	B7-05, B8-05, B8-05	57-59
Langkleberen	2	B13-05, B14-05	60-61
Langkleberdalen	2	B3-05, B5-05	62-63
Bananvann S	2	B1-05, B1-05	64-65

**Enclosure:**

Location map for the soapstone deposits

## **Introduction**

The Linnajavri Area is located in the Hamarøy Municipality in Nordland County, close to the Swedish border. From the end of the road, constructed when building the hydroelectric power plant of Kobbelv, to the center of the soapstone field, the distance is 12 km. The distance from Reinoksvatn to Kobbvassgrenda is 20 km. The distance from Kobbvassgrenda to E6 is 3 km and from E6 junction along E6 to the sea harbor at Elvkroken is 6 km

A location map is given in Fig. 1.

The Linnajavri area and the valley of Gjerdalen is owned by the Government and managed by Statskog (State Land and Forest Managing Organization). For exploitation of mineral resources an agreement with Statskog has to be established. The local administrations in Hamarøy and Sørfold Municipalities are positive towards exploitation of the deposits, and are working to designate this area for mineral extraction in their local areal management plans.

Results from our work in the Linnajavri area have been published in a number of reports given in the list of references. The soapstone types for dimension stone has been presented in various meetings, such as our previous project PNASTNA (Promotion of Natural Stone deposits In the Northern Areas). This report presents a comprehensive inventory of the various types of potential soapstone deposits in the Linnajavri area. This report is also available on the web. This data from the area are so far presented as a part of the NIBA (Natural stone In Botnia Atlantica) project.

## **Discovery and recognition of the deposits.**

Strong arguments to visit the Linnajavri area in Hamarøy Municipality was initiated by Lars Petter Nilsson and Ingvar Lindahl in 1999/2000, and the first visit in late fall 2000 led to the discovery of significant volumes of soapstone in the area. In 2001 and 2002 a detailed geological mapping of the numerous ultramafic bodies with their soapstone deposits was carried out. The major bodies of soapstone were sampled for talc flotation and slabs sawed out for evaluation of soapstone types. The general geology of the area hosting the soapstone deposits has also been mapped out and reveals an uncommonly interesting geology from a scientific viewpoint (Lindahl & Nilsson 2008, Nilsson & Lindahl 2010a,b): the strongly dismembered ophiolite hosting the soapstone deposits is also hosting komatiites and other uncommonly occurring rocks in ophiolites.

The soapstone is sampled for dressing (30-80 kg samples) and slabs (10-30 kg), the latter for evaluating the quality for dimension stone. In general the soapstone is very little weathered, only half a centimeter of the carbonates and very little weathering of the talc. However, some weak, yellowish brown weathering of the carbonates can sometimes be found down to 10 cm. The samples are taken by chain saw and surface weathering is removed from the samples for dressing. Samples for geochemistry have been collected by hammer or hammer drilling down to 50 cm, collecting the dust.

The estimation of the reserves is based on the detailed geological mapping of each body of ultramafic rocks; structure geology of wall rocks of the ultramafics and detail local geology. It has been possible to map the reserves quite accurately because of exceptionally good outcrops. The area is mapped in scale 1:5 000 and the ultramafic rocks in even larger scale. For some of the deposits the outcropping area of soapstone was mapped with laser

measurements. No drilling has been undertaken. The reserves are estimated conservatively down to a depth of a few tens of metres. The resources of each deposit are estimated. In total ca. 100 mill. tons are located in 17 different soapstone bodies, each larger than 1 mill. tons. In addition some bodies with reserves smaller than 1 mill. tons is well suited for dimension stone quarrying. The largest single deposit is the Kleberflåget deposit containing 50 million tons on the Norwegian side of the border, with an additional 20 million tons in the same body on the Swedish side.

The highest potential for additional resources is in the Southern Area with a series of ultramafics on a distinct geological level in the shallow open synform at Ridoalgiokkka, with a low angle fold axis towards east.

The soapstone quality of the in each deposit is evaluated by mineralogy and geochemistry. Mineralogical investigations have been done by polished thin sections and SEM-analyses, digital image analyses and semi-quantitative XRD-analyses. Additional MLA-analyses (mineral liberation analyser), an advanced mode analysing method, have been carried out by GTK in Outokumpu, Finland. Whole rock geochemistry and trace element chemistry have been carried out on the samples. Mineralogical characterization has been done, aimed at exploitation of the soapstone for talc flotation and for dimension stone. The mineralogical and geochemical data are also of value evaluating the quality of the soapstone as dimension stone.

*In conclusion: Huge soapstone resources of national importance are proven in the Linnajavri area. The resources may have potential for utilization as dimension stone and for flotation of talc.*

## **The soapstone types**

The name *soapstone* includes a number of rock types, used for a *soft rock*. Most of the soapstones exploited are fine to medium grained talc-chlorite rocks, with varying amounts of amphibole and serpentine and minor amounts of carbonates. Some of the soapstones with high carbonate and talc are named talc-carbonate rocks. A more specific nomenclature should be developed.

The soapstones of the Linnajavri area are a product of alteration of ultramafic magmatic rocks. The primary rock was a peridotite: lherzolite, wehrlite, harzburgite and dunite. Prior to the soapstone alteration process, these rocks were partly altered to serpentinite. The soapstone alteration fronts can be seen developing as sharp fronts into all these rock types. At one locality, at Klebergryta Øvre, it can be seen an example of stepwise alteration from dunite to serpentinite to soapstone.

The soapstones of the Linnajavri area contain in average 40-50 % talc. The major minerals in addition to talc, are magnesite+dolomite, and locally the amount of chlorite is up to 20 %. The soapstone has 2-4 % magnetite, very seldom sulfides. Extensive tests carried out reveal no asbestos minerals. The grain size, structure and color vary within and between deposits. The grain size varies from fine- to coarse grained. The coarse grained soapstone show cm-large carbonate crystals with talc as matrix mineral. Several types of structure and texture are found in different scales, decorative for the soapstone as dimension stone. Some places the primary magmatic texture is inherited in the soapstone and some places a foliation and banding is

found (see figures). Only at a few localities the soapstone is so sheared that the technical quality is poor.

The dominating color of the Linnajavri soapstones is light grey to medium grey. This may be seen on slabs and on weathered outcrops, meaning that this color will be the permanent color of the dimension stone from the area. The fine-grained types may be used for more detailed ornaments, while the coarse-grained has its use as slabs and ovens.

Locally the soapstones may have a greenish tint, mainly along Vakkerdalen in the Linnajavri Southern Area. The structure and texture of the greenish soapstone is similar to the grayish one. In a few of the deposits also a fine-grained soapstone type, with bluish tint with carbonate veining with considerable volumes are found, like in the deposits of Kleberflåget and Gryta Nedre. Also a fine grained green soapstone with considerable volume are found as a part of the Rido 1248 deposit, a bit similar to the type used in the medieval Nidarosdomen cathedral, not so far examined in detail.

*In conclusion: In the bodies of soapstone in the Linnajavri area several types of soapstone are located, with different textures and decorative structures. Most of the reserves of soapstone are grey to light grey in color.*

**Fact sheet for the Linnajavri soapstone deposits**

Deposit	Estimated size Mill. tons	Altitude m a. s. l.	Accessibility exploitation	Distance from road (km)	Grain size	Color	Structure	Field- and compositional characteristics with additional comments
								abbreviations: ultramafic/ultramafite (um); serpentinite (serp); soapstone (soapst); talc (tlc); chlorite (chl); carbonates (carb)
<b>North (9)</b>								
Boarta	0,5	840	good	6	medium	light grey	massive	Soapstone-altered um body with a thin serp lid on top, carbonate-rich rock, low in chlorite: on average 50 - 55 % talc, c. 5 % chl and c. 40 % carbonates
Klebervann	1,7	880	good	8	coarse	light grey	banded	Elongated um body conformably located in its host melange zone, um body totally altered to carbonate-rich soapst on average c. 45 % talc, c. 13 % chl and c. 40 % carbonates (n = 7 samples)
Njaskas 985	0,5	860	difficult	9	medium	grey-green	massive	W end of an um lens showing layered cumulate rocks repr. fragment of lower oceanic crust, hence altered to soapst of sign. varying composit. in-situ: expect. talc-rich dunite-derived soapst alternating with amph/chl-rich wehrlite-derived soapst
Kvitfjell NV	2,9	780	ok	9	coarse	light grey	mass/band	Partly tlc-rich (estim. up to 57 % talc), partly carb-rich (up to 45 % carb) and partly very chl-poor (< 2 % chl) soapst, some serp fragments occurring in the deposit, average composition: c. 50 - 55 % talc, < 2 - 15 % chl and 30 - 45 % carb
Kvitfjell SØ	1,0	860	difficult	10	coarse	light grey	mass/band	Variabl. look., generally tlc-rich soapst: markedly pale yellowish grey where fluids from melange zone have affected the SW part of the deposit, some serp incl. in deposit, estimated average composition: 55-60 % talc, c. 5 % chl and 35 - 40 % carb
Øhokul	6,0	900	bad	11	coarse	grey	mass/band	Large flat lying lens (80 x 400 m) repr. outcropping part of a hidden large and roughly circular um body (diam. c. 1 km) interpret. from airborne magn. Large underground potential of tlc-rich (expect. c. 50 - 55 % talc), chl-poor (< 10 % chl) soapst
Kleberlia	1,3	800	good	13	medium	grey/green	massive	SW part of um lens, on the whole talc-rich and locally very talc-rich with up to 80 % talc and only 10 % carb, located close to neighboring Helikoptergangen deposit. On average c. 55 - 60 % talc, 5 - 10 % chl and 30 - 35 % carb
Helikoptergangen	0,4	800	good	13	coarse	grey	massive	Generally talc-rich soapstone, deposit intersecting soapstone altered breccia zone close to Kleberlia, on average c. 45 - 55 % talc, c. 10 % chl and 30 - 40 % carb
Grensegangen	1,5	740	ok	14	medium	grey	massive	Dep. intersect. soapst altered breccia zone close to the Swedish border, dep. partly on Sw side, large and spectacular serp inclusions on NW side, very tlc-rich and carb-poor soapst, estim. c. 65 - 70 % talc, c. 10 % chl and 20 % carb in large sample),
<b>South (14)</b>								
Kleberflåget	50,0	800	good	15	fine-coarse	grey/green	mass/band	Extraordinary large deposit, loc. on both sides of the Norw-Sw frontier, remn. of thin serp capping on top, minor parts of dep. alt. to listwaenite, dep. generally chl-rich (estim/calcul. 15 - 30 % chl, 45 - 50 % talc and 25 - 30 % carbonates)
Vakkerdalen	3,0	820	ok	14	medium	greenish	massive	Soapstone enveloping serp + Al-Ti rich peridotite, soapst generally carbonate-poor and both chlorite- and talc-rich: estim/calcul. c. 15 - 25 % carb, c. 20 - 30 % chl and c. 45 - 60 % talc
Hatten	2,0	860	ok	14	coarse	grey/green	massive	Soapstone enveloping serp, soapst generally carbonate-poor and chlorite-rich, locally very chlorite-rich: calculated mineral content in sample of most chl-rich variety: < 20 % carb, c. 40 % chl and c. 40 % talc
Klebergryta Nedre	2,5	900	ok	14	med-fine	grey/green	mass/band	Soapstone enveloping serp + per, soapst generally chlorite-rich, locally uncommonly chl-rich: on average estim/calculated c. 30 - 35 % carb, c. 20 - 25 % chl and c. 45 % talc, in the extreme up to c. 45 % chl, c. 35 % talc and c. 15 % carbonates
Klebergryta Øvre	8,0	960	difficult	14	med/coarse	grey	massive	Complex alteration pattern with serpentinite bodies in soapstone, partly carbonate-rich soapstone and partly chlorite-rich soapstone, both with talc-contents about 40 - 45 %
Nåva	1,0	950	bad	14	medium	light grey	mass/band	Ordinary soapstone (c. 45 % talc, c. 15 % chl and 35 % carbonates) mainly for underground mining due to very steep topography
Kleberbotn	0,2	920	good	13	fine-coarse	grey	mass/band	Small um lens totally altered to soapst of two distinctly diff. types: the core of the body consists of mt + chl + tlc-rich soapst nearly without carbonates ("blue soapst") whereas the outer zone consists of carbonate-rich, chl-poor pale silky soapst
Kleberbreen	7,0	1040	bad	13	coarse-med	grey	mass/band	Intersecting soapstone altered breccia zone partly covered by glacier, abundant pale yellowish dunite-derived talc-rich soapstone with c. 40 - 55 % talc, c. 15 - 20 % chl and c. 25 - 35 % carbonates
Rido 1248	10,0	1180	good	14	coarse-fine	l.grey/green	massive	Large deposit totally altered to soapst, partly covered by glacier, including distinct sub-deposits "Raskleberen" and "Nesten-kleberen". The locally talc-rich soapst holds on average c. 40 - 55 % talc, c. 15 - 25 % chl and c. 25 - 35 % carbonates
Ridi 1192 V	1,5	1140	good	14	medium	grey	massive	Western part of an ultramafic lens in the eastern continuation of the Rido 1248 deposit, relatively talc-rich soapst with c. 50 % talc, 15 % chl and c. 30 % carbonates
Rido 1192 Ø	2,5	1130	good	14	coarse-med	grey/greenish	massive	Eastern part of ultramafic lens close to neighboring Langkleberdalen deposit, abundant chl-rich and carb-poor soapst with c. 45 - 50 % talc, 30 - 35 % chl and 15 - 20 % carb
Langkleberen	7,0	1120	good	15	coarse-med	grey	massive	Elongated 1.5 km long deposit totally altered to soapst, compositional data are regrettably so far completely lacking
Langkleberdalen	2,5	1120	good	14	coarse-med	grey	mass/band	Soapst enveloping two um lenses. Located close to Rido 1192 Ø, significantly varying comp. of soapst: c. 35 - 50 % talc, 15 - 45 % chl and 15 - 40 % carb, the most chl-rich members are also the most tlc-poor and especially carb-poor ones
Bananvann S	4,0	1110	ok	15	medium	grey/green	mass/band	Complex alteration pattern with serp fragments in the soapst, significantly varying comp. of soapst: c. 45 - 50 % talc, 15 - 45 % chl and 5 - 30 % carb, the most chl-rich members are also the most carbonate-poor ones

## Litterature

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Nilsson, L. P. & Lindahl, I. 2010b: Geologisk ressurs og akademisk godbit. GEO 7/2010, 10-14.



Fig. 1: Location map of the Linnajavri area.

Figures 2-55: Scanning and photos of the soapstone types



Boarta (B3-02)

0 5 cm



Klebervann (9-01)

0 5 cm



Klebervann (11-01)

0 5 cm



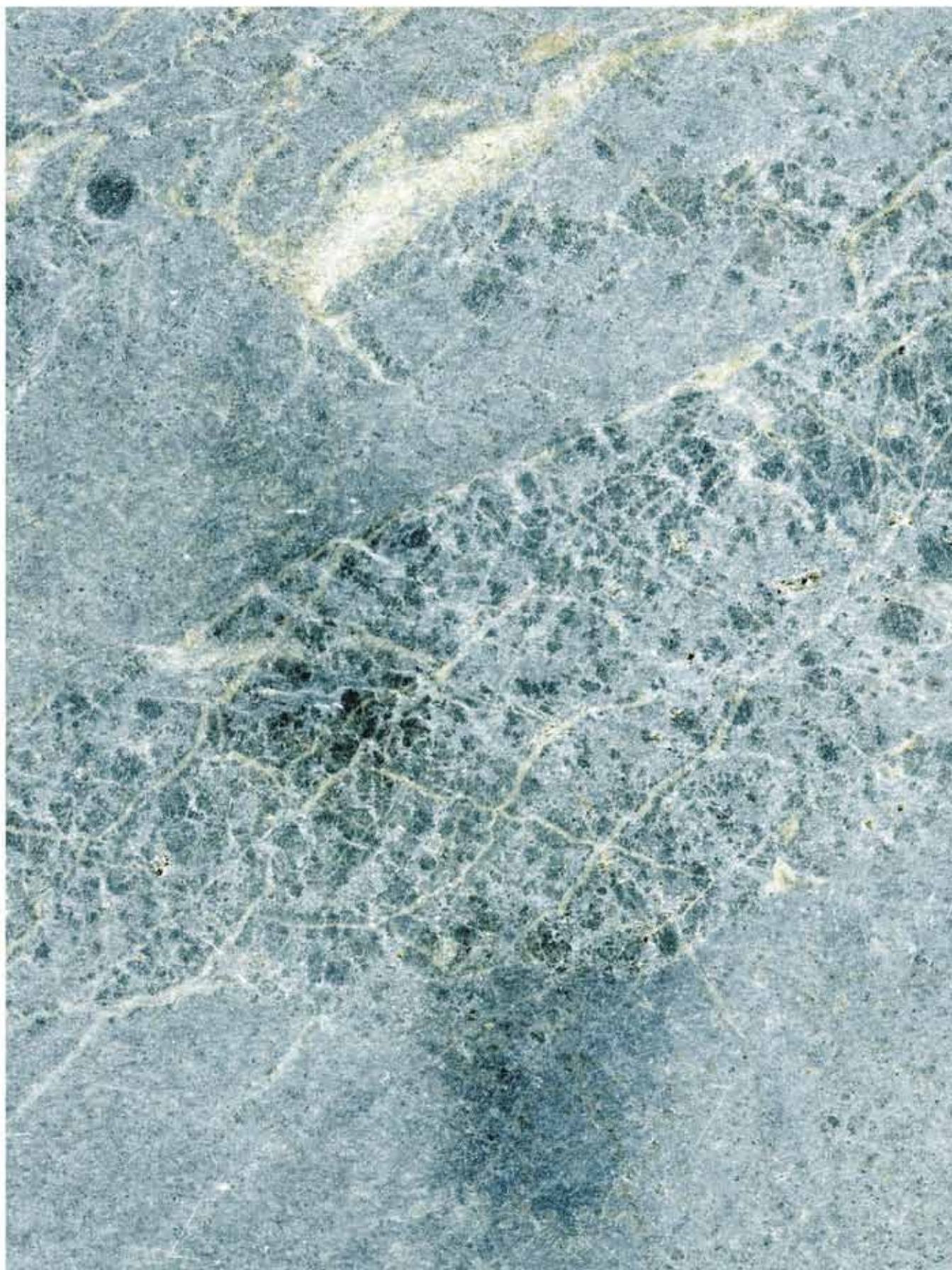
Klebervann (11-01)



Njaskas 985 (NV2-02)



0 5 cm



Njaskas 985 (NV1-02)



Njaskas 985 (NV1-02)

0

5 cm



Kvitfjell NV (H1-00)



Kvitfjell NV (B41-05)



Kvittfjell NV (B42-05)

0 5 cm



Kvitfjell SØ (13-01)



Kvitfjell SØ (KV-02)

0

5 cm



Cohkul (Ck-02)





Cohkul (Ck-02)

0 5 cm



Kleberlia (17-01)

0

5 cm



Kleberlia (15-01)



Kleberlia (17-01)

0

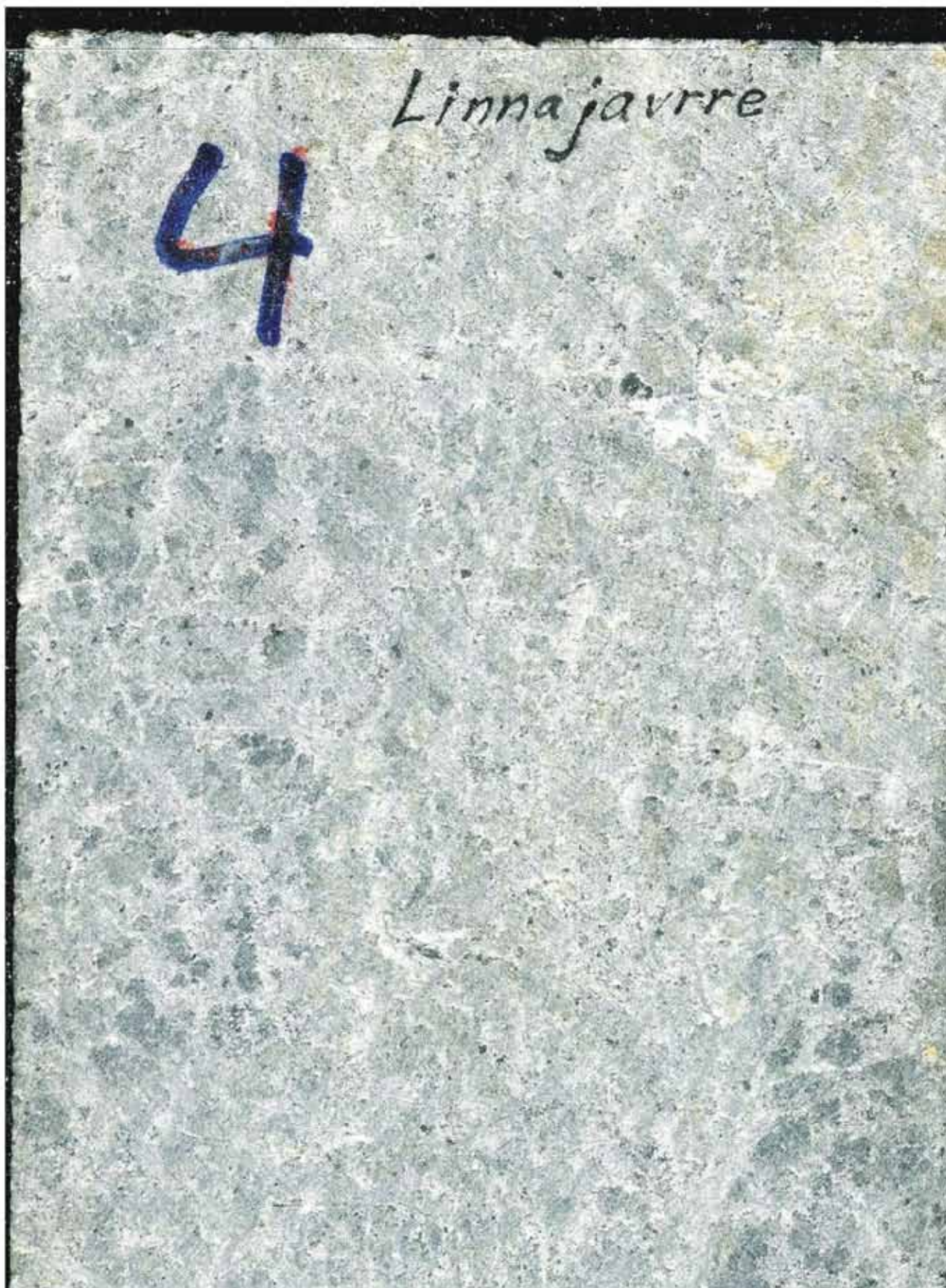
5 cm



Helikoptergangen (H3-00)

0

5 cm



Helikoptergangen (H4-00)



Grensegangen (G-02)

0 5 cm



Kleberflåget (8-01)



0 5 cm



Kleberflåget (6-01)

0

5 cm



Kleberflåget (7-01)



Kleberflåget (B40-05)



Vakkerdalen (B35-05)



Vakkerdalen (B34-05)



Hatten (B32-05)



Hatten (B33-05)

0 5 cm



Klebergryta nedre (02-01)



0

5 cm



Klebergryta nedre (04-01)

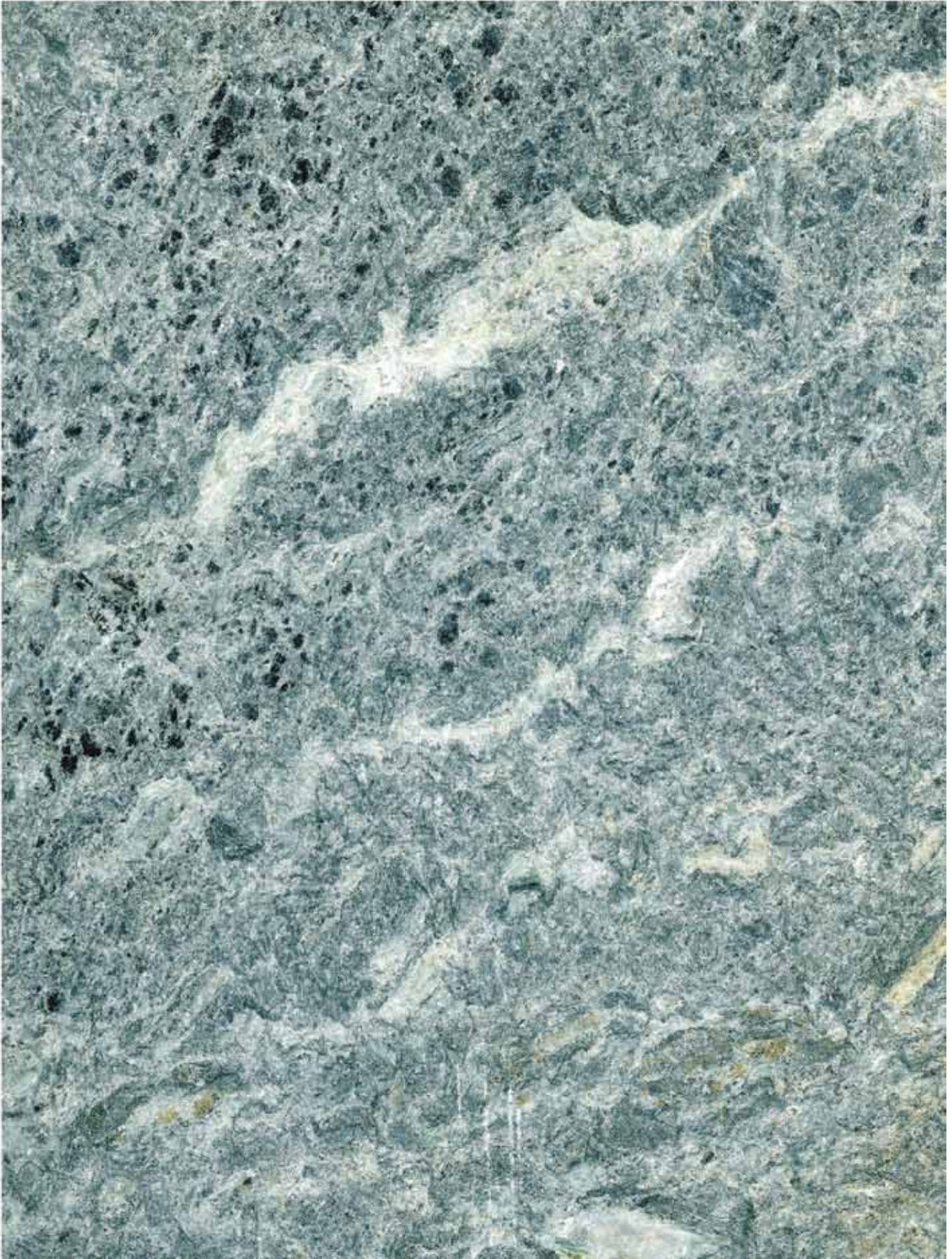
0

5 cm



Klebergryta nedre (03-01)

0 5 cm



Klebergryta øvre (01-01)



Klebergryta øvre (B30-05)



Klebergryta øvre (B28-05)



Nåva (B29-05)



Kleberbotn (B26-05)



Kleberbotn (B24-05)

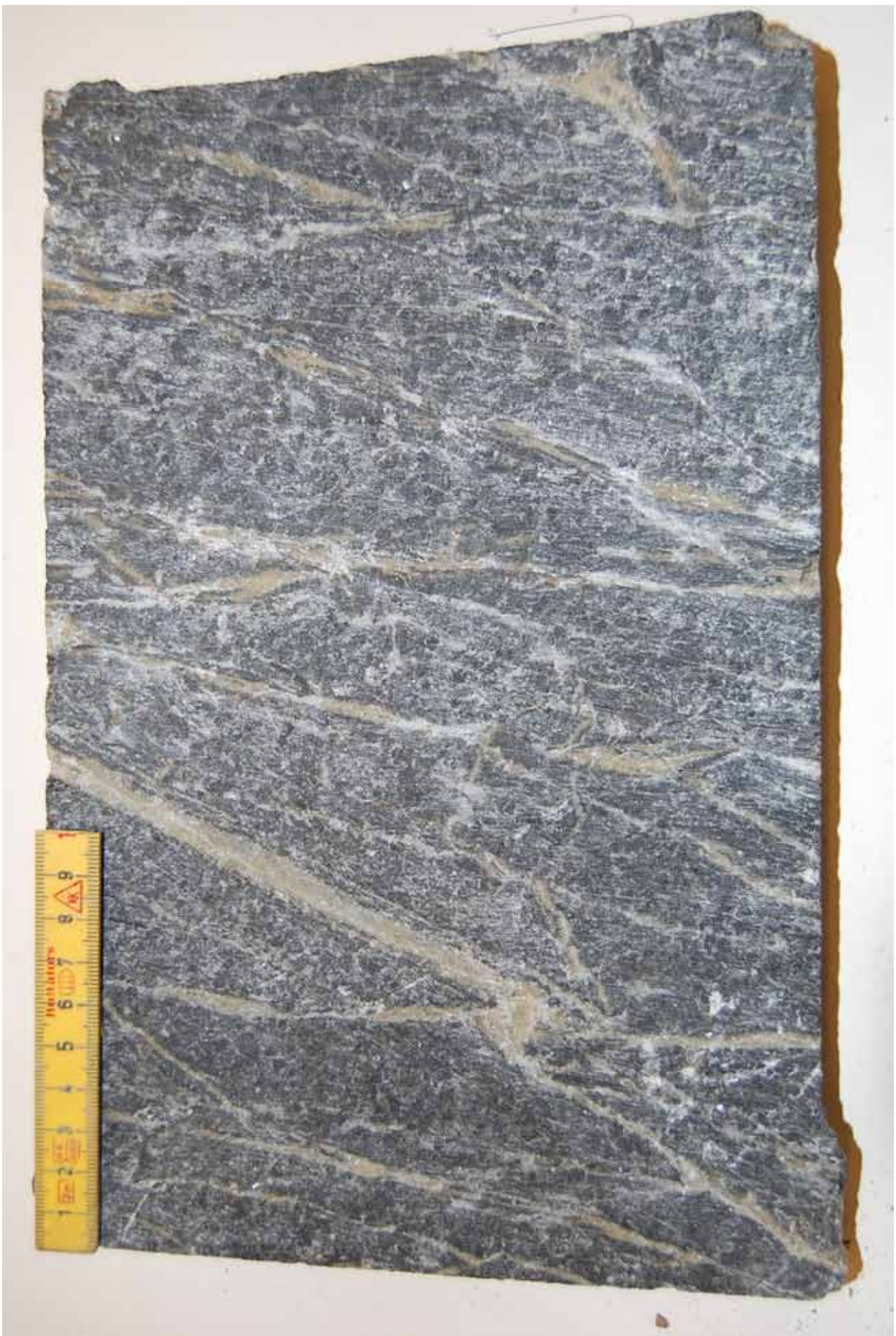




Kleberbotn (B25-05)



Kleberbreen (B21-05)



Kleberbreen (B23-05)



Rido 1248 (B17-05)



Rido 1248 (B18-05)



Rido 1248 (B19-05)



Rido 1192V (B15-05)



Rido 1192V (B15-05)





Rido 1192Ø (B7-05)



Rido 1192Ø (B8-05)



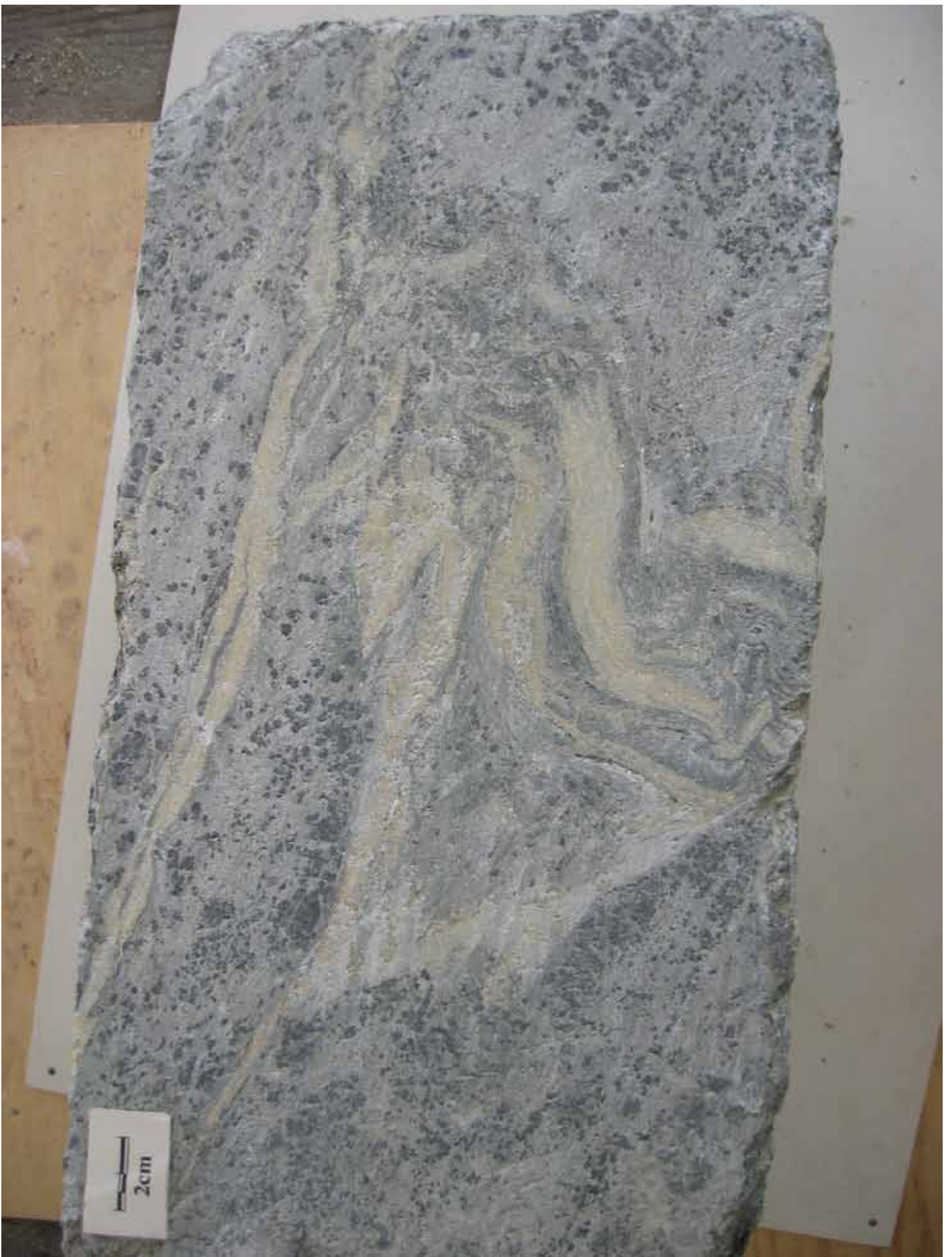
Rido 1192Ø (B8-05)



Langkleberen (B13-05)



Langkleberen (B14-05)



Langkleberdalen (B3-05)



Langleberdalen (B5-05)

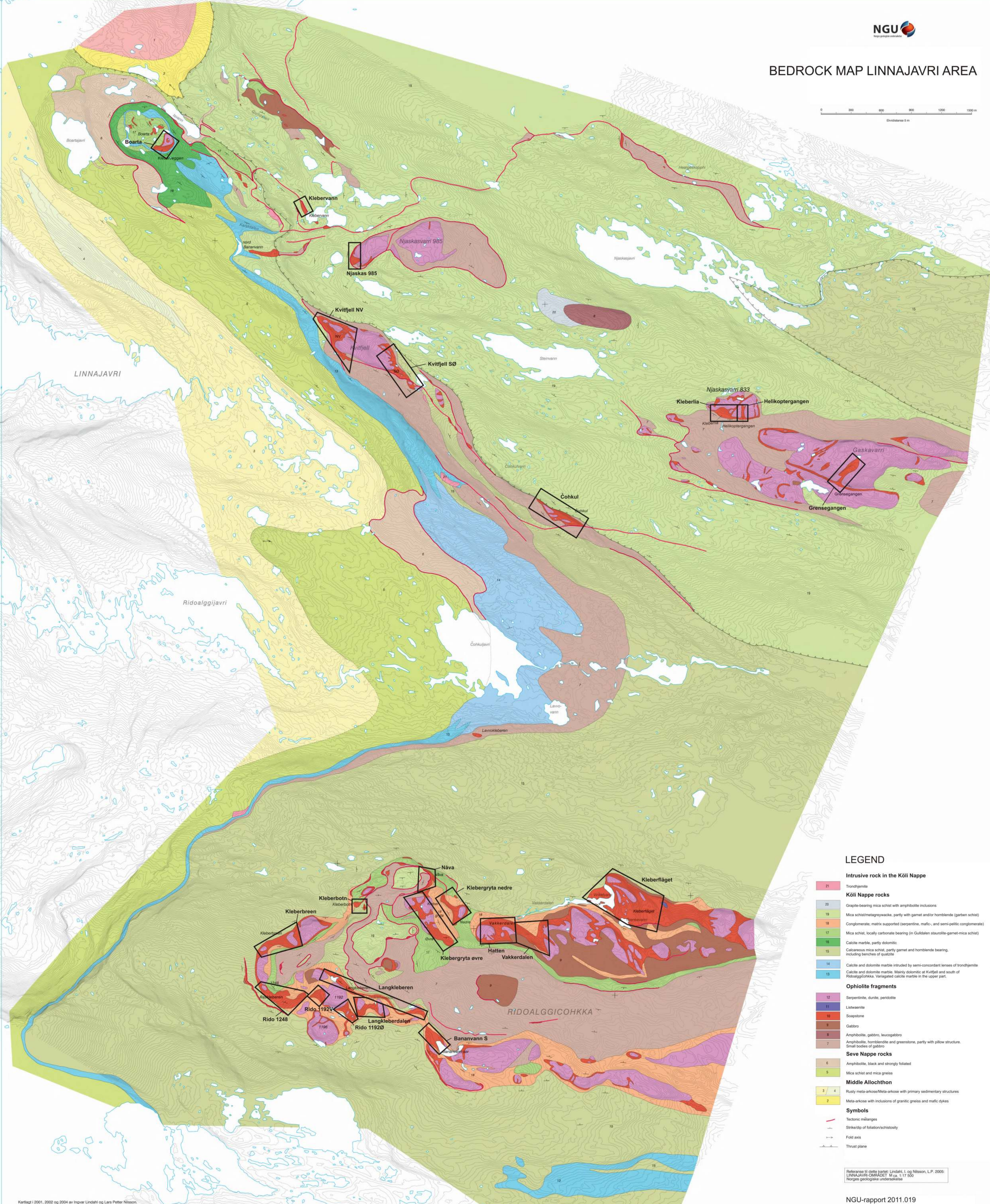


Bananvann S (B1-05)





Bananvann S (B1-05)



**LEGEND**

- Intrusive rock in the Kõli Nappe**
- 21 Trondhjemite
- Kõli Nappe rocks**
- 20 Graphite-bearing mica schist with amphibolite inclusions
- 19 Mica schist/metagreywacke, partly with garnet and/or hornblende (garben schist)
- 18 Conglomerate, matrix supported (serpentine, mafic-, and semi-pelitic conglomerate)
- 17 Mica schist, locally carbonate bearing (in Guldalen staurolite-garnet-mica schist)
- 16 Calcite marble, partly dolomitic
- 15 Calcareous mica schist, partly garnet and hornblende bearing, including benches of quartzite
- 14 Calcite and dolomite marble intruded by semi-concordant lenses of trondhjemite
- 13 Calcite and dolomite marble. Mainly dolomitic at Kvitfjell and south of Ridoalggihokka. Variegated calcite marble in the upper part.
- Ophiolite fragments**
- 12 Serpentine, dunite, peridotite
- 11 Listwaenite
- 10 Soapstone
- 9 Gabbro
- 8 Amphibolite, gabbro, leucogabbro
- 7 Amphibolite, hornblende and greenstone, partly with pillow structure. Small bodies of gabbro
- Seve Nappe rocks**
- 6 Amphibolite, black and strongly foliated
- 5 Mica schist and mica gneiss
- Middle Allochthon**
- 3/4 Rusty meta-arkose/Meta-arkose with primary sedimentary structures
- 2 Meta-arkose with inclusions of granitic gneiss and mafic dykes
- Symbols**
- Tectonic midlines
- Strike/dip of foliation/schistosity
- Fold axis
- Thrust plane

Referanse til dette kartet: Lindahl, I. og Nilsson, L.P. 2005: LINNAJAVRI-OMRÅDET. M ca. 1:17 500 Norges geologiske undersøkelse