

Introduction

This report contains our field data from the rivers Severnaya Dvina and Vaga in the Arkhangelsk region, NW Russia collected during the period 02.06 -01.07 2008. The report purposes to provide the other field-participants with our field data and is a documentation of our contribution to the GlaciPet and SciencePub -projects field-work in 2008. As we worked together as a group the whole period, the descriptions from the sites given by Maria Jensen, Denis Kuznetsov, Hilde Krogh, Aurelian Van Welden and Valery Shebotinov must be considered to get the complete descriptions and evaluations of the investigated sites.

The main objectives of the field-work were to study glaciolacustrine and fluvial sediments distal and proximal to the ice limit of the last glaciations, as well as glacial sediments inside the ice limit boundary.

Directional measurements in the report are not corrected for deviation from true north.

Trondheim 12.05.2010

Astrid Lyså

Eiliv Larsen

Participants

Geologists:

Eiliv Larsen (project leader), Geological Survey of Norway, Trondheim

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Aurelian van Welden, Geological Survey of Norway, Trondheim

Maria Jensen, University of Svalbard

Denis Kuznetsov, Hertzen University, St. Petersburg

Dmitri Subetto, Hertzen University, St. Petersburg

Valery Shebotinov (PhD student), Hertzen University, St. Petersburg

Other:

Gudmund Løvø (journalist) Geological Survey of Norway, Trondheim

Hilde Krogh (Master student in geology), University of Tromsø

Susanne Lund Johansen (journalist student), Oslo University College

Liv Sofie Utvær (high school student) Fyllinsdalen videregående skole, Bergen

Ingrid Eidsvaag (high school student) Bergen Katedralskole

Support personnel:

Evgenij Vyatkin (driver/boatman from Kotlas)

Evgenij Vyatkin jr. (dagdriver from Kotlas)

Valery Sobolev (driver/boatman from Shenkursk)

Vitali Ivanov (driver/boatman from Shenkursk)

Valery Shebotinov (driver from Arkhangelsk)

Alexej (field assistant from St. Petersburg)

Field work in Russia 2008 - overview

020608: Departure from Trondheim, Værnes 06:45. Arrival St. Petersburg 13:30. Dmitry A. Subetto and Denis Kuznetsov met us in the airport. Accommodation hotel Azimuth.

030608: St. Petersburg

040608: St. Petersburg.

050608: Departure from St. Petersburg by train to Kotlas (07:40)

060608: Arrival Kotlas at 9:40. Do errands and meet the field assistant and drivers in Kotlas. Leave Kotlas for Tolokonka by car. At 21:00 the tent camp is arranged.

070608: Field work at Tolokonka section.

080608: Field work at Tolokonka section.

080608: Field work at Tolokonka section.

090608: Field work at Tolokonka section.

100608: Field work at Tolokonka section.

110608: Field work at Tolokonka section.

120608: Field work at Tolokonka section.

130608: Field work at Tolokonka section.

140608: Field work at Tolokonka section.

150608: Field work at Tolokonka section.

160608: Eiliv, Astrid and Maria strike their camp in the morning. Practical information about the field work and logistics are given to the rest of the group that will stay at Tolokonka until the end of the field work period. Aurelian (responsible for the team from this date), Hilde and Valery are left at Tolokonka together with the field assistant and the driver/boatman. Arrival Kotlas at 17:00. Accommodation at hotel Sovjetskaya.

170608: Errands in Kotlas. Leave Kotlas for Shenkursk by car (new driver) at 12:00. Arrival Shenkursk 22:30 where we meet Vitali. Accommodation at hotel Vaga.

180608: Meet Vitali and Valery (driver/boatman) at 11. Drive from Shenkursk 12:00 for Smotrakovka. The camp at Smotrakovka is set at c. 19:00.

190608: Field work at Smotrakovka section.

200608: Field work at Smotrakovka section.

210608: Field work at Smotrakovka section.

220608: Field work at Smotrakovka section.

230608: Strike the tent camp at Smotrakovka. Drive from the camp c. 11:30 and arrive Shenkursk at 16:30. Accommodation at hotel Vaga. Dinner in the restaurant together with Vitali and Valery and their wives.

240608: Discuss/make plans for possible future field work along the Vaga (Sev. Dvina) rivers using Vitali and Valery as boatmens. Drive from Shenkursk 11:10. Arrival Arkhangelsk 19:00. Maria has reservation at hotel Pur Navalok. No vacant hotel rooms for the rest of the group in Arkhangelsk. Farewell dinner with Maria at restaurant Bobrov. Accommodation at hotel in Maley Karely for Denis, Eiliv and Astrid. The driver leaves us at the hotel.

250608: Meet the new driver from Arkhangelsk (Valery) at 10:00. Field work at Matera section. Made agreement with a boatman for the next day. Maria leaves Russia.

260608: Field work at the Trepzovo and Psaryovo sections. We used local boat for reaching these localities.

270608: Valery drives us and all the equipments from Maley Karely to hotel Pur Navalok in Arkhangelsk. Packing and logistics. Bank errands.

280608: Errands and logistics. Farewell lunch with Denis who leaves for St. Petersburg. Start to do office work (prepare "blogs", field notes etc.).

290608: Office work, Arkhangelsk

300608: Office work, Arkhangelsk

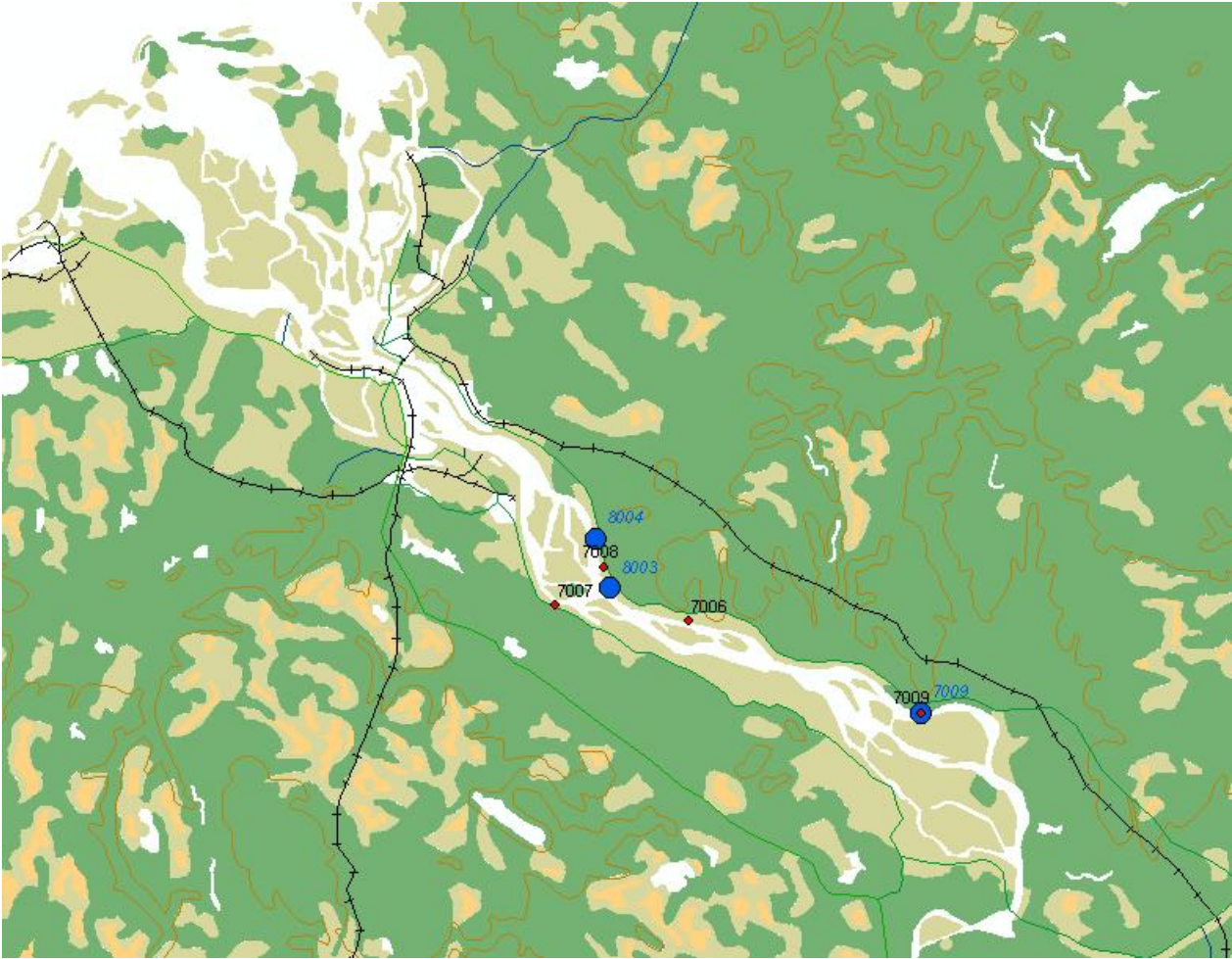
010708: Travel Arkhangelsk-Tromsø-Trondheim.

List of sites

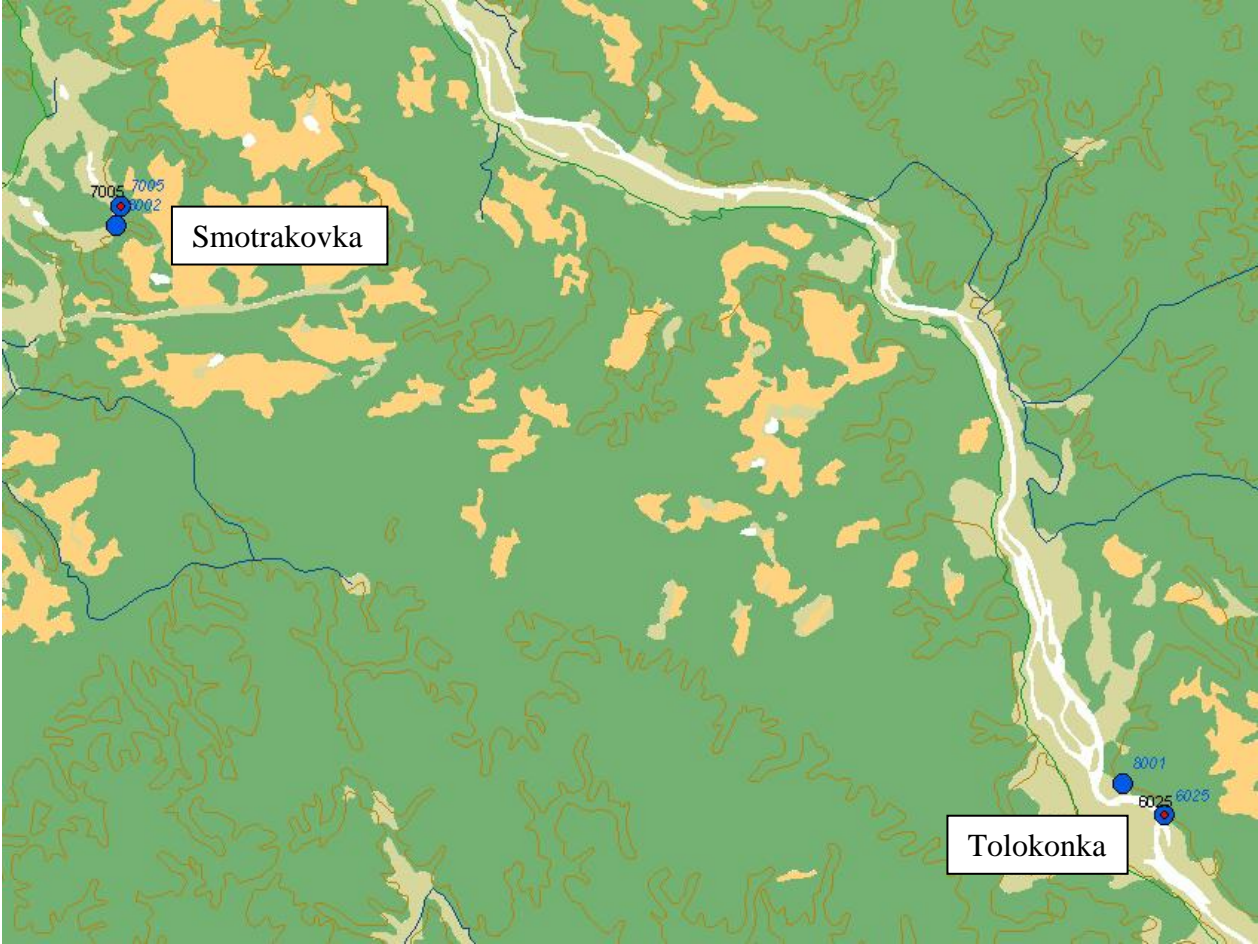
Site No	Site name	UTM	Note	Date visited
06025	Tolokonka	38W 525972 6846573		6/6-16/6
08001	Tolokonka-2	38W 520845 6849686		6/6-16/6
07005	Smotrakovka	38W 402380 6904019		18/6-23/6
08002 (9614)	Smotrakovka-2	38 W 4021769018337		18/6-23/6
07009	Matera	37W 629261 7133629		25/6
08003 (9703)	Trepyzovo	37W 598244 7139669		26/6
08004 (9702)	Psaryovo	37W 596060 7143979		26/6

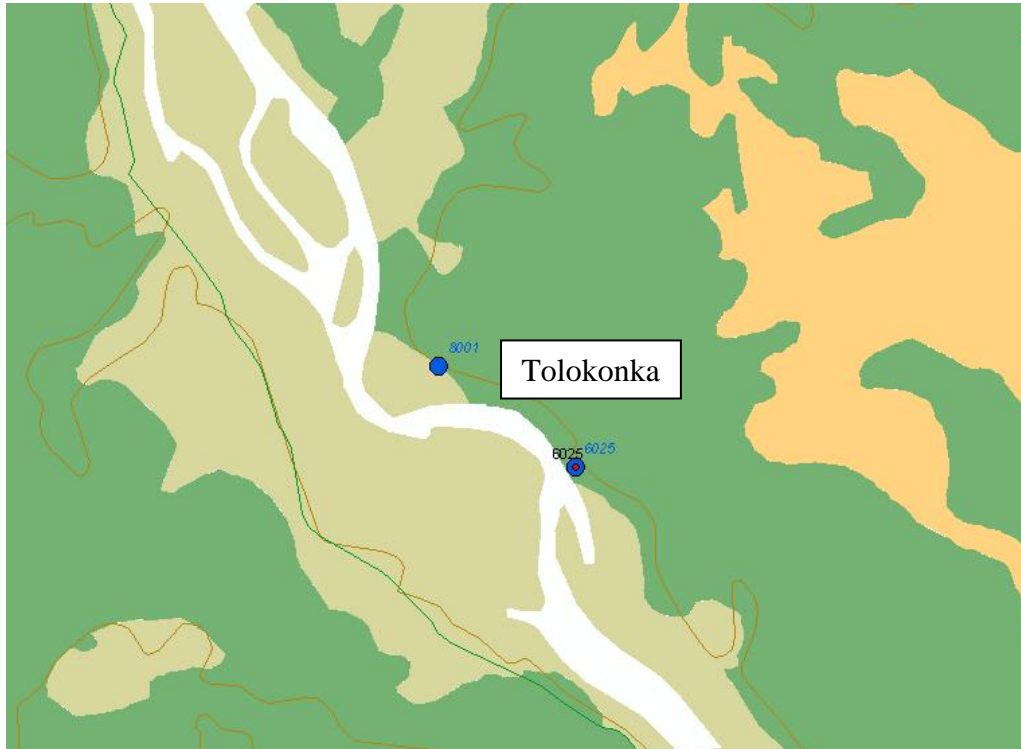
Location of investigated sites along the Severnaya Dvina and Vaga rivers, Arkhangelsk region –2008

Lower Dvina



Vaga and upper Dvina





Field notes

Monday 02.06 – Travel

Maria, Astrid, Eiliv, Gudmund, Hilde, Liv Sofie, Ingrid, Susanne

Maria, Eiliv, Gudmund and Astrid left Trondheim at 06:45 and flew to St. Petersburg via Oslo, arrival at 13:30 local time. In total we had 17 pieces of luggage (312 kg). We were allowed to bring 4x40 kg and had to pay overweight for 100 kg (NOK 2 x 4000,- as we changed plane in Oslo). In Oslo we met Hilde, Susanne, Ingrid and Liv Sofie. Denis and Dmitri met us at the airport in St. Petersburg where they had two cars. All persons and luggage were transported to the hotel Azimuth. The hotel did not accept our vouchers and there were some problems with the payment from VIA in Trondheim. We had to wait in the reception for four hours before the payment from VIA was ok (and that was only for the first night). Except for the Russians, we all had dinner at the hotel.

Tuesday 03.06 – Arkhangelsk

Maria, Astrid, Eiliv, Gudmund, Hilde, Liv Sofie, Ingrid, Susanne

In the morning, Marie stays at the hotel to help out with the communication between VIA and the hotel so that the payment for the rest of the stay get cleared. Eiliv, Astrid, Gudmund, Liv Sofie, Ingrid and Susanne meet Denis in the town in where all except Astrid and Eiliv visit Dmitri at the Herzen University. Eiliv and Astrid do bank errands before meeting Maria in the town. All meets at the restaurant "Literatura" for dinner at 19:00.

Wednesday 04.06 Arkhangelsk

Maria, Astrid, Eiliv, Gudmund, Hilde, Liv Sofie, Ingrid, Susanne, Aurelian

We meet Aurelian at the hotel in the morning. He had arrived St. Petersburg the evening before and stayed at another hotel. Eiliv gave an introduction/briefing to the project (Science Tour power-point presentation), aim and plans etc. in hotel room, before we all went out for different purposes. Eiliv, Astrid and Maria went to the summer-palace whereas the other went to the Hermitage and Zoological Museum. Eiliv, Astrid, Maria and Aurelian had dinner in the down. Before we went back to the hotel in the evening, we bought food for the train trip.

Thursday 05.06 Travel St. Petersburg-Kotlas

Maria, Astrid, Eiliv, Gudmund, Hilde, Liv Sofie, Ingrid, Susanne, Aurelian, Valery, Alexej

We leave the hotel at 06:15. (15 minutes by car to the railway station, very little traffic). Denis helps us in the morning, but goes not with us to Kotlas. At the railway station we meet Dmitri, Alexei and Aurelian. Train leaves for Kotlas at 07:40. The Russians are in a separate wagon. Unfortunately, we others are spread within one wagon. On the trip, Susanne interviews us about the science in the project, field work and general climate changes.

Friday 06.06 Travel Kotlas-Tolokonka

Maria, Astrid, Eiliv, Gudmund, Hilde, Liv Sofie, Ingrid, Susanne, Aurelian, Dmitri, Valery, Alexej

Arrive Kotlas on time 09:30. Evgeni and another driver meet us at the railway station in Kotlas. Eiliv, Astrid, Aurelian, Hilde and Alexej drive with Evgeni to Tolokonka to start putting up the camp. Evgeni has brought his boat. Big problems with that car due to water-filled channels. We have to use the boat over the channel, meaning that we have to walk with luggage and equipment to the camp sites (not fun!). Maria, Liv Sofie, Ingrid and Valery buy food whereas Dmitri, Susanne and Gudmund buy some camp equipment. At 21:00 the camp is set and supper served. Cold day and evening.

Saturday 07.06 Field-work Tolokonka

Maria, Astrid, Eiliv, Gudmund, Hilde, Liv Sofie, Ingrid, Susanne, Aurelian, Dmitri, Valery, Alexej

Cold night in the tents. The Russians slept inside the cabin. We spent some time preparing for the practical field work. As all wanted to go out to the Tolokonka section, three boat trips were necessary. Eiliv, Maria, Astrid and Susanne went with the first boat.

• Site 06025 (Tolokonka 1)

Very high water level in the river makes the section more difficult and dangerous to work in than during field work in 2007. We estimate the river level to be 1-1.5 m higher than in 2007, but the level is suggested to fall within 1-2 weeks. No "beach" exists at the water level meaning that it is problematic for so many people as we are to move around in the section. After lunch, we gave a shortly introduction to the "geology" and safety rules before we started to recognize what we did in 2007. Maria and Aurelian started in the northern part of the section.

Eiliv and Astrid found the "dm-horizon" and decided where to start working the next day. We find the "dm-horizon" at 06025-2.91 km and at 2.94 km, and then more lateral continuously towards 3.01 km.

At the end of the day we sailed along the entire section to assess the possibility and potential of the southern part of the section. It seems that the fine grained parts of the sediments are missing in that part of the section. Sand dominates. Most of the sediments have been sliding, causing it difficult to work in the southern part of the section.

Photos AL (070608)

Photo 1 Liv Sofie and Ingrid at Tolokonka
Photo 2 Susanne at Tolokonka
Photo 3 Liv Sofie and Ingrid at Tolokonka

Sunday 08.06 Field-work Tolokonka

Maria, Astrid, Eiliv, Gudmund, Hilde, Liv Sofie, Ingrid, Susanne, Aurelian, Dmitri, Valery, Alexej

Maria, Eiliv, Dmitri and Aurelian go with the first boat trip to assess the section north of 06025.

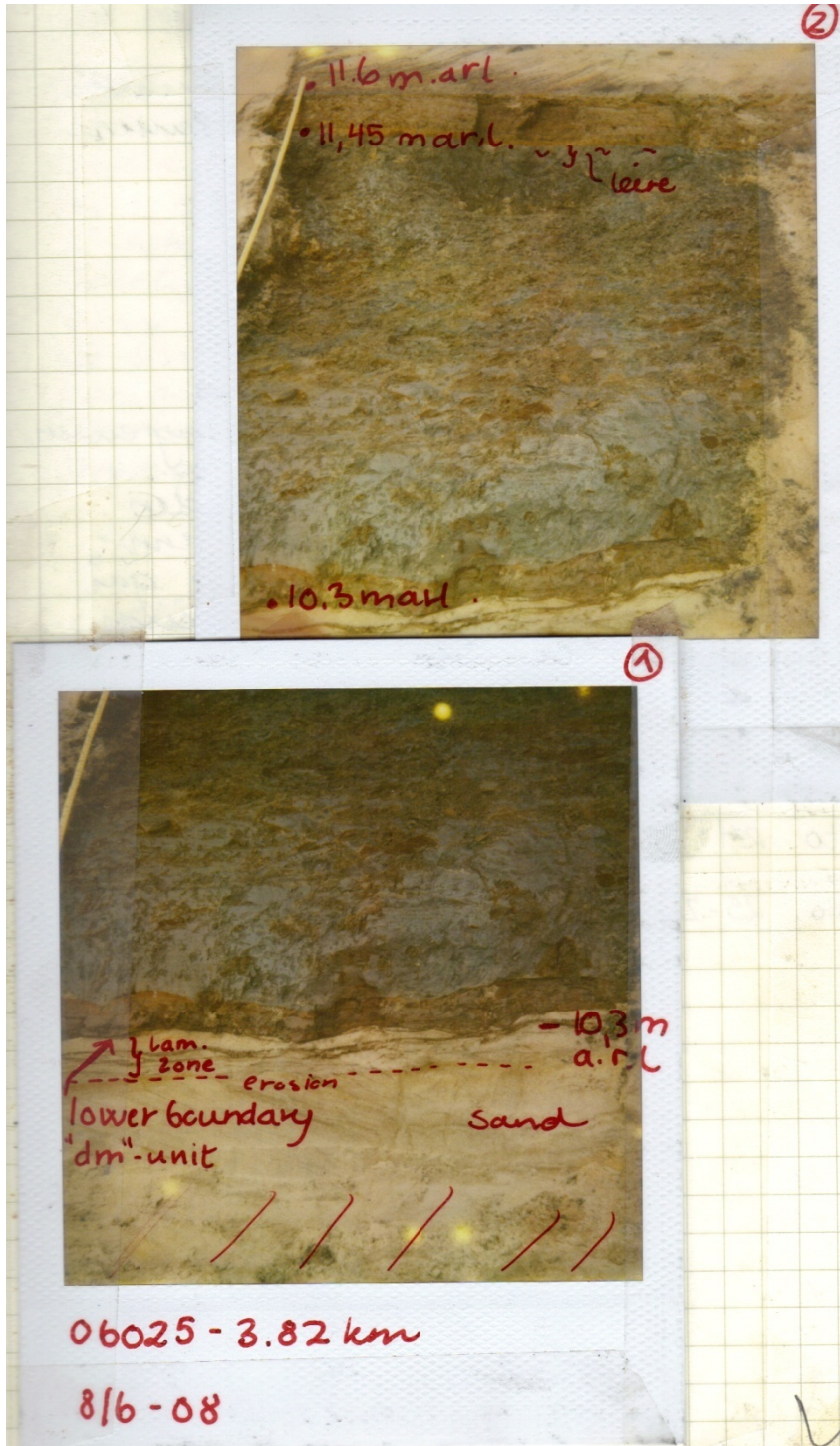
This new section is site 08001 (Tolokonka 2). The following conclusions are made:

- There is a potential to work on the "dm-horizon" at this section. The dm seems to dip northwards almost to river level, and seemingly has a relatively uniform thickness. Eiliv and Astrid will start on that at site 08001, and continue at site 06025. The aim is to map the unit/horizon and come up with good and reasonable interpretations of these sediments.
- Hilde will do her work for the thesis at site 06025 (northernmost ca. 1 km part of the section). She will concentrate on the lower deltaic-sandy unit. Focus will be on architecture and geometry.
- Valery will do his work at the same place as Hilde, but he will concentrate on the entire stratigraphy and sample for Pollen, U/Th etc.
- Aurelian and Maria will continue to work on the architecture and geometry of the units in site 06025 (repeat the results from 2007 and continue southwards).
- Aurelian will sample the fine grained units for his work (geochemistry etc.) (at the best locality for this).

• Site 06025-3.82 km (Tolokonka 1)

We start to work with the "dm-unit" described from 2007.

2 Polaroid of the section:



Description of the sandy unit below the "dm-unit":

The unit consists of fine sand foreset beds that show an erosive upper boundary. In between the foresets and the "dm" there is a 10-12 cm zone/ horizon of fine sand (cf. polaroid). This sand is laminated (partly by silt and partly by finer and coarser sand), and some of the silt laminae are undulating. In places the laminae seem to be stretched. Intraclasts and "pieces" of the silt laminae appear in the sand. The lowermost 5-8 cm is laminated by very fine sand that has been stretched out. This horizon shows a very sharply (cut) contact boundary towards the silt/ ("dm") above. However, the boundary is in places some uneven and slightly undulating. We think that this horizon may be a tectonite.

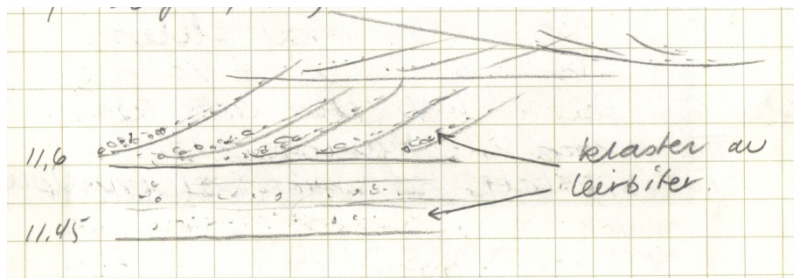
Description of the silt/ "dm" unit (from level 10.3 m arl. up to 11.45 arl):

Massive grey, unsorted silt with scattered grains of sand. In the lower part (at least the lowermost 40 cm), zones and laminae of sand appear together with the background sediments. One of the laminae contains very fine gravels. Further upwards the sediment is fractured (dried) and it is difficult to see eventually primary structures. A few (<10) scattered medium gravel clasts appear in the sediments. The uppermost < 10 cm of the unit seems to be more fine grained and show a higher content of clay. At the top the unit is clayey.

Description level 11.45 m arl-11.6 m arl.:

Stratified silt with zones of clayey intraclasts (cf. sketch). The intraclasts are in very fine gravel fraction, some few fine gravel fraction. The stratification continuous laterally over 2-3 m. An erosive boundary occurs towards tangential foresets. These foresets consist of fine sand with laminae of clayey intraclasts (in very coarse sand and very fine gravel fraction).

Sketch level 11.45-11.6:



Photos AL (080608)

- Photo 1-2 Eiliv at Tolokonka
Photo 3 Liv Sofia, Ingrid, Gudmund and Susanne at Tolokonka
Photo 4 Ingrid, Liv Sofie and Gudmund at Tolokonka
Photo 5 Maria
Photo 8-10 Hilde and Dima at Tolokonka
Photo 11 Alexei at Tolokonka
Photo 12 Site 06025-3.82 km. Overview of the "dm-unit" and the lower and upper boundaries.
Photo 13-15 Site 06025-3.82 km. Overview of the "dm-unit" and the lower and upper boundaries. Mosaic cf. photo 12.
Photo 16-17 Gudmund and Eiliv. Interview at Tolokonka.
Photo 18-23 Site 06025-3.82 km. Details from the lower boundary of the "dm-unit", starting at the right side. On photo 22 the water escape structure that penetrates from the underlying sand and up into the zone/laminated horizon below the lower "dm-unit" boundary. The water escape structures end in this zone.
Photo 24-26 Site 06025-3.82 km. details level 11.45-11.6 m.
Photo 27-33 Camp at Tolokonka

Photos ELA (080608)

- Photos 1-3: Overview diamicton
Photos 4-9: Lower boundary diamicton. Note shear zone below the gray dm.
Photos 10-12: Brown, laminated and granulated transition to fluvial above dm.

Monday.09.06. Field-work Tolokonka

Maria, Astrid, Eiliv, Gudmund, Hilde, Liv Sofie, Ingrid, Susanne, Aurelian, Dmitri, Valery, Alexej

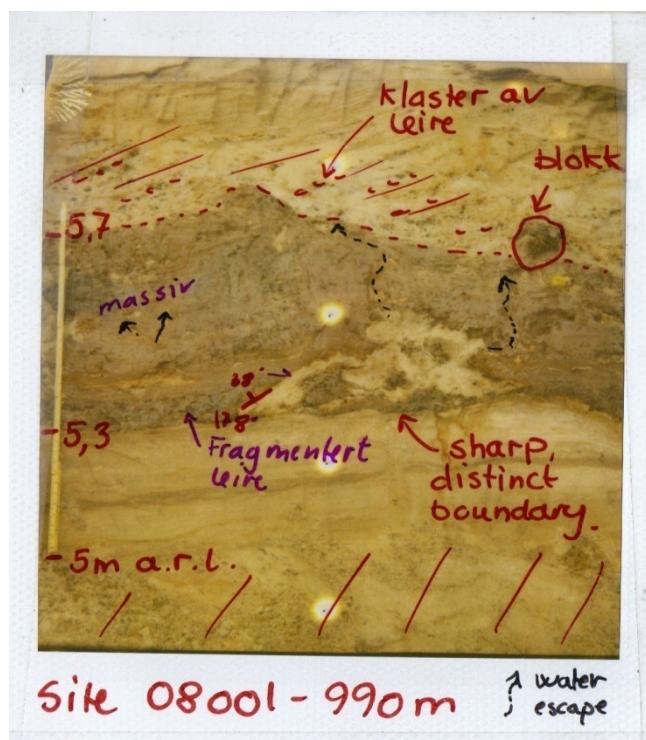
Gudmund, Susanne, Liv Sofie and Ingrid leave the field camp for travelling back home. Astrid and Eiliv work together in the section.

• **Site 08001 (Tolokonka 2)**

Zero point in the southernmost end of the section. The section is 1.18 km long.

• **Site 08001-990 m (Tolokonka 2)**

We clean up the silt/ "dm-unit" that stratigraphically correspond to the "dm-unit" in 06025. No description done today.



Photos (AL 090608)

- Photo 1-5 Maria, Eiliv, Astrid
- Photo 6 Ingrid and Liv Sofie
- Photo 7 Eiliv and Maria
- Photo 8-15 Liv Sofie, Ingrid and Susanne get their Russian diploma
- Photo 16-18 The entire group at Tolokonka
- Photo 22-27 Tolokonka section, view from the boat.
- Photo 28-36 Site 08001, Tolokonka 2 section. View from the boat.
- Photo 32 Eiliv
- Photo 37-38 Site 08001-990 m, Tolokonka 2 (cf. polaroid)

Photos ELA (090608)

Photos 1-2: Left part of the dm in the section.

Tuesday 10.06. Field-work Tolokonka

Maria, Astrid, Eiliv, Hilde, Aurelian, Dmitri, Valery, Alexej

Astrid and Eiliv work together and continue at site 08001-990 m.

• **Site 08001-990 m (Tolokonka 2)**

We clean the section from yesterday for making description and picturing. Eiliv uses the macro-objective.

Description of the silt/ "dm-unit":

The lower boundary of the unit is very sharp and distinct, somewhat irregular and not planar. The relief is maximum 5-8 cm, and some of the irregularities are on the clast-scale. In places the underlying sand has been stretched or sheared up into the silt/ "dm-unit".

In the lower part there is a 5-10 cm thick zone of fractured clay. The individual clay clast has an angular shape, and the clasts appear in a chaotic pattern. In between the clayey clasts, some sand and lenses of sand exist. The sediment is clast supported by clayey clasts. The next ca. 10 cm of the unit shows alternating between silt and very fine/fine sand, in where the sand appears as stretched lenses and laminae. In one place we measure a (likely) shear movement: $172^{\circ}/38^{\circ}$ (cf. polaroid from 09.06)

Further upwards there is compact and apparently more massive clayey silt. Some thin (< 1 mm, grain size thickness) laminae exist, in addition to a couple of ca. 1 cm thick laminae (fine sand with isolated clasts of very fine gravel). In this part of the sediment we also find isolated, vertically and sub-vertically sand "fingers" that are up to 20 cm long. Some of them penetrate up to the overlying sand. We suggest that these vertically sand "fingers" are parts of a larger water-escape structure (cf. polaroid from 09.06).

The upper boundary of the unit shows a relief up to 30 cm. The boundary is clearly formed by current erosion related to the overlying fluvial sediments. This sediment contains clasts of clay, especially in the lowermost part, in where these clay clasts appear within foresets. Along the boundary appears one large boulder (15 cm, non-crystalline).

• **Site 08001-360 m (Tolokonka 2)**

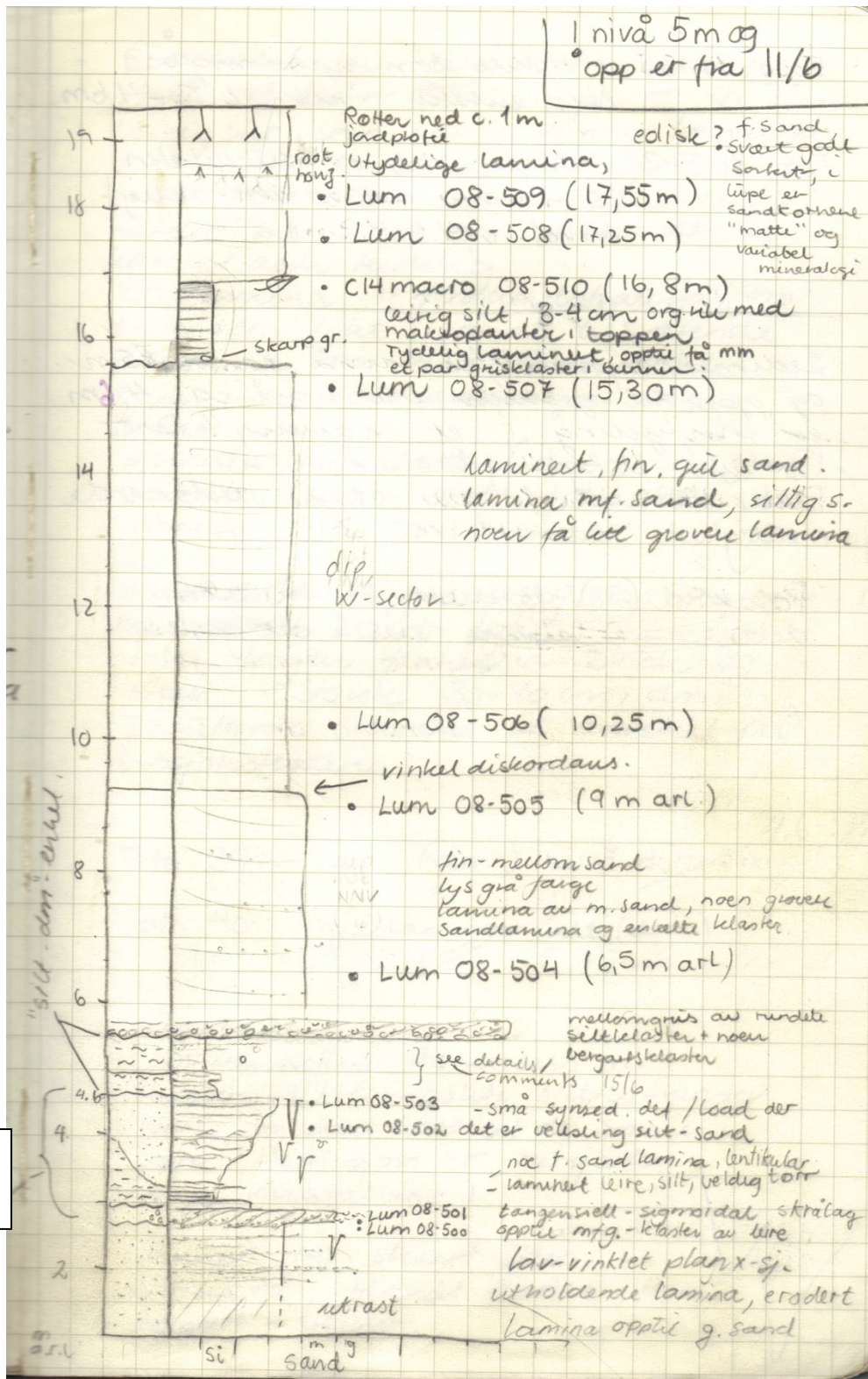
For description of the sediments, see log of the site.

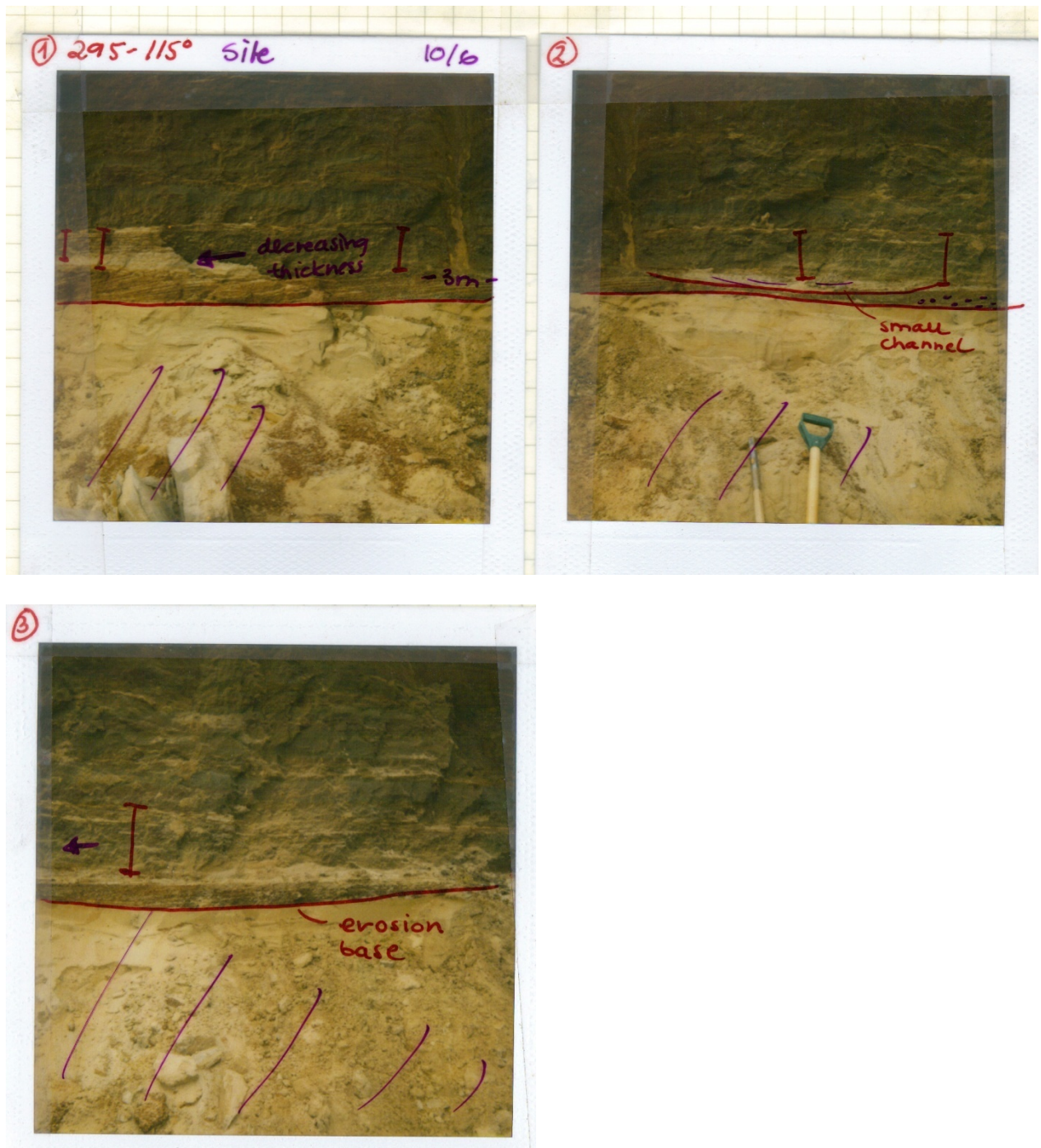
Level 2.75-4.6 m arl: The sediments are infill of a small basin shown by the lowermost bed that decreases in thickness towards 295° . See also polaroid (below).

Level 4.4-5 m arl (silt/ "dm-unit"): Clayey silt with very thin, horizontal laminae of very fine sand and silt. The laminae appear as 1-2 cm thick sets. Can see one 1 cm thick fine sand lamina and one that is 0.5 cm thick. We are not able to see any grading in the laminae. Few scattered clasts of gravel (up to medium gravel) occur in the sediment.

Above the silt/ "dm-unit" lies a gravel lag that is up to 20 cm thick. Within this occur cobbles/boulders (maximum 30-40 cm). The largest ones occur enriched along the boundary. The gravel is dominated by very hard and compact silt/clayey clasts. Some of the gravels (those in the largest fractions) are of bedrock, of which many of them are crystalline. We do find one striated clast on the river beach (among many bedrock cobbles).

Log site 08001-360 m:
 (description level 1-5 m is from 10.06, level 5 m and upwards from 11.06)





Samples

Lum 08-500 (2.6 m a.r.l.): Site 0801-360. F to m sand.

Lum 08-501 (2.7 m a.r.l.): Site 0801-360. F to m sand.

Lum 08-502 (4.15 m a.r.l.): Site 0801-360. Ripple laminated.

Lum 08-503 (4.5 m a.r.l.): Site 0801-360. Planar laminated.

Photos (AL 100608)

- Photo 1-4 Site 08001-990 m. "Dm-unit", pictures taken from left to right.
- Photo 5-13 Site 08001-990 m. Details from the "dm-unit", see photos 1-4.
- Photo 14-17 Site 08001-500 m. Details from the fluvial forest beds, intraclasts of silt, just above the "dm-unit".
- Photo 18-19 Eiliv at site 08001-360 m
- Photo 20-23 Site 08001-360 m. Lower 2-2.75 m a.r.l.
- Photo 24-25 Site 08001-360 m. Level 2.75 m a.r.l. showing the lateral variation of the forset beds that contain clayey and silt intraclasts.
- Photo 26 Site 08001-360 m. Overview level 2.75-4.6 m a.r.l.
- Photo 27 Site 08001-360 m. Details around level 4.5 m a.r.l. (see photo 26 and log).
- Photo 28 Site 08001-360 m. details around level 3.1 m a.r.l. Laminated part just above the forests (with clayey intraclasts). Lenticular and wavy fine sand lamina between clay and silt lamina.
- Photo 29 Site 08001-360 m. Details from level just above photo 28 (above 3.1 m a.r.l.).
- Photo 30-31 Site 08001-360 m. Details from level just above photo 29. Ice wedges that end towards sandbeds.
- Photo 32 Site 08001-360 m. Ripples at level ca. 4 m a.r.l.
- Photo 33 Site 08001-360 m. Level up to c. 4.6 m a.r.l., see photo 26.
- Photo 34-35 Site 08001-360 m. Ice-wedge that goes through the entire unit, level c. 3-4.6 m a.r.l.
- Photo 36-38 Site 08001-360 m. Lower part of the silty "dm"unit, level c. 4.6-4.9 m a.r.l, see log.
- Photo 39 Site 08001-360 m. Silt/ "dm-unit", level 4.6-5.75 m a.r.l. See log. (wrong level in the field note!?)
- Photo 40 Site 08001-360 m. Gravel lag above the silt/ "dm-unit", level c. 5.75 m a.r.l. (wrong level in the field note!?)

Photos ELA (100608)

- Photos 1-12: Site 08001.990 m. Details in dm (macro lens). Taken from left towards right (mostly). Can be localized in Astrids photos.
- Photos 13-14: Site 08001. Striated clast found on beach below section. Probably from dm or top of dm.
- Photos 17-18: Beast guarding section.
- Photo 19: Astrid at site 08001.
- Photo 20: Site 08001-360. Lower gravel, above lowermost sand.
- Photo 21: Site 08001-360. 2.75 – 4.6 m arl.
- Photos 22-25: Site 08001-360. Details in the interval 2.75 – 4.6 m arl from the base up.
- Photos 26-27: Site 08001-360. Ice-wedge cast 2.7-4-6 m arl.
- Photos 28-33: Returning by boat from the Tolokonka section. Evgenij and Astrid.

Wednesday 11.06. Field-work Tolokonka

Maria, Astrid, Eiliv, Hilde, Aurelian, Dmitri, Valery, Alexej

Heavy rainfall (extremely). Eiliv and Astrid work at site 08001-360 and use the "rainweather notebook". Short day in the field due to the weather condition.

• **Site 08001-360 m (Tolokonka 2)**

We continue logging from 5 m arl and upwards (see log site 08001-360 m, 10.06).

General comments:

The uppermost fine-grained laminated clayey silt (from about 15.6 m a.r.l.) is rich in organic plant remains at the top (also macro remains). This silt unit has a lateral continuity throughout the section. On top of this, there is light grey sand towards the present surface. This sand is likely eolian.

The silt/ "dm-unit" exist also laterally continuous throughout the entire section. Along the present river beach appear numerous cobbles and boulders, and they are likely originated from the lag on top of the erosional surface of the silt/ "dm-unit".

Samples:

Lum 08-504 (6.5 m a.r.l.). Site 08001-360. Grey, f to m sand.

Lum 08-505 (9.0 m a.r.l.). Site 08001-360. Grey, f to m sand.

Lum 08-506 (10.25 m a.r.l.). Site 08001-360. Yellow, f sand.

Lum 08-507 (15.30 m a.r.l.). Site 08001-360. Yellow, f sand.

Lum 08-508 (17.25 m a.r.l.). Site 08001-360. Well sorted, f sand.

Lum 08-509 (17.55 m a.r.l.). Site 08001-360. Well sorted, f sand.

C14 (macro) 08-510 (16.8 m a.r.l.). Site 08001-360. Plant fragments.

Photo ELa (110608)

Photos 1-3: The transition between the light grey and the yellow sand, level 9.6 m a.r.l.

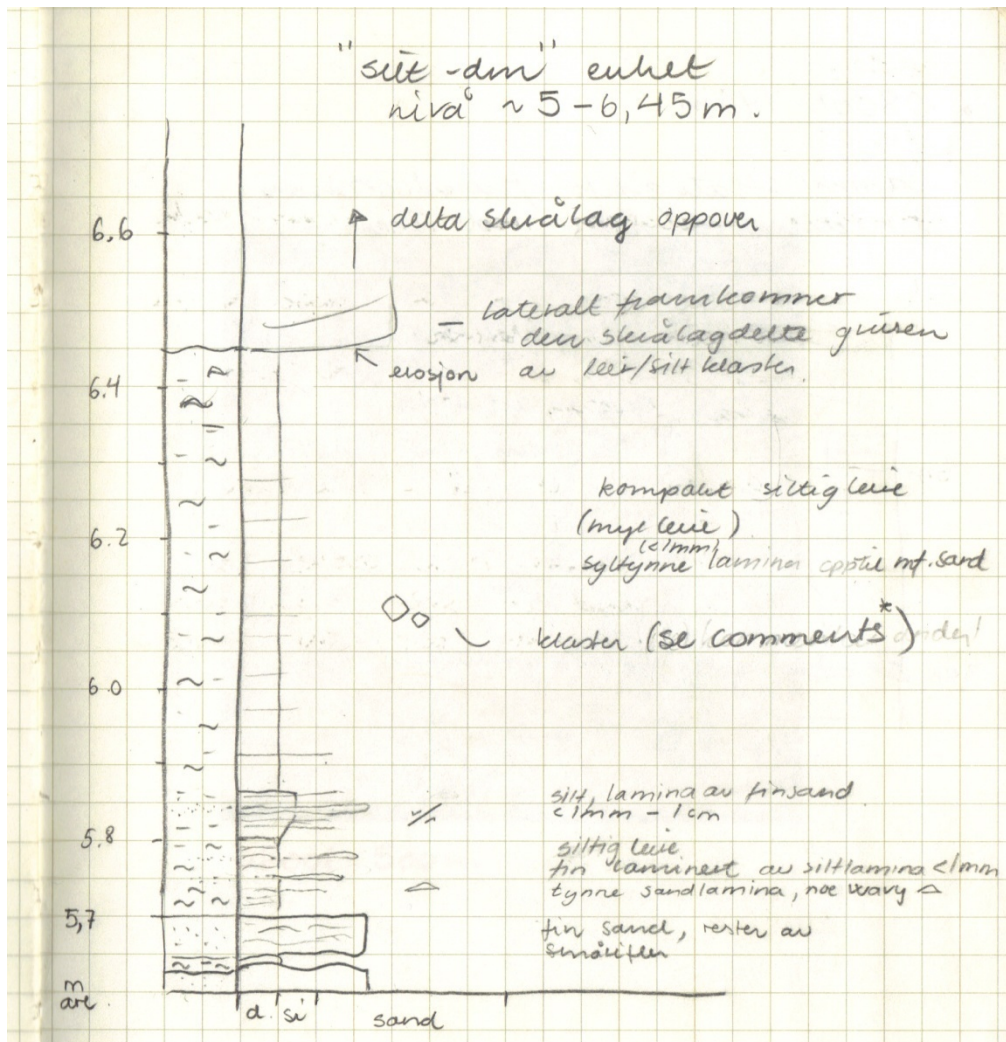
Photo 4: Valery Shabatinov at Tolokonka

Thursday 12.06. Field-work Tolokonka
 Maria, Astrid, Eiliv, Hilde, Aurelian, Dmitri, Valery, Alexej

• Site 08001-390 m (Tolokonka 2)

We log the silt/ "dm-unit" in details (see log).

Log 08001-390 m (details level 5-6.45 m a.r.l.):



Comments on the clasts within the clayey silt:

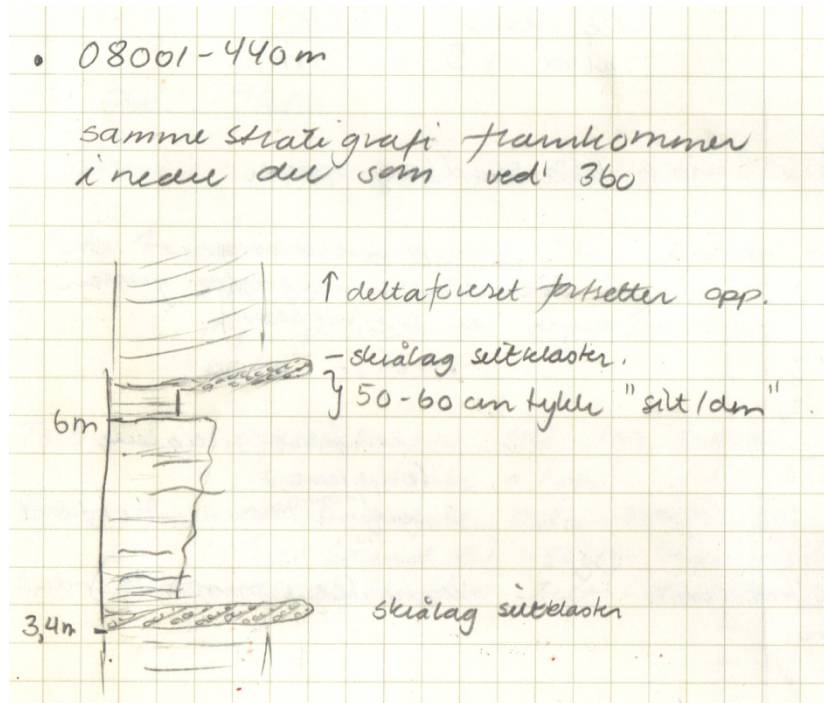
One clast is 4 cm, is striated, scoured and has an angular-rounded form.

One clast is a block (a= 24 cm, b=17 cm, c= 3 cm), lies parallel with the ab-plane, is angular but some abration along the edges.

• Site 08001-440 m (Tolokonka 2)

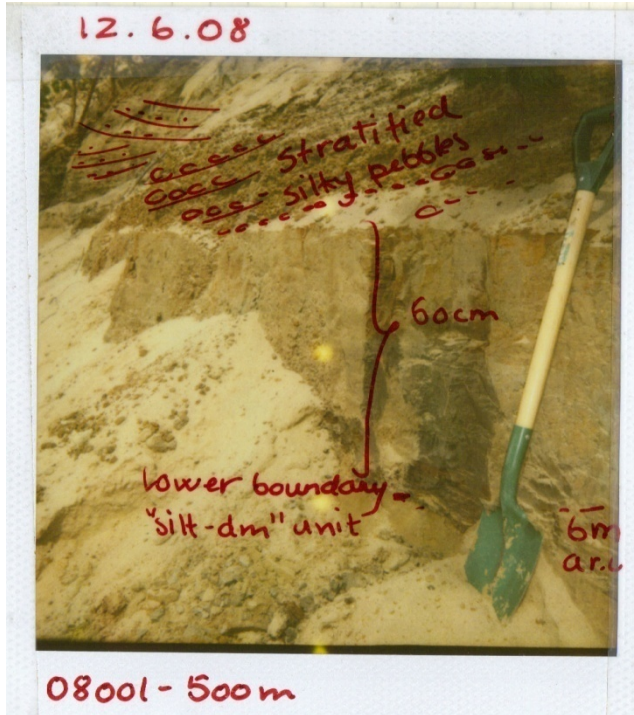
The stratigraphy resembles the stratigraphy described from 360 m.

Sketch/log (site 08001-440 m):



• Site 08001-500 m (Tolokonka 2)

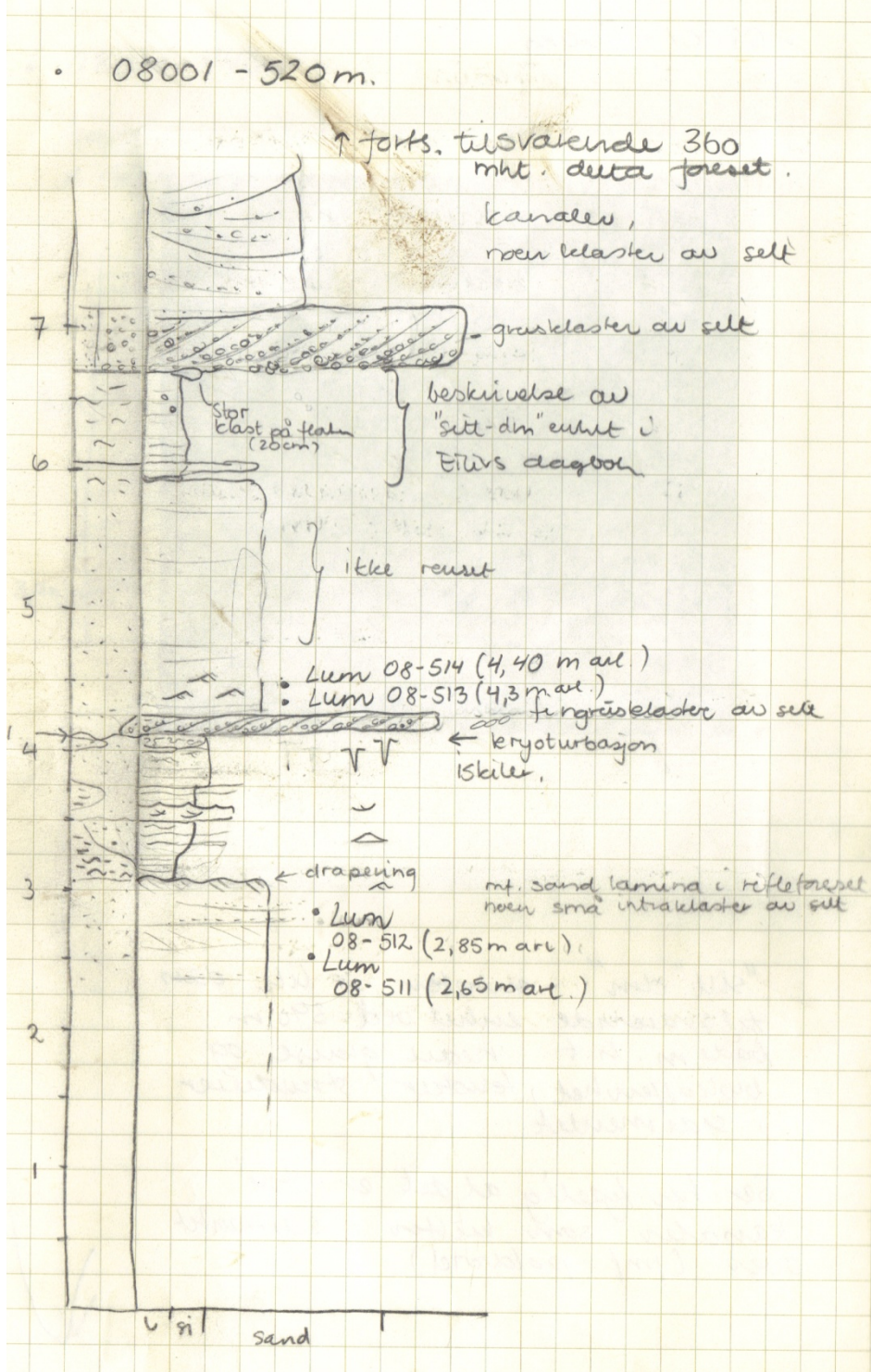
Polaroid site 08001-500 m:



The silt / "dm-unit" resembles the unit described from 08001-390 m regarding the lower boundary, structures and sediment texture. At this site we clearly see that large channels occur in lower part of the overlying fluvial sediment (see polaroid).

• Site 08001-520 m (Tolokonka 2)

Log site 08001-520 m:



Silt/ "dm-unit" at site 08001-520: the lower boundary at 6.1 m a.r.l. The transition from below is: At the base a thin silt lamina, above this 2-3 cm fine sand followed upwards by 5 cm laminated silt/clay. The so-called "dm" above this is composed of a series of 1-3 cm thick clay/silt stringers separated by mm thin sand stringers.

• **Site 08001-604 m (Tolokonka 2)**

The silt/"dm-unit" is 90 cm thick at this site. The sediments, structures and texture resemble what seen at 520 m. Lower boundary is at 6.3 m a.r.l. The erosional upper boundary is only at places covered by the bed of "silty intraclasts". Other places it is covered by plan-laminated sand. Some small channels are seen.

• **Site 08001-625 m (Tolokonka 2)**

Description of the upper laminated silty clay. See log from 1006 in where this clay unit is indicated around 16 m a.r.l. At 604 m this clay unit is 1.9 m thick, lower boundary is at 14.5 m a.r.l. Eolian (likely) light colored fine sand appears on top, thickness 1.5-2 m.

Description of the laminated silty clay (level 14.5-16.4 m a.r.l.):

Fine laminated (varves) clay and silt. Very sharp lower boundary at 14.5 m to underlying sand.. Very small relief at the lower boundary is likely caused by loading. Iron precipitation within the lowermost 10 cm. The lowermost 1.2 m of the silty clay is finely laminated, and the sediment becomes more massive above this (towards the top). Lamina appears as variations between clay and silt, lamina thickness from very thin up to 3 mm. Some of the lamina are of very fine sand.

• **Site 08001-660 m (Tolokonka 2)**

The silt/"dm-unit" is at this site 90 cm thick. Lower boundary at 5 m a.r.l. Both the lower and upper boundaries resembles the boundaries at 520 m. Above the unit occur cross-bedded (channels) fine and medium sand with some intraclasts of silt (in gravel fraction).

• **Site 08001-705 m (Tolokonka 2)**

Similar to 08001-660 m (regarding the silt/"dm-unit").

• **Site 08001-730 m (Tolokonka 2)**

Similar to 08001-660 m (regarding the silt/"dm-unit"). Thickness of the unit is 90 cm, lower boundary is at 6 m a.r.l.

• **Site 08001-770 m (Tolokonka 2)**

Similar to 08001-660 m (regarding the silt/"dm-unit"). Thickness of the unit is 90 cm, lower boundary at 6 m a.r.l. The laminated fine sand within the unit is in places folded and deformed. It is not possible to measure any stress directions.

Photos AL (120608)

Photo 1 Site 08001-390 m. Level 2.75 m (see log 1006). Lower boundary of forest with intraclasts of clay and silt.

- Photo 2 Site 08001-390 m. Overview of the silt/ "dm-unit". 1 m scale. See detailed log 1206.
- Photo 3 Site 08001-390 m. Lower boundary of the silt/ "dm-unit" , transition from the sand and up to the silt/ "dm-unit".
- Photo 4-10 Site 08001-390 m. Details from the silt/ "dm-unit". Note the striated clasts at level c. 6.1 m a.r.l. (see log 1206).
- Photo 11 Site 08001-520 m. Overview level 2.5-4.5 m a.r.l. (see log 1206)
- Photo 12 Site 08001-520 m. Level 2.5-3.75 m a.r.l. (see log 1206).
- Photo 13 Site 08001-520 m. Details, knife at level 3.5 m a.r.l. (see log 1206).
- Photo 14 Site 08001-520 m. Details, knife at level 4 m a.r.l. (see log 1206).
- Photo 15 Site 08001-520 m. Overview, cf. photo 14 (see also log 1206).
- Photo 16 Site 08001-520 m. Ice wedge at level < 4 m a.r.l. (see log 1206).
- Photo 17 Site 08001-520 m. Details, cryoturbation and knife at level 4 m a.r.l. (see log 1206).
- Photo 18 Site 08001-625 m. Overview of the upper laminated clay unit. Lower boundary at 14.5 m a.r.l.
- Photo 19-22 Site 08001-625 m. Details through the upper laminated clay unit, from the lower boundary and upwards the unit. See photo 18.
- Photo 23 Site 08001-625 m. Lower boundary of the laminated clay unit at level 14.5 m. see photos 18 and 19.
- Photo 24-29 Site 08001-625 m. Details from the upper laminated clay. Cf. photo 18.
- Photo 30-32 Site 08001-770m. Note the folded and deformed sand lamina in the silt/"dm-unit".

Photos ELa (120608)

- Photo 1: Site 08001-390. Cross-bedding below fine-grained. Ca 2.5 m arl.
- Photo 2-5: Site 08001-390. Dm at around 5.7-5.9 m arl. Note drop stones in 5.
- Photo 6-7: Striated clast from silt/dm unit.
- Photo 8-9: Site 08001-440 m. Cross-beds with intra clasts of silt. Lower boundary at 3.4 m arl.
- Photo 10-11: Clasts somewhere between 440 and 625 m.
- Photo 12-13: Site 08001-625 m. Clayey (varve-like) with sharp lower boundary at 14.5 m arl.
- Photo 14-15: site 08001-625 m. Clayey (varve-like) just above lower boundary.
- Photo 16-17: Site 08001-770 m. Sharp lower boundary of dm (at ca. 6 m arl.), and deformational structures in the lower part of dm.
- Photo 18-19: Tolokonka, looking upstream (towards S). Astrid in the foreground.
- Photo 20-32: Series of pictures from Tolokonka 2 when leaving the section by boat.

Samples:

- Lum 08-511: Site 08001-520 m. Fine sand. 2.65 m arl.
- Lum 08-512: Site 08001-520 m. Fine sand. 2.85 m arl.
- Lum 08-513: Site 08001-520 m. Fine, planar laminated sand. 4.3 m arl.
- Lum 08-514: Site 08001-520 m. Fine, rippled sand. 4.4 m arl.

Friday 13.06. Field-work Tolokonka

Maria, Astrid, Eiliv, Hilde, Aurelian, Dmitri, Valery, Alexej

The entire group went to the section to discuss what has been done and observed so far. Dmitri leaves the camp after noon.

• **Site 06025-3.83 km (Tolokonka 1)**

This site (described from 2007) has described and logged by Valery (at 3.2 km in his notes). Valery has sampled 27 samples from the sediments and the peat above (for pollen). Hilde will work at this site and make a log. Maria has made notes and taken photos. At the top of the unit in where the peat appears, large load- structures occur lateral to this (Maria has noted this).

We discuss the formation of this part of the stratigraphy: Fluvial sediments (channels) with overbank sediments on top, succeeded by the transition to terrestrial sediments (the peat). This sediment package is very similar to what Eiliv and Astrid noted from site 08001-520 m.

• **Site 06025-4 km (Tolokonka 1)**

At the river level, organic gyttja rich in plant remains, twigs, cones and one bone crops out. The gyttja has a lateral extent of at least 2 km. Thickness is 1.5-1.9 m. The sediment is very fine grained with high organic content. Some lamination occurs. We suggest that the sediments represent a long time interval. It may be possible to dig down to the lower boundary around the river level (will be better when the river level falls). We find a few gravel clasts within the sediment in the lower part.

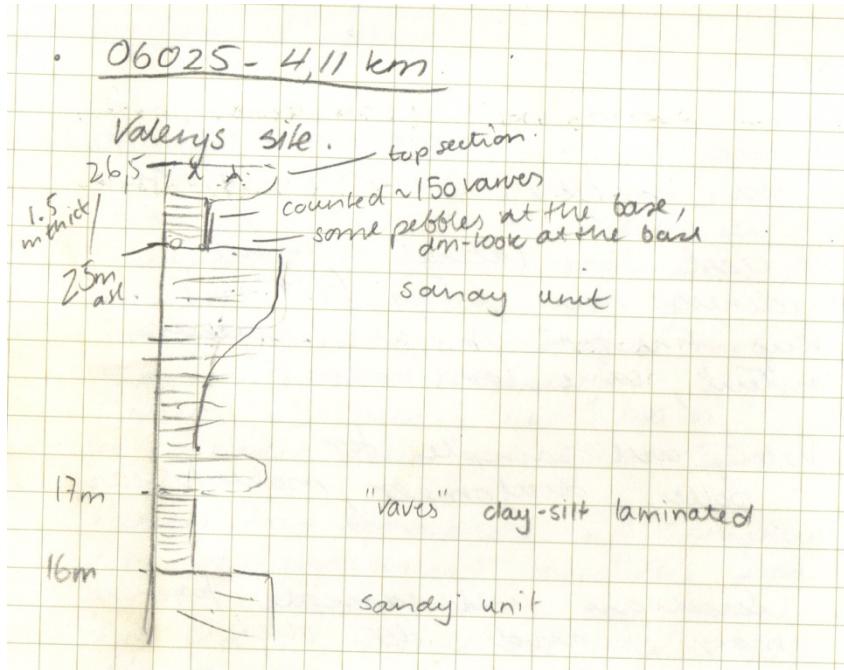
Valery will sample this unit for pollen, diatoms and macrofossils.

Aurelian will sample for mag. and geochem. and do detailed description of the unit.

• **Site 06025-4.11 km (Tolokonka 1)**

Valery's site. The uppermost part of the stratigraphy of Tolokonka.

Skematic log of site 06025-4.11 km:



Valery has sampled this site for pollen etc. He will also count the varves.

Aurelian will sample for mag. and geochem.

The laminated (varved) silt/clay unit wedges out towards the south in the section. We have described a very similar unit further south in the section in 2007. Is it the corresponding unit? Aurelian and Valery will check this up and make detailed logs/descriptions. The laminated clay in the upper part (cf. log) has a 5-10 cm basal part that looks like a diamict. Pebbles are found at this level. Valery and Aurelian have found larger blocks at this stratigraphic level at other places in the section.

• **Site 06025-3.47 km (Tolokonka 1)**

Log and sketch in Marias notes.

We sample for Lum in the fluvial channel sediments below the overbank sediments (lower part of the Tolokonka stratigraphy)

• **Site 06025-3.29 km**

Astrid and Eiliv did clast fabric in the lower ca. 40 cm of the dm at the site. The lower boundary is at 14.5 m arl. At small scale the boundary is somewhat uneven (wavy), but horizontal at larger scale, i.e. appears loaded. The dm has a clayey/silty matrix with sand. Relatively abundant

occurrence of clasts of coarsest sand to gravel. Parts of the dm is massive, other parts contain quite abundant lenses/lamina of fine sand. These are somewhat undulating and laterally discontinuous. One flaky clast was found in vertical position.

Samples

Lum 08-515 (2.8 m a.r.l.). Site 06025-3.47 km. Medium sand.

Lum 08-516 (3.75 m a.r.l.) Site 06025-3.47 km.

Photos AL (130608)

Photo 1-4 Sampling for Lum (Eiliv, Aurelian, Maria)

Photo 5-6 Maria making field notes

Photo 7-8 Sampling for Lum (Eiliv, Aurelian, Maria)

Photo Ela (130608)

Dog interested in Astrid's breakfast.

Fabric, site 06025-3.29 km (Not corrected for deviation):

<i>Direction of dip</i>	<i>Dip</i>	<i>Direction of dip</i>	<i>Dip</i>
60	8	140	16
126	40	166	10
125	20	180	16
314	22	172	16
50	10	186	6
94	16	174	28
70	30	90	18
	90	110	10
180	6	260	8
	90	300	0
90	8	72	10
200	6	260	8
240	8		

Saturday 14.06. Field-work Tolokonka

Maria, Astrid, Eiliv, Hilde, Aurelian, Denis, Valery, Alexej

Denis arrives the field camp during the day.

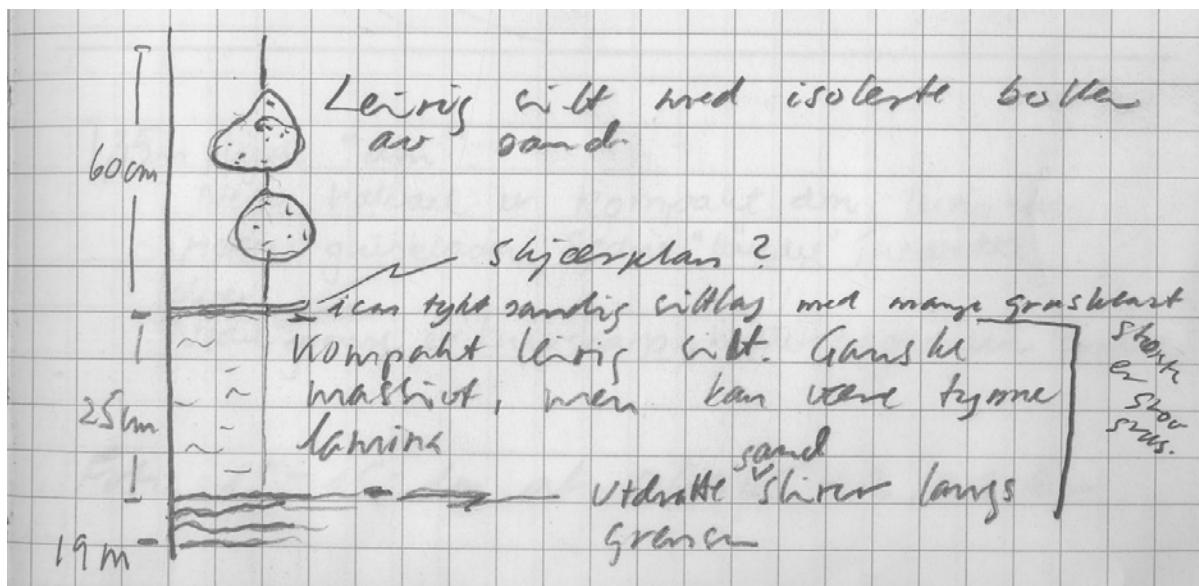
Eiliv and Astrid continue to work with the silt/"dm-unit"

• Site 06025-2.40 km (Tolokonka 1)

Top of section at 28 m arl.

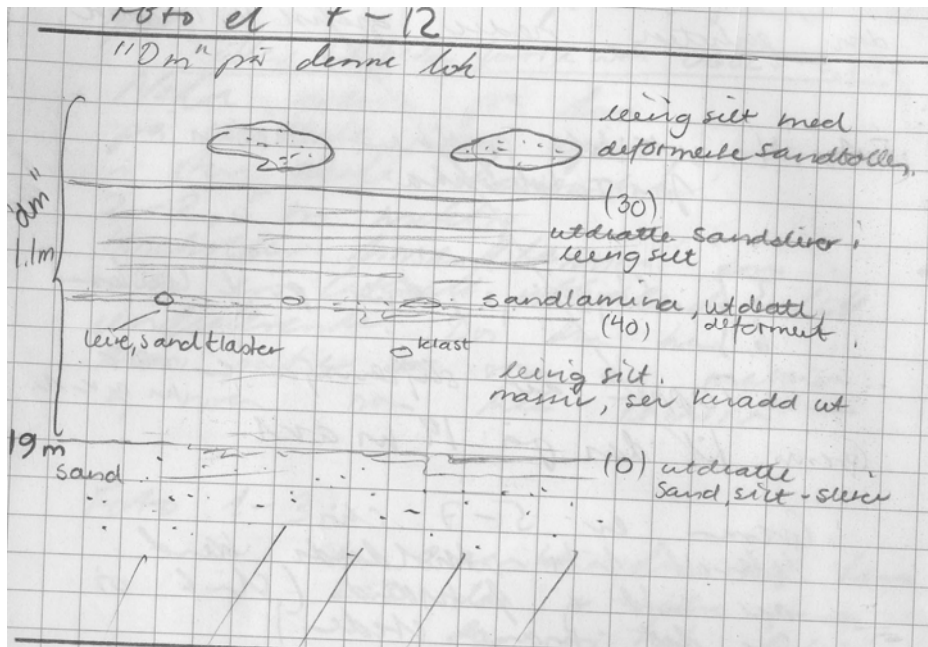
Lower boundary dm at 19 m arl. Thickness of dm ca. 90 cm.

The boundary (transition zone) is 5-7 cm thick. Composed of silt and fine sand bands that are not laterally persistent.

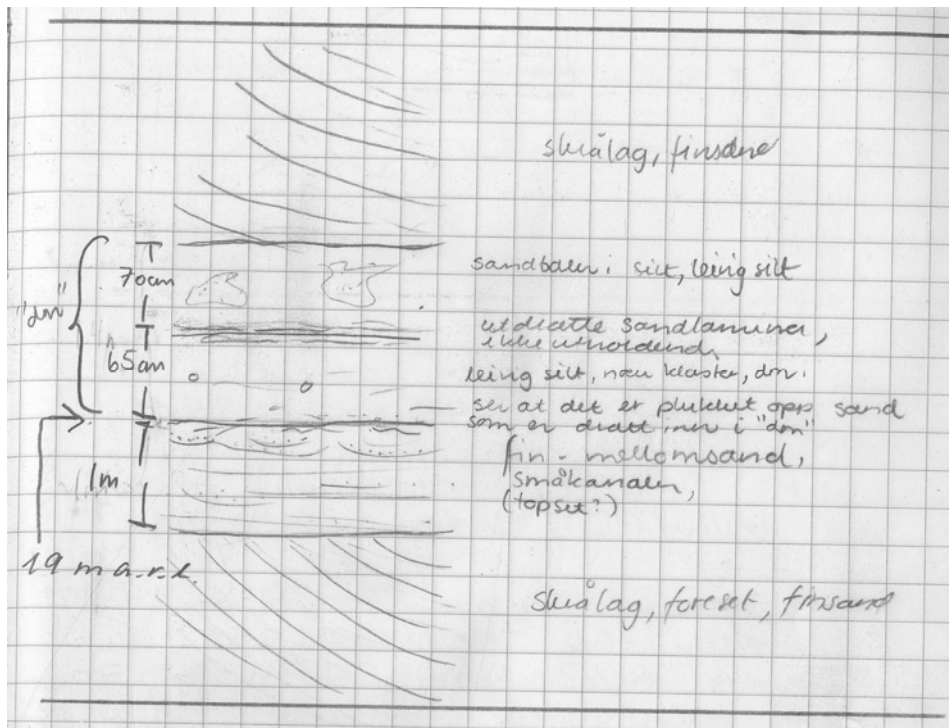


Find again the same type of sediment 7-8 m downstream of this site.

• Site 06025-2.39 km (Tolokonka 1)

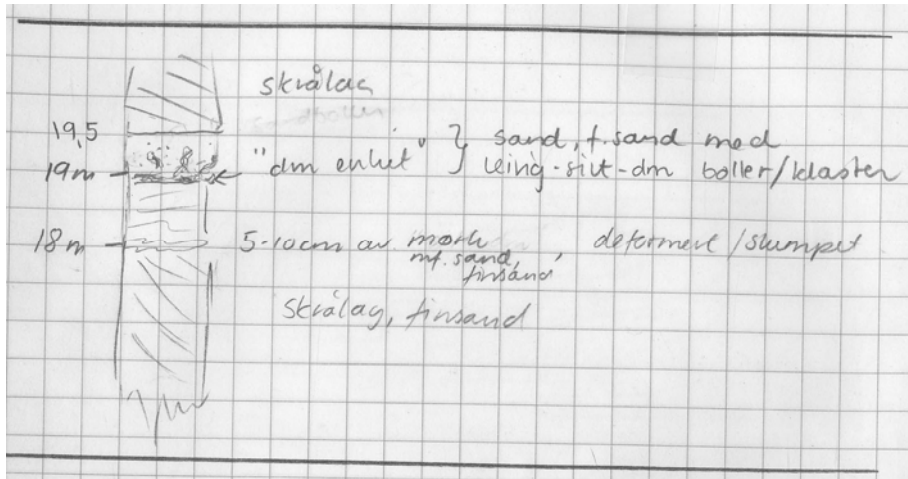


• Site 06025-2.29 km (Tolokonka 1)



Dm is 1.35 m thick. Lower half is compact dm, clayey silt, some gravel clasts. Partly banded, stretched out lenses. Lower boundary knife sharp. Cuts bedding below.

• Site 06025-2.25 km (Tolokonka 1)



Only remnants left of the "silt-dm" unit, some 4-5 cm at this site. Somewhat laminated near base (a question if the lower boundary is intact). Above there is a fine sand appearing chaotic with its content of clay-silt balls and clasts.

Further to the south in the section, evidently the dm unit disappears in that the above situated delta sediments cuts completely through. By walking the next 25 m southwards along the river bank, we found no **pebble??** Clasts.

Photos AL (140607)

- Photo 1-3 View of Dvina (southwards)
- Photo 4-6 Site 06025-2.4 km. Silt/"dm-unit".
- Photo 7 View of Dvina (southwards)
- Photo 8 Site 06025-2.4 km. Silt/"dm-unit".
- Photo 9-11 Eiliv in the section (Tolokonka)
- Photo 12-14 View of Dvina and the Tolokonka section (southwards)
- Photo 15-16 Site 06025-2.39 km. Overview of the silt/"dm-unit".
- Photo 17 Site 06025-2.39 km. Lower boundary of the silt/"dm-unit".
- Photo 18 Site 06025-2.39 km. Details from the silt/"dm-unit".
- Photo 19 Site 06025-2.39 km. Lower boundary of the silt/"dm-unit".
- Photo 20-21 Site 06025-2.39 km. Details from the silt/"dm-unit".
- Photo 22-23 Site 06025-2.29 km. Overview of the silt/"dm-unit".
- Photo 24 Site 06025-2.29 km. Lower boundary of the silt/"dm-unit" at 19 m a.r.l.
- Photo 25-27 Site 06025-2.25 km. Overview lower boundary of the silt/"dm-unit" in the place where this unit wedges out. Eiliv has better photos.

Photos ELA (140608)

- Photo 1: Site 06025-3.29 km. Overview dm to laminated.
- Photo 2-3: Site 06025-3.29 km. Dm where fabric was made and lower boundary of dm.

Photo 4: View of Dvina southwards from Tolokonka.
Photo 5-6: Site 06025-2.40 km. Dm and lower boundary.
Photo 7-10: Site 06025-2.39 km. Dm and lower boundary.
Photo 11-12: Site 06025-2.39 km. Dm.
Photo 13-15: Site 06025-2.29 km. Dm and lower boundary.
Photo 16-20: site 06025-2.25 km. thin dm.

Sunday 15.06. Field-work Tolokonka

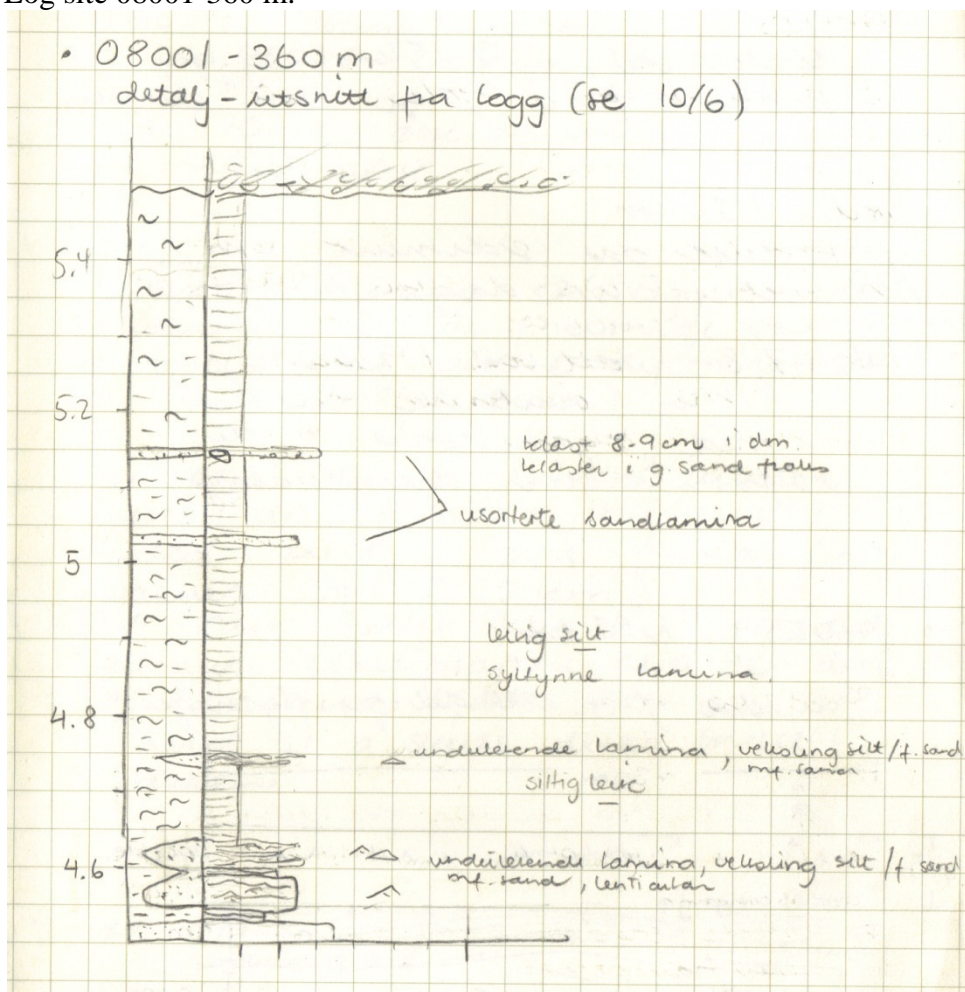
Maria, Astrid, Eiliv, Hilde, Aurelian, Denis, Valery, Alexej

Eiliv, Astrid, Aurelian and Valery started at site 08001. Maria and Denis came some later. We discuss what we (Astrid and Eiliv) have done in this section. Aurelian suggests this section to have good potential regarding the fine-grained (lake) units (both the silt/"dm-unit" and the uppermost lake unit). He and Valery will do description and sample from this section.

• Site 08001-360 m (Tolokonka 2)

We make a detailed log from level 4.5-5.6 m a.r.l. (cf log from 1006)

Log site 08001-360 m:



The unit in the top of the section (level 16.9 m a.r.l. and upwards) is likely eolian. It consists of very well sorted fine sand. Within magnifying glass we can see that the individual sand grains are dim/not glossy (windblown) and that the grains are of variable mineralogy. This is in contrast to fluvial grains that dominate by quarts and are more transparent (this explanation is by Aurelian).

A soil profile is developed down to 0.5 m below the surface. Possible cryoturbation occurs at this level.

- **Site 08001-625 m (Tolokonka 2)**

Laminated clay unit, level 14.5-16.4 m a.r.l. Aurelian will sample for mag., geochem., etc. Eoloian sediments on top will be sampled for SEM.

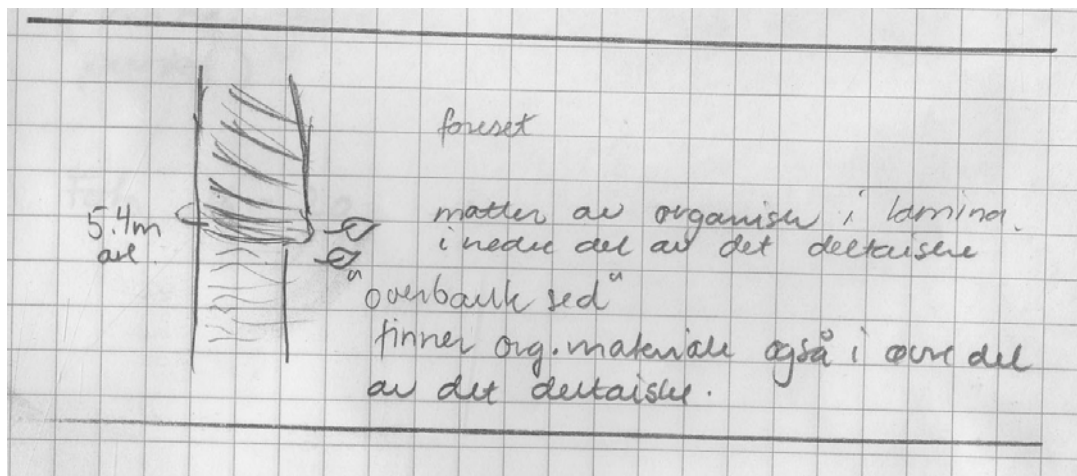
- **Site 06025 (Tolokonka 1)**

Eiliv and Astrid start at 2.25 km and walk upstream trying to follow the silt/"dm-unit".

- **Site 06025-2.03 km (Tolokonka 1)**

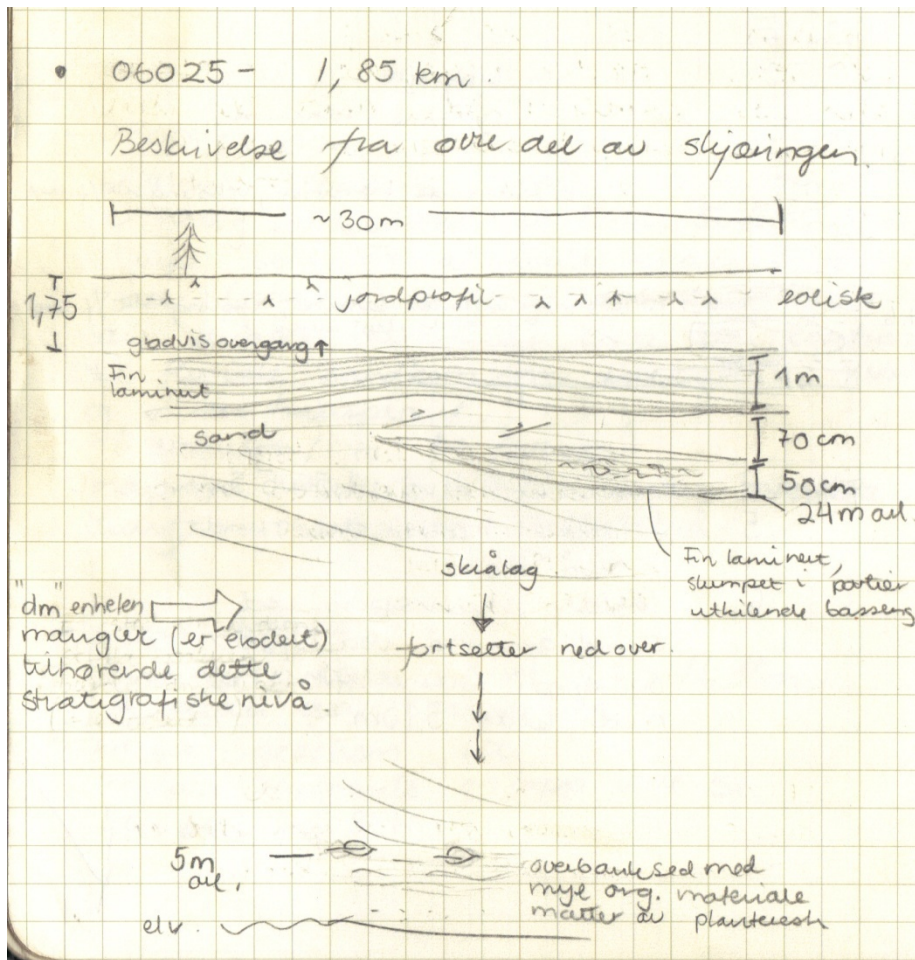
Along the riverbank from 2.25 to 2.03 km there are several crystalline clasts, pebbles and boulders. The unit disappears at 2.25 km and is apparently eroded.

At 2.03 km:



- **Site 06025-1.85 km (Tolokonka 1)**

Sketch of the section at 1.85 km:



Reverse faults appear in the sand that lies between the fine-grained beds. These are likely caused by internal deformation within the sediment basin (cf. sketch). We do not find the silt/"dm-unit" at this site. The unit disappears at 2.25 km in where it is cut by the overlying fluvial-deltaic package. We are not able to pinpoint the stratigraphic level in which this unit is supposed belonging to, e.g. the stratigraphic level separating the two different delta foreset packages.

• **Site 06025-1.77 km (Tolokonka 1)**

Ball and pillow structures above the fluvial overbank sediments. At this site, the high-content organic plantlayers are missing. Level around 5 m a.r.l.

Photos AL (150608):

- Photo 1-3 Aurelian
- Photo 4 Site 08001-360 m. Overview level 4.5-5.5 m (cf. log)
- Photo 5 Site 08001-360 m. Details level 4.6 m a.r.l. See log.
- Photo 6 Site 08001-360 m. Details, knife at level 5.03 m a.r.l. and upwards into the sandlamina with gravel clast at 5.15 m a.r.l. See log.
- Photo 7 Site 06025-1.93 km. Eiliv. Overbank sediments with high-organic "layers" on the top. Delta sediments above.

- Photo 8 Site 06025-1.93 km. Overbank sediments with high-organic "layers" on the top. Delta sediments above.
- Photo 9 Site 06025-1.85 km. Overview upper part of 06025-1.85 km. View towards N.
- Photo 10-14 Site 06025-1.85 km. Upper part, cf. sketch.
- Photo 15-18 Site 06025-1.77 km. Ball and pillow structures on top of the fluvial overbank sediments, just below the delta forest beds. Level c. 5 m a.r.l.
- Photo 19 Nice sand fans.

Photo ELa (150608)

- Photo 1-2: Site 08001-360 m . From lower boundary and upwards into "dm"/lacustrine.
- Photo 3-5: Site 06026-1.83 km. Lacustrine (not laterally continuous) at two levels , separated by sand.
- Photo 6-8: Site 06025-1.77 km. Ball and pillow in overbank sediments.
- Photo 9: Site 06025-1.77 km. Overview, looking north from 1.77 km.
- Photo 10-12: Tolokonka. Modern fans at the base of section.

Monday 16.06. Travel Tolokonka-Kotlas

Maria, Astrid, Eiliv, and Denis.

Before leaving the camp (Maria, Eiliv, Astrid and Denis), we went through all practical doings regarding detailed lists of equipments and field-store in St. P. (responsible Valery), how Aureliens samples should be transported and stored before Denis take them over to Finland, and finally, what Hilde has to bring back to Norway and send to NGU (field equipment and first aid kit). We arrive Kotlas at 17:00. Alexander visits the dentist and Eiliv visits a doctor (insect bit). Accommodation hotel Sovjetskaya and dinner at 20:00.

Tuesday 17.06. Travel Kotlas-Shenkursk

Maria, Astrid, Eiliv, Denis, Evgenij jr.

Errands in Kotlas (money exchange, food supplying). We start driving to Shenkursk around noon and arrive around 22:30. The "fishery inspector" Vittali meets us before we check in to the hotel.

Photo ELa (170608). Coolpix.

Photo 586-91: Scenes from Veliki Ust Yug.

Photo 592: Astrid in church tower Veliki Ust Yug.

Wednesday 18.06. Travel Shenkursk-Smotrakovka

Maria, Astrid, Eiliv, Denis, Evgenij jr., Valery and Vittali

We did some errands in Shenkursk in the morning. Met Valery and Vittaly at 11:00 and they drove and sailed us to Smotrakovka where we put up the tent camp on the river bank opposite to the section. Dinner in the camp at 20:00.

Photos AL (180608):

Photo 1-8 Pictures from Shenkursk

Photo 3 Astrid in Shenkursk

Photo 9 Evgenij jr., Valery and Vittali and the car.

Photo 10 Vittali, Maria, Valery and Evgenij jr.

Photo 11-12 The boat

Photo 13 The car setting the boat on the river.

Photo ELa (180608). Coolpix.

Photo 593: Astrid, Maria, Evgenij jr., Valery and Vittali in camp at Smotrakovka.

*Thursday 19.06. Field work Smotrakovka
Maria, Astrid, Eiliv and Denis*

Eiliv and Astrid start to work with the upper dm/till unit. Denis samples the fine-grained unit for pollen (the unit in between the two fluvial units mapped in 2007, at level around 15 m a.r.l.). Maria starts also with this unit aiming to follow it laterally and see what happens with the two fluvial units.

• **Site 07005-70 m (Smotrakovka 1)**

We start to clean a section at the lower boundary of the dm/till. The lower boundary is at 20 m a.r.l. The total thickness, including the laminated lake sediments on the top, is 5,5 m. The top of the section is at 25.5 m. The laminated unit at the top is 1-1.5 m thick and is laterally continuous along the entire section.

The dm/till unit is divided into 5 subunits: A-B-C-D-E. See Polaroid.

Lower boundary dm at 20 m (i.e. the lowermost occurrence of dm):

Boundary to underlying sand sharp, but somewhat irregular with a relief of 2-3 cm. 6-7 cm large clast at boundary. The boundary is almost horizontal, or slopes maybe weakly towards W/NW. this lowermost boundary is a transition from sorted fine sand below to poorly sorted sandy silt (almost dm) above. Lenses of sand are stretched out along the boundary. Strike/dip on one of these: $200^{\circ}/6^{\circ}$ (i.e. stress towards SE). At other places along the boundary there are more pebbles than at this spot.

Description of the subunits:

From this boundary upwards, we divided the dm into subunits (A to E), see Polaroid photos below.

Subunit A.

Ca. 1.25 m thick. Overall: changes between laminated fine sand and silty to clayey dm.

The sand horizons in A: laminated fine sand, internally deformed. The lowest, thickest sand is 15-25 cm thick. Primary structures in this is cut from below, possibly due to differential deformation between sandy and silty diamictic parts of the unit.

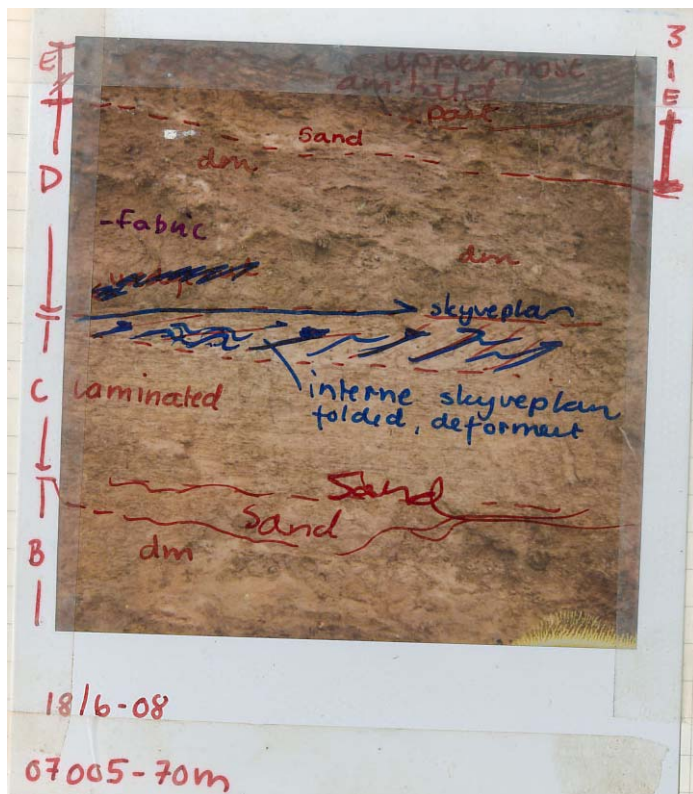
Above the thickest sand bed in the subunit there are interchanges between dm and laminated fine sand/silt. The dm's have a sandy/silty, partly clayey matrix. Clasts in the dm up to 15 cm in diameter. The laminated sand lenses are deformed/stretched out. Strike/dip of fold plane 230/16 (stress towards SE), see Polaroid.

Subunit B.

Boundary towards A partly sharp, partly diffuse. Sharp where underlying sand lamina are cut.

Matrix in dm is sandy to silty. Dominantly massive. Clasts observed throughout, largest 13 cm.

Lower ca. 20 cm stratified. Stratification follows shape of underlying surface, i.e. the movement may have been following this surface. See fabric 22.06.08.



Subunit C.

Transition B to C is a contrast from dm to poorly sorted fine sand with small gravel clasts and intraclasts of clay. Weak lamination in the lower part may suggest running water, and the intraclasts suggests erosive boundary. The sand fines up over 20 cm, and is capped by another some 2 cm thick sand, but somewhat variable due to extension. Upon there, 10 cm very fine silty sand. Next upwards is ca 50 cm laminated sediments (lacustrine). Large contrast between lamina in the pairs: Pure sand versus clayey silt or silty clay. Sandlaminae are lenticular, maybe rippled, and not very persistent laterally. No gradation between sand and fine grained. Maybe mainly quiet water with episodic pulses giving sand.

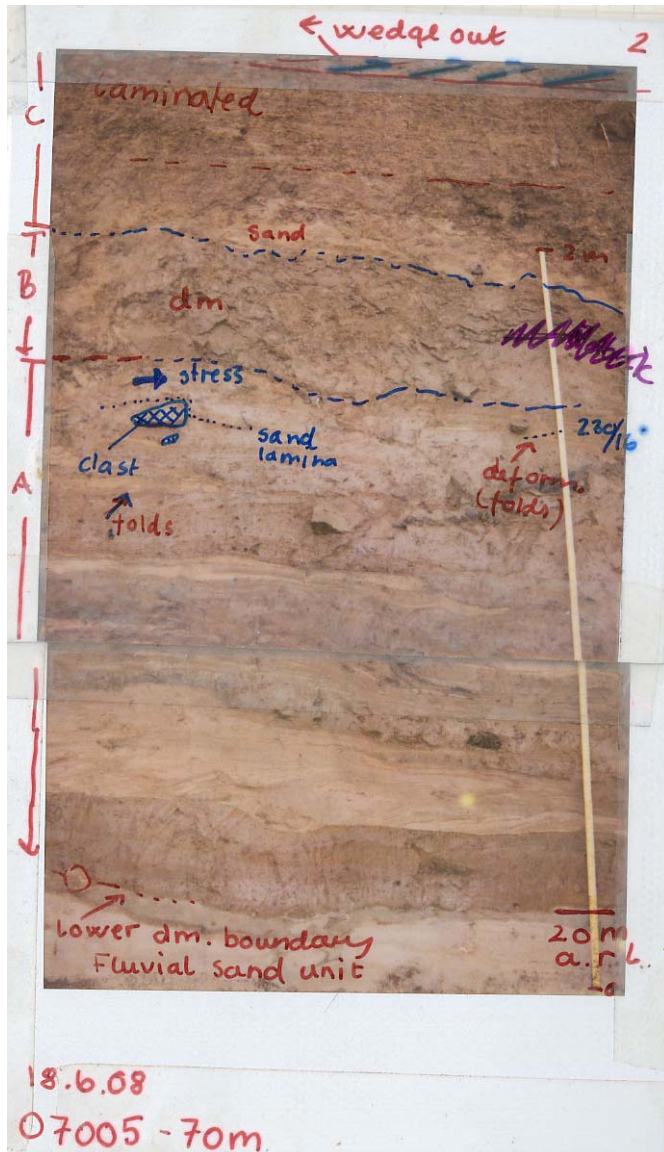
On top of this is a maximum 30 cm thick sheared up unit of the underlying laminated. However, sand dominates over silt/clay. Many internal shear planes suggesting multiple repetitions. Strike dip on two internal shear planes:

225/12 and 230/8 (stress towards SE).

Subunit D.

Thick dm, cleaned 1.1 m of lower part. Lower boundary marked by a series of parallel planes over a zone of 5-6 cm. banding continuing further up in the lower part, but dying out and the dm becomes massive. Sandy – silty matrix, all size fractions represented. Towards the top, thin stringers of laterally non-persistent sands.

See fabric 20.06.08.

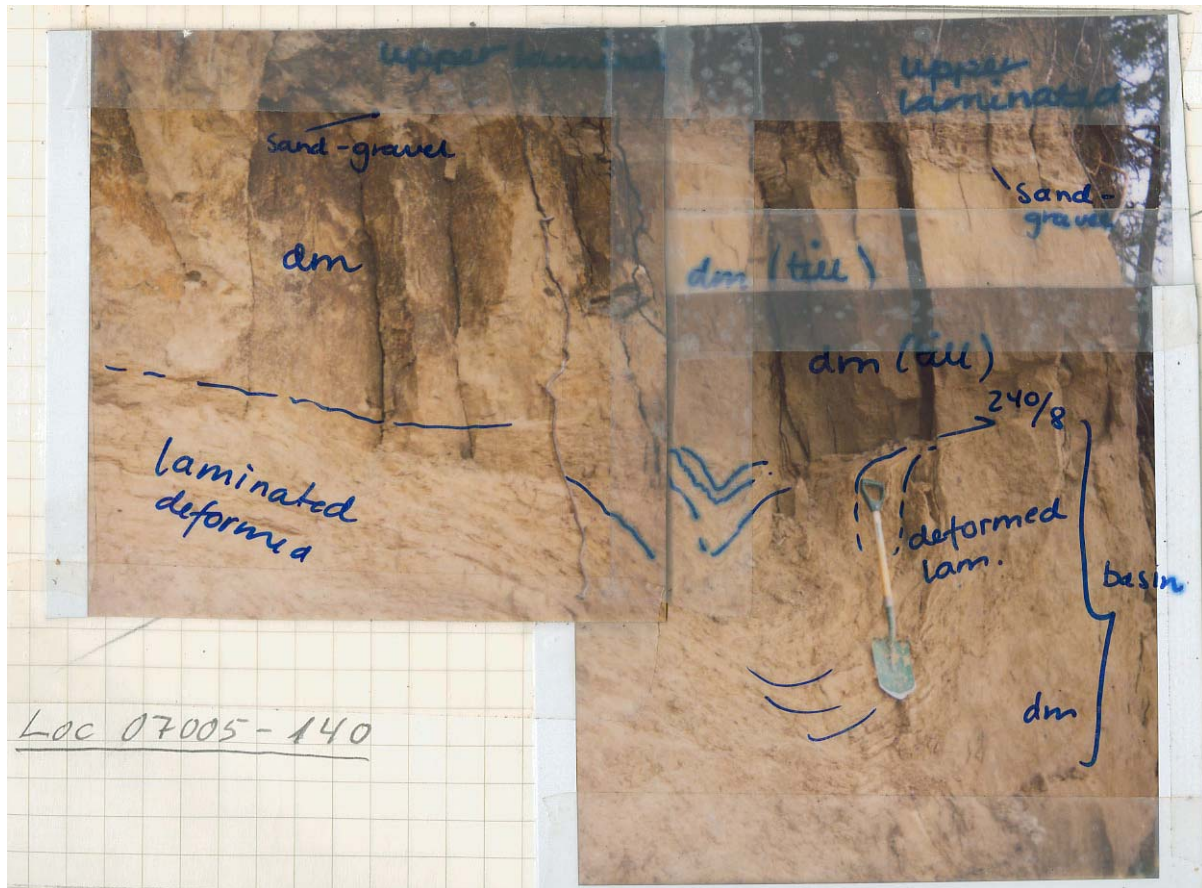


Subunit E.

Poorly sorted, dominantly massive sand, 20-25 cm thick. Irregular lower boundary. Small clasts of dm in the sand, thus erosive lower boundary. Mainly fine sand, but clasts up to gravel fraction. Thereupon ca. 50 cm very fine sand with some silt at the base fining up to clayey silt at the top. Some gravel clasts throughout. Deformed laminations, slump structures. Thereupon ca. 1.5 m laminated sediments, silt and clay lamina interchanges. Laterally persistent. Grade from coarsest to finest. Sets are maximum 3 cm thick.

As we go southeast-wards in the section we are able to trace the unsorted sand-gravel bed at the base of subunit E. We can follow this bed at least to 120 m.

Site 07005-140 m (Smotrakovka 1)



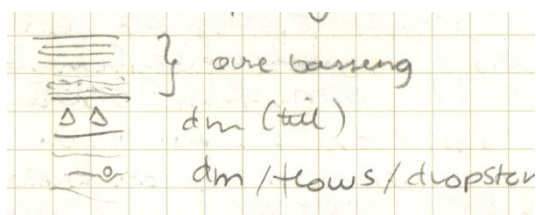
Deformation below dm involving lower glaciolacustrine unit. Shear plane: 280/8.

From the top:

Ca. 1.5 m laminated, glaciolac. Underneath ca. 1.5 m dm cutting and deforming underlying glaciolac.

• Site 07005-180 m (Smotrakovka 1)

Sketch, site 07005-180 m. Dropstone in the stratified dm.:



185 m: drop stones in lower glaciolac. with nicely bent lamina underneath.

Photos AL (190608)

- Photo 1-2 Site 07005-70 m. Overview of the upper part of the section, cf. Polaroid. Photo 2 at the topmost part.
- Photo 3-7 Site 07005-70 m. Details of the upper part of the section, cf. Polaroid, and photo 1-2. Photo 7 at the topmost part.
- Photo 8-9 Site 07005-70 m. Lower boundary of the dm.
- Photo 10 Site 07005-70 m. Lower part of the dm and upwards.
- Photo 11-12 Site 07005-70 m. Details from the lower ca. 70 cm above the lower boundary (of the dm)
- Photo 13-14 Site 07005-70 m. Details from the lower ca. 100 cm above the lower boundary (of the dm). A small fold structure is seen below the clast.
- Photo 15 Site 07005-70 m. Details ca. 80-100 cm above the lower boundary of the dm.
- Photo 16 Site 07005-70 m. Details ca. 70 cm above the lower boundary of the dm.
- Photo 17-19 Site 07005-70 m. Details ca. 110 cm above the lower boundary of the dm.
- Photo 20-21 Site 07005-70 m. Details ca. 80-100 cm above the lower boundary of the dm.
- Photo 22-26 Vittali prepares the fish for dinner
- Photo 27-29 Site 07005-70 m. Details from the dm, subunit B. See Polaroid. Photo 29 at the topmost part.
- Photo 30-32 Site 07005-70 m. Details from the laminated part (subunit C) of the dm unit (see Polaroid).
- Photo 33-35 Site 07005-70 m. Details from the laminated part (subunit C). The details are from the upper part where a wedge formed laminated sand is internally deformed (folds, shear planes). The topmost part/upper boundary is likely a shear plane.
- Photo 36 Site 07005-70 m. Subunit C.
- Photo 37 Site 07005-70 m. Details from the laminated part (subunit C). The details are from the upper part where a wedge formed laminated sand is internally deformed (folds, shear planes). The topmost part/upper boundary is likely a shear plane.
- Photo 38 Site 07005-70 m. Dm (subunit D) and lower part of subunit E.
- Photo 39-40 Site 07005-70 m. Details from the unsorted sand-gravel bed at the base of subunit E.
- Photo 41 Site 07005-70 m. Overview upper part of the profile.
- Photo 42-43 Site 07005-70 m. Details of the lower part of subunit E.
- Photo 44 Denis
- Photo 45-46 Site 07005-90 m. Unsorted sand-gravel bed in the upper part of the dm unit.
- Photo 47 Site 07005-90 m. Overview of the upper part of the upper part of the profile. See also photo 45-46 for details.
- Photo 48-52 Site 07005-140 m. See also Polaroid. The photos cover the upper part of the section and show deformation within the "basin" sediments, overlaid by the dm (till) and lacustrine sediments at the top.
- Photo 53 Site 07005-150 m. Upper part of the section. See sketch.
- Photo 54-55 Site 07005-150 m. Upper part of the section. See sketch. Dropstone in the stratified dm.

Photos ELA (190608)

- 1-2: Site 07005-70. Overlap upwards from lower boundary dm.
- 3-6: Site 07005-70. Overlap upwards from lower boundary dm.

- 7: Site 07005-70. Detail lower boundary dm at 20 m.
- 8: Site 07005-70. Transition dm – internal sand at 20.3 m.
- 9: Site 07005-70. Stretched out lenses of sand in dm at 20.5 to 20.7 m.
- 10-11: Site 07005-70. Def structures at 21.1 to 21.3 m.
- 12: Site 07005-70. Def structures at 21.4 m.
- 13-15: Site 07005-70. Dm, subunit B.
- 16-17: Site 07005-70. Transition subunits B-C.
- 18: Site 07005-70. Towards camp from section.
- 19-20: Site 07005-70. Sheared up sed in subunit C.
- 21-23: Site 07005-70. Transition dm – upper glaciolac.
- 24-25: Site 07005-185. Drop stones in lower glaciolac. Nicely bent lamina underneath.

Friday 20.06. Field work Smotrakovka

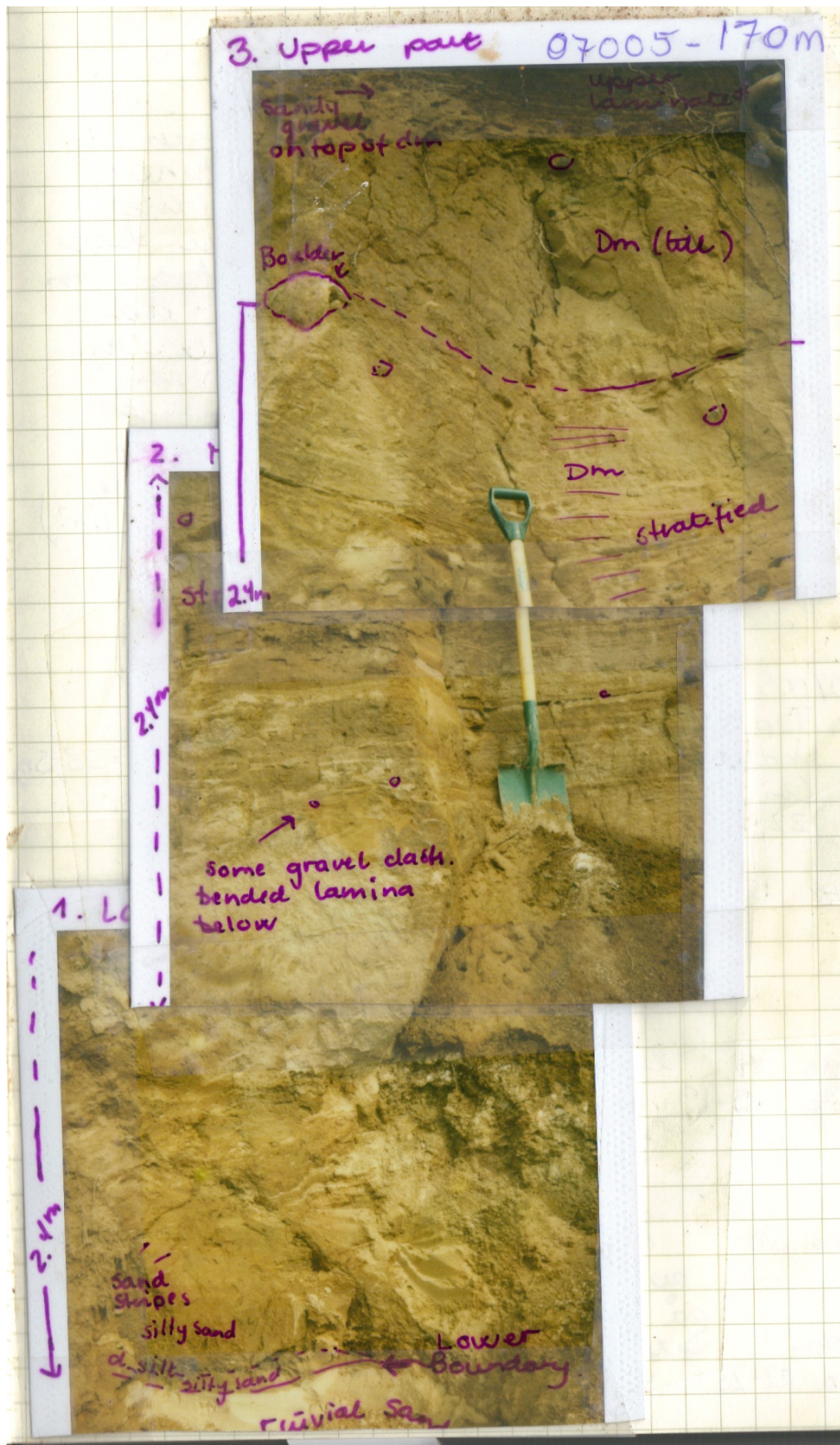
Maria, Astrid, Eiliv and Denis

Heavy rain during the night and in the morning. Delayed start at 9:30. Eiliv and Astrid do fabric and make notes in the "rain-weather" notebook.

Fabric at 07005-70m. Subunit D (Notes 19.06.08), 30-40 cm above lower boundary:

<i>Dip orientation/dip</i>	320/10
356/16	170/2
340/4	340/12
40/8	334/0
168/6	34/8
352/16	358/6
356/4	340/14
10/2	354/6
178/0	360/0
310/10	350/6
228/6	6/0
348/8	92/2
182/8	84/20

• Site 07005-170 m (Smotrakovka 1)
Polaroid (07005-170 m):



Description from the upper part of the section:

From the boundary of the fluvial sand and upwards (= basin sed. –till – glaciolacustrine sequence). See Polaroid.

-Lower boundary is sharp and shows a large color contrast towards the underlying light grey fluvial sand. We do not clean the section in details to document this boundary. The basin sediments start with ca. 5 cm very fine sand that is draped by ca. 3 cm clayey silt layer. This silt contains some gravel clasts.

Sediment succession upwards:

-Above the lower boundary and 95 cm upwards:

The sediments dominated by silty fine sand with scattered gravel clasts, non-continuous lamina and streaks of fine sand that is partly deformed (slumped). Zones within the sediment are more massive.

-Above this and 90 cm upwards: Stratified and laminated (continuous and planar) sand (very fine and fine sand) and silt. Sharp boundaries occur between fine and coarse sand laminae. Some scattered gravel clasts (between < 1 mm up to 2 cm). A few slump structures appear in the sediment (slumped lamina). We do find bended lamina at the base of one clast.

-Above this and 40 cm upwards: Dm, massive. Matrix of silty very fine sand. Many scattered clasts occur in the matrix, maximum 10 cm in size.

-Above this is 2-5 cm stratified dm (fine sand). One boulder ca. 30 cm in size, occurs in this part.

-Above this is a ca. 1.7 m thick dm (till).

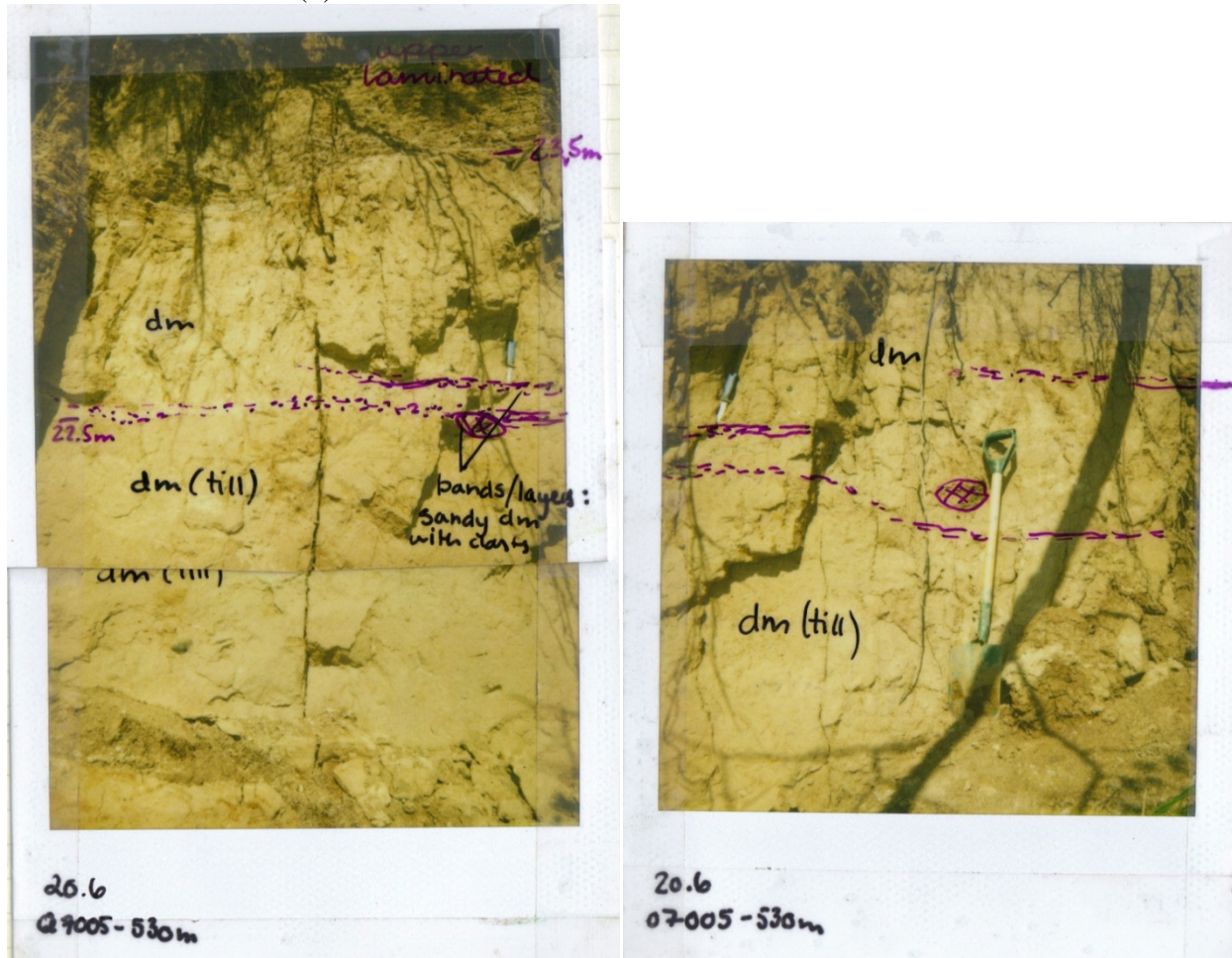
-Above this is a glaciolacustrine unit (topmost unit, 70 cm thick) with the sand-gravel bed at the base. The sand-gravel bed is observed several places along the section (many pictures are taken of this).

• Site 07005-810 m (Smotrakovka 1)

The southern part of the section. In the upper part of the section is the ca. 1.5 m thick laminated, glaciolacustrine sediment which we found along the entire section. At the base of this unit is a ca. 25 cm "dm"-like bed that appears clearly separated from the underlying dm(till). The till is here 75 cm thick. Below the till is one unit of stratified sediment similar to the stratified sediment at 170 m. The thickness is here estimated to be maximum 1 m. The boundary between the fluvial sand and the "dm"-basin sediment is at 24 m a.r.l.

• Site 07005-530 m (Smotrakovka 1)

Polaroid 07005-530 m (3):



The top of the section is at 25 m a.r.l. The lower boundary of the laminated glaciolacustrine unit is at 23.5 m a.r.l. The unsorted light grey sand-gravel (dm) bed is at 22.5 m a.r.l., and there is dm above and below (till below). See Polaroid.

Description from the top of the section:

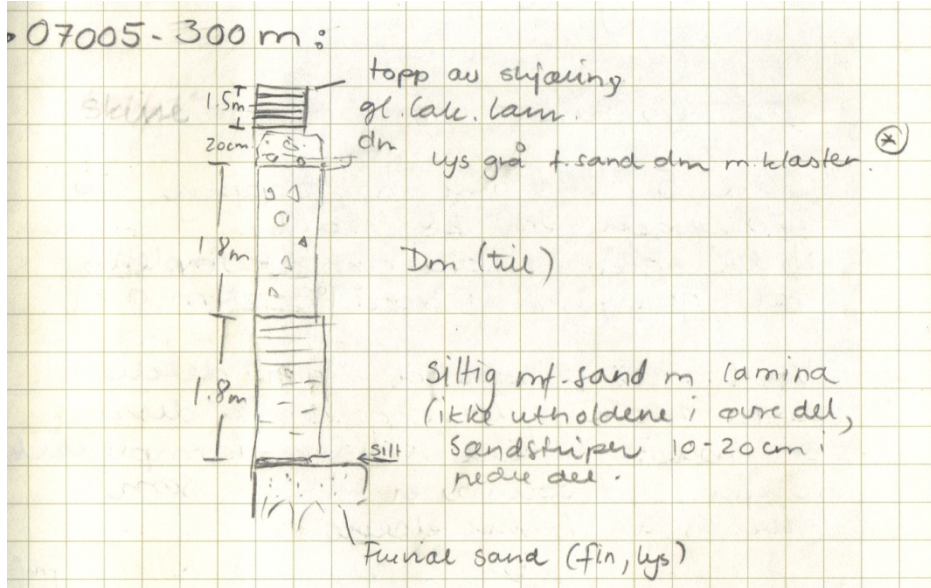
-Glaciolacustrine laminated sediment resemble the sediments we described from the 70 m position. Some relief/topography along the lower boundary.

-About 1 m of dm that partly is massive. Contains a few "bands" of sandy (very fine and fine) dm with some clasts. The dm has a sandy-silty matrix with clasts up to 20 cm in size. Some of the clasts are strongly weathered, especially those within the "bands". The lowermost "band" has a light grey color, is here 3-4 cm thick and is laterally continuous. Looking from distance (seen from the boat), it seems that this "band" is a light grey horizon that is laterally continuous along the entire section. In places, this horizon appears just below the glaciolacustrine unit. Other places, it appears within the dm-unit below the glaciolacustrine unit.

-Minimum 1.5 m massive dm (till). Matrix is sandy (very fine to fine sand) silt. Clasts appear in all sizes up to 40 cm. We do not clean the lower boundary at this place.

• Site 07005-300 m (Smotrakovka 1)

Sketch of the stratigraphy:



(*) Note to the sketch:

In places within the section, the light grey sandy-dm "band" appears just below the fine laminated glaciolacustrine unit. Other places this "band" lacks the clasts and contains only the light grey very fine-fine sand. However, the "band" can be traced as a more or less continuous horizon along the entire section.

Photo AL (200608):

- Photo 1 Site 07005-170 m. Overview of the upper part of the section. See Polaroid photos (the upper two). The photo covers the stratified/laminated part of the sediment/dm and the till above.
- Photo 2 Site 07005-170 m. Lower part of the silty sand, just above the fluvial sand. Sand "streaks" are shown.
- Photo 3 Site 07005-170 m. Stratified/laminated part below the dm/till. Stretched sand lamina, "boudinage"-structures.
- Photo 4 07005-170 m. Stratified/laminated part below the dm/till. Planar lamina.
- Photo 5 07005-170 m. Dropstone in the stratified/laminated sediment.
- Photo 6 07005-170 m. Dropstone in the stratified/laminated sediment, "boudinage"-structure.
- Photo 7 07005-170 m. Dropstone in the stratified/laminated sediment.
- Photo 8-11 Valery, fish
- Photo 12-13 07005-530 m. Overview of the section. See Polaroid (the knives position is at the same place).

- Photo 14 Eiliv
- Photo 15-19 07005-530 m. Mosaic, cf. photos 12-13 and Polaroid. (the knives and spades position are at the same place).
- Photo 20 07005-530 m. Details from the upper dm with the two "bands" of sandy dm (cf. Polaroid). The knives position is as in photos 12-13.
- Photo 21 07005-530 m. Details, lowermost "band" of sandy dm.
- Photo 22-23 07005-530 m. The dm (till), cf. Polaroid.
- Photo 24-25 Denis
- Photo 26-27 07005-490 m. Glaciolacustrine sediments at the top of the section. This photo is representative for this unit as it occur salong the entire section.
- Photo 28-31 07005-490 m. Light grey "band" of sandy (very fine-fine) dm. Located here ca. 30-35 cm below the glaciolacustrine laminated unit.
- Photo 32-33 View from the river 07005 towards the Smotrakovka section from 1997.
- Photo 34 At the bone-fire in the evening.

Photo ELa (200608):

- 1-2: Site 07005-170. Overview where polaroids at the site.
- 3-4: Site 07005-170. Details in laminated.
- 5: Site 07005-530. Overview. Knife and spade as in Polaroid.
- 6-7: Site 07005-530. Dm to lacustrine.
- 8-9: Site 07005-530. Astrid.
- 10: Site 07005-530. Dm
- 11-13: Site 07005-530. Gravelly bands between dm's.
- 14-15: Site 07005-530. Dm
- 16-17: Site 07005-490. Light grey sandy dm band.
- 18-19: Vaga river from site 07005 towards 1996 site.
- 20, 22-23: Site 07005-250. Laminated sand under massive dm which again is underlying dm with gravel band. On top glaciolac.
- 24: Camp at Smotrakovka.
- 25-26: Valery.

*Saturday 21.06. Field work Smotrakovka
Maria, Astrid, Eiliv and Denis*

Sunny day.

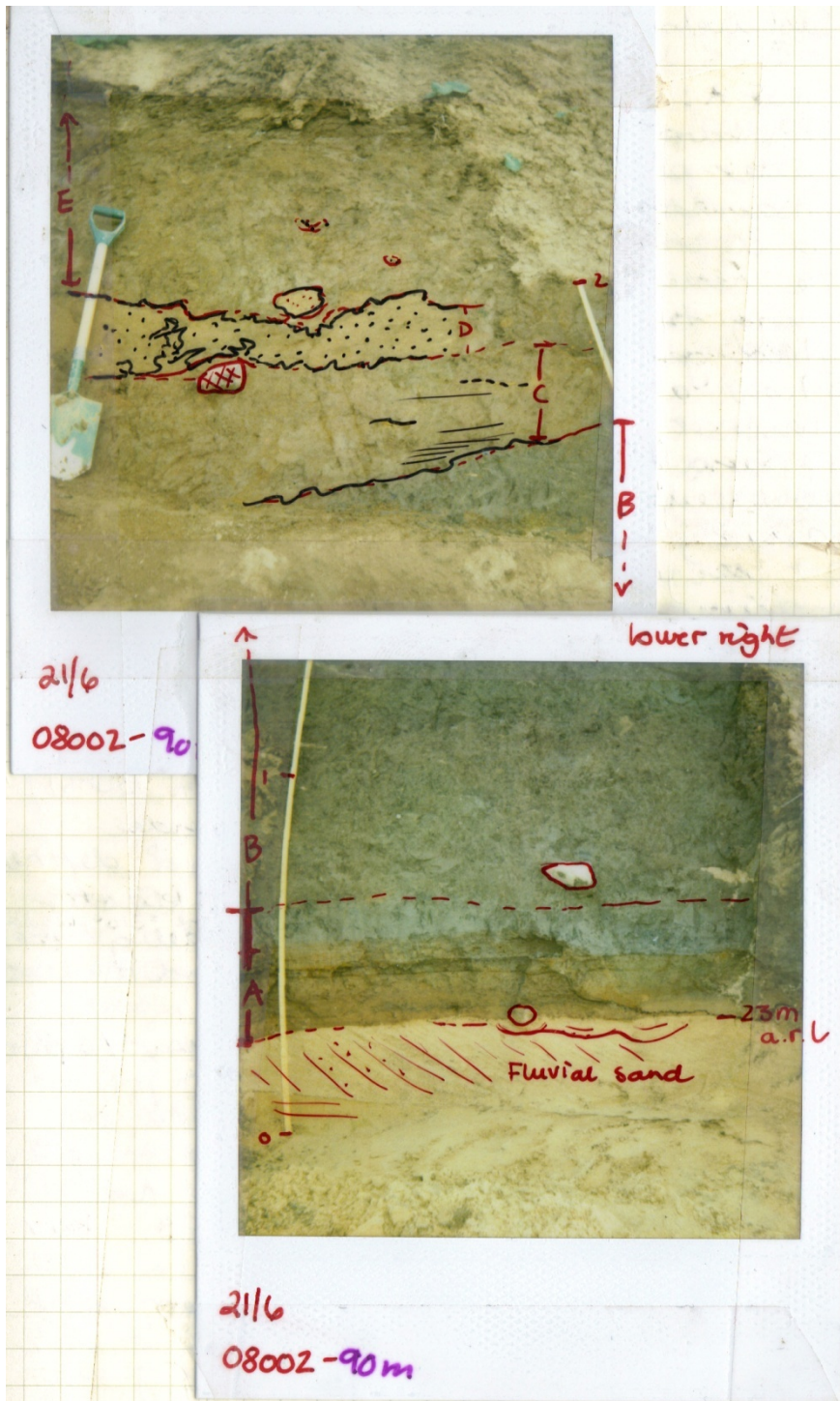
• Site 08002 (Smotrakovka 2)

This site was investigated by us in 1996. The section is located upstreams to site 07005. The zero-point is in the downstream end of the section at sailing mark 115 (= 2.19 km upstreams to the zero point of site 07005).

In 1996 we did fabric measurements both below and above a light grey sandy dm "band", that is described to appear within the 5 m thick upper dm (at that time interpreted as a thick till). Lum-dates just below this gave ages about 19-20 ka.

• Site 08002-90m (Smotrakovka 2)

Polaroid (2):



We describe the upper 5 m of the section. Top of the section is at 28 m a.r.l. Lower part of the dm/till complex is at 23 m a.r.l. (= upper boundary of the fluvial sand). We separate the dm/till complex into subunits (A-B-C-D-E), see Polaroid photos.

Description of the dm/till complex (upper 5 m of the site)

-Subunit A:

The lower boundary is very sharp, horizontal, and cuts the underlying fluvial cross-bedded sand (fine and medium sand). One clast, ca. 8 cm in size, appears along the boundary. Subunit A is in total 30 cm thick. The lower 20 cm shows a generally fining upwards development from fine sand to more silty sand. Some gravel clasts appear scattered. The upper 5-7 cm of the upwards fining succession is parallel-laminated, alternating between sandy silt and very fine sand. The uppermost 10 cm is clayey sandy silt (more massive) and contains some clasts (maximum size 2 cm). It looks like that this massive silt has been dumped on top of the laminated silt as lamina appear bended (and partly removed) at the right side of the section wall.

-Subunit B: (dm/till):

The lower boundary is irregular and has a relief up to 5 cm. In places the boundary is sharp and clear, other places more gradual and difficult to define. The matrix is sandy-silty and several/numerous clasts occur (maximum size 20 cm). At the surface of the largest clast (it appears to be flat-lying) we find consistent striations direction towards 310°. A few sand-streaks and sand-inclusions occur in the dm. A few (very) small shell fragments appear. The dm is about 90 cm thick (has a inclined and irregular upper boundary). Color: dark grey.

-Subunit C (dm):

Thickness varies between 35 and > 50 cm. Brownish color. Matrix is very similar to matrix of subunit B and contains clasts. The lower boundary is irregular and partly diffuse, and it inclines at the right part of the section wall. The boundary is defined by the change in color, but this may be difficult to see in places. Within the dm occur up to 20 cm of weakly laminated (scale 3-5 mm), non-continuous lamina. Stretched sand-lenses (about 10 cm long) and "bands" of sand occur within the sediment. Other places the dm seems to be more massive. Some clasts occur within the dm, the largest is 15 cm in size. This one lies inclined, and has striations (20°-200°).

-Subunit D (sand):

Very fine to fine sand. The lower boundary is chaotic and sediments (dm) from the underlying subunit C has been incorporated into the sand. Thickness about 30 cm. Seemingly, subunits C+D+E have been slumped together (at the same time).

-Subunit E (dm):

The lower boundary is chaotic. Intraclasts from the underlying subunit D (sand) have been incorporated into the dm, and appear up to 50 cm above the lower boundary. Thickness 2.2 m. There is a gradual change from about 1 m and upwards; the clast content decreases, the dm becomes less compact and very diffuse lamination (non-continuous) appears. Matrix (in the top part) is silty very fine sand. Matrix at the base is sandy (very fine) silt. The change in matrix is gradual. The content of clasts decreases upwards. A few shell fragments occur scattered.

-Subunit F (glaciolacustrine clay):

The transition from subunit E is gradual from silty very fine sand to mainly silt with few lamina/stratified beds of very fine sand. These variations appear within the lowermost 60 cm of the subunit. Above this, subunit F consists of very fine laminated silt and silty clay (high content of clay). At the upper part, the very fine sand lamina has disappeared. Thickness 1.7 m in total.

Fabric (subunit B, level 20-25 cm above the lower boundary of the subunit):

275/20	76/16	276/26	266/16	285/14
280/20	88/06	325/08	335/04	260/10
30/08	346/20	260/22	22/26	310/02
30/02	250/06	206/34	285/16	24/10
320/04	280/10	46/00	244/08	270/06

Fabric (subunit E, level 35 cm above the lower boundary of the subunit):

270/12	265/22	274/14	60/04	250/12
46/06	80/08	20/12	184/02	280/14
340/28	135/10	70/04	255/22	56/04
265/14	294/24	230/16	88/06	86/06
264/04	270/04	180/02	220/04	40/04

Photos AL (210608):

- Photo 1-2 Vittali and Valery
- Photo 3 Maria
- Photo 4-5 Camp at Smotrakovka
- Photo 6 Vittali, Valery, Eiliv and Maria in the boat
- Photo 7 Vittali in the boat
- Photo 8-9 Valery and Vittali in the boat
- Photo 10-11 Site 08002-90 m. The photo covers the lower part of the dm-complex (cf. Polaroid)
- Photo 12 Site 08002-90 m. Overview of the upper part of the section (cf. Polaroid)
- Photo 13-14 Site 08002-90 m. Subunit A and lower part of subunit B. The knife is at the boundary between A and B. see Polaroid.
- Photo 15 Site 08002-90 m. The knife is at the boundary between subunits A and B. see Polaroid.
- Photo 16 08002-90 m. The knife is at the boundary between subunits B and C. See Polaroid.
- Photo 17 08002-90 m. Subunits C and D. The knife is at the lower boundary of subunit D.
- Photo 18-19 Astrid

Photos ELa (210608)

- 1-3: From camp Smotrakovka.
- 4: Site 08002-90 m. Overview of the upper part of the section (cf. Polaroid)
- 5: Site 08002-90. C to E?
- 6-7: Site 08002-90. Fluvial to dm (B). Knife at the top of A. Striated clast to the right in A.
- 8: Site 08002-90 m. The knife is at the boundary between subunits B and C.
- 9-10: 08002-90 m. Subunits B to E. The knife is at the lower boundary of subunit D.
- 11-25: From camp Smotrakovka.

Sunday 22.06. Field work Smotrakovka

Maria, Astrid, Eiliv and Denis

Warm day, partly clouded. Before lunch Astrid and Eiliv continued at 07005-70 m. After lunch Eiliv and Astrid went through the entire section together with Maria and Denis and made up a summary and composite stratigraphy/succession.

Fabric in subunit B at 07005-70, 10-20 cm below upper boundary (Field notes 19.06.08):

<i>Dip orientation/Dip</i>	254/6	30/20
245/4	250/8	190/12
254/6	258/10	300/6
300/10	270/2	230/4
255/4	246/6	250/10
120/4	125/14	240/14
270/8	276/4	135/16
245/4	286/6	272/8
284/6	266/10	

Eiliv and Astrid traced the light grayish sand-dm horizon, aiming to get a more detailed description of this. Several places within this horizon we find normal graded sand/silt. At few places we find reverse grading. Other places we find it to be more unsorted with "floating" clasts (the largest ones) within the matrix. From a distance this horizon seems to be a continuous band. As we trace the horizon laterally, the horizon consists of several bands that not necessary are continuous, but lie within the same stratigraphic level. And several bands may appear above each other/or appear separated above each other. In places the "band" fingers into several bands that appear on top of each other. In places the band appear just below the glaciolacustrine clay (topmost unit), other places it lies below and down into the dm-unit. We suggest that the process that formed these was time-transgressively active.

At the end of the day we made a composite stratigraphy of the Smotrakovka section:

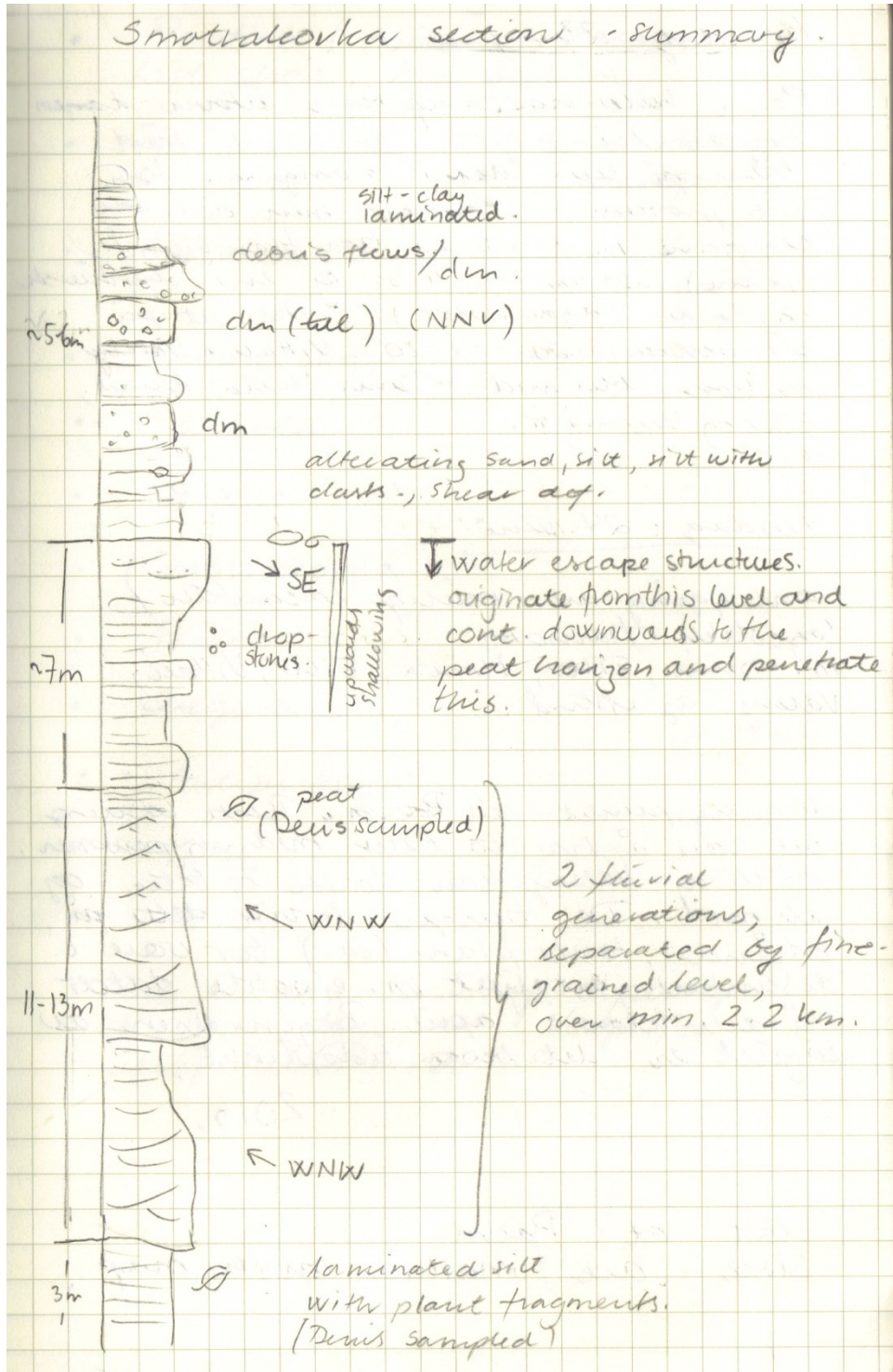


Photo AL (220608):

- Photo 1-5 Site 07005. Details from the light grey sandy-dm band
Photo 6-7 Site 07005. Details from the light grey sandy-dm band and the glaciolacustrine laminated sediment above.
Photo 8 Site 07005." Flow"-bands within the dm.
Photo 9-11 Site 07005. Graded sediments within the dm (flows).
Photo 12-13 Site 07005. Slump-deformation structures within the dm (flows)
Photo 14-15 Site 07005. Details from the light grey sandy-dm band close to the glaciolacustrine laminated sediment above.
Photo 16-17 Site 07005. Dm (flows)
Photo 18-19 Site 07005. Small (mini) deformation structures/folds within the dm (flows)

Photo ELa (220608):

- 1-2: Camp Smotrakovka.
3-19: Light grey sandy-dm band forming the base of the glaciolacustrine basin.
20-21: Valery mending nets.
22-30: Light grey sandy-dm band forming the base of the glaciolacustrine basin.

Monday 23.06. Travel Smotrakovka-Shenkursk
Maria, Astrid, Eiliv, Denis, Vittali, Valery, Evgenij jr.

Heavy rainfall during the night and the day. Strike the camp. We drive the car from the camp (the boat on the hanger behind). Due to many persons and a lot of equipment, we needed to drive in two groups. We had some problems in the terrains due to the wet ground, but we managed it (thanks to the experiences of Vittali and Valery). Started at 11:30 and arrived at Vaga Hotel in Shenkursk at 16:30. We met in the restaurant (same one as we visited in 2007) in the evening. Vittali and Valery with their wives joined us.

Photos AL (230608):

Photo 1-3 Striking the camp at Smotrakovka

Photos Ela (230608)

1-3: Dinner at the restaurant in Shenkursk (3: the wives of Valery and Vitaly).

Tuesday 24.06. Travel Shenkursk-Arkhangelsk
Maria, Astrid, Eiliv, Denis and Evgenij jr.

In the morning we meet Vittali and Valery and discuss future (2010) field work and logistic. They recommend us to do field work in the beginning of August. They have the possibility to help and join us in **August 2010** and will be able to find two suitable boats for the work. They need to know about the plans a while before the field work: First plan in Dec. 2009, details regarding the dates must be decided due April 2010.

During the planned field work we aim to follow the ice-dammed sediments from outside the LGM boundary (in the Vaga basin), and find out what happens within the ice-dammed basin as the ice move into it. Also we want to understand what happens within the basin as the glacier starts to retreat.

The following (potential) sections should be visited:
(the sites are marked on the map!)

- Start at Pasva
- Rovdino (north of Pasva), left shore, big section
- Paloginskaja (between Rovdino and Ust Padenga), left shore
- Osinovskaja (inside LGM, Ust Padenga)
- Grebinovskaja
- Raibola
- Korbola
- (Smotrakovka)
- Peribor
- Shegevara
- Antipiskaja
- Kitsa
- Ust Vaga

-There are other possible sections along the lower part of Vaga (before the junction with Dvina).
-There are also sections downstreams to Tolokonka, but in that area we need a larger boat. Vittali and Valery will contact some colleges in that district to check out for possibilities.

Valery Sobolev (+7 9214882445, cell phone)

Vittaly Ivanov (+7 9210768421, cell phone, +7 9118727910, cell phone)

We drive from Shenkursk at 11:10 (after visiting Vittali at his office and copying/downloading pictures). Arrive Arkhangelsk at 19:00. Maria stays at Pur Navalok. As we other not had made a reservation at this hotel, there was no vacancy when we arrived. We spent several hours trying to find other accommodation in Arkhangelsk without success. We met Maria at restaurant Bobrov at 21:00. After the dinner we said fairwell to Maria who left for Norway the next day. Evgenij jr. drove us to hotel Maley Karely where Denis, Astrid and Eiliv accommodated at the luxury place "Hotel Maley Karely". We paid Evgenij jr. and took farewell with him.

Wednesday 25.06. Fieldwork at Matera (close to Maley Karely)

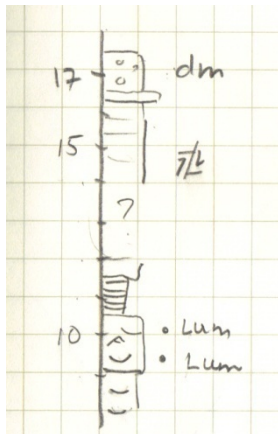
Astrid, Eiliv, Denis and Valery

Denis had phoned to the driver (Valery) and we met him at the hotel at 10:00. We visited site 07009 (described by Maria in 2007) aiming to work with the uppermost dm/till unit.

• **Site 07009 (Matera)**

We find the section that was described by Maria in 2007. The section is about 15 m high and the uppermost ca. 6 m is exposed.

Sketch of the stratigraphy (made from Marias notes):



The topmost dm we were supposed to find and describe was slumped and mainly covered by sediments, roots and vegetation. We were not able to find *in situ* dm-sediment. Behind the top of the section, the surface is flat. On top of his surface we recognize an old (abandoned) river channel.

We conclude that there is nothing we can do at this site.

We drove to find the section at Trepuzovo (site 9703), but we didn't find it. We concluded that we need a boat to find this section. Denis manages to find a boat for the coming day.

Photos ELa (250608):

- 1-2: Astrid at Maly Kareli
- 3: Valery, Denis and Astrid having lunch.

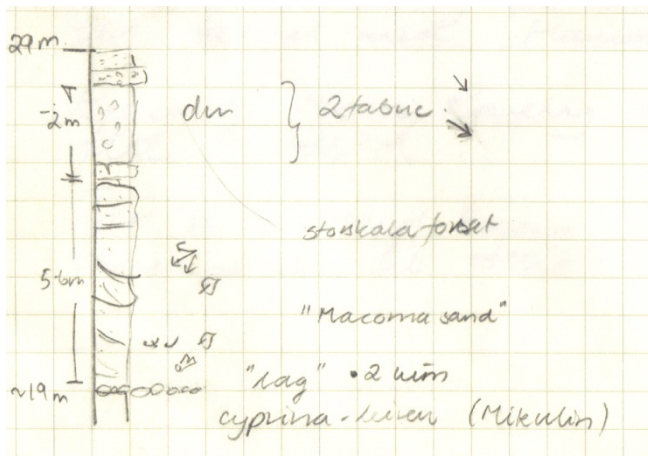
Thursday 26.06. Fieldwork at Trepuzovo (close to Maley Karely)

Astrid, Eiliv, Denis and Valery

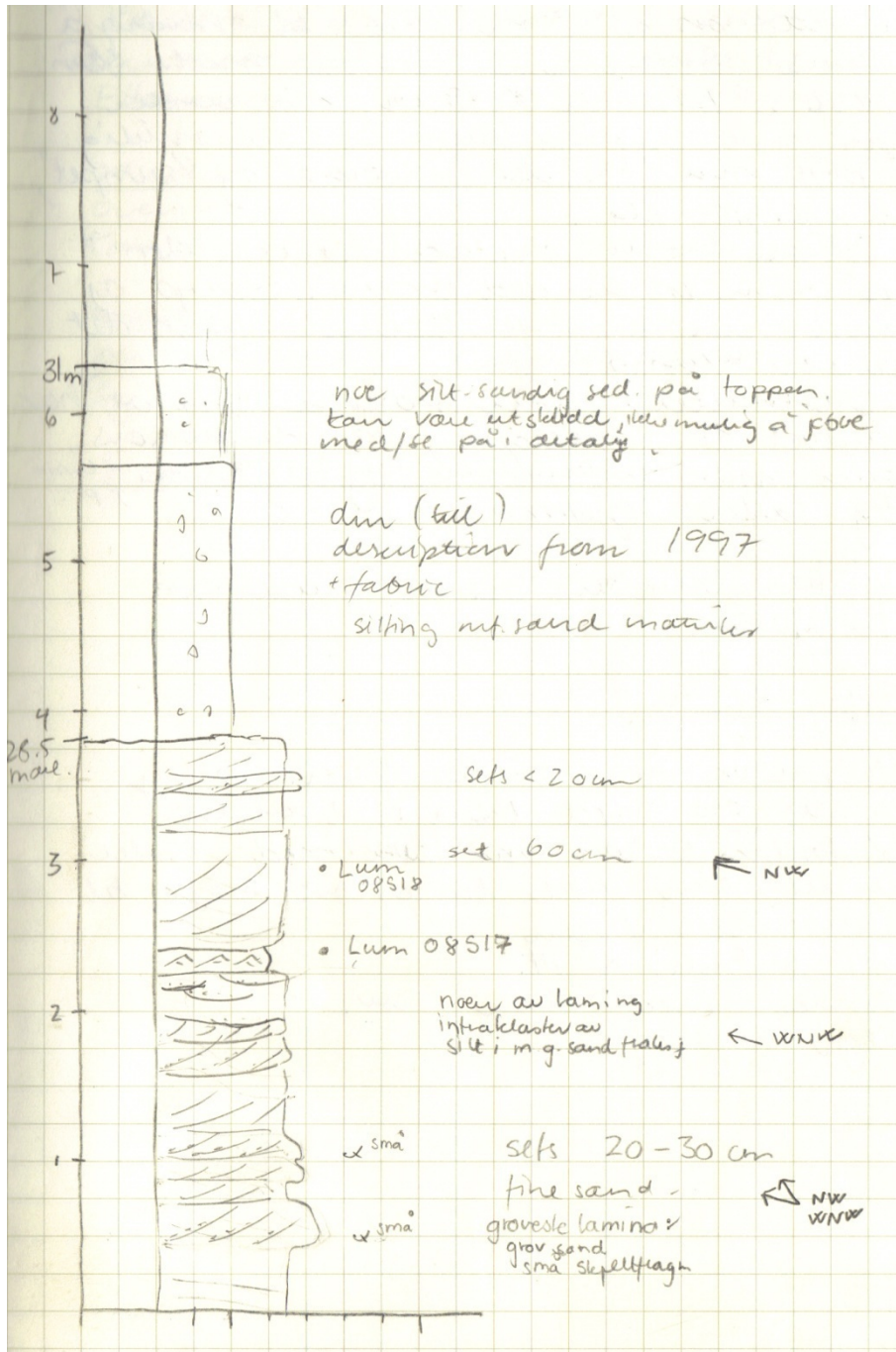
• Site 08003 (Trepuzovo)

We think we have found site 9703 that was described in 1997. Top of the section is 31 m a.r.l. The boundary at the "Cyprina-clay" is at 18 m a.r.l. (top of the clay). The lower boundary of the till is at 28 m a.r.l. The section is difficult and dangerous to work in, sediments are slumping all the time.

Sketch of site 9703 (from the 1997 notes):



Log site 08003:



0-point: at beach on downstream end of site.

Top marine (Mikhulin) at 18 m arl.

Top of section (terrace level) at 31 m arl.

Base dm at 28.5 m arl.

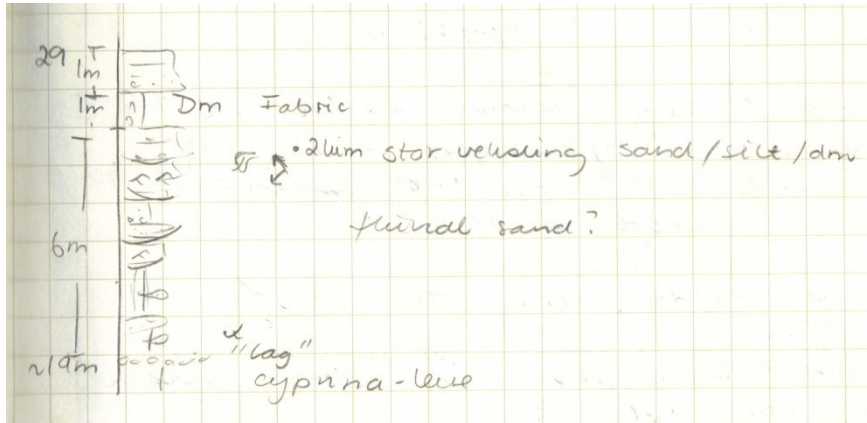
Section oriented at 300-120.

Lower boundary dm: In downstream part of section sharp, straight and horizontal. Upstream part, wavy, irregular with relief up to 1 m. Obviously slumped. Maybe primary in downstream part.

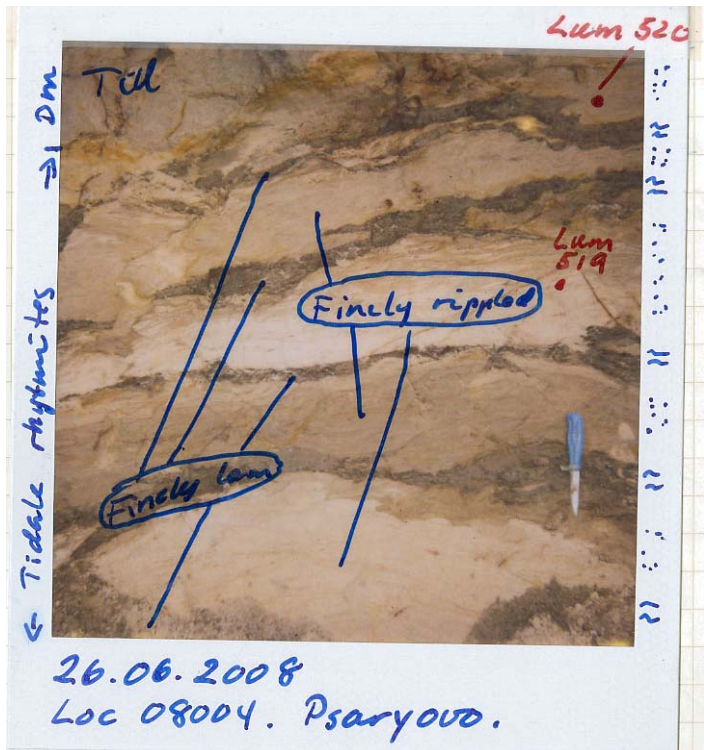
• Site 08004 (Psaryovo)

We sail from Ljabla to Psaryovo.

Sketch of site 9702 (from the 1997 notes):



In this area several sections appear along the river and it is possible to work in these. The sections are up to 30 m high. It is not possible to work at levels below 18-19 m, *i.e.* the topmost level of the "Cyprina-clay". At these low levels the sediments are slumped, wet and slippery. We agree on our earlier interpretation that the upper dm is a till (uppermost > 1 m). The lower boundary is very sharp and erosive. The underlying sediments we find indicative to be tide-water sediments.



Base dm at the site is 25 m arl. Dm 2 m thick, i.e. terrace level at 27 m arl.

With sharp boundary to the above dm, there are sets of 15-30 cm thick f to mf rippled sand in systematic changes with 3-5 cm thick bands of finely laminated clayey silt. Mud drapes observed in some ripples in the sand sets, but not seen double drapes. In the fine sets, there are fine lamination and fining up sequences.

Transition sand to silt sets are sometimes graded. Some silt sets are topped by 1-2 mm thick clay drapes.

Interpreted as tidal sediments.

Well sorted silt layer stands out 4 m below dm. further 0.5 m down there are sand (see log Astrid 1997). 20 m upstream there are nice tidal structures in this silt. Just below there is sand, and a clayey dm (not till), log Astrid 1997.

Sample 08-517. Site 08003. OSL. Fluvial sand 27 m arl.

Sample 08-518. Site 08003. OSL. Fluvial sand 27.5 m arl.

Sample 08-519. Site 08004. OSL. Tidal sed 80 cm below dm.

Sample 08-520. Site 08004. OSL. Tidal sed 40 cm below dm.

Photo AL (260608):

Photo 1 Eiliv

Photo 2-3 Site 08003 (Psaryovo). Tidal sediments.

Photo 4-10 Boat man from Ljabla

Photo 11 Denis

Photo ELa (260608):

1-5: Site 08003. Overview from boat.

6-8: Site 08003. Upstream end where samples 517 and 518 were taken.

9: Site 08003. Overview logged area.

10-11: Site 08003. Boundary fluvial sand – dm at 28.5 m.

12-18: From boat between Trepuzovo and Psaryovo.

19-25: Site 08004. Tidal sed below till at Psaryovo.

Friday 27.06. Arkhangelsk
Astrid, Eiliv, Denis and Valery

We arrive Arkhangelsk at 14:00. Valery had to drive twice from Maley Karely with his small car. We have packed some equipment that Valery will store at his place until the field work in August (Mezen field work). We do some errands in Arkhangelsk (bank etc.) and prepare/pack equipment for storing and transport home. All the tents were dried at Maley Karely. Accommodate at Hotel Pur Navalok.

Saturday 28.06. Arkhangelsk
Astrid, Eiliv, Denis

Office work at the hotel. We had lunch with Denis before he left for St. Petersburg. City festival in the evening.

Sunday 29.06. Arkhangelsk
Astrid, Eiliv

Office work at the hotel. We made outline for the Smotrakovka –paper.

Monday 30.06. Arkhangelsk
Astrid, Eiliv

Office work at the hotel. We made outline for the Kuryador –paper. Shopping in the city.

Tuesday 01.07 Travel Arkhangelsk-Trondheim
Astrid, Eiliv

Travel Arkhangelsk – Trondheim via Murmansk. We had some troubles with luggage declaration and the custom before leaving Murmansk. Declaration (of all our goods) must be done on arrival to Russia. (We have never done this before).