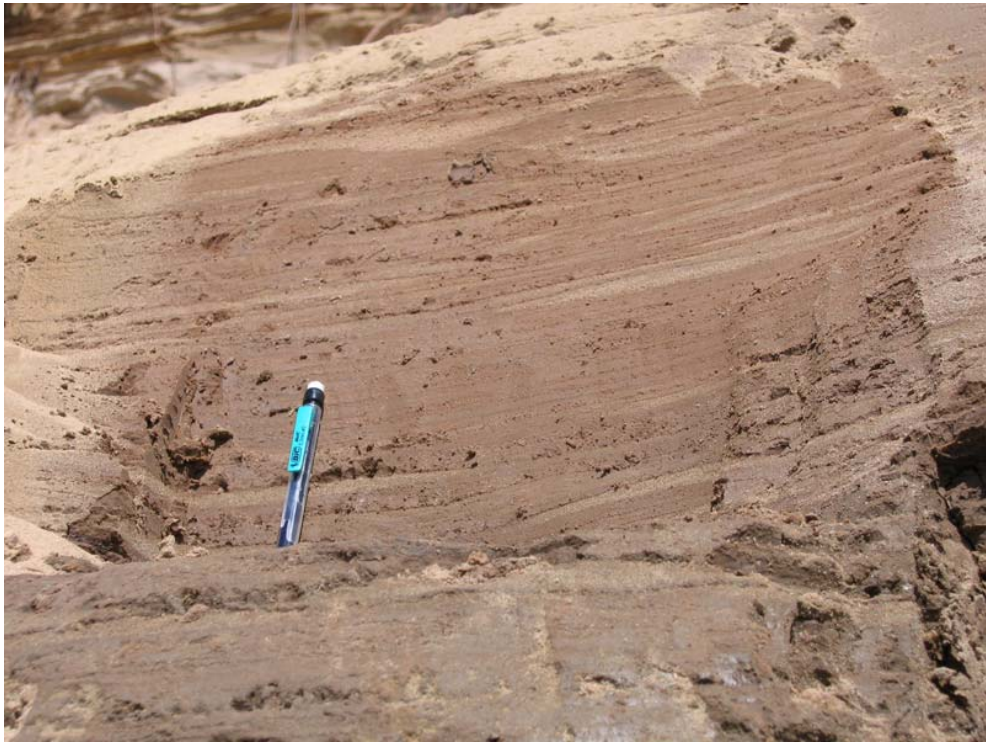


ACTIVITY REPORT

Severnaya Dvina river (Arkhangelsk province)

2008



Laminated sediments from Tolokonka Section

Aurélien van Welden

Geological Survey of Norway

Introduction

The present report contains my field data from River Severnaya Dvina in Arkhanglesk Province, NW Russia, collected during the period 04.06.2008 and 24.06.2008. The aim of this report is to provide complementary information about the Tolokonka section, previously investigated by NGU's Eiliv Larsen, A. Lyså and M. Jensen between 2006 and 2007, and in complement to Eiliv Larsen & Astrid Lyså 2008 field report.

My contribution to the study of the section was focused to the sampling of laminated glacio-lacustrine intervals formerly identified in section 06025 and the newly described 08002 section, located 1 km Northwards from 06025 section. In addition to the sampling, my task was to supervise UiT student Hilde Krogh, who's report is available online and Russian U. St Petersburg Valery Shebotinov (report available in Russian).

The main aim of our field campaign was to characterize the geometry of the glacio-fluvial and lacustrine deposits (H. Krogh master thesis) in order to define a sedimentation model in time, during the last glacial cycle, in relationship to the growth and decay of major ice sheets (see Larsen et al., 2006 for a comprehensive review).

In addition to the field notes, the location of samples which were studied further in Trondheim as well as the results and interpretations are included in the report.

The present report contains:

- Description of the sections
- Photographs
- Sample list (and location)
- Up to date sedimentological investigations and related interpretations

Due to bad quality/lack of readability, some schemes were redrawn in Trondheim.

Aurélien van Welden

Trondheim, 2011

Participants

Geologists

Eiliv Larsen: SciencePub project leader, NGU, Trondheim, Norway

Astrid Lyså: NGU, Trondheim, Norway

Aurelien van Welden: NGU, Trondheim, Norway

Maria Jensen: UNIS Svalbard, Norway

Denis Kuznetsov: Hertzen University St. Petersburg, Russia

Dimitri Subetto: Hertzen Univ. St Peterbourg, Russia

Journalist

Gudmund Løvø: NGU Trondheim, Norway

Students

Hilde Krogh (geology, master): Univ. Tromsø, Norway

Valery Shebotinov (geology, PhD): Univ. Hertzen St. Petersburg, Russia

Susan Lund Johansen (Journalism, master): Oslo Univ. College, Norway

Liv Sofie Utvær (high school): Fyllingsdalen Videregående skole, Bergen, Norway

Ingrid Eidsvaag (high school): Bergen Katedralskole, Norway

Russian support Personnel

Evgenij Vyatkin: driver/boatman Kotlas

Evgenij Vyatkin Jr.: day driver from Kotlas

Alexej Lioja Bleh: cook/field assistant, St. Petersburg

Field Overview

03.06. 08: Departure from Chambéry (France) 4.00 a.m. to St Petersburg via Geneva and Helsinki. 04.06.2008: St Petersburg.

05.06. 08: Departure by train to Kotlas (7.40 am)

06.06. 08: Arrival in Kotlas at 9.40 am. Do errands, meet field assistants and drive to Tolokonka by van. The camp is ready at ca. 9.00 pm.

07.06.08: introduction to field site and fieldwork in groups in Tolokonka section

08.06.08 – 24.06.08: fieldwork in Tolokonka

24.06.08: drive from Tolokonka to Kotlas and train trip to St Petersburg

25.06.08: arrival in St Petersburg in the morning, and flight back to France in the evening.

Field notes

2 sections were studied: one Northwards the other Southwards. The fieldwork consisted in describing sedimentary units in order to define the sedimentation dynamics in this area, in relationship with glacier advance during Late Quaternary. The main section is 4 km long (useful length of 2 km), it's the southernmost unit. Northern unit was studied on 1 km.

04/06/08

Briefing in St Petersburg: presentation of the SciencePub project, the aim of our research and some of the methods. In the afternoon, we walk around to visit Hermitage Museum (a very little part of it) and the museum of Natural History.

05/06/08

Departure to Kotlas, 26 hours of train.

06/07/08

Arrival in Kotlas, errands. The weather is cold and cloudy. We put all the stuff in the car, have some meal and get the cars to Tolokonka. Onsite, we install the camp after crossing the river by boat, due to high water level.

07/06/08

After a cold (0°C) snowy night, start of the field work...

Introduction to the fieldwork. Presentation of the section and the global time pattern: Weichselian (40-30 ka BP) and LGM. The Watershed of 40 km², mainly continental deposits. The sedimentary features of the site are prograding fluvial foresets, fine-grained (silty clays of clayey silts) sediments with intercalated fluvial deposits and laminated lacustrine units (occurrence of real Varves ?). Some Hummocky Cross Stratifications (HCS) were also previously identified downstream. Eiliv, Astrid and Maria explain that when the glaciation is occurring, Ice Sheets block Dvina river, inducing a reverse flow to the south. They also emphasize the possibility of marine structures (such as flaser-bedding) during last interglacial's transgression.

Eiliv, Astrid and Maria try to recognize the outcrops but erosion is very fast so it's hard to identify back. In addition, Dvina river level is quite high which do not help for landing.

During the whole field campaign at Tolokonka, the Divna level will fall from about 3 meters...

Eiliv distributes the tasks:

Valera + Dima will do stratigraphy and sampling of the biggest section (S) while Hilde will deal with the geometry of sedimentary bodies and the overall architecture of the area. Maria and I deal with upstream geometry. Eiliv and Astrid will study the diamicton deposits, especially the fabric.

During these first days we are big groups on field with Gudmund (NGU Journalist), Susanna a student in journalist, two young students (Live Sofia and Ingrid) and the Russians: Alexi, Yvgeni, Valeria, Dimitri and Denis (who arrived later). We familiarize ourselves with Tolokonka sedimentary facies and structures.

08/06/08

06025 4.0 km

Cold weather, with snow, some sun and clouds in the afternoon.

4 m above river level (a.r.l), description of the site. Pict 2151 to 2154.

We see the limit between the lowermost unit available at this time, a sandy unit (medium sands) with foresets dipping downstream (WNW) and an upper unit characterized by dark silty-clayey unit interbedded with fine sands sometimes presenting foresets. Fine-grained unit present deformation. The mean relative thickness of fine sediments is more important than the sandy units.

06025-3.83 km

Rapid sketch of the mixed unit (pict. 2155). 4 m arl, 2.5m thick.

The fine-grained material exhibit some laminations that could correspond to lacustrine sediments.

06025-4.01 km

After a lunch on some peaty sediments, Aurelien details a log at this point while Eiliv and Astrid go for diamicton. Suzanne, Goedman, Maria, Dima, Hilde and Valeria go to see some facies together. Mixed unit is 2 m thick. Clay layers are deformed but there is no clear load structure such ball and pillow/convolute bedding. Sandy layers present cross bedding. Pict. 2157 is a zoom on deformed mixed fine-grained sediments, Pict. 2158 shows a detail of laminations in sandy sediments.

A detailed log is made at this point (Figure 1 to 3)

TOP

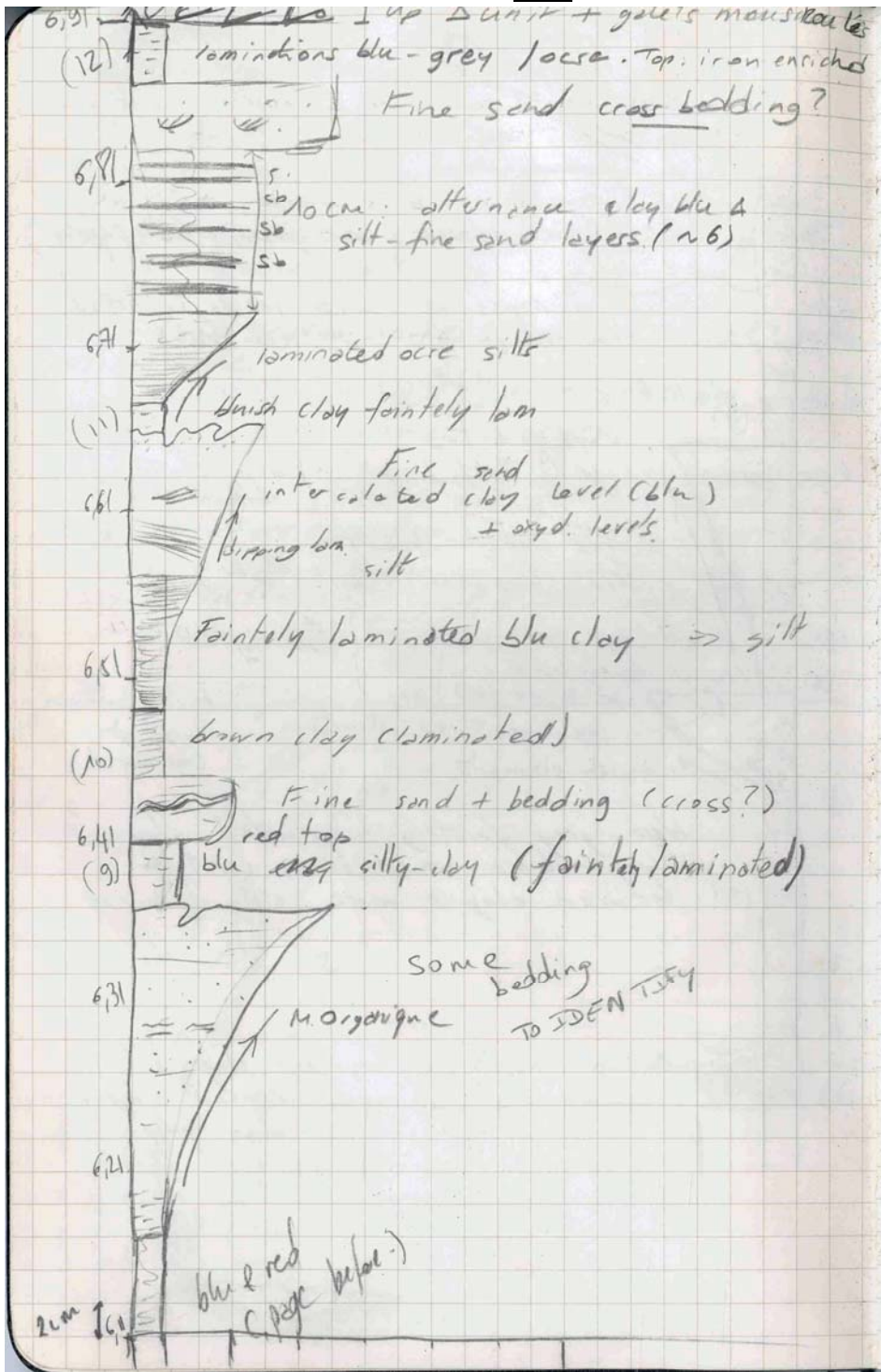


Figure 1: top of the log

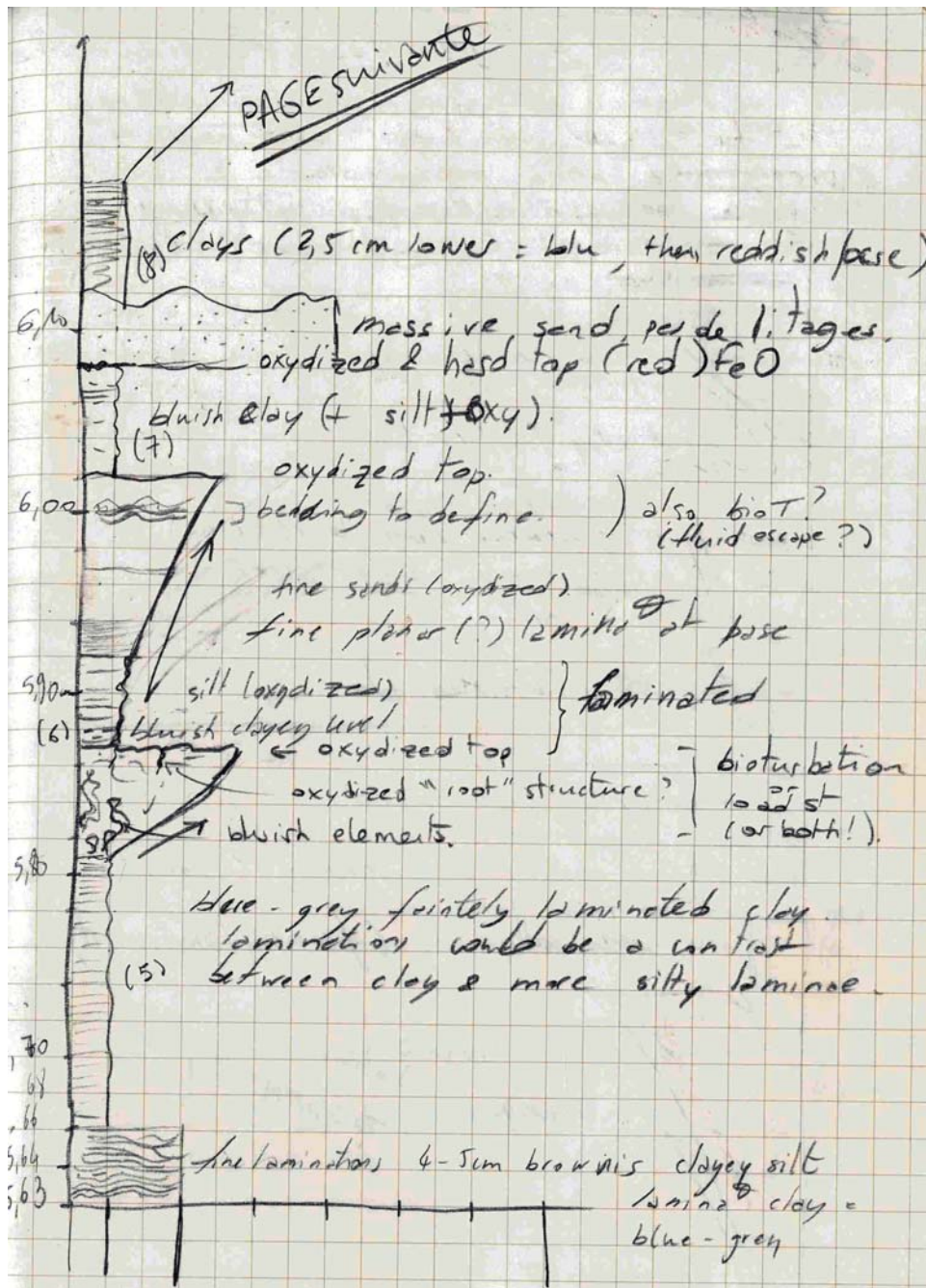
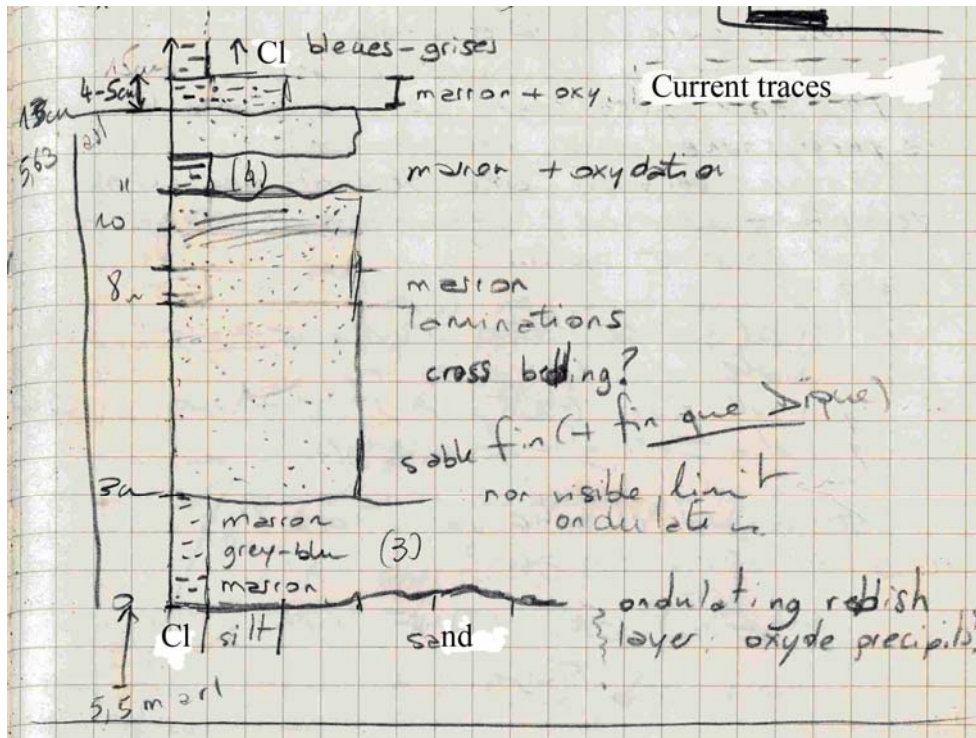


Figure 2: Log continued



BASE

Figure 3: end of the log.

12 levels of fine grained sediments were identified in this section, corresponding to 12 phases of lower energy sedimentation.

Between 6.73 m and 6.83 m, fine sand layer (< 1 cm to ~ cm) are interbedded with bluish clays.

A clear erosion surface is identified at 6.91m (Figure 4) with rounded mudclast and onlapping coarse sediments.

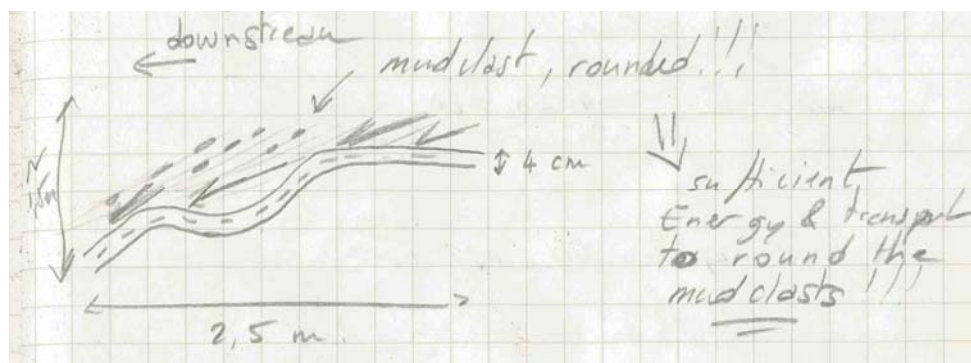


Figure 4: rough observation of erosion

09/06/08

At 8.30 am, weather is grey, slowly windy and little rainy. Temperature increased (no snow).
 Fieldwork boat 1: Maria, Susanna, Aurélien & Valeria. Descriptions at 3.81 km and 3.79 km

(Maria's report). In the afternoon: precise description of erosive boundary of "fluvio-lacustrine" unit (Figure 5).

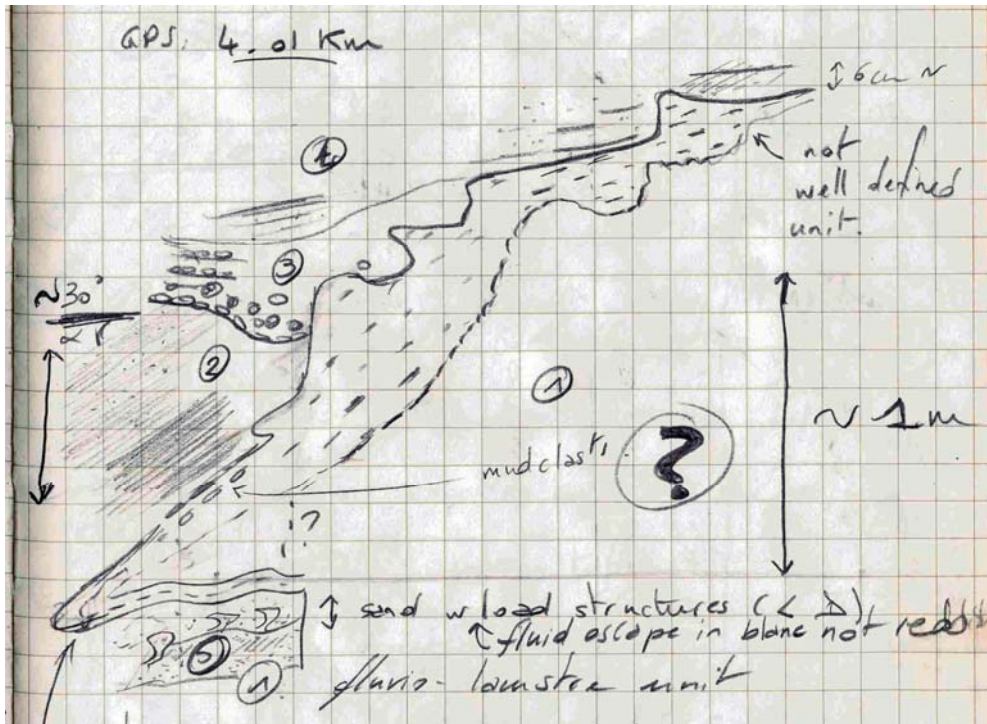


Figure 5: Detail of the erosional surface

- 1: fluvio-lacustrine unit
- 2: Lower deltaic unit
- 3: High energy deposits (coarse sands, mudclats...) related to erosive surface.
- 4: Upper reddish deltaic unit
- 5: Base deltaic unit (below "fluvio-lacustrine" unit).

In the afternoon, Maria and I walk upstream to have a global vue of the facies' evolution (Figure 6).

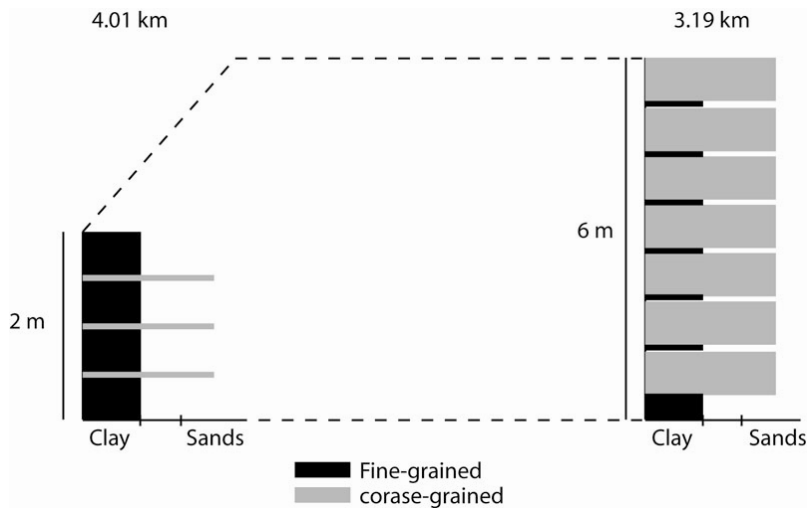


Figure 6: sketch of facies lateral evolution ?

At the end of the day, Maria slides on a pine tree trunk and falls into the river, losing her scrapper.

10/06/08

Fair, cloudy weather. Eiliv and Astrid go to 08002 section, Dima and Alexi go on the older section, Maria, Hilde and Aurélien stay on the camp due to boat engine failure. Aurélien checked the sampling material. Morning team comes back at 7 pm.

Synthesis of "typical" stratigraphic serie (Figure 7).

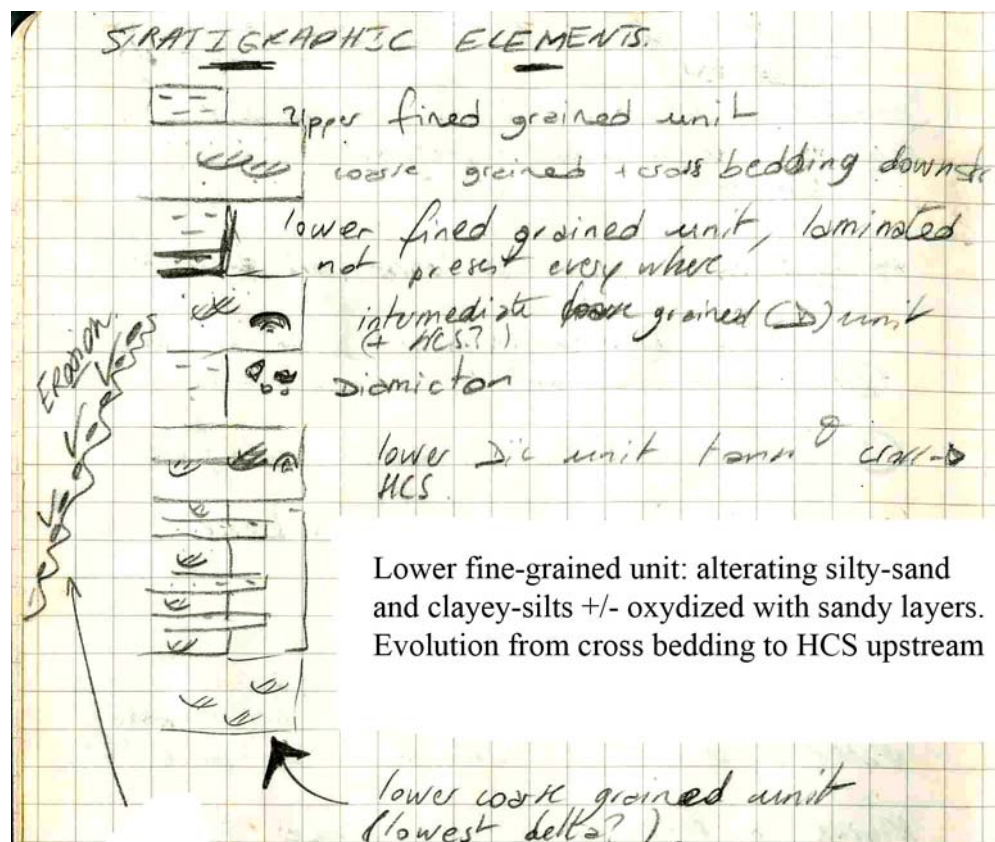


Figure 7: synthetic sketch

11/06/08

Cold and rainy day. Still some problems with boat engine. First half of the day is lost. Look on Dvina's flood plain deposits which are dominated by fine sands with few clay particles. In the afternoon, Aurélien started to sample the heterolitic at 3.78-3.79 km (pict. 2170-2171). Sampling scheme is shown in figure 8.

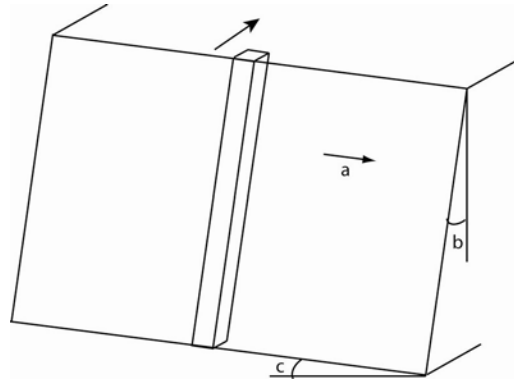


Figure 8: sketch of sampling. Parameters: a =azimuth, b = dip of the outcrop to the horizontal, c =dip.

Samples details are presented in Table 1.

Due to heavy rain and wind, it's very difficult to sample the material from the section walls. We go back to the camp earlier.

12/06/08

06025 3.46 km

Long stop on interbedded unit (overbank ?). Detailed observations of the bedding and laminations of sandy and silty-sand units. Sandy units mainly present downstream dipping foresets whereas it is difficult to determine the orientation of laminae (dynamic ?) from finer units. It is difficult for Maria and I to rule out the hypothesis of marine deposits.

Some load structures are identified on the top of mixed unit (pict. 2177) with a thin peaty level. Sandy sediments above peat level are mostly structure-less but some hummocky-like forms can be seen in the upper part of the section. Fine-grained enriched levels, with intense bioturbation (vegetal roots or digging worms), can be found especially on top of hummock shapes.

See schematic drawing figure 9 for scale.

Two samples were taken just under the organic level (08603 a and b) and one 1 m below the organic level (08604).

An erosive layer is visible between units 2 and 3.

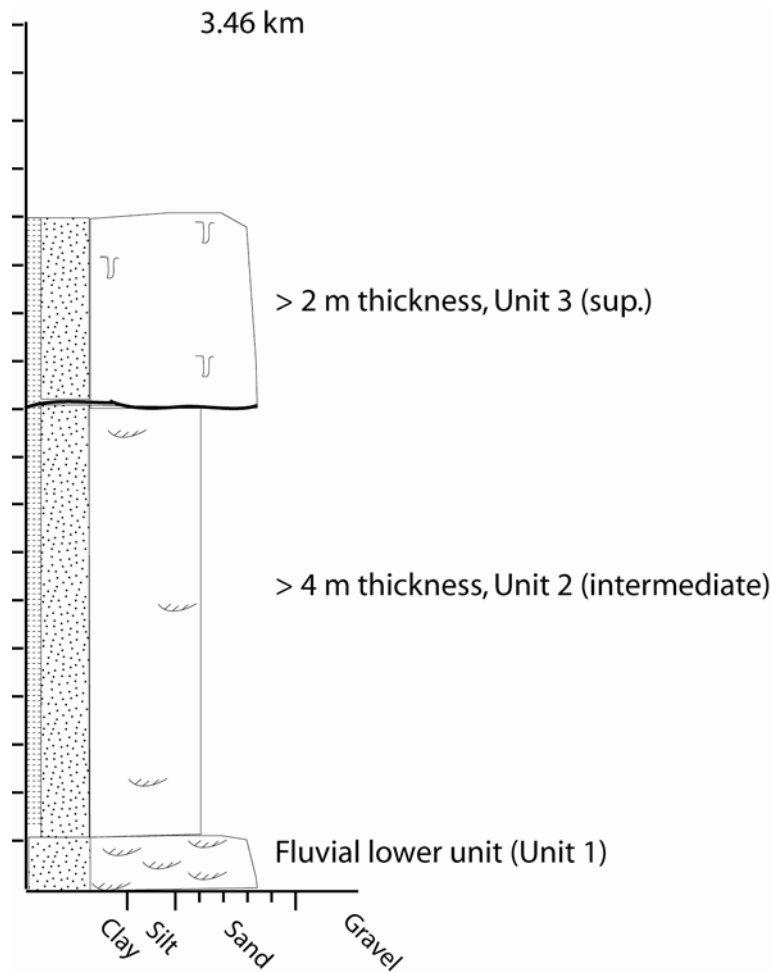


Figure 9: sketch of outcrop at 3.46 km.

06025 3.38 km

Sampling clay-rich below peat (1.5-2 m, sample 08605) and 6 m a.r.l and diamict unit (13-15 m a.r.l, sample 08606).

06025 3.29 km

Maria and I identify hummocky-like structures, only above the peat.

3-4 m above river level, 6 meters of sediment exhibit the lower fluvial unit, the intermediate unit (with fine-grained intervals) ending with an organic rich level above which we observe the hummocky sands.

After this close-up, I go on the top of the 3.29 section to observe the finely laminated units above diamicton. These sediments present contrasts in oxidation. The laminated sediments are characterized by silty-sand laminations and the presence of sand lenses whereas fine-grained laminations are clayey-silts or silty-clays. The upper laminated unit is characterized by drop stones and a small diamicton at its base.

13.06.2008

Sun, heat, mosquitoes. Maria and I start after 10 am at 3.83 km.

06025 3.83 km

We check the heterolithic unit which was formerly sampled by Dima and Valery (27 samples). Maria and I discuss of the possibility between marine and fluvial origin of the sediment sequence.

06025 4.01 km

Sample 08607: mudclasts

06025 4.11 km

I got to 16 m a.r.l to have a look on the laminated sediments.

06025 3.47 km

Eiliv, Astrid and I take 2 OSL samples in the lower fluvial unit (see Eiliv notes). Samples 08515 & 08516.

06025 3.29 km

Maria and I have a look on the hummocky shapes (photos), and we notice that 3D structure does not correspond to real Hummocky Cross Stratifications. We then walk up to the diamicton.

Big clasts and rounded pebbles are visible. A laminated interval is visible on the top of the diamicton sediments.

14.06.2008

06025 3.24 km

Mudclasts are organized in foresets above disturbed clay-rich unit 6 m a.r.l. See photo in Maria's report. Hummocky structures at 7.5 m a.r.l. Hummock bedding is 15 cm thick and its cross-view indicates a 30° dipping to N183. Bedding measurements are made by Hilde. A synthetic scheme of the outcrop is visible fig. 10. Hilde had to focus on peat deformation along the profile.

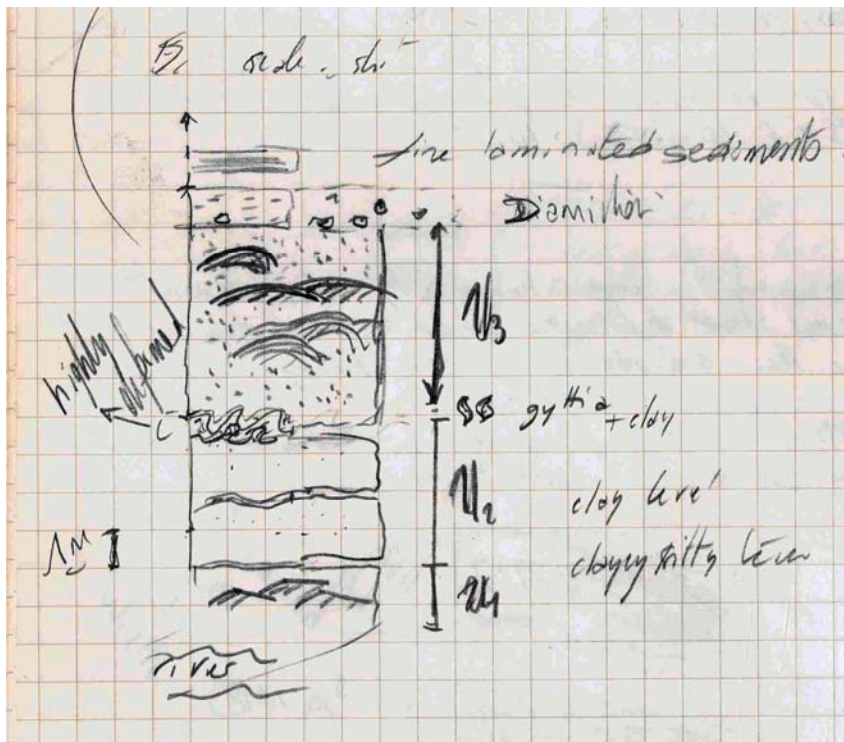


Figure 10: sketch from 3.24 outcrop. U1 corresponds to lower fluvial sediments, U2 to the heterolithic unit and U3 to the upper fluvial below diamicton.

06025 3.24 km

Photo 2180: peculiar bedding and ice wedge cast.

06025 3.15 km

Three fine grained levels are identified in the heterolithic unit. They are present as thin levels and are hardly deformed.

06025 2.95 km

No clear occurrence of organic layers but some thin horizons with finer grains and organic remains. Some green minerals can be seen. An erosional surface can be seen 4 m a.r.l. Unit U3 is here dividable into sub-units with a reddish base with bad sorted material and an upper part characterized by cross bedding just below the diamicton. At this point, first laminated unit is located 1 m above diamicton and is separated from the upper lacustrine unit by a bedded sandy body.

15.06.2008

Warm morning. We go on the new section, northwards. A new origin point is taken at the beginning of the section.

08002 347 m

The lower boundary of the diamicton is located 4.6 m a.r.l (log Astrid). Ice cast wedges are visible in the heterolithic unit, in the coarse-grained material. The top of the diamicton is destructured with rounded clay clasts mixed with sand (see photo 2205 08002 at 627 m).

Eiliv and Astrid do an introduction to Valery and I. Afterwards we separate tasks: I focus on laminated units and Valery checks the overall stratigraphy.

08002 627 m

Aurelien goes for the sampling of the laminated sediments. The unit is 1.9 m thick and its base is situated ca. 14.5 m a.r.l.

Sample 08608: sands under the lake unit

Samples 08609a and 08609b (photo 2196) cover the base of the lacustrine unit. Samples 08610 (1 cm overlap, N085, 4°W), 08611 (1.3 cm, N090, 3°W), 08612 (1 cm, N100, 3°W), 08613 (1.7 cm, N092, 2°W), 08614 (2 cm, N082, 3°W), 08615 (1.5 cm, N080/78°S, 3°W, sampled the 17.06). Location of samples on pictures 2202, 2203, 2204.

16.06.2008

Day at the camp. Eiliv has to fix business issues with Jenia. Eiliv, Maria and Astrid leave to do fieldwork on their own. Aurelien stays as "supervisor" for Hilde and Valery. We sort out samples and decide a strategy for the next days. Aurelien tries to make the inventory of Valery's samples:

08002/360 m: 9 samples

06025/4.11 km: 5 samples... Valery and Dima have taken much more samples but I don't have the possibility to know either where precisely or how many they have been taking.

17.06.2008

Aurelien goes back to 08002/347m to make a rough log and finish the sampling of laminated interval. Valery has made a log. Photography of cryoturbation (picture Po-08001), reflecting destabilization of permafrost (Ice cast wedge) as well as a coarse layer w/ foresets and clay clasts.



Po-08-001

17/06/08 08002

Back to 347m

Note that ice wedges are synsedimentary and cryoturbations occur at the same time.

Valera log already done!

o. sample

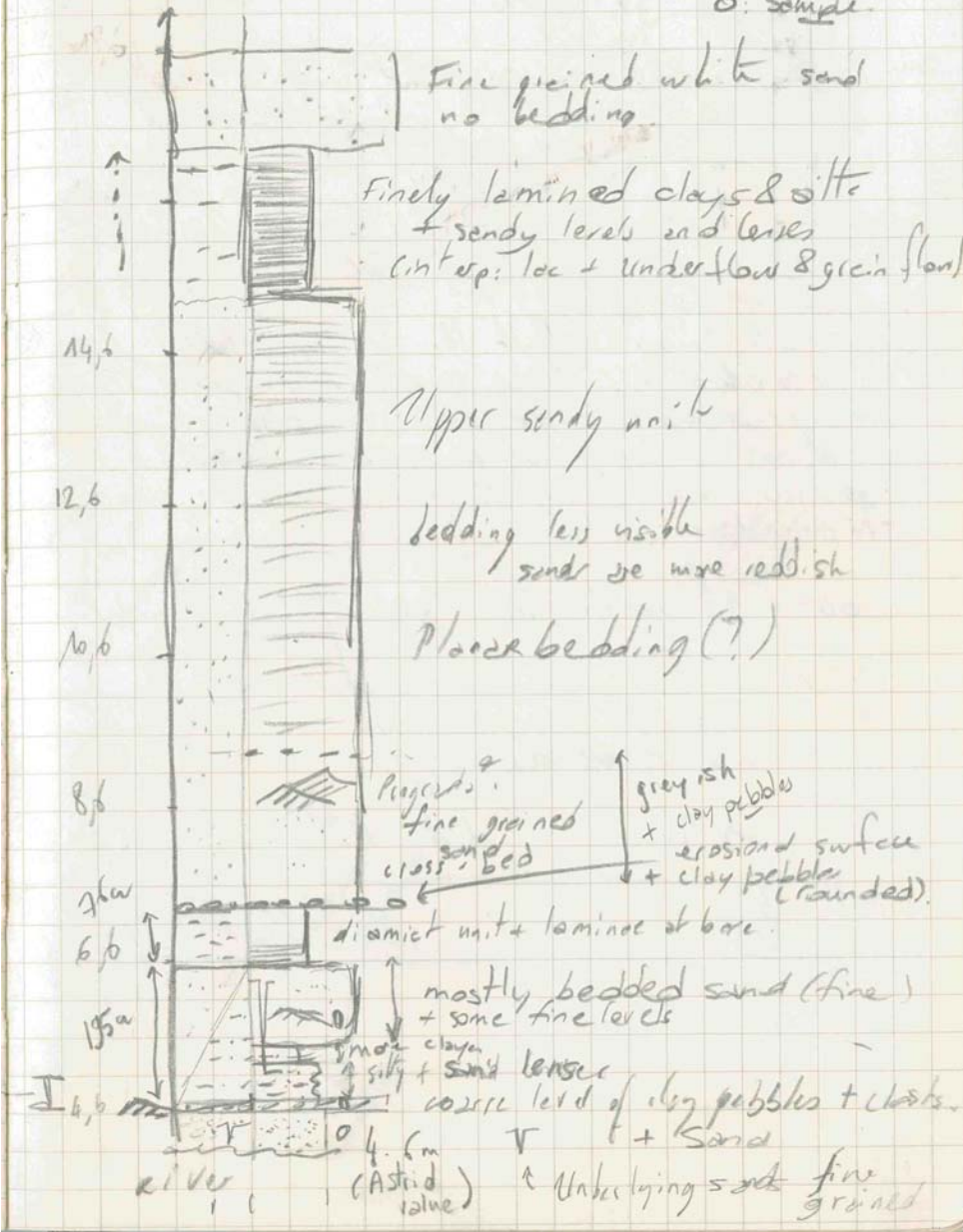


Figure 11: Synthetic partial log from section 08002, at 347 m from starting point.

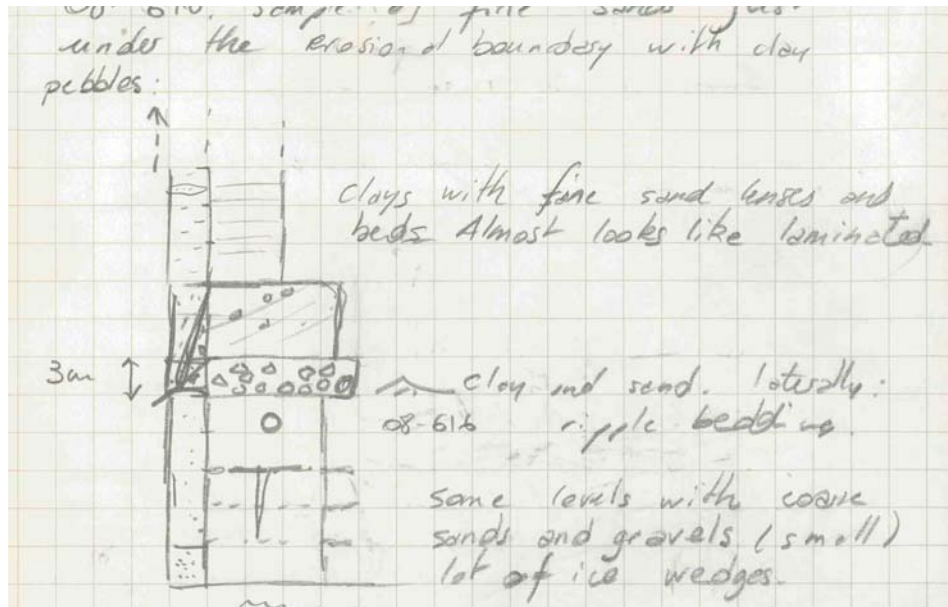


Figure 12: detail of the log where sample 08616 was taken

The clay clasts present in the coarse layer (Sample 08617) are not rounded (on the contrary of what was observed in section 06025) which would imply a reduced transport from the source material.

Azt of the layer: N272, dip of the foresets: 3° (upsteam) to 21° (downsteam).

Sample 08618: 4.72 m a.r.l, fine sand inside overbank unit, climbing ripple bedding.

Site 08002/630

Sample 08619 (1.6 cm, N084/85°S, 4°W), 08620 (1.5 cm, N080/72°S, 4°W), 08621 (2 cm, N080/80°S, 2°W). Presence of drop stones (1,23m above lake sediment's base) and oxidation front.

Sample 08622: sands overlying the laminated sediments

Sample 08623: Uppermost white sand.

Corresponding pictures: 2206-2207-2208-2209.

Weather of the day was fine, with enough wind to avoid any mosquitos blitzkrieg.

18.06.2008

During the day, Hilde and Aurelien go back on section 06025 to look for stratigraphic boundaries between the lower units. Valery is somewhere studying the upper units. The evening will be devoted to a black sauna. Nice sunny day, quite warm.

06025 2.90 km

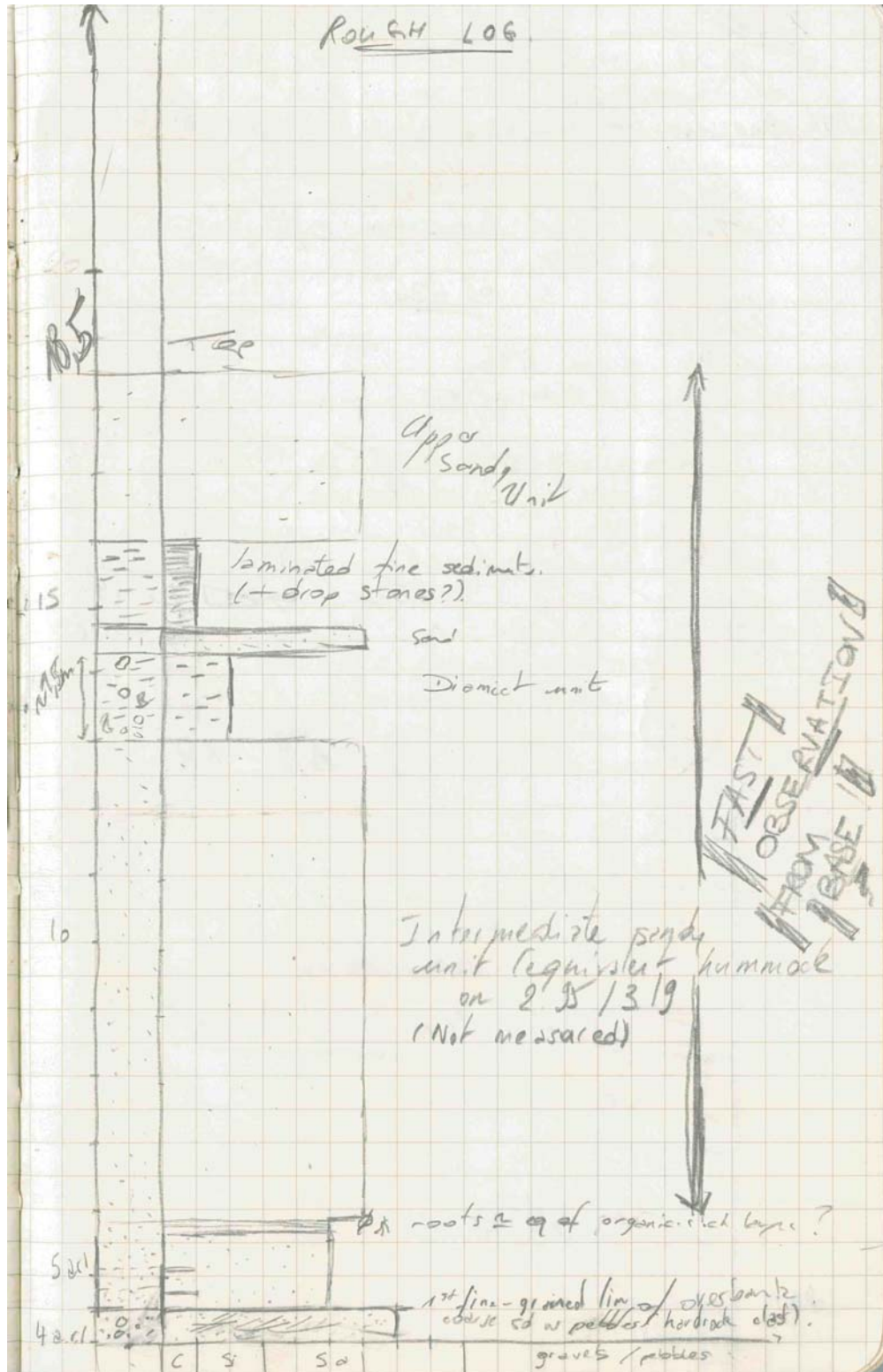
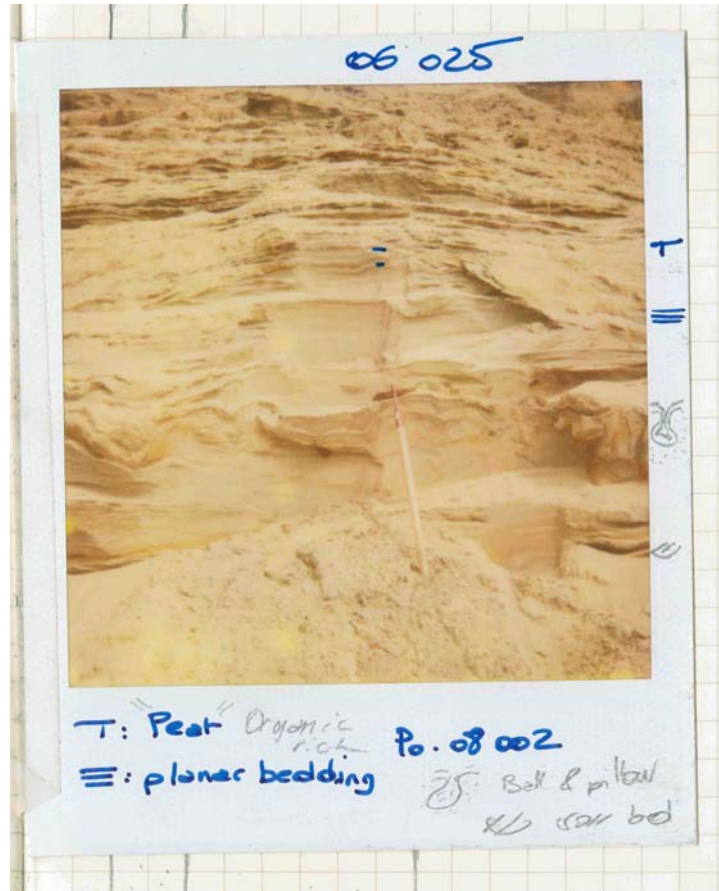


Figure 13: schematic log, see Hilde's work for details



Po-08-002: stratigraphy at 2.90 km

Picture Po-08-002 illustrates the overbank unit, characterized by a top organic unit, planar bedding in the central part of the unit and a lower fine-grained unit deformed by water escape. The underlying cross-bedded unit is also deformed in its upper part.

06025 3.00 km

Hilde and Aurelien go downstream to measure the thickness of the units and do precise stratigraphy (see Hilde thesis for details and figure 14).

Sample 08624 us taken in the sand unit overlying the lake deposits at ca. 19.8 m arl.

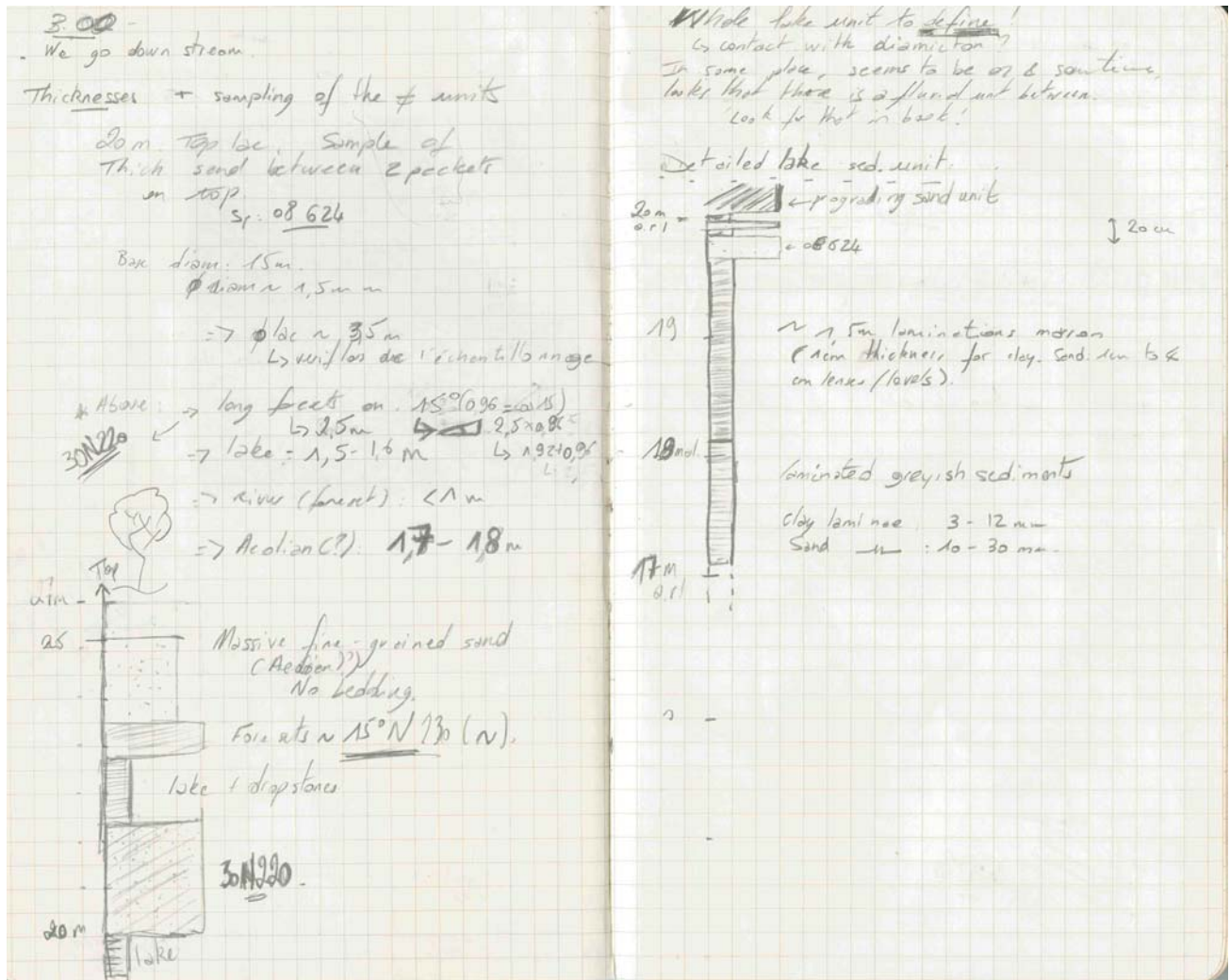


Figure 14: description of site 3.00

19.06.2008

Once again the day starts late as we have to wait for Hilde... The weather is grey with some expected rain. Valery works on his own, Aurelien and Hilde sample the overbank unit during the morning and then they split: Hilde continues her stratigraphic work and Aurelien starts the sampling of 3 other fine-grained units. Aurelien proposes a preliminary sketch explaining the succession of facies between 3.19 and 3.50 km (figure 15, left side).

06025 2.95 km

Schematic log (figure 15). Astrid/Eiliv/Maria must have a precise log as the location has been scrapped. A thin unit of sand is observed between the laminated deposits and the diamicton, which is not observed at site 3.00 km. Sample 08625 is taken in this sandy unit. Samples 08626 and ongoing are taken continuously (w/ overlap) in the laminated unit (figure 16 and picture Po3).

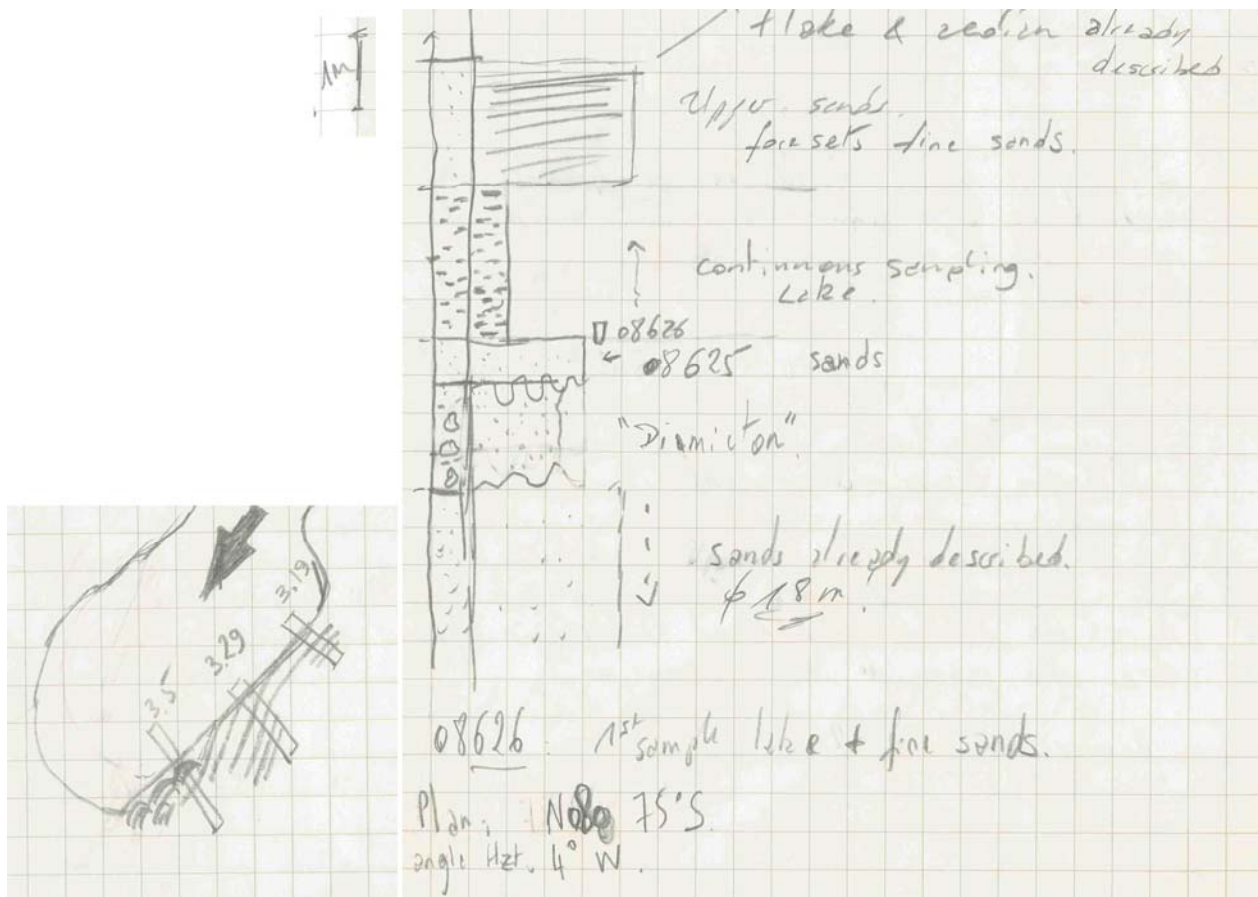


Figure 15: proposition of depositional model between 3.19 and 3.50 km (left) and log+sampling location for 06025 2.95km site.

08626 (N080/75°S, 4°W): start of the sampling of laminated sediments.

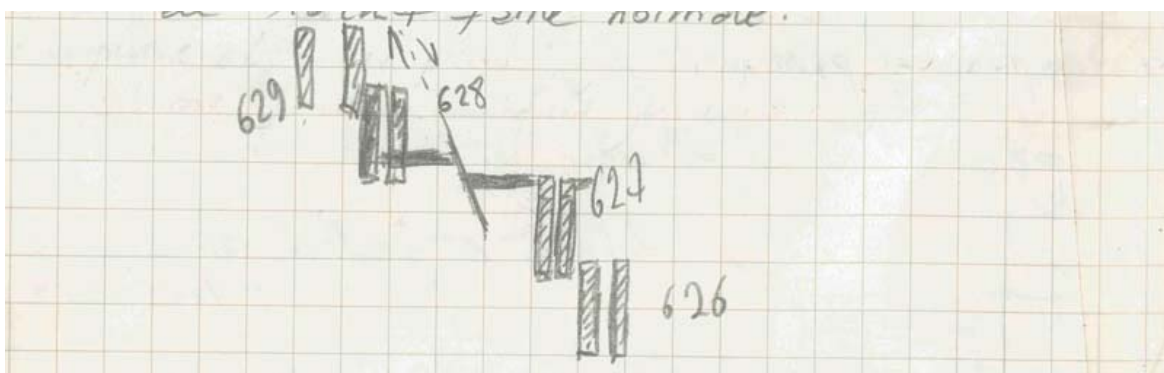


Figure 16: scheme of the sampling strategy



Po3: scheme of sampling of lower lake.

Samples: 08627 (3 cm, N080/75°S, 4°W), 08628 (2.5 cm, N080/75°S, 4°W), 08629 (2.5 cm, N080/75°S, 4°W), 08630 (2 cm, N080/75°S, 4°W).

The sampling conditions are very bad: the blowing wind pollutes the samples. This will have to be taken into account when doing geochemistry measurements (avoid ICP).

06025 2.96 km

Due to bad outcrop conditions, I have to move 1 m downstream to take the following samples (after having checking the lateral continuity of samples 08629 and 08630)

Sample 08361 (N090/85°S, 5°W), 08632 (1-1.5 cm, N090/85°S, 5°W), 08633 (2 cm, N090/85°S, 5°W), 08634 (1.5 cm, N090/85°S, 5°W).

20.06.2008

Heavy rain and wind, Aurelien decides not to go on field. Sampling under these conditions would be useless and the safety is not optimal as we have to spread on the section. Hilde was already taken in a sandflow (without any damage) and none of us have heard her screaming.

The weather gets better after lunch but as Hilde left the camp without telling where she was going, Aurelien and Jenia spent some fuel to look for her in the river. She fortunately was just

walking away from the camp, safe. As a consequence, Jenia refuses to use the boat to get on the section as we did not pay for this extra fuel... This day is thus stupidly completely lost.

21.06.2008

It's a warm ($>>20^{\circ}\text{C}$) and long day in order get back some of the lost time from yesterday.

Sample 08635 (2 cm, N100/80°S), 08636 (2 cm, N100/80°S), 08637 (1.5 cm, N100/80°S) but issues with sand lenses.

The sand lenses which are observed in the top of the laminated units, often present foresets. The relative importance of sand sediments and sand lenses increases towards the top of the laminated unit, indicating a shallowing trend of the sedimentation environment (classical for proglacial lake sedimentation).



Po5 and Po6: uppermost part of the lower laminated unit, showing lens-shaped sand deposits

Samples 08638 (2 cm, N100/80°S), 08639 (1.8 cm, N076/90°), 08640 (1, 2 cm, N076/90°), 08641 (1 cm, N076/90°), 08642 (2 cm, N076/90°). Sample 08643 includes the last laminations and the lower part of the overlying sand unit.

Each sandy lens is capped by a fine-grained lamina (silty-clay or clayey-silt).

22.06.2008

2 days of fieldwork left, which are devoted to the sampling of the lowermost fine-grained unit in which Dima and Valery had found the mammal bone. Hilde and Valery check their field area for the last detailed measurements and observations. Aurelien starts the sampling of the unit, to be finished the 23. Due to the lack of time, there will not be any dual sampling as was made for the laminated units.

The weather is warm and nice in the morning. Aurelien and Hilde start at the same point (06025, 4.00 km) and thus discuss the overall stratigraphy as well as preliminary interpretations (figure 17), especially on the occurrence of 2 erosional surfaces which Aurelien was evidencing at the beginning of the field campaign.

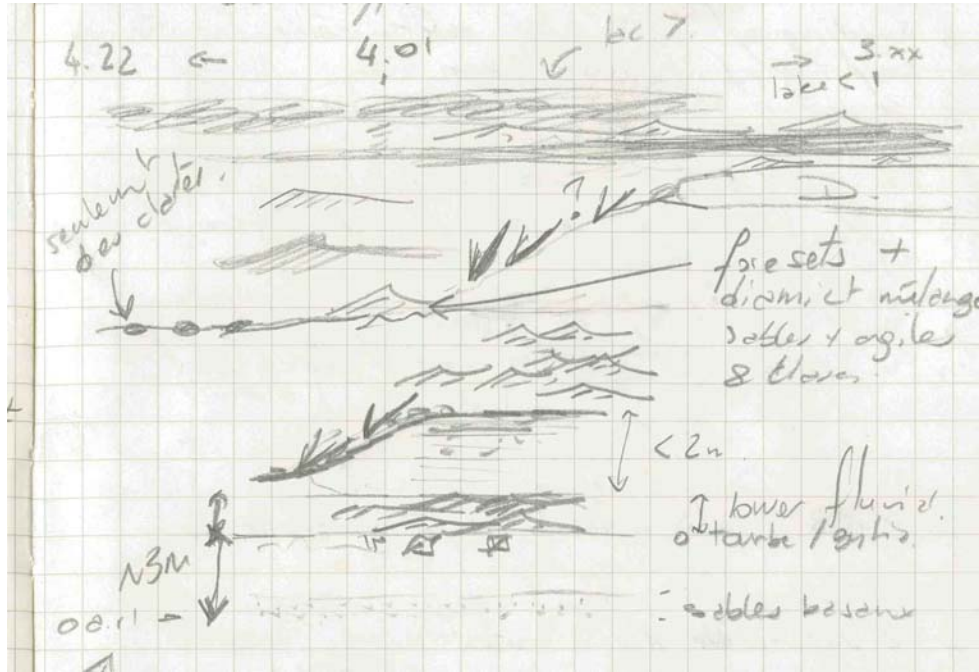


Figure 17: attempt to propose a stratigraphic synthesis while discussing w/ Hilde. See also in Maria report.

Mid afternoon: Hilde samples sand and clayey units at 3.99 km. Aurelien goes for observations and sampling between 3.83 and 4.01 km.

3.83 km: site sampled by Valery

3.88 km: site where the diamicton can be observed, eroded on top.

4.01 km: sample 08644: taken 1 cm above the erosion layer which covers the diamicton. Sample 08645 is taken 20 cm below this limit.

4.01 km: study of lower units. Total thickness: 3.20 m from river level, including a lower sandy unit which must be genetically be related to the organic unit (Polaroid Po 7).

Log is presented in figure 18.



Po7: lower units at 4.01 km: 3 sand units of different oxydo-reduction state (different colots) covered by sandy and silty organic unit.

Sampling:

08646: lowest sand (yellow to grey), 08647: middle sand (blue-grey), 08648 : upper sand (yellow).

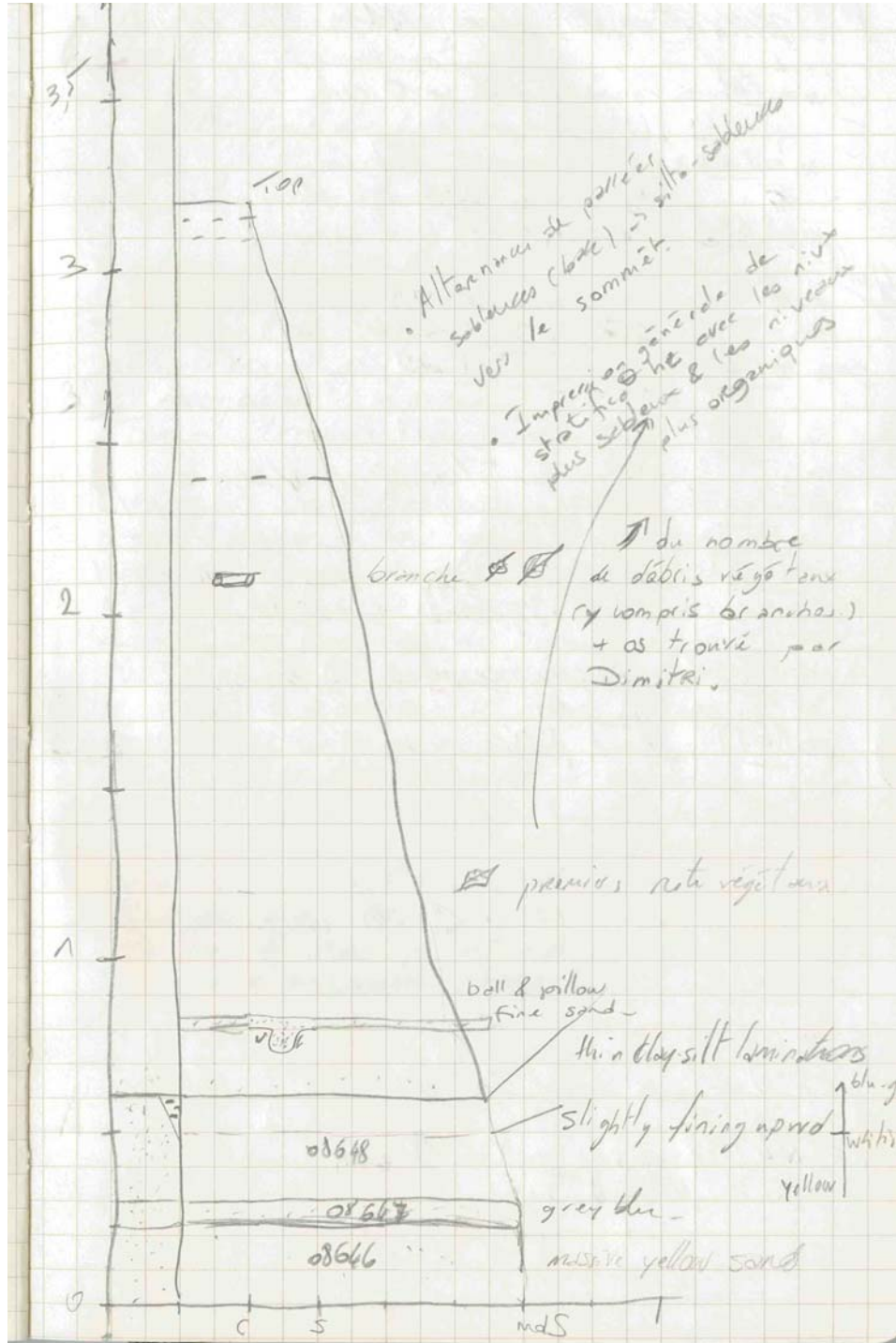


Figure 18: Synthetic log of the lower sands and overlying organic unit at 4.01 km.

Samples: 08649 (base of organic unit, 62 cm arl, N110/80°S, vertical), 08650 (no overlap, same plan), 08651 (7 cm overlap), 08652 (2 cm).

23.06.2008

Nice weather, the last day of fieldwork starts ca. 9.30.

Aurelien, Hilde and Valery are spread on the section; Aurelien finishes the sample of the organic unit.

Samples: 08653 (1.5 cm overlap), 08654 (2.8 cm), 08655 (1.7 cm), 08656: sample taken at 2 m arl. 08657: sample taken at 1.75 m arl. 08658 (2 cm), 08659: rock pebble at 2.1 m arl. 08660: sample of carbonated element at 2.12 m arl. 08661 (1 cm, N090/90°), 08662 (2 cm, N090/90°), 08663 (1.5 cm, N090/80°S), 08664 (1 cm, N090/89°S), 08665 (2 cm, N100/80°S); 08666 (N100/80°S, sample between and 2.96 m and 3.15 m arl), 08667 (sample covering the uppermost 19 cm).

24.06.2008

Drive to Kotlas and train back to St Petersburg

List pictures TOLOKONKA Sections

06/06/2008

- 2128 part of the group in Kotlas
- 2131, 2133 high level of water
- 2134 A tractor to cross the river ?
- 2135 A garden in Tolokonka
- 2136 Astrid, the tractor and the boat
- 2137, 2138 boat trip

07/06/2008

- 2140-2141 meal and camp
- 2143 On the way to outcrop, Ivgueni and Valeria
- 2147 After the working day, Liv Sophia plays guitar

08/06/2008

- 2149 snow in the morning

06025-4.00 km

- 2151 Sand Unit
- 2152 Sand Unit + mixed silt/clay-silt/sand unit + OM
- 2153 Sand Unit
- 2154 Fine grained sediments with coarser laminae

06025-3.83 km

- 2155 Contact lower fluvial & mixed fine/sand

06025-4.00km

- 2156 Zoom on fine grained particle interbedded with sand.
- 2157 Sedimentary deformations
- 2158 Zoom on 2157 laminated sediments

09/06/2008

- 2159 Boat on Dvina river
- 2160 erosion surface, mud clasts and foresets at **06025 4.01 km**
- 2161 in the boat, Hilde

2162 in the boat, Maria
2163 in the boat, landscape
2168 in the camp, landscape

11/06/2008

2170-2171 outcrop at **06025 3.78-3.79 km**, sampling of samples ***08601 (knife) & 08602 (sample holder)***
2171 Mil-Mi 28 Hip in the grey rainy sky

12/06/2008

2173, 2175 sedimentary structures of Dvina, camp.
2176 Dvina deposits, camp
2177 **06025 3.46 km**: load structure

13/06/2008

2178-2179 **06025 3.29 km**, Hummocky Cross-Stratification in well sorted sands. Clayey-silt deposited on hummocks

14/06/2008

2180 **06025 3.19 km**, mix between two sedimentary facies. Fine to medium sands and silty-fine sands thin layers.
2181 the section 0625.

15/06/2008

2195 vue from the boat
2196 **08002 627 m**. Sampling of laminated unit. Fine layers are silty clays or clayey-silts. Coarse grains are fine to medium well sorted sands.
2201 view of the section
2202-2204 sampling the laminated sediments.

17/06/2008

08002 347

2205-2207 ice-wedge cast, sampling for OSL.
2208 Diamicton unit
2209 view of diamicton unit, with some pebble drop-stones. Two sandy units, which exhibit different oxidation degrees, with obvious foresets.

20/06/2008

2210: diverse views of the camp and people (Alexi, Hilde and Valeria).

21/06/2008

2229 **06025 2.96 km**, laminated level, sampled.

23/06/2008

2230 **06025 4.01 km**, base of organic rich unit and limit with underlying sands.

2231 top part of the organic rich level.

24/06/2008

2241 Hilde frisør























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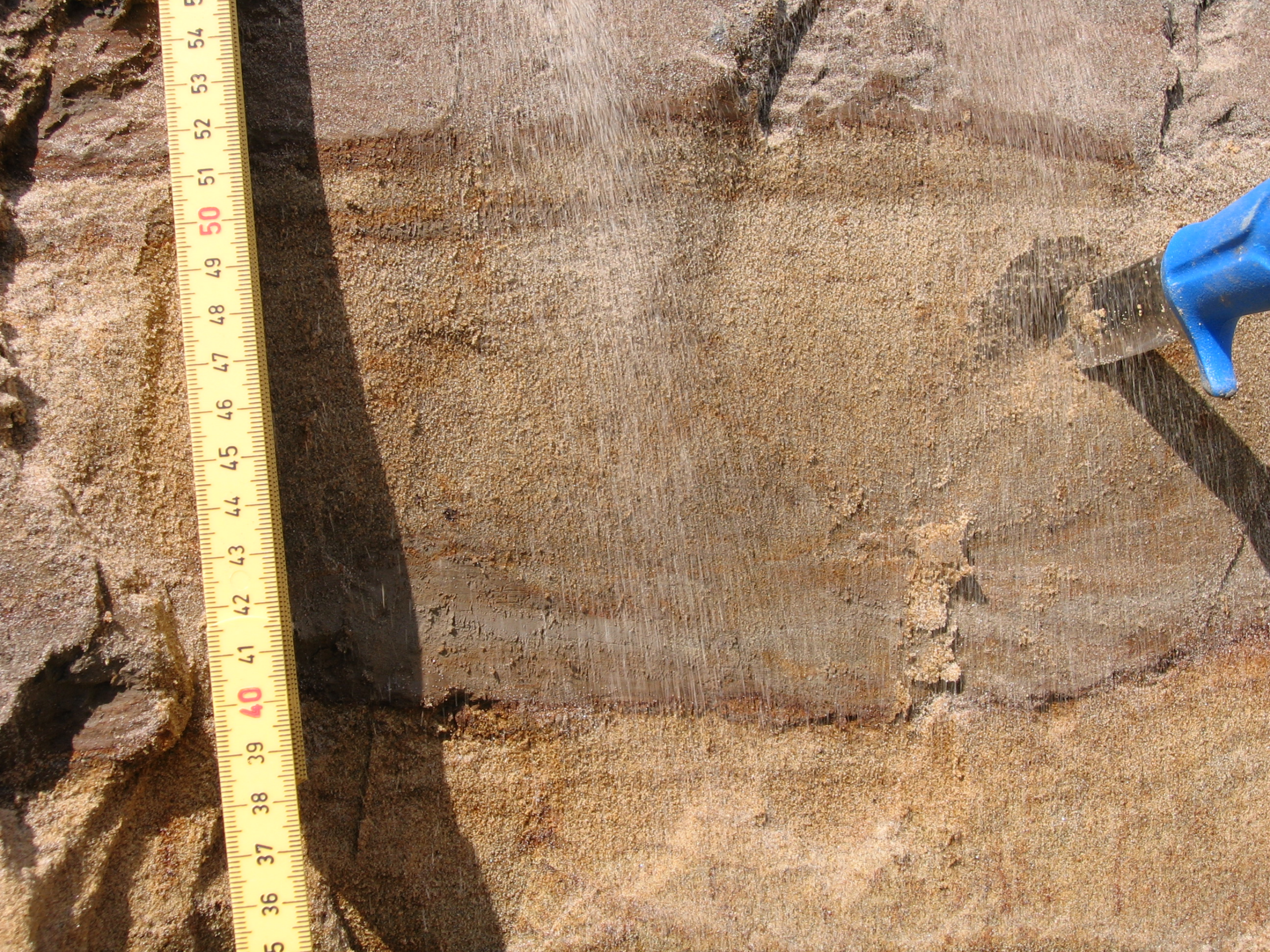


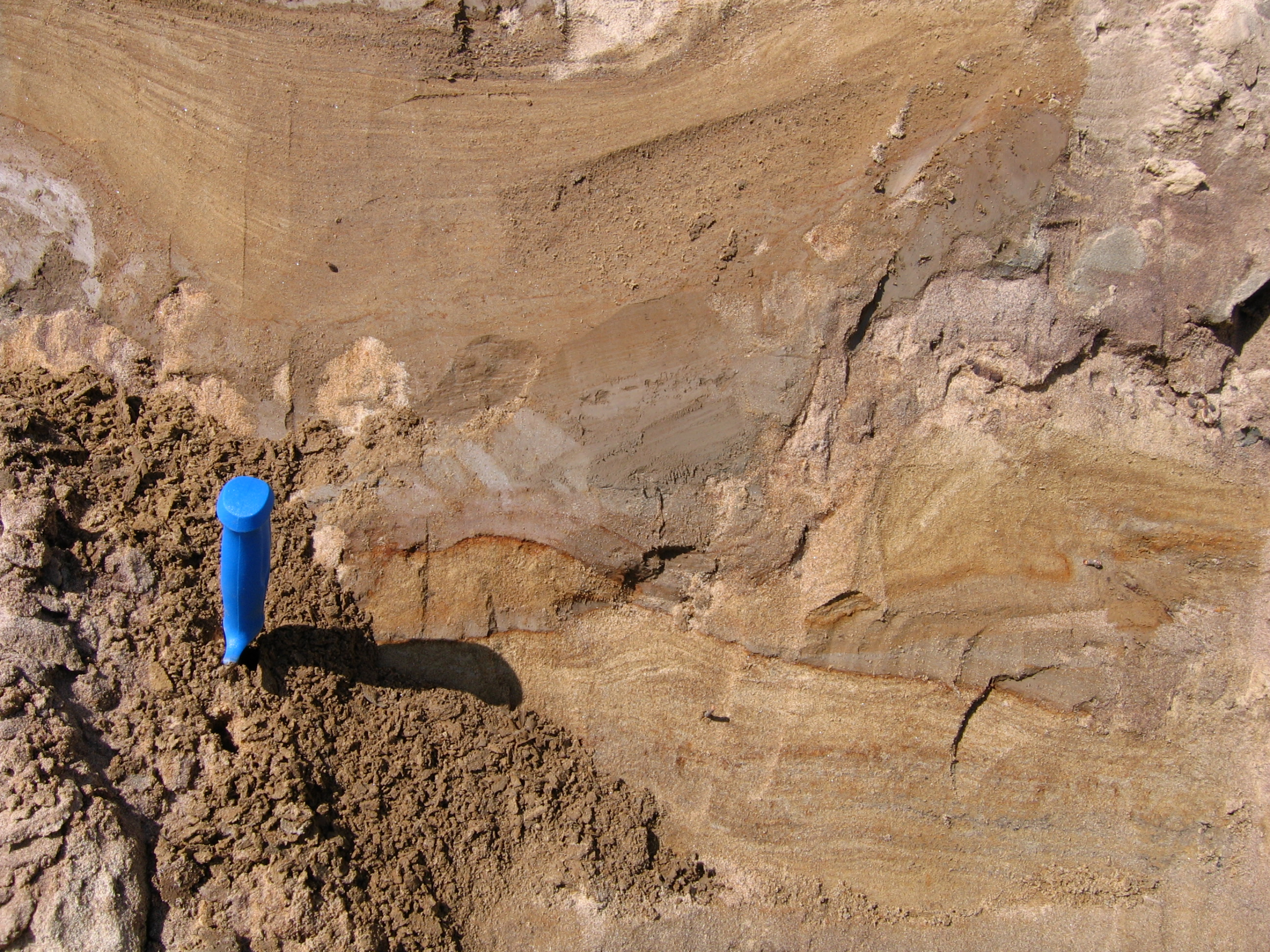






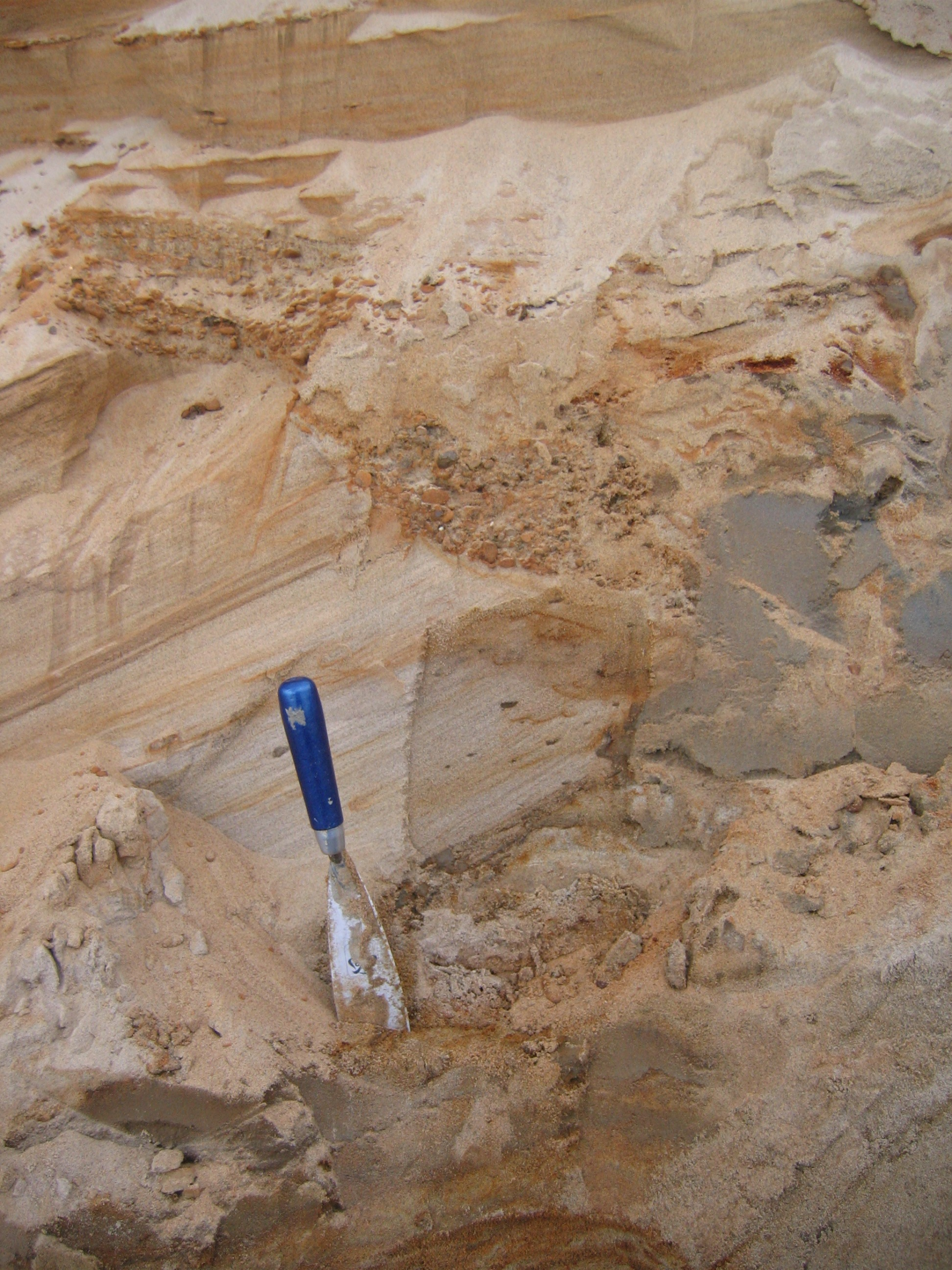














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