FIELD REPORT
Expedition NW Russia 2007

Vychegda, Severnaya Dvina, Mezen

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MEZEN
SEVERODVNSK
ARKHANGLSK
BOBROVO
EMEZK
BEREZNIK
TULGAS
SHENKURSK
JARENSK
STOROZHVSK
OZYAG
TOLOKONKA
SYKTYVKAR
UST-NEM SC
KRASNOBRSK
KOTLAS
N
W
E
S
Image NASA
Image © 2007 TerraMetrics
Google
Pointer lat 62.564459° lon 47.993176°
Streaming 100%
Eye alt 658.31 km

Expedition members:

Eiliv Larsen
Astrid Lysså
Maria Jensen
Achim Beylich
Gudmund Løvø
Denis Kuznetsov
Udo Müller
Alexander Smirnov
Yevgenij
Natalia

31st May 2007: Kuryador section - site 06010

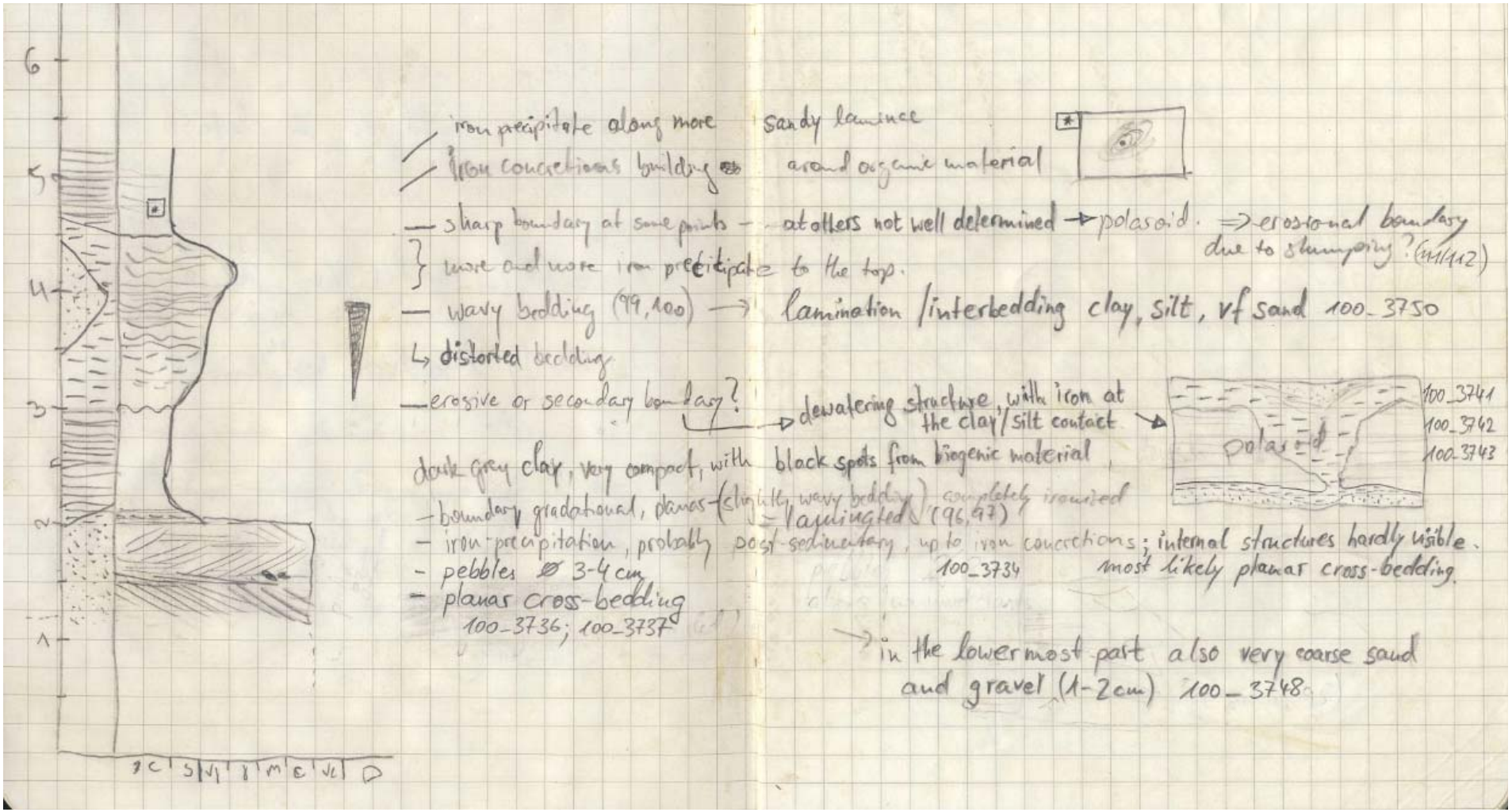
- the weather is variable: rain and sunshine, muddy conditions
- locality is situated about 6km north of Ust'-Nem
- Kuryador-section is 300m wide and 10-25m high
- aim of this study: find evidence for changes in waterlevel
  identify lacustrine sediments
  trace boundaries in detail
- shovelling and digging at several spots, determination of sediment-bodies and boundaries

01st June 2007: Kuryador section - site 06010

- cold weather, very windy, sporadic snowfall
- Denis and Udo work on site 06010_10; digging and logging
- Astrid, Maria and Eiliv try to get an overview of the section
- Gudmund is taking pictures

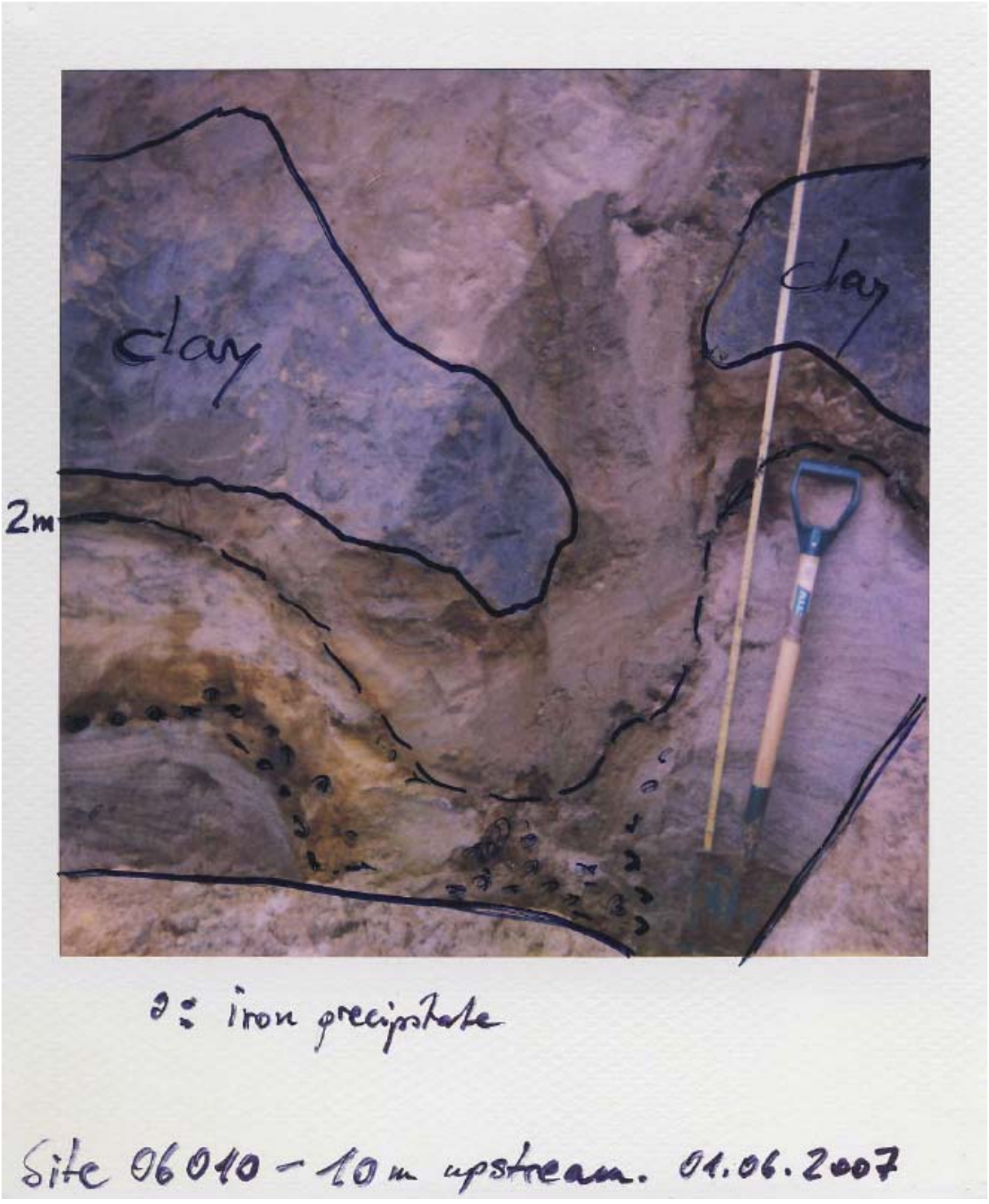
List of data: Log of profile at Kuryador section; Site 06010_10
Polaroid 1
Polaroid 2
List of pictures from site 06010_10 (Kuryador)

Site 06010_10, Log of profile at Kuryador section

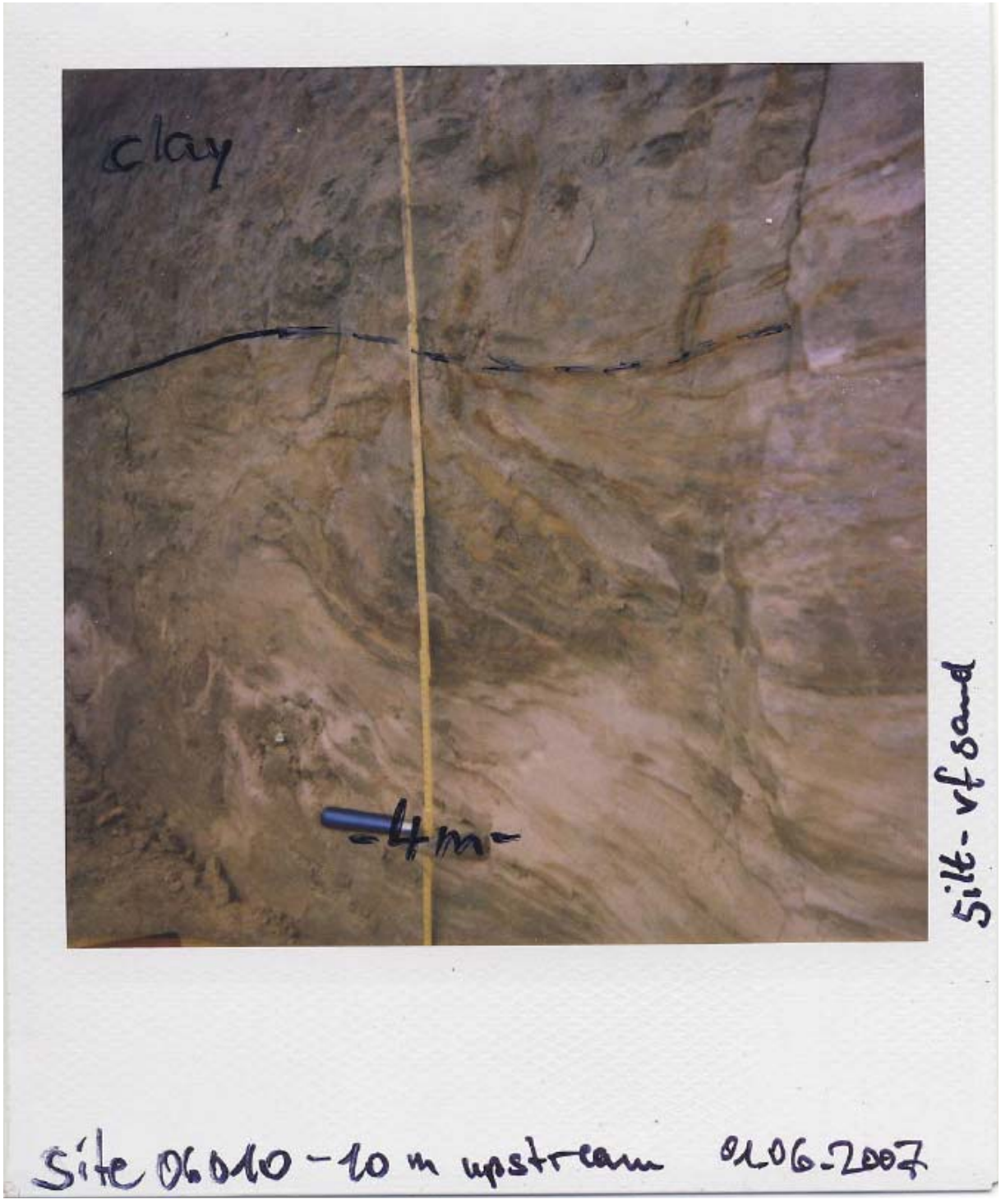


numbers 96, 97, 99, 100, 111, 112 correspond to picture numbers 100_ 3745, 100_3746, 100_3748, 100_3749, 100_3761, 100_3762 respectively

Polaroid 1: Dewatering structure, with iron precipitate at the clay/silt contact



Polaroid 2: sharp boundary at some points - at others not well determined
erosional boundary due to slumping?



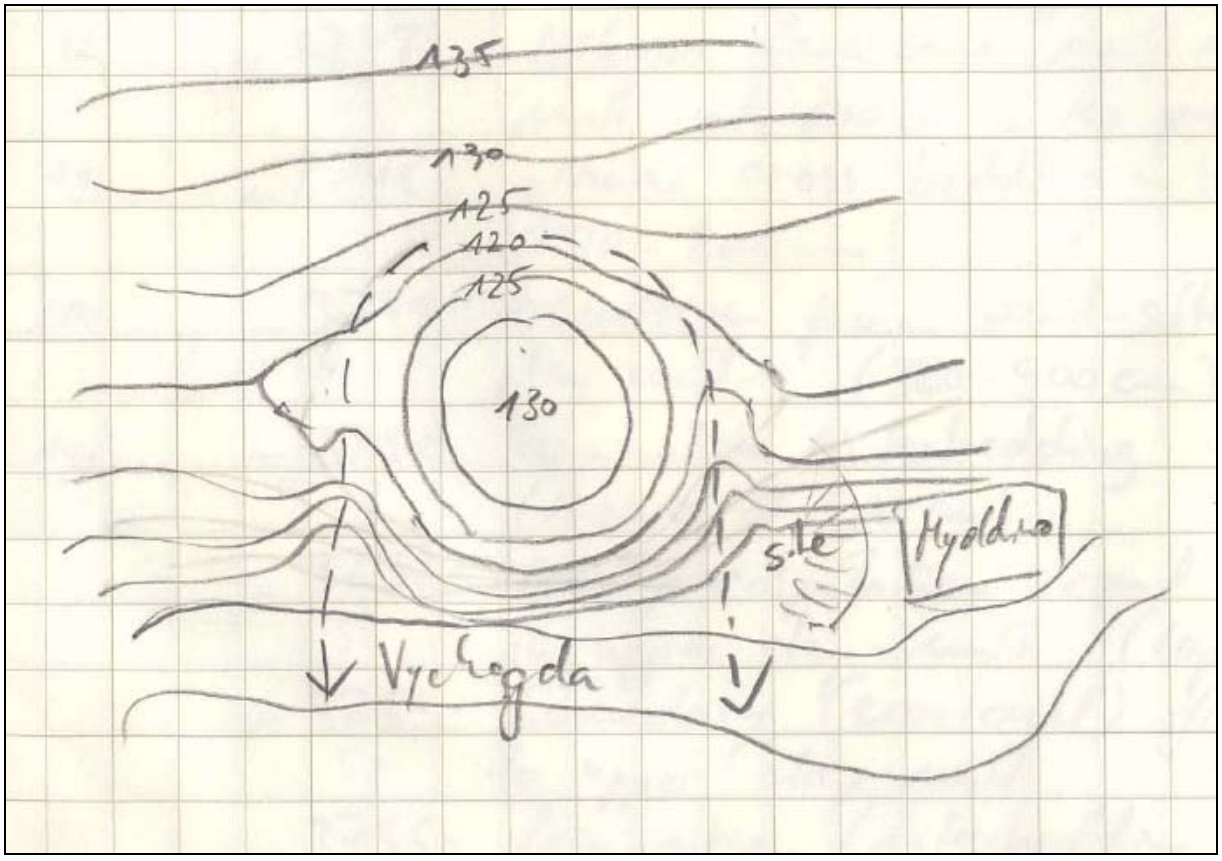
List of pictures from site 06010_10 (Kuryador)

100_3733	Location overview
100_3734	post-sedimentary iron precipitate between 150cm and 200cm. belongs to the sand-unit (1) but internal structures are hardly visible
100_3735	lower sand-unit underlying clay-unit
100_3736	detail iron precipitate planar cross-bedding in lower sand-unit
100_3737	detail iron precipitate planar cross-bedding in lower sand-unit
100_3738	detail iron precipitate
100_3739	detail: gradational boundary between lower sand-unit and overlying clay-unit: laminated (cf. 100_3746, 100_3747)
100_3740	complete iron precipitation in gradational boundary
100_3741	dewatering structure cutting through the clay unit
100_3742	dewatering structure cutting through the clay unit
100_3743	dewatering structure cutting through the clay unit
100_3744	group working
100_3745	Denis watching
100_3746	lamination in the gradational boundary between lower sand-unit and overlying clay-unit at 200cm in the profile
100_3747	lamination in the gradational boundary between lower sand-unit and overlying clay-unit at 200cm in the profile
100_3748	planar cross-bedding in lower sand-unit (120-200cm)
100_3749	transition from clay to sand-silt unit to the upper clay unit (320-500cm)
100_3750	lamination/ interbedding of clay/ silt/ vf sand (trowel at 400cm)
100_3751	iron-precipitation around organic material in upper clay-unit (top of meter-stick = 500cm)
100_3752	iron-precipitation around organic material in upper clay-unit (top of meter-stick = 500cm)
100_3753	boundary (erosional) from silt-sand-unit to upper clay-unit
100_3754	boundary (erosional) from silt-sand-unit to upper clay-unit
100_3755	lamination/ interbedding in clay/ silt/ sand-unit (top of picture at 400cm)
100_3756	overlap pictures of the whole profile
100_3757	overlap pictures of the whole profile
100_3758	overlap pictures of the whole profile
100_3759	overlap pictures of the whole profile
100_3760	overlap pictures of the whole profile
100_3761	erosional boundary between silt/sand-unit and upper clay-unit (lamination just below)
100_3762	erosional boundary between silt/sand-unit and upper clay-unit (lamination just below)

02nd June 2007 Ust'-Nem, Kuryador, Myoldino

To get an idea about the sedimentation pattern at Kuryador, it was important to find some evidence in the surrounding geomorphology. At Myoldino we find a small creek that might be part of the drainage system.
Further into the woods, we also find a lightening, which brings up the suggestion, that there must have been a more or less important drop of waterlevel.

Due to a dense vegetation cover the gully we can see in the googlemap-image, is hard to find in a first place. It is a few hundred meters wide and 30-35m deep gully that is pointing to the Kuryador section.



draft of the geomorphology near Myoldino

03rd June 2007 Oz'yak

- river Vychegda has cut a few meters deep into sandy sediment
- How does a palaeosol look like? How to detect it?
- a lot of digging and shovelling
- profile logs are made by Maria, Astrid and Eiliv

04th June 2007 Kebanyol, Site 06015

- find evidence in the geomorphology for a dendritic river system that can be inferred from googlemaps.
- there is in fact a lot of ups and downs

05th June 2007 Gam Terraces

- along the way back to Kotlas
- a short visit on the Gam Terraces for a Photo-shooting

07th June 2007 Tolokonka section, Site 06025; along Severnaya Dvina river
- all data presented refer to Log 3.20km downstream from the reference point 06025
- for elaborated data, please confer to the project work presented by Udo Müller in September 2007 at the University of Leipzig.

draft description and preliminary thoughts:
- uppermost top of the section: finely laminated clay, deformed and broken, scattered appearance; looks as if it had been frozen. permafrost feature?
- underlain by a sandy unit
- below: Varvite, 340 countable pairs
- underlain by a sandy unit that visually can be separated into two parts by their different colour. In between Scandinavian? pebbles - maybe dropstones.
- below: unit of deformed clay
- underlain by a sandy unit with beautiful waveripples
- below: sandy unit - delta foresets?
- underlain by a sandy unit - bottom sets? with Hummocky Cross Stratification

- the Scandinavian pebbles could be of Saalian age; but the sandy unit below doesn't look old enough to immediately support the idea.
- the Weichselian ice sheet advance stopped about 200-300km further to the north of our locality: IRD might be a possible interpretation of pepply material

08th June 2007 Tolokonka section, Site 06025; along Severnaya Dvina river
- Log of profile at 3.20km downstream of the reference point 06025
- digging and shovelling
- determination of sediment units
- tracing boundaries

some thoughts:
- the light-coloured/ beige sand unit (3) with the oscillation ripples might actually dip at a very low angle into a SE direction.
- the erosive boundary described between unit (3) and (4) might not be erosive everywhere on the lateral extend - but a gradual transition to the deltaic sediments described in unit (4).
Question: Can oscillation ripples develop on the topsets of a deltaic sedimentary environment? - admit that they would not develop in the main channels
- Questions: Is there a boundary between the foresets (4) and the underlying horizontally bedded sands?

Could it be, that they represent the actual bottomsets of a delta prograding into the basin?
Wouldn't it explain the HCS at the distinct water depth: below the normal wave base and above the storm wave base?

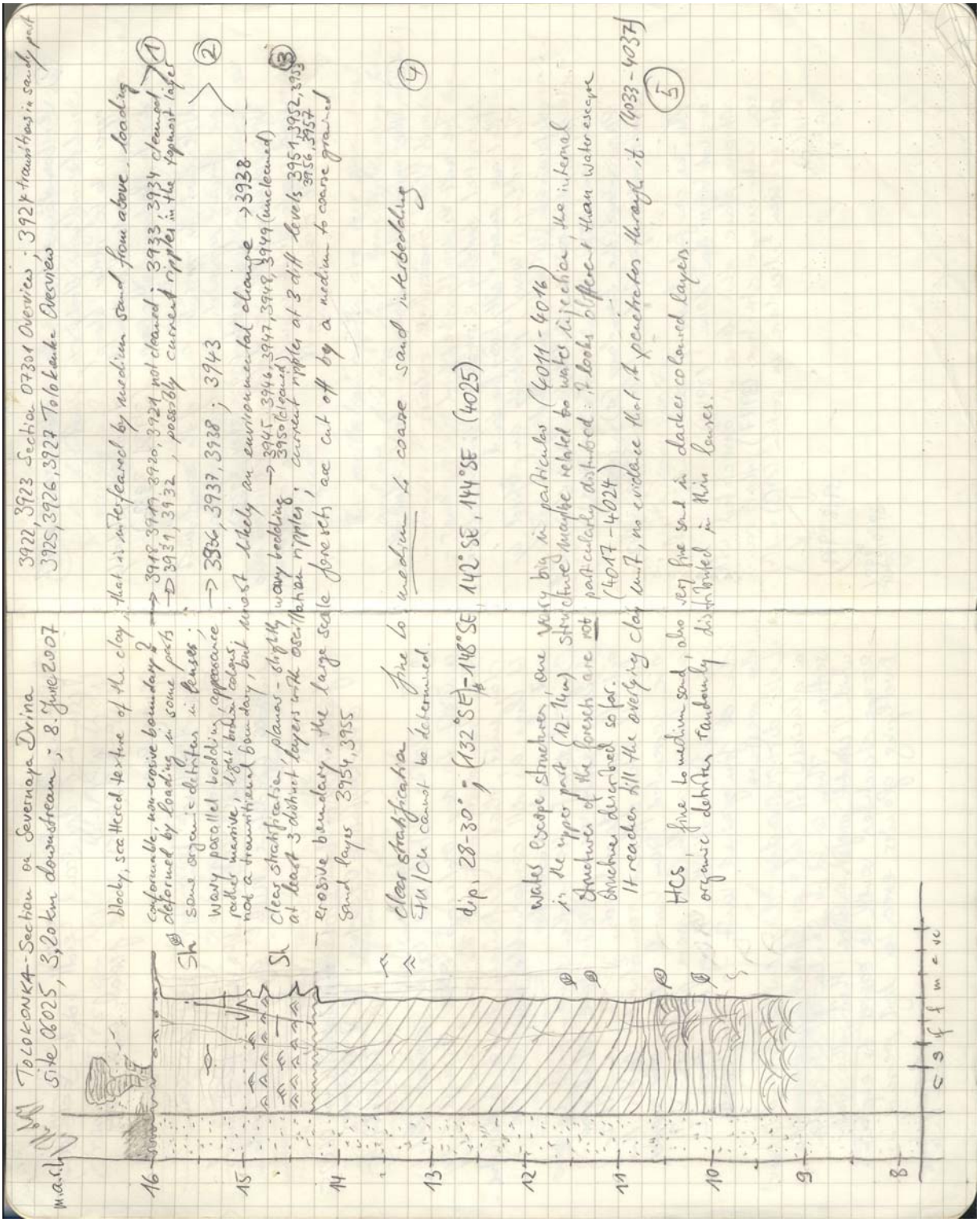
- boundary at 16m a.r.l.: though it shows clear ripple structures, the transition from medium/coarse-grained sand to silt and clay is much thicker at the locality 3.50km (100_3968, 100_3969, 100_3970, 100_3971) and the locality 3.57km (100_3974, 100_3975, 100_3976).
Also compare blocky clay unit from 3.20km and 3.50km (100_3972, 100_3973)
Till wedge at 2.40km?

- measure the dip of the foresets at other places of the section. My guess is that they all show southern directions, but not exclusively south-eastern directions.
A delta has of course several channels that move into a basin.

- the water escape structures in the foresets might actually reach to the overlying blocky scattered clay unit and even cut this one also to the sand above. No prove found so far.

09th June 2007 Tolokonka section, Site 06025; along Severnaya Dvina river
- Astrid and Eiliv come for a visit to my outcrop. We discuss the boundary between the sand and the clay unit, which is definitely hard to describe. It has as well conformable and erosive and deformed character.
- Despite the faults in the sandy part, we also discover water escape structures, that are actually going downwards. This might be due to two different groundwater levels that are separated from each other: the upper one having a higher pore pressure will communicate with the lower one through the fine grained unit to equilibrate the pressure.
- Later during the day, Astrid and Eiliv might have discovered a glacial till in a part further upstream the section. It could be Saalian or Weichselian, the latter I would prefer. Given that, the water escape structures would be easier to explain. Overlying glacier executes high pressure…
- The group likes the idea of the prograding delta into the basin. With a definite transition from the foresets to the bottomsets.
The planar-parallel horizontally bedded sand unit (with oscillation ripples) above the foresets could be the topsets of the delta, but since they cut the foreset structures there is no scientific prove so far.
This idea needs to be proven at another site maybe.
- A very interesting and rather sensational discovery are the HCS that can be found in the bottomsets of the delta. A marine environment can here be almost excluded: Only an ice-dammed lake can explain the high water level.
To find HCS in a lacustrine environment is a very uncommon feature and suggests a huge lake to explain the building-up of big waves that are able to form hummocks within the storm wave base.
- Nevertheless, foresets, bottomsets and HCS form a very nice example of sequence stratigraphy at my working-site.
- The idea of Saalian or Weichselian till needs to be discussed further. Contrary to what is known so far, it would suggest the ice-edge must have come at least 200km further to the south/ south-east. Even in an ice-dammed lake the ice would have been grounded and maybe formed some sort of shelf onto the lake.

Tolokonka Log 3.20km downstream; Site 06025; lower part



Tolokonka Log 3.20km downstream; Site 06025; upper part

additional notes to profile Log 3.20km; site 06025 Tolokonka

 # 1

- The boundary between the medium sand unit and the overlying blocky clay unit appears to be rather sharp.
In some parts though, it is deformed: probably due to loading from above (3931, 3932).

- Note, that the upper 5-10cm of the sand unit are fining upward (FU) from coarse/very coarse sand with a few gravels (3933, 3934, 3935) to medium and fine sand at the top, where we can also find ripple structures with laminae of brownish clay/silt drawn into it.

 # 2

- The uppermost sand unit is about 1m thick and light brownish in colour. The unit is weakly stratified, the planar-parallel bedding is suggested by thin layers that are more silty/ very fine sand.
- The bedding is wavy, probably amplified by deformation, which is suggested by minor faults, that can be found here and there, and also reach #3. 100_3940, 100_3941.
- 20cm below the boundary (#1) organic material is deposited in lenses. 100_3939, 100_3942.

- Also one can find lenses of coarser sand, which are not bigger than 10cm. 100_3944
- At one place this lense is associated with a water escape structure (100_3977), that can also be seen elsewhere in the profile (#2, #3 cf. 100_3978, 100_3979; #4 cf. 100_3980, 100_3981 and #5)

 # 3

- This medium to coarse grained sand unit is lighter in colour (beige) than the overlying unit.
- A CU or FU tendancy cannot be determined at a macroscopic level: throughout this part of the section can be found medium sand, though there is a coarse sand fraction inside the current ripples: foresets ~5cm.
- This part (#3) weathers faster than #2, so the colour change between #2 and #3 might also be due to a difference in water content.
- The oscillation ripples are very symmetrical and are 1-2cm high. Apparently they always follow after 1-3 laminae of a more organic input (dark grey - black).
- Faults that were described in #2 continue in this part of the section and one of them even reaches #4.
- The two sand units #2 and #3 are not separated by a distinct boundary: it is more the colour change that catches the eye.
- No change in grainsize, but internal structures are more difficult to see in the upper part.

 # 4

- overview mosaic: 100_3961, 100_3962, 100_3963, 100_3964, 100_3965, 100_3966, 100_3967.
- deltaic foresets prograding into the basin
- clearly stratified unit of mainly fine sand to medium sand, also very fine sand
- dewatering structures: water escape downwards as described in #2 and #3
one of them is very elongated
- organic detritus deposited
- seemingly the source area of the sediment input has not changed throughout the deposition of bottomsets, foresets and maybe topsets (with oscillation ripples!)
- there is a continuous alteration/ interbedding of grey-brownish very fine sand layers with brownish fine sand layers and leight-beige medium sand layers.
- an outstanding CU or FU cannot be determined.

- At the upper boundary the foresets are cut off by the overlying sands that show oscillation ripples. Still, they might represent the actual topsets. But it needs further prove.
- as can be observed in the profile, there is no lower boundary to the underlying sands that show HCS in some layers. There is a gradual transition from bottomsets environment (#5) to foresets einvironment.

 # 5
- In this part we find the same kind of sediment as described in #4
- very important to point out is the fact that we can observe hummocky-cross-stratification (HCS) in an almost undoubtful lacustrine sedimentary environment.
- this is no doubt sensational, since it suggests a rather huge lake to explain the building-up of big waves - capable of forming HCS.

Pictures referring to #4 and #5: 100_3980, 100_3981, …, 100_4007

 # 6
- cf. pictures: 100_4038, 100_4039, …, 100_4055
- starting with a mixture of dark brown and dark greyish clays that have a very blocky, scattered texture
- form above there is a massive fine to medium sand mixed/ worked into it. This mixture has even reached the lower boundary in two spots, where it penetrates to the uppermost sand layer (medium to coarse sand, with very coarse grains and gravel)
- clay clast in the massive sand seem to have been ripped off very rapidly, as they appear very blocky and show no rounded edges.
- one can find gravel of differing size in the clay and in the massive sand. also differing in roundness and sphericity
- some packages of very fine sand worked into the unit.
- the unit seems to be a diamicton, where the gravel component is rather small.
- the gravel component has most likely Scandinavian and/ or Karelian provenance.

 # 7
- cf. pictures: 100_4057, 100_4058, …, 100_4067
- above the diamicton and below the laminated clay unit, we find a deposition of weakly but horizontally stratified medium to coarse sand grains and gravel in the lower part
- seems to be nivelling out the diamicton deposits
- turning with a gradual transition (very fast) to the laminated clay.
- little erosion though, might be possible; cf. 100_4087
- this boundary is outstandingly similar to the one below the diamicton!
    medium to coarse grained sand is interbedded with dark brownish silt/ clay in a more or less wavy pattern, for about 2-5cm.
- the overlying laminated clay seems to follow this wavy pattern until the nivelling out is completed
- deformation must not be excluded; cf. 100_4087, 100_4088

 # 8
- cf. pictures: 100_4068, 100_4069, …, 100_4077
- this unit was introduced as a Varvite, where Igor has counted ~340 pairs/ couples

- rhythmical deposition can be seen, interbedding dark grey clay (a few laminae are black in the lower part - organic rich) and more light grey to dark brownish silt/ very fine sand in the lower part of the unit.
- gradual overall coarsening upwards, towards the overlying sand unit.
- at 19.10m a.r.l. there is a 2-3cm thick layer of very fine/ fine sand with iron precipitate at the sand - clay/silt contact.
- towards this very fine sand layer we get a more and more lenticular bedding, showing oscillation ripple character.
- above this very fine sand layer, the clay component is very much recessing. And the rhythmic deposition continues with interbedding clayish silt with very fine sand in a more and more wavy bedding (partly flazer bedding).

- at 19.60m a.r.l. we get a 5cm thick layer of fine to medium sand. It shows an interesting hummock (maybe ripple?) at one point; cf. 100_4089, 100_4090.

- the interbedding of silty/ very fine sand and fine sand continues for another 30-35cm, showing a wavy pattern with a more and more sandier input until the deposition of more fine-grained material stops
    - transitional boundary: cf. 100_4092, 100_4093, 100_4094.

- deformation: cf. 100_4079, 100_4080, …, 100_4084
- the "varved" unit seems to be uniform, - undisturbed in some parts; in other parts it is deformed. It is unclear which kind of deformation this could be, the overlying sand unit seems not to be involved in that deformation
- we get a diffuse idea of either mixing due to pore pressure differences or even reverse faulting; cf. 100_4095

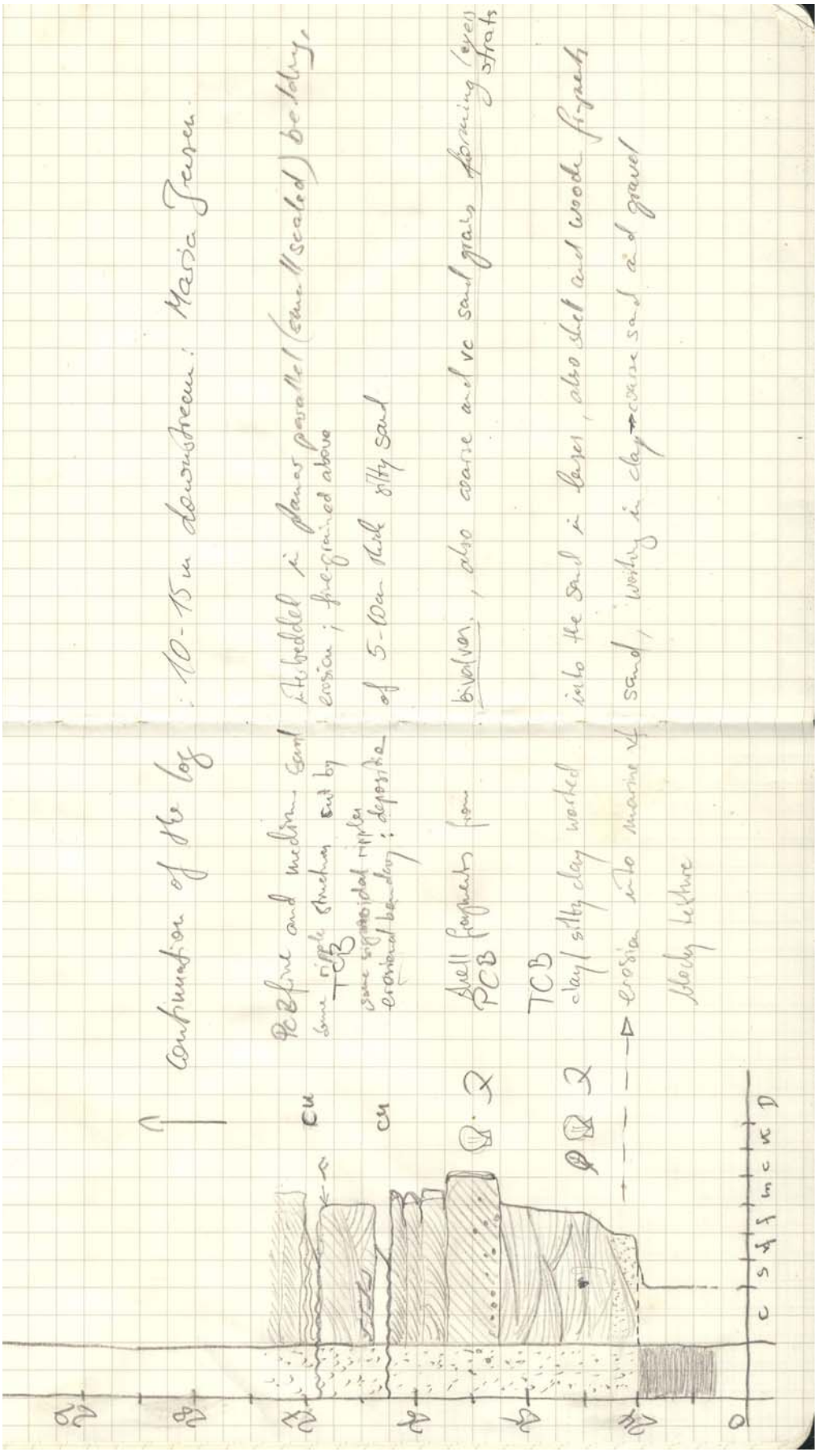
 # 9
- cf. pictures: 100_4103, 100_4104, …, 100_4109
- interbedding of mainly fine sand, with medium sand and few layers of very fine sand (silty)
- the planar-parallel horizontal bedding is basically visible because of the switch/ change in grainsize.
- the layers in itself appear rather massive
- some layers are wedging out here and there, also one can see dewatering structures (downwards)

- one of these dewatering structures is rather big in size and causes downwards bending and reverse faulting of the layers.
- it needs to be investigated, whether it reaches the underlying laminated fine-grained unit #8
    - it might explain the deformation there.
- ~20cm below the boundary to the overlying clay, there is coarse to very coarse sand deposited in thin lenses.

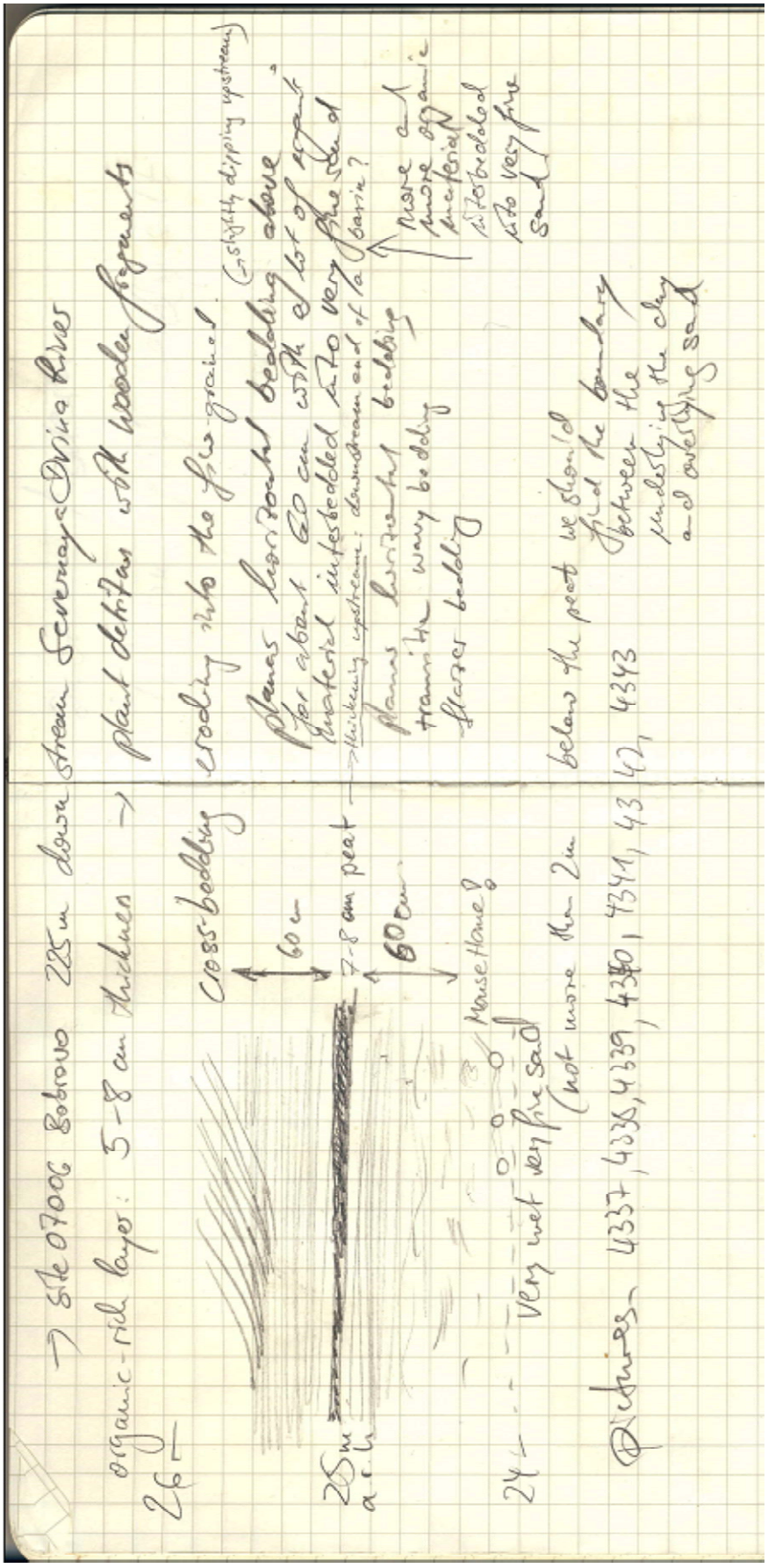
14th and 15th June 2007 Smotrakovska section; Vaga river, near Shenkursk
- major transportation struggles, bearing a lot of fun but no time for work
- wheather conditions don't make things easier.

cf. pictures: 100_4261, 100_4262, …, 100_4273
- Astrid and Eiliv take over the profile Log that Denis and Udo started.

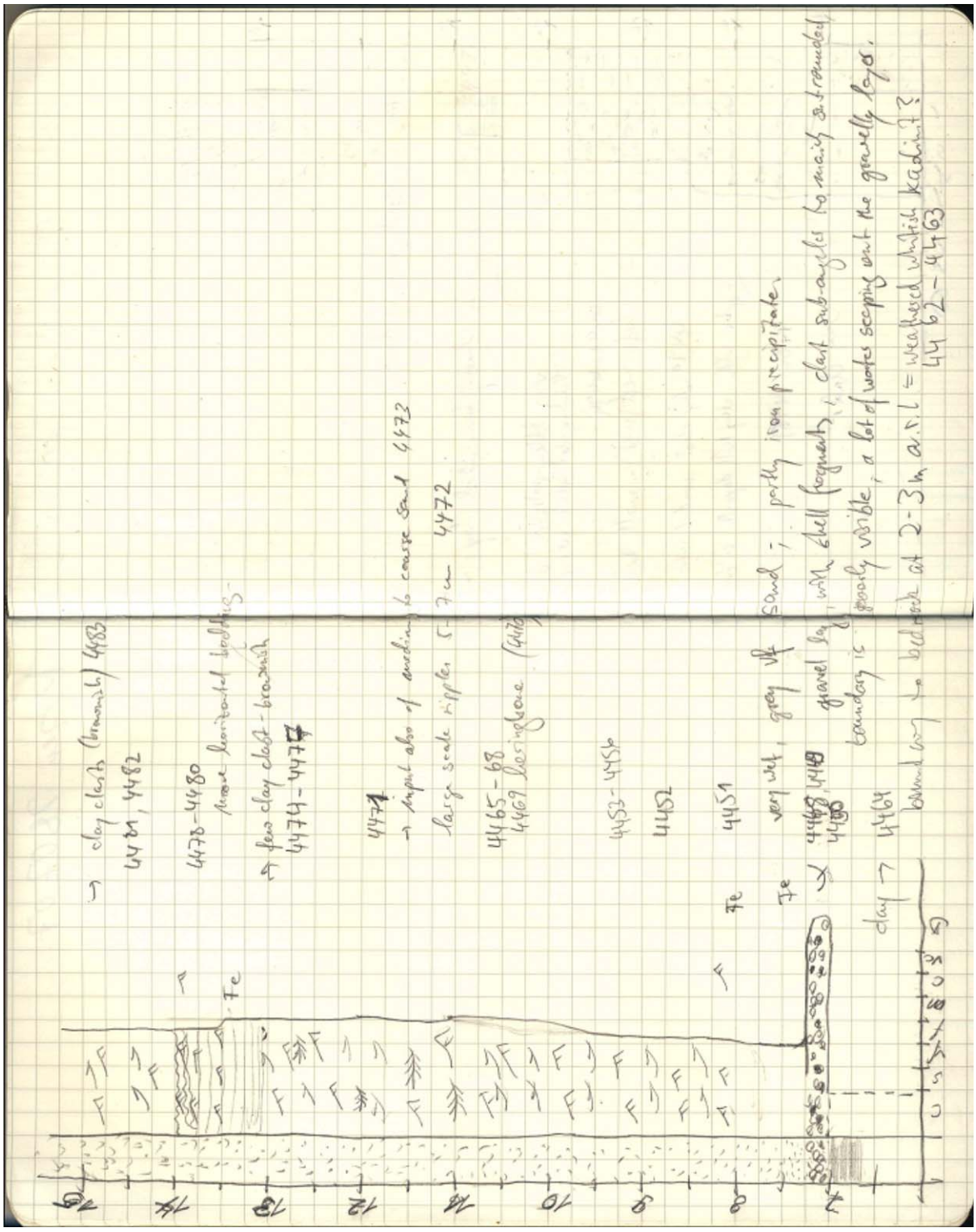
17th and 19th June 2007 Bobrovo section; Severnaya Dvina river, outside Arkhangelsk
- 30m downstream



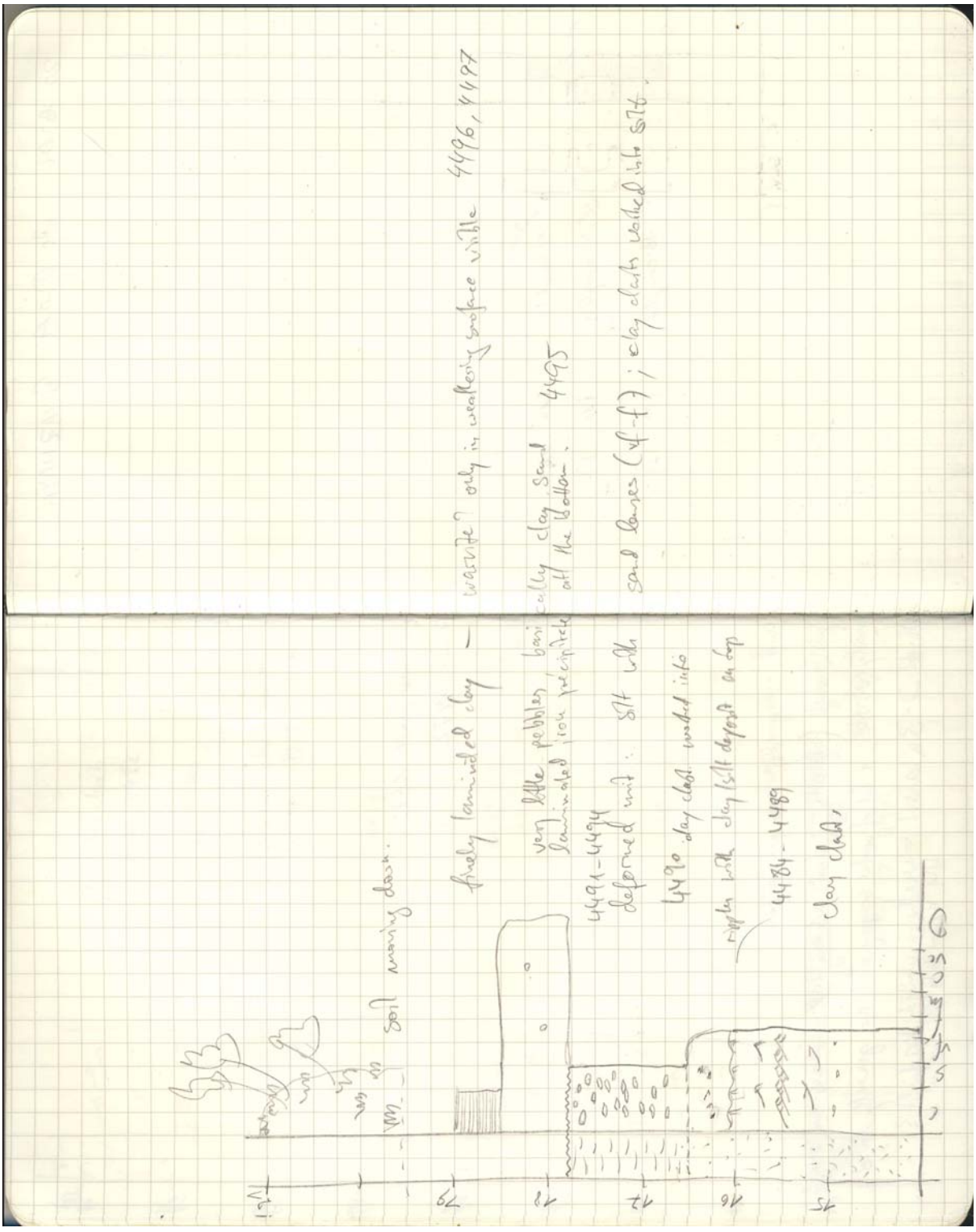
Bobrovo section



28th June 2007 Mezen river, part one



28th June 2007 Mezen river, part 2



30th June 2007 Gryaznaya; Mezen river; tidal rhythmites