

4.7.2. Measurements of the coast relief in the area of Mamontov Klyk and ice and sediment sampling

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4.7.2.1. Introduction

One of the main tasks of the expedition "Lena 2003" was an estimation of coastal erosion retreat rates at the about three kilometer long coastal segment in the area of Mamontov Klyk. One of a reasons of these studies is the beginning of the new Laptev Sea System Project "Dynamics of Permafrost". In the frame of this project, during spring 2005, a relatively deep profile consisting of a number of boreholes (up to 200-250 meters in depth) is aimed in that area.

4.7.2.2. Methods

Geodetic measurements have been carried out at the key site, using a laser theodolite Elta 50 R, to obtain the modern horizontal and altitudinal position of the shore line (Figure 4.7-5). Theodolite profiles and benchmarks recorded in the field were identified and compared with the aerial photographs and maps. At erosional shores the position of the cliff base and the cliff upper edge was measured. Characteristic terrestrial features, which could also be identified on aerial photographs, such as sharp turns of small streams, small water bodies, boundaries of different types of vegetation etc., served as natural marks. A number of aerial photographs (scales 1: 30,000 – 1:50,000) and topographic maps (scales 1:25,000-200,000) were analysed. Theodolite profiles and benchmarks recorded in the field could be identified in the remote material. Furthermore, aerial photos and maps are used for long-term analysis of coastal dynamics of the key sites by computer techniques, which allow us to estimate an average rate of shoreline retreat and long-term trends of the Laptev Sea coast quite precisely.

The undisturbed sediment and ice wedge sampling was conducted from the key coastal section by chain saw (Figure 4.7-6).

Detail information concerning general goals and methods of multi-stage coastal studies of Joint German-Russian expedition is presented in previous Reports of Polar Research (Rachold, Grigoriev, 1999, 2000, 2001; Pfeiffer, Grigoriev, 2002; Grigoriev et al., 2003).



Figure 4.7-5. Theodolite survey of the coastal cliff top in the area of Mamontov Klyk (August 2003)



Figure 4.7-6. Coastal sediment and ice wedge sampling by chain saw (area of Mamontov Klyk, August 2003)

4.7.2.3. Preliminary results

The coasts of studied area mainly consist of Ice Complex deposits, which are eroded very fast (Figure 4.7-7). Primary coastal forms are: cliffs, solifluction slopes (Figure 4.7-8), alas remnants and gullies. In 2000, the first measurement of coastal erosion rates at the area of Cape Mamontov Klyk was carried out by coastal team of the Expedition "Lena 2000". It was determined that the average retreating rates of ice-rich cliff tops and cliff base of the whole observed coastal sector for long-term period (1971-2000) are about 4.0 and 4.4 m/year, respectively (Grigoriev et al., 2001).



Figure 4.7-7. 20 meters altitude icy cliff west of Mamontov Klyk Cape (August 2003)

In 2003, at this site additional coastal line measurements and observations were carried out. They have shown that the average coastal retreat rate of studied shore has kept the same range as in the previous period (about 4.0 m/year). Most active coastal retreat takes place in the sections, where the "block" type of shore destruction takes place (Figure 4.7-9). The maximum velocity of coastal erosion was observed at the local limited shore section west of the Nyuchcha-Dzhiele River mouth (up to 6 m/year) and west of Cape Mamontov Klyk (5.8 m/year). Quite moderate retreat rates have been determined on the coastal segments adjacent to mouth of the Nyuchcha-Dzhiele River and Mamontov Klyk Cape (1-3.5 m/year).



Figure 4.7-8: Typical solifluction slope adjacent to Ice Complex shore (area of Mamontov Klyk, August 2003)



Figure 4.7-9.:The "block" type of destruction of the ice-rich shore (west of mouth of the Nuchcha-Dzhihle River)

According to the task of Arctic Coastal Dynamics (ACD) Project, a number of undisturbed sediment and ice wedge samples were collected from the key coastal section and transported to Germany (Table 4.7-1). This site is located in the beginning of prospective drilling profile.

Table 4.7-1: Frozen sediment and ice wedge samples (August 2003)

No.	Name and depth	Coordinates	Description	Number of samples
1	MAK-VI (1-5) Cape Mamontov Klyk	73-36-26.9 N 117-10-38.9 E	Ice block (10x10x10 cm)	5
2	MAK-VS (1-5) Cape Mamontov Klyk	73-36-26.9 N 117-10-38.9 E	Ground block (10x10x10 cm)	5

4.7.1.4. Further investigations

We plan to continue a coastal study and sampling in the area of Cape Mamontov Klyk in the future. Probably in 2005 a deep drilling will be conducted in the coastal zone of that area. Investigated coastal segment belongs to the largest coastal section (120 km) of the Laptev Sea, which almost continuously consists of Ice Complex deposits. This segment is one of the most active in respect of coastal erosion and play a very important role in sediment and organic carbon balance of the Laptev Sea.