EURASIAN ICE SHEETS:

Expedition to the lake Lyadhej-To (Polar Urals), July-August 1998

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Introduction

In order to establish a more reliable reconstruction of the glacial and climatic history of the Eurasian Arctic the project EURASIAN ICE SHEETS was initiated in 1997.

The project, funded by the European Science Foundation, is going to be run from 1998 until 2000, coordinated by John Inge Svendsen, University of Bergen, Norway.

6 groups from Norway, Finland, Sweden, Germany and Great Britain and their cooperative Russian scientific partners carry out extensive land-based fieldwork at geological key sites in different sectors of the Russian Arctic.

Within 'Working package 2: Southern flank of the Kara and Barents ice sheets' the scientific task of the AWI Potsdam is to contribute to the reconstruction of the late Pleistocene glacio-climatic history by investigating lake sediment sequences.

Reconnaissance expedition to the Lyadhej-To (Polar Urals) / Program

After a study of satellite images and air-photographs, the lake basin of Lyadhej-To (68°15'N, 65°45'E, 150 m a.s.l.) was recommended by Valery I. Astakhov, Institute for Remote Sensing Methods in Geology (VNIIKAM) St. Petersburg, to be a suitable sedimentary archive which is expected to accumulate continuously since last deglaciation.

The lake is situated at the NW-rim of the Polar Urals in a relatively fresh glacially formed Tundra landscape.

The lake basin is ca. 2,5 km long and 1,5 km wide, presumably carved into bedrock. The Lyadhej-To is surrounded by numerous smaller lakes.

Because until recently no ground-based information was available, a reconnaissance expedition in the frame of the Russian-Norwegian expedition PECHORA-98 was carried out to the lake and its surroundings.

This expedition should help to gain experience on the local situation and on the logistical possibilities and restrictions of Russian transport agencies and of

the Geological Survey 'Polarnouralgeologiya', Vorkuta, as possible partners to a contract treaty in the planned 1999 coring field work.

The main scientific objectives of the fieldwork were the following:

1. to establish bathymetric maps of the Lyadhej-To and of some other unnamed smaller lakes in its surroundings;

2. hydrochemical studies on the water column (pH-, Eh-values, conductivity, oxygen content), sampling of water and of suspended load;

3. short coring of lake sediments by a gravity corer (length <60 cm);

4. geomorphological and glaciogeological reconnaissance of the surroundings of lake Lyadhej-To.

The search for suitable future lake sediment coring sites was carried out in cooperation with the 'Geomorphological group' (O. Maslenikova, VNIIKAM; M. Henriksen, Uni Bergen) who were collecting field evidence for the establishment of a geomorphological sketch map.

Course of the expedition:

July, 23, 1998:	Flight Berlin - St. Petersburg with full expedition equipment (250 kgs).
July, 24 - 25:	Preparation works in St. Petersburg, logistic support by agency VICAAR Ltd., St. Petersburg.
July, 26 - 28:	Transfer of equipment and people by train to Vorkuta.
July, 28 - 30:	Preparation works in Vorkuta.
July, 31:	Flight of the complete team of PECHORA-98 by Helicopter Mi-8 to the study area at lake Lyadhej-To (150 km, 1 hour) with a stopover on a endmoraine at 68°07'N, 65°43'E for a short local geomorphological survey.
July, 31 - August, 13:	Field work in the area Lyadhej-To.
August, 14 - 16:	Post-expedition work in Vorkuta.
August, 16-18:	Transfer of equipment and people by train from Vorkuta to St. Petersburg.
August, 19-21:	Post-expedition stay in St. Petersburg.
August, 22:	Flight St.Petersburg - Germany.

Sampling

Sampling of water and lake sediment cores was carried out from a rubber boat. The water depth was determined by sonar, navigation was performed by GPS.

Hydrochemical parameters (pH, Eh, conductivity, dissolved oxygen) were determined with an oxymeter and multifunctional water tester onboard.

For further laboratory investigations the water samples were splitted: One part was filtered (<45µm), the other one was poisoned by $HgCl_2$.

Short sediment coring (< 50cm) was done by a gravity corer using liners. After recovery the liners were sealed. On the camp site the samples were treated in two ways:

1) Immediate subsampling: The core was cut into subsamples of two centimetres length. The subsamples were stored in PE-containers, the uppermost subsamples (0-2cm) were poisoned with $HgCl_2$ to avoid biological activity.

2) Sealing for treatment at AWI: The uppermost (empty) part of the core tube was cut off before the tube was sealed.

Preliminary field results

The Lyadhej-To and the unnamed lake fro which core 1408 was taken are mesotrophpic to oligotrophic, even the bottom water is rich in oxygen, and pH is neutral to slightly basic. The unnamed lake with sampling site 1407 seems to be dystrophic.

The average conductivity of 58 µS/cm of the Lyadhej-To water is relatively low, the one of the two small unnamed lakes (PG 1408 and PG 1407) is even lower.

The thermal stratification of the Lyadhej-To indicates a metalimnion at depths between 7-8m to 13-14m.

References

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Table 1: Sampling sites & list of sediment cores/samples.

Sample name	core length (cm)	Water depth (cm)	Positon (N)	Position (E)	Remarks
PG1400-1	37,5	8,5	68°14'22"	65°46'35"	South-eastern shore-area of Lyadhej- To
PG1400-2	39	8,5	68°14'22"	65°46'35"	
PG1400-3	40,5	8,5	68°14'22"	65°46'35"	
PG1401-1	43	16	68°14'36"	65°47'15"	Ridge between the two lake basins
PG1402-1	42	24	68°14'25"	65°46'50"	Centre of the southern basin
PG1403-1	41	23	68°14'32"	65°47'02"	ca. 150m NE of PG 1402-1
PG1404-1	41	11	68°15'12"	65°47'47"	Local basin in northern part of Lyadhej-To
PG1405-1	40	21	68°15'04"	65°47'24"	Centre of the northern basin
PG1405-2	40	21	68°15'04"	65°47'24"	
PG1406-1	36	21	68°15'04"	65°47'24"	Water depth consists on a large area
PG1406-2	39	21	68°15'04"	65°47'24"	
PG1407-1	45	2	68°14'19"	65°46'13'	Small lake near the camp
PG1408-1	26	15,5	68°14'05"	65°45'39"	Small lake , ca. 600m SW' camp
PG1409-1 to9	–	-	68°14'12"	68°44'48"	Cliff at the bank of the river Malaya Lyadhejyakha, ca. 1,3km to the SW of the camp

Table 2: Results of hydrochemical in-situ studies (end of July 1998).

Sampling Site PG1402-1, Lyadhej-To, Southern basin					
z (m)	t (°C)	O_2 (mg/l)	PH	Eh (mV)	Conductivity (µS/cm)
0,1	16,3	9,6	7,8	276	62
5	16,4	8,8	8,0	228	68
10	12,9	8,8	7,9	231	49
15	10,3	9,1	7,5	249	57
20	10,2	10,5	7,5	253	57
24	9,2	10,0	7,6	238	58

Sampling Site PG1405-1/2, Lyadhej-To, Northern basin					
z (m)	t (°C)	O2 (mg/l)	pH	Eh (mV)	Conductivity (µS/cm)
0,1	16,2	9,4	8,3	216	55
10	13,9	8,0	7,9	212	59
15	10,0	8,1	7,5	212	56
20	9,6	8,5	7,5	223	55
21	9,8	7,8	7,7	197	56

Sampling Site PG1408-1					
z (m)	t (°C)	O2 (mg/l)	pH	Eh (mV)	Conductivity (µS/cm)
0,1	12,6	9,9	7,9	233	45
15	7,5	6,3	7,0	220	40

Sampling Site PG1407-1					
z (m)	t (°C)	O2 (mg/l)	pH	Eh (mV)	Conductivity (µS/cm)
0,1	11,1	9,1	7,3	266	21

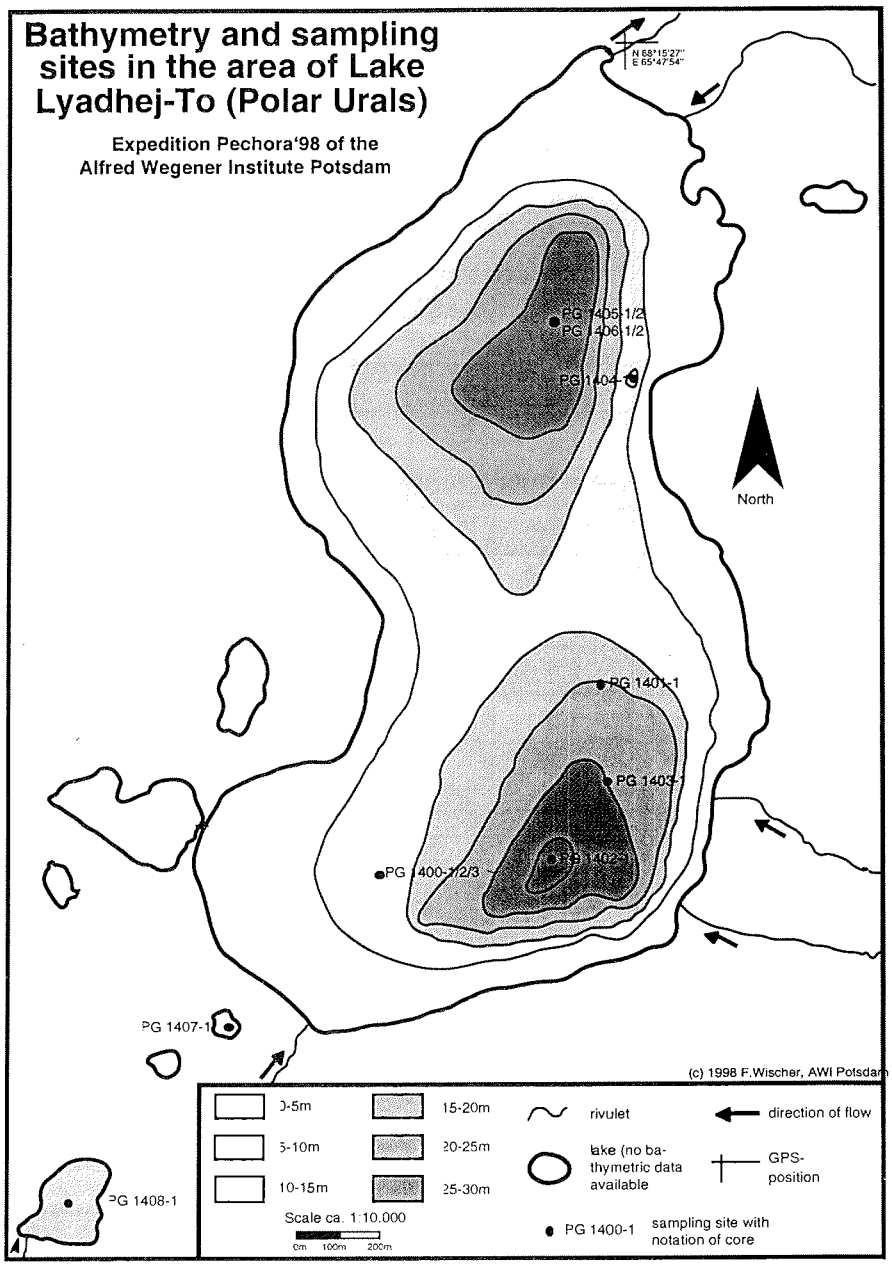

Figure 1: Bathymetry and sampling sites.