4.3. Geomorphologic route along the Urasalakh River

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4.3.1 Structure of Quaternary deposits along the Urasalakh River valley

From 7 to 18 August, two investigators made a traverse from the Pronchishchev Range along the Urasalakh River to the river mouth, which is located 16 km to the west of the main camp in the vicinity of Cape Mamontov Klyk. The traverse was undertaken under the purpose to investigate the geological and geomorphologic structure of the coastal lowland between the Pronchishchev Range and the Laptev Sea. We used a rubber boat make the travel by the river.

The Pronchishchev Range in the headwaters of the Urasalakh River consists of three cuesta ridges extending from northwest to southeast. These are low mountains with heights up to 270 m formed by a monoclinal southwestward dipping strata of sandstones and siltstones and their gentle southwest slopes being concordant with the dipping of the rocks. The valleys of modern watercourses are located between the cuesta ridges. One of them is the Urasalakh River valley. The valleys between the cuesta ridges are non-terraced. Their slopes are gentle and complicated by nivation niches. The deposits at the slopes are predominantly rudaceous. The fragments are practically non-rounded.

The valleys to the north of the range cut into loose sediments of pebble-sand deposits outcropping at the foot of the hills for example at the northern slope of Lake Mentikelir East (site 1410). They are overlain by silty-sandy Ice Complex deposits containing fragments of ice veins, which are rarely exposed in the upper reaches of rivers and which are mainly detected by a thermokarst mounds relief. The coastal plain with heights up to 40-60 m a.s.l. is mainly composed of sandy-silty basin deposits. Ice Complex deposits as represented by laminated silts with a large quantity of plant detritus and ice wedges permeating them are rarely exposed in the valleys. They are observed at the eastern slope of Lake Mentikelir East (site 1401), at the east coast of Lake Tungus-Yunkyur (site1417), in a thermokarst mound area (site 1421) – in a distance of 6 km from the Urasalakh River mouth, and in its lower reaches. Therefore, it can be concluded that typical Ice Complex deposits occur only in the coastal part of the studied area. In the upper reaches of the Urasalakh River, sand-silty deposits are only found as they underlay the Ice Complex deposits outcropping further north at the surface. These deposits are described in sections of high terraces along the Urasalakh River – sites 1415, 1418 (Figures 4.3-2, 4.3-3). In such outcrops Ice Complex deposits gradually turn to the underlying silt-sandy deposits. Sampling of sands was made for determining their age by the OSL method. Ice wedges only rarely cross the Ice Complex boundary and penetrate into the underlying sands.

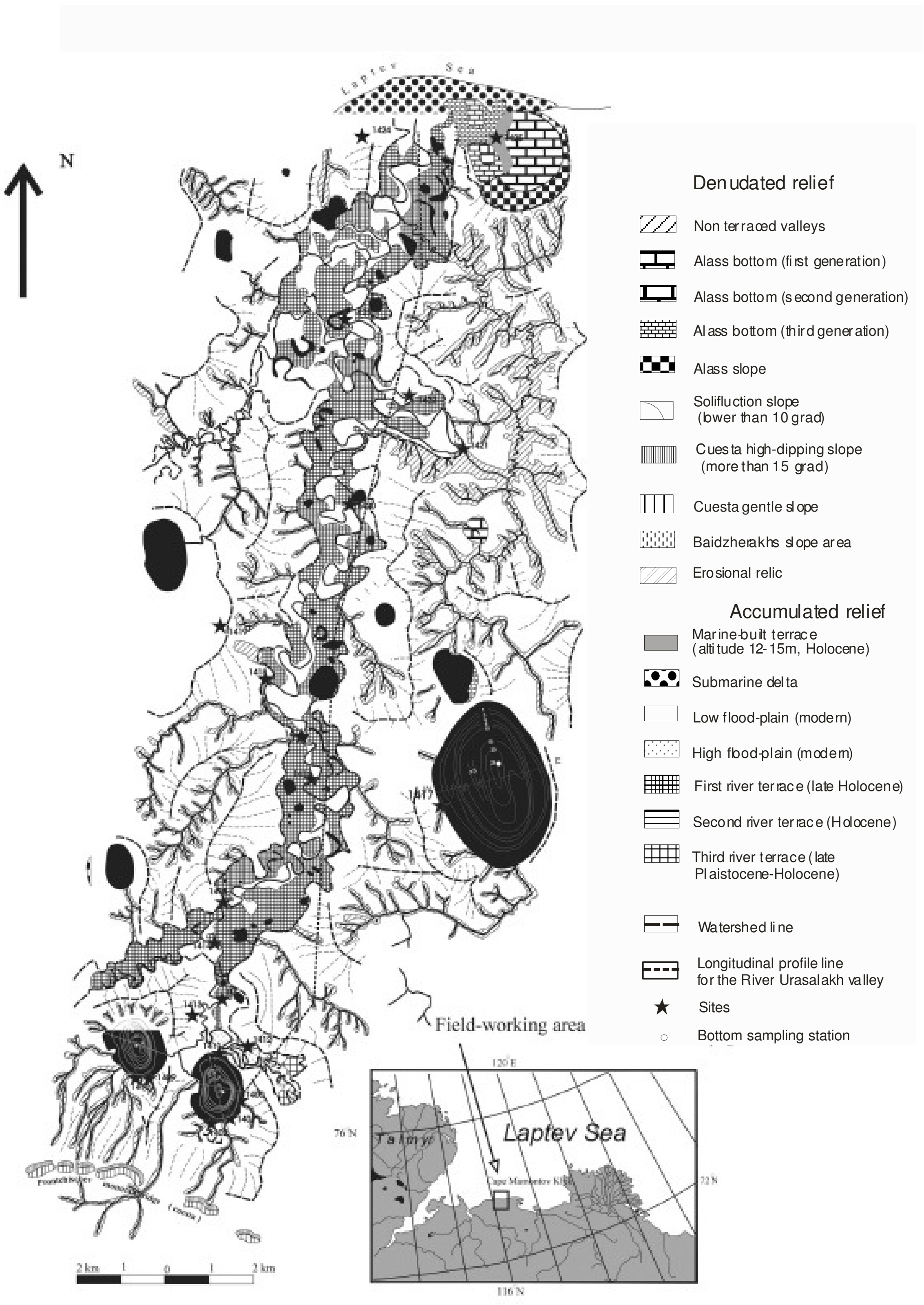

Fig. 1

Figure 4.3-1: Geomorphology scheme of the Urasalakh River valley and adjacent area, south coast of the Laptev Sea.

4.3.2 Geomorphologic structure of the valley

The Urasalakh River valley extends over 20 km from the northern ridge of the Pronchishchev Range. Up to the mouth, the river freely meanders along the valley with a width of 1.2 –2 km. The channel sinuosity coefficient is 2.9.

During the traverse, the river terraces were studied conducting measurements on the height and width of the terraces and observations of their structure. This results in a longitudinal profile of the Urasalakh River valley (Figure 4.3-3). The route firstly passed along the right tributary of the Urasalakh River – the Urasalakh-Batyta River. In the main valley, low and high floodplains and three above-the-floodplain terraces are developed. In the Urasalakh-Batyta River, the low floodplain is very restricted and narrow. The floodplains are composed of alluvium. The first above-the-floodplain terrace has sometimes a basement, which consists of similar sand deposits that underlay the Ice Complex deposits near the coast. At the longitudinal profile, a straight inclined line connecting the upper point of the route with the mouth characterizes the valley bottom. Unfortunately it was impossible to measure the true bottom inclination on different river segments. However, judging by the changes of the river current speeds, the bottom profile is similarly complicated as the profile of the terraces. According to the measurements, the first terrace, which usually has a height of about 5 m on the lower segment of the valley with a length of about 2 km (between sites 1421 and 1423), rises up to 7 m to the north. Here, the river sharply goes eastward along the valley forming the most extended meander – up to 2.5 km from the general direction of the river. The ancient sandy fundament of the terrace surrounded by alluvium beds up to 1 m thickness is exposed exactly here.

In the middle reach of the river a local elevation of the second above-the-floodplain terrace was observed, which usually has a height of 10-11 m, but here, the elevation rises up to 13-14 m.

The third above-the-floodplain terrace with a height of 20-22 m is more persistent by height.

All terraces decrease in general downstream. The studies of the longitudinal profile of the terraces, which reveal their local elevation, indicate that modern block tectonic uplifts of the Earth’s crust bend the terrace surface.

In the river valley, there is not only a river terrace but also a basin terrace. It was detected on the shore of the Laptev Sea where its height is 12-13 m a.s.l. Upward the valley, the terrace is traced by some relics and merges with the river valley bottom in a distance of 13-14 km from the mouth. This terrace, which was described and sampled at the site 1425, is interesting because it is located within a thermokarst depression with three various age stages of alas formation. The radiocarbon age determination of plant remains contained in the sands would be helpful to clear the age of the basin formation as well as the ages of the alas stages.

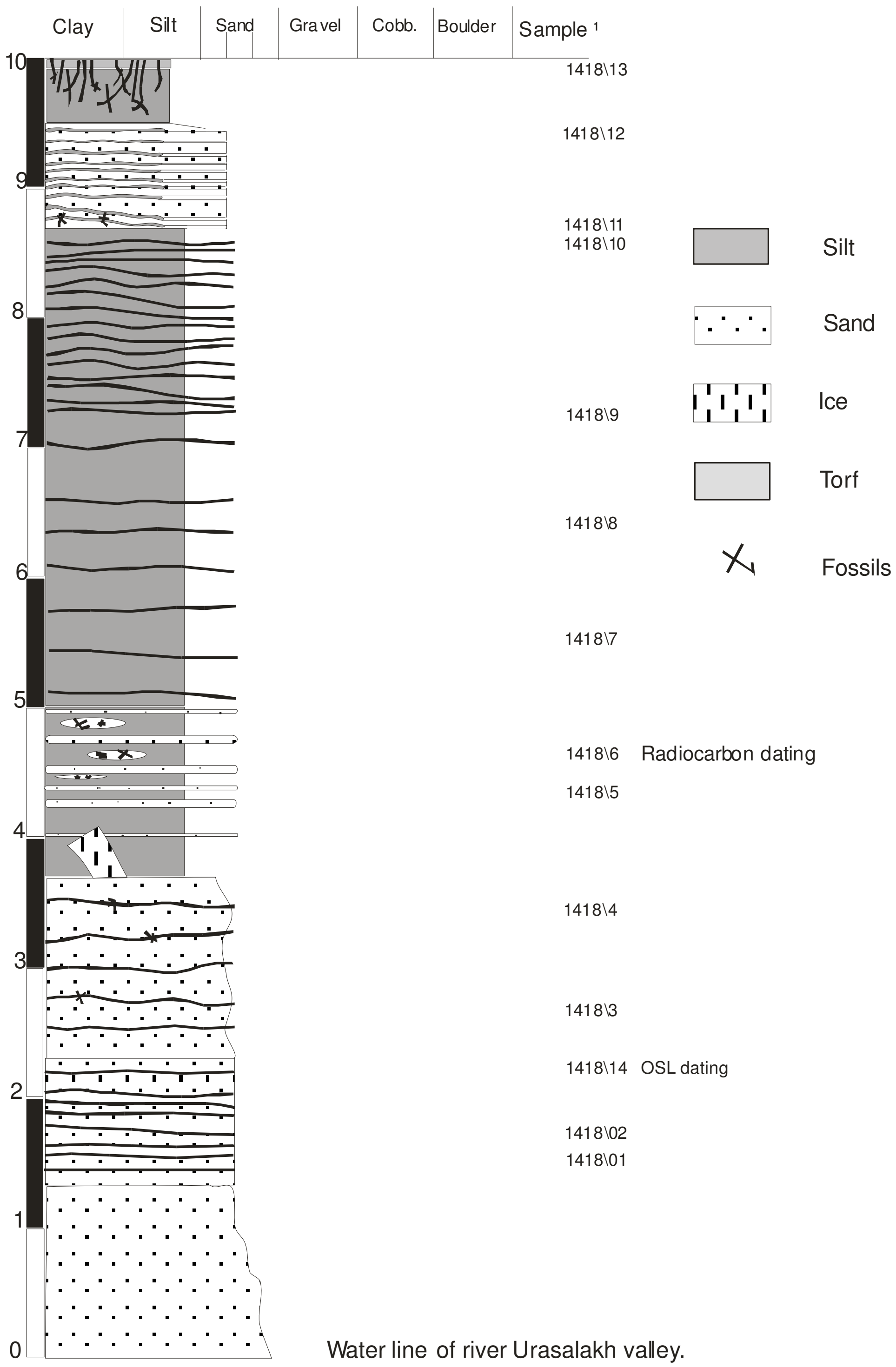

Figure 4.3-3: Profile of the exposure [1] 1418, river Urasalakh River valley (N 73° 32,798 E 116° 23,382)

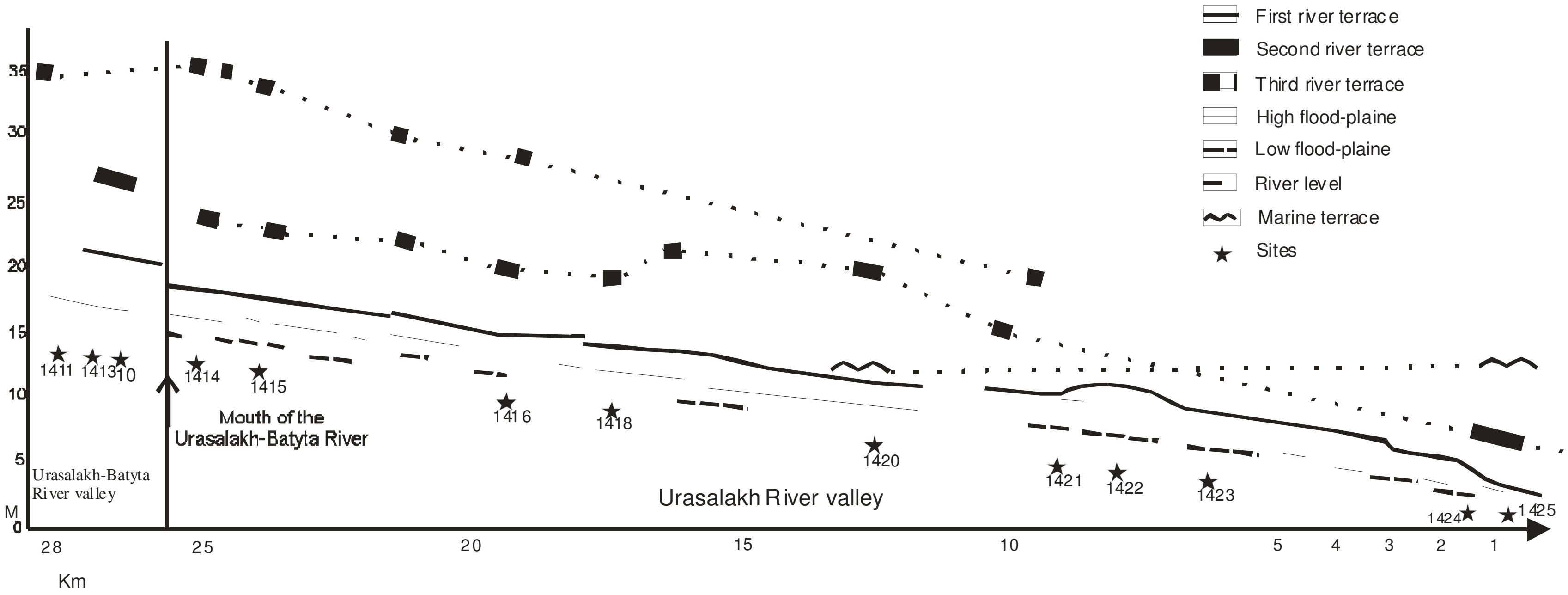

Figure 4.3-2: Gemorphological profile of the Urasalakh River valley

This basin terrace was not only revealed in the valley of the Urasalakh River, but also in other valleys of the coastal plain. In the valley of the Nucha-Dzhielyakh River where the main camp of the expedition was situated, it is well traced along the left slope of the valley having a height of 13-15 m and a width up to 500 m. There is also an extensive terrace approximately at this height in the vicinity of Cape Terpyai-Tumus, which was observed during the flight onboard of the helicopter. Thus, there are a basin terrace in the study area with a height of 13-15 m and lower marine terraces (up to 5 m) along the shore of Laptev Sea, which were also sampled for age determination of driftwood partly buried at the terrace surface.

Based on the results of en-route observations, a geomorphologic scheme of the study area was compiled, which is presented in Figure 4.3-1.

4.3.3 Studies of lakes

Two lakes near the foot of the Pronchishchev Range have been studied: their long axes from NNW to SSE orient both The Lake Mentikelir East and the Lake Mentikelir West. Their length is equal at around 1600 m. The western lake is slightly wider compared to the eastern one, and their widths obtain 1500 m and 1200 m, respectively. The eastern lake is located in 2 km distance from the northern cuesta of the range and the western lake in 2.5 km distance. This insignificant difference in the location significantly influences the sediment load flux to the lakes. The western lake is supplied by sediments of the northern range slope, while the valley of the river flowing to Lake Mentikelir East cuts the first ridge and penetrates further east to the low mountain relief of the range and collect the runoff in the depressions between the cuestas. This gives a significant superiority in the water runoff and sediment load discharge to Lake Mentikelir East compared to Lake Mentikelir West. A comparatively extensive delta is formed in the eastern lake at the flow of the supplying river. The observed rate of the water level increases in the lake during abundant precipitation comprised 30-40 cm over 24 h (8 August). The water transparency in the lakes also probably depends partly on the water and sediment load discharge when the river has a noticeable runoff. It comprises 1.3 m for the eastern lake and 3.0 m for the western lake. However, the geological structure of the shores of the lakes is of decisive importance for water saturation with suspended matter. Lake Mentikelir East has steeply shaped shores, which consist of sandy silt strata with ice wedges. These ice wedges veins are not visible today, but thermokarst mounds (baidzharakhs) are the common relief forms along the slopes of the east and north coast. In the south, the silt-clayey strata have a contact with the underlying sands and pebble-beds. In the Lake Mentikelir West mainly sands and pebble-beds existing at the water line along its coast are washed out and which are observed in a redeposited form in shallows near the shores. Due to this, the water turbidity of this lake is much lower compared to the eastern lake.

The height of lake terraces of Lake Mentikelir West is 7.5 and 10.5 m. The height of the terrace of Lake Mentikelir East is 5-7 m and the site width is 30-40 m. It is traced along the southeast, south and southwest coast. At the southwest and northwest coast, there is an additional terrace with a height of 8.5-10.5 m and a width of several tens of meters. Judging by the height of the terraces and the current level of the lakes, both terraces mark the level of one common basin that occupied both lake troughs some time in the past.

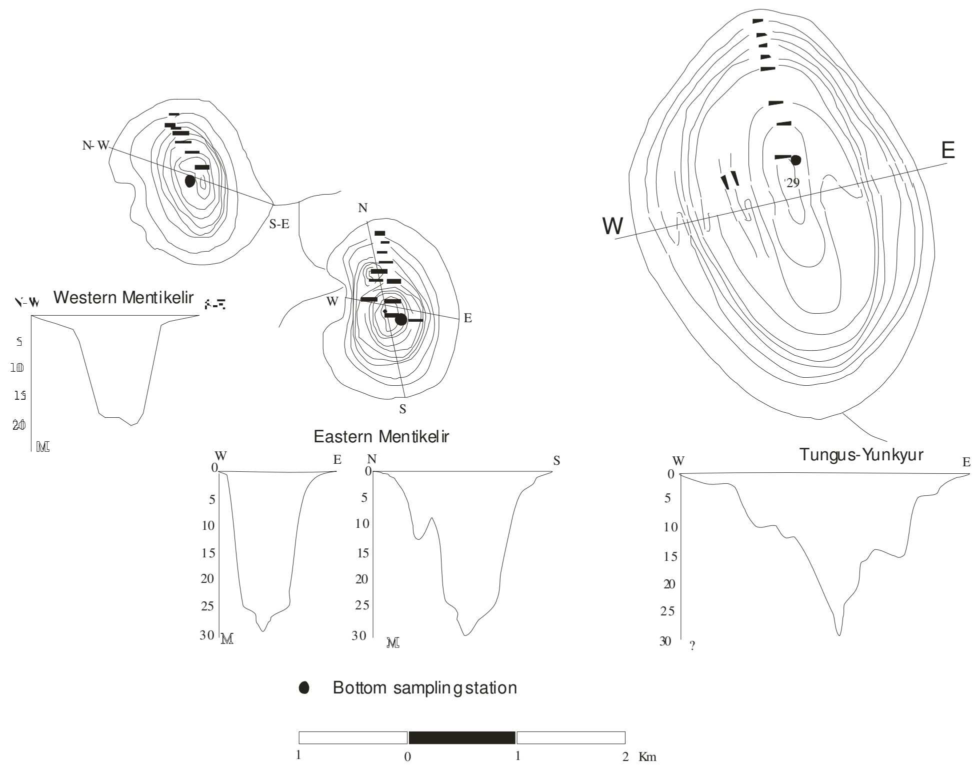

Figure 4.3-4: Bathymetric schemes and profiles Mentikelir Western, Mentikelir Eastern, Tungus-Yunkyur Lakes.

The bottom relief of both lakes is similar. These are deep troughs at the centre of the lakes with steep slopes and wide shallow water along the shores. Figure 4.3-4 presents the bathymetry maps of the lakes and the measurement profiles made by echo-sounders from a rubber boat.

The western lake has a wider shallow border. The width of the terrace with a depth of up to 1.5 m is up to 300 m. The greatest depth in the centre of an inverted saddle-shaped trough comprises 20.5 m. The eastern lake has a narrower shoal up to 150 m and a deeper trough up to 29 m. Besides, there is an additional trough in the northern part of the lake with a depth up to 14 m. The slopes of the troughs are also steep similar to the western lake.

Lake Tungus-Yunkyur located in the middle of the route along the Urasalakh River is greater in size and is also elongated from NNW to SSE similar to Lake Mentikelir. However, the trough structure is somewhat different. At the measurement profile from the west to the east shore some terrace-like benches were observed in 9-12 m depth at the west underwater slope and in 14-17 m depth in the eastern slope. The relief of these benches is complicated with steps up to 1-2 m high. The western shallow area up to 2 m depth has a width of up to 500 m and the eastern shallow area is up to 200 m wide. The maximum detected depth is 27 m, and the lake centre has not such an inverted saddle-like structure like the Lakes Mentikelir. The underwater trough slopes are less inclined (see Figure 4.3-4)

A steep eastern slope represents the part of the trough above the water level with a height up to 28 m. In the front of this slope, an ice wedge with a width up to 20 m is exposed. The entire slope is complicated with thermokarst mounds. The deposits with the ice wedges consist of sandy silt.

At the southwest lake coast, there is a pronounced terrace with a front height of 9 m and a rather steep slope (20-25º) up to 50 m wide. Valleys of runoff streams dissect the western trough slope. The east shore does not practically have valleys and the water divide is near the water line in the lake.

The water turbidity in the lake is 3.2 m by Sekki disk.

In all three lakes, bottom sediment cores up to 60 cm length were sampled for studies of climate changes and changes of the hydrological lake regime during the last millennium.