

## MONITORING OF THE ONEMEN BAY COAST (CHUKOTKA)

**A.N. Kotov and O.D. Tregubov**

*Chukchi Scientific Center*

Onemen Bay coast has been studied annually since 1989. Special genetic and facial heterogeneity of sediments composing coastal cliffs are found using cryofacial approaches of analysis. It essentially affects dynamics of breaking down of the coast.

A 2.5 km section of late Pleistocene and Holocene ice-complex sediments is exposed north of the Cape Rogozhny (Kotov 1991). The late Pleistocene sediments are composed of sections of brown fine-grained, sand between 10 and 18 m thick. The average weighted diameter of the sand grains range between 0.06 and 0.14 mm. The content of water-soluble salts is 0.036 – 0.05 % per 100 g of sediment. The cryogenic composition of the deposits include several layers of syngenetic, repeated-vein ice (RVI) of width between 0.8 and 2 m and in vertical extent up to 14 m. The cryogenic texture of sands ranges from massive to basal and ataxitic. Volumetric ice content of sediments exceeds everywhere 60%.

The low geomorphological levels were formed in the Holocene along the creek valleys during the thermo-erosion partitioning of the Pleistocene surface into separate segments. They are folded by products of destruction of the late Pleistocene cryolitogenous sediments (deluvial-solifluction deposits) and by peat. The thickness of this deposits ranges from 2-3 m up to 7 m. The deposits are penetrated throughout by RVI up to 2 m in width. The lower ends of veins are hidden beneath the waters of Onemen Bay. The cryogenic texture rhythmically varies from massive up to basal and ataxitic throughout the profile. The last one is often accompanied by ice schlieres of up to 3 cm in thickness. Volumetric ice content of the Holocene deposits of the ice complex is 70 - 85%.

The extremely unstable pattern of destruction of the coast formed by the ice-complex deposits was observed during the past 13 years. The bottom of the coastal cliff was impacted by strong gales in 1989. This led to the exposure of the buried RVIs that occurred everywhere and to the active thermo-abrasion. During one year from 1m up to 4 m of the coastal cliff. Were destroyed But in 1991 the RVI exposures were completely covered by re-deposited sediments. The coastal destruction has proceeded only by forming of thermo-erosion ravines in the top of cliffs. Small exposures of thawing RVIs were observed in 1995 - 1997 when the average annual air temperature were 1 –2.7° C higher than the long-term average

The destruction of the coast composed of the ice complex (moraine) is sustainable over time. It is composed of pebbly-boulder deposits filled with loamy sand and loam. Large inclusions of ice are not found. On such coastal cliffs the wave-driven niche is formed and coastal cliff destruction is gradual. Many boulders up to 1.5 m in diameter with characteristic glacial hatching are found in the sandy beach below the cliff.

Destruction of the coast to the east of Cape Rogozhny formed by glacial-marine deposits is unstable. It is the result of the formation of in thermokarst cirques in locations of sheet ice. During the observational period the first thermo-cirques were exposed in 1991. Afterwards only in 1996 were several thermo-circuses exposed because of the increase of annual air temperature. The initial state of in forming a thermo-cirque is disastrous. Sliding of huge amount of deposits takes place. Landslide tongue can penetrate up to 50 m into the water area of the bay (Kotov 2002). The glacial-marine deposits are composed of bluish-grey clay with

infrequent admixture of sand and pebble, and rarely boulders. The content of the clay fraction (less than 0.005 mm) ranges between 52 and 87%. The amount of water-soluble salts reaches 0.493 % per 100 g of sediments. The cryogenic texture changes from the bottom upward from ataxitic to irregularly wide netlike with thickness of schlieres up to 5cm. From the bottom upward cells of the net become less and schlieres of ice become thinner (1-2 mm). The glacial-marine deposits are overlapped by sandy sediments of the late Pleistocene ice complex with syngenetic RVI's. The latter ones are similar to the described above sediments (Kotov 1997, 2001).

The glacial-marine deposits include flat ice deposits (FID). When FID thaw through, the thermo-cirques emerged. FID are not a uniform layer. They are represented by separate structures located at different altitudes (from 2 to 9 m) above the bay level. The lower boundary of FID was not determined. It is covered by mud-streams at 1-5 m above the bay level. The maximal visible thickness of ice (7 m) was monitored in 1997. In one of thermo-cirques, two layers of ice were observed. They were divided by an 8-m thick glacial-marine deposit.

Thermo-cirques at the northern coast of the Onemen Bay emerged in August 1996 and were studied in detail. Size was: width 46m; height of the frontal wall 15m. The volume of the ground sliding down at a time exceeded 15000 m<sup>3</sup>. Seven transects were set up along the perimeter of the thermo-cirque to monitor its development. The measurements on transects for September 1997 showed that: the frontal wall of a thermo-cirque has receded 14.7 to 20.5 m; the width exceeded 1.5 to 5 m. The volume of ground removed during one year (the summer season of 1997) was about 10000 m<sup>3</sup>. In 1998 the development of the thermo-cirque was terminated. There was a relative flattening out of the frontal wall and many mud-streams of a sod were found. In 2001 the thermo-cirque was nearly completely covered by vegetation (Kotov 2002). The close relationships in dynamics of climatic parameters, active-layer thickness, and appearance of thermokarst cirques were found.

The detailed study of the deposits of the northern coast of Onemen Bay, including pollen spectra, hydrochemical and isotopic analysis of underground ice, dating of absolute age by C<sup>14</sup>, allows the reconstruction of the history and paleogeographic conditions of their formation. It enables us to trace the dynamics of the coastline from mid Pleistocene to the present.

Starting in 2001 annual mapping of the northern Onemen Bay coastline using GPS has been organized. A total of 18 transects were established to measure the coastal dynamics. Shrubs from bottoms of an old vegetated thermo-cirques are sampled to determine their age using dendrochronological approaches.

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