

Holocene tsunami deposits and tephrochronology in Paramushir Island, northern Kuril Islands

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A geological study of tsunami deposits was conducted on the Pacific coast of Paramushir Island, northern Kuril Islands, in September, 2007. The main subjects of the survey is stratigraphy, tephrochronology, and distribution of tsunami deposits. The study areas are lowlands of downstream region of Medvezh'ya (Hamanaka) River and Zaozernaya (Akaishi) River, northeastern part of Paramushir Island. This area has some marshes, peat bogs, and small lakes, eg. Lake Melkoe. The coastal area has a few beach ridges. Tsunami deposits and tephra are described on the following four transects:

Transect-1, a 450m-length transect on the left side of Medvezh'ya River, has a 70m-width foreshore and backshore, a 150m-width sand ridge, and a more-than-250m-width peat bog. Three pits on the sand ridge and four on the peat bog were excavated.

Transect-2, a 205m-length transect between the coast and Lake Melkoe, has a 60m-width foreshore and backshore, a 140m-width sand ridge, and a 50m-width peat bog. Four pits on the sand ridge were excavated.

Transect-3 is a 150m-length transect parallel to the coast. Five pits were excavated at various elevations from 6 to 16 m above sea level.

Transect-4 has two outcrops beside Zaozernaya River at 360m and 520m from the coast. Additionally, two pits were excavated on a peat bog at 570m and 610m from the coast.

Paramushir Island has seven active volcanoes, such as Ebeko (Chishima-Iwozan) volcano, Chikurachki (Chikuradake) volcano, etc. and has Alaid (Araido) volcano on the 30 km northwest of Paramushir. Thus, not only tsunami deposits, but also many volcanic deposits occur in the Holocene sediments on Paramushir. In many cases, tsunami deposits are hardly distinguished from tephra in a volcanic area. In the present study, sandy deposits are classified into tephra or tsunami deposits, by roundness and components of grains, based on microscopic observations. Besides that, tsunami deposits usually change the thickness and grain size from the sea into the land, while tephra layers more constant.

Samples of sandy deposits collected from the outcrop on Transect-4 and the 2m-depth pit on Transect-1 show that 27 tephra layers occur in the sedimentary sequence of the last 9000 years. Three of them are identified as the tephra from volcanoes in Kamchatka: Kambalny phreatic ash (KMB_{phr}: ca.700 ¹⁴C yBP), Ksudach (Shtuebel cone) tephra (KSht₁: 1090+-31 ¹⁴C yBP, 960-1052 cal yBP), Kuril Lake Caldera tephra (KO: 7666+-19 ¹⁴C yBP, 8413-8453 cal yBP). KMB_{phr} and KSht₁ occur 30-40cm below the surface in many peat bogs.

Observation of the pits and outcrops reveals that three prominent tsunami layers (TS1, TS2, and TS3) are intercalated with the peat layers formed during the last 1000 years. The uppermost layer TS1 and TS2 are observed on the inland area about 600m from the sea (Transect-4), and on the terrace surface about 12m above sea level (Transect-3), as well as on the seaside lowlands. These layers can be correspond to the historical tsunamis in AD1952 and AD1737. A charred material between TS2 and a lower tephra on Transect-3 yields a radiocarbon age of 599+-19 yBP (calibrated 553-639 cal yBP, AD1310-1400). TS3 occurs above KMB_{phr} and KSht₁. Furthermore, 15 sandy layers between KSht₁ and KO are presumed to be tsunami deposits.