



The postglacial environmental changes in vicinity of the Barentsburg settlement (West Spitsbergen)

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The Grondalen is the largest valley situated most close to the Barentsburg settlement (West Spitsbergen). The valley stretches about 20 km from the low foothills, partially occupied by small glaciers, to the shore of Gronfjord. The valley has a wide (up to 3 km), flat bottom and narrow terraces up to 20-25 m high, leaning against steep high slopes of bedrock.

In 2015, the outcrop (Site GD-1) with a thickness of 3,7 m was studied on the slope of a terrace (16 m a.s.l.) near the valley mouth. From the surface of terrace, the sediments are represented by a stratum of interlayered silt, sand, loam, enriched with plant remains (thickness 1,5 m), followed by gravel-pebble material (2 m) and again with silt and loam at the outcrop base. The laboratory studies of the GD-1 sediments included radiocarbon dating, stable isotope (C, N), diatom and pollen analyses.

In 2017, a 21,5-m-long core was extracted from well (site C8) drilled in a 15,9 m high terrace at a distance of about 300 m from the site GD-1. The core sediments consist of silt, loam, gravel and pebbles with plant remains down to a depth of 5 m, and clay below. To the moment, radiocarbon age of sediments at a depth of 2,65 m (8500 yr BP) and 20,35 m (23450 yr BP) was determined.

The lithology and age of sediments from the C8 well suppose that the lower part of the valley was not overlapped by active glaciers during the last glacial maximum. This is confirmed by the results of diatom analysis of the GD-1 basal sediments, which were accumulated in a shallow freshwater cold basin about 14,5 ka BP. From 14 to 6-5 ka BP, at the GD-1 point, the gravel-pebble stratum was formed, which contains no diatoms, but has evidence signals of the ancient material redeposition. The accumulation of this stratum took place during a period of transgressive rise and subsequent fall of sea level. Probably, the sea water did not rise in the valley above the modern elevations of 15-17 m, and melting snow and small glaciers in the valley produced large amount of melt water during this period.

The diatom and spore-pollen complexes of the upper 1,5 meters of GD-1 allow us to distinguish stages of environmental change during last 6-5 thousand years. In the Middle Holocene, up to about 4,5 ka BP, there was a shallow freshwater basin at the point GD-1 with favorable conditions for development of freshwater benthic diatoms, and, on the land, a comparatively rich flora developed (climate warming). The subsequent evolution of diatoms in the water basin and vegetation cover in the vicinity went under less favorable conditions to about 1000 yr BP, and then conditions again improved for a short time. The absence of diatoms and poverty of the spore-pollen complex in overlying sediments reflect severe climatic conditions of the little ice age until about 250 yr BP. During the last centuries, environmental conditions of the region gradually acquired modern features.