Early investigations of permafrost in Siberia by Baltic-German and German scientists

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In the 18th and 19th centuries several German and Baltic-German scientists investigated almost unknown territories of the Russian Empire. Many of them were invited by Russian emperors and became academicians of the St. Petersburg Academy of Sciences. German naturalists like Georg Wilhelm Steller (1709-1746), Johann Georg Gmelin (1741-1811), Karl Ernst von Baer (1792-1876), Ferdinand von Wrangell (1797-1870) and Alexander Theodor von Middendorff (1815-1894) traveled through Siberia collecting information about the flora, fauna, geology, climate, ethnology, history and economy of the Far East of Russia. Their results were mostly published in journals of the Russian Geographical Society. Information about Russia became available in Europe through special journals edited by Germans such as P.S. Pallas [1], J.G. Georgi [2], Th. Fr. Ehrmann [3], A. Middendorff [4], K.E.v. Baer and G.v. Helmersen [5].

First soil temperature studies in Yakutsk

The western world was first informed of the permanent frozen ground in Siberia by J.G. Gmelin who had reported about such a phenomenon in Yakutsk, but Leopold von Buch (1774-1853) was doubtful and considered impossible that plants were growing in this region on the permanently frozen soil [6] [7]. On the initiative of the merchant of the Russian-American Company, Fedor Shergin, a shaft was dug in Yakutsk to get drinking water. To Shergin’s surprise, they did not reach water. Ferdinand von Wrangell, new Governor of the Russian America, insisted in 1829 on continuation of digging at the expense of the Company in order to study the frozen ground underneath Yakutsk. Between 1828 and 1837, they reached the depth of about 116.5 m, but the soil was continuously frozen [8]. The shaft appeared to be of great importance for further geological studies.

First measurements of the frozen soil temperature were carried out therein in April 1829 by the German physicist Adolph Erman (1806-1877). Down to the bottom of the shaft (about 15 m deep at that time) he recorded continuously –7.5° C in deeper parts, which corresponded well to the mean annual temperature in Yakutsk of –7.4° C. This result can be regarded as the first record of the depth of permafrost of “Zero Annual Amplitude”. Erman expected liquid water at the depth of about 190 m [9] [10]. Shergin’s measurements published in 1833 on –0.8° C at the bottom of the shaft [8]. Several scientists were doubtful about Shergin’s data [11]. Regular measurements in the Shergin shaft (1844-1846) were carried out by A. Th. von Middendorff. He reported on a bottom temperature –3.0° C [12] and published his detailed geological observations, including data on the thermal conductivity of soils – a result of geothermal measurements in the Shergin shaft [13].

Hunting for Mammoth carcasses

The Russian empire participated in the 1st International Polar Year of 1882-1883 with two Arctic stations, one on Novaya Zemlya and the other on Sagastyr Island in the north of the Lena delta. Regular soil temperature measurements in three different depths were included in the meteorological program of both stations. On Sagasty, these observations were carried out by the astronomer and geophysicist Adolph Eigner (1854-7) [19], while Alexander von Bunge (1851-1930) served as a medical doctor. Both were Baltic Germans. The head of the station was Lieutenant Nikolaus D. Jürgens (1847-1888). Bunge was especially interested in mammoth carcases and visited Bykovskiy peninsula where the first find was recorded in 1798. In 1883, he learned that close to the Sagastay station there was a place, well known to indigenous people, where a mammoth was found. He prolonged the trip for another year and found the carcass [20].

In 1883-1886, an expedition organized by the St. Petersburg Academy of Sciences under his command studied New Siberian Islands where mammoth ivory was frequently found [21]. Eduard von Toll (1854-1902) acted as the zoologist and geologist of the expedition. It was the first natural scientific expedition to the archipelago in which numerous remains of Pleistocene mammals were found referring to a relatively warm climate in late Pleistocene. The expedition members were impressed by huge ground ice complexes they found.

References

[1] Baer, K. E.: On the Ground Ice or Frozen Soil of Siberia. The Genesis of the “fossil ice” and “ice rock” (Steinis in geology) [22]. Alexander von Bunge did not agree with him. In 1902, Bunge was the first one to publish a hypothesis of the genesis of ground ice by thermal contraction [23].

Genesis of ground ice

Scientific world was deeply impressed by the first photographs of huge ground ice wedges published by Baron Eduard von Toll in 1887. He speculated that these formations were relics of glaciers and introduced terms like “fossil ice” and “ice rock” (Steinis in geology) [22].