On Genesis of the Lower Kolyma Yedoma Based on New AMS 14C Dates from Duvanny Yar

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Introduction

In recent years, careful attention has been paid to the study of Ice Complex (loess-like silts enclosing thick ice wedges) as one of the most significant sources of organic matter incoming to the Arctic watershed rivers. In this connection in 2008-09, in the scopes of the POLARIS project, we conducted studies aimed to refine structure, genesis and ancient organic material of this complex, widespread on the Kolyma Lowland (Fig.1).

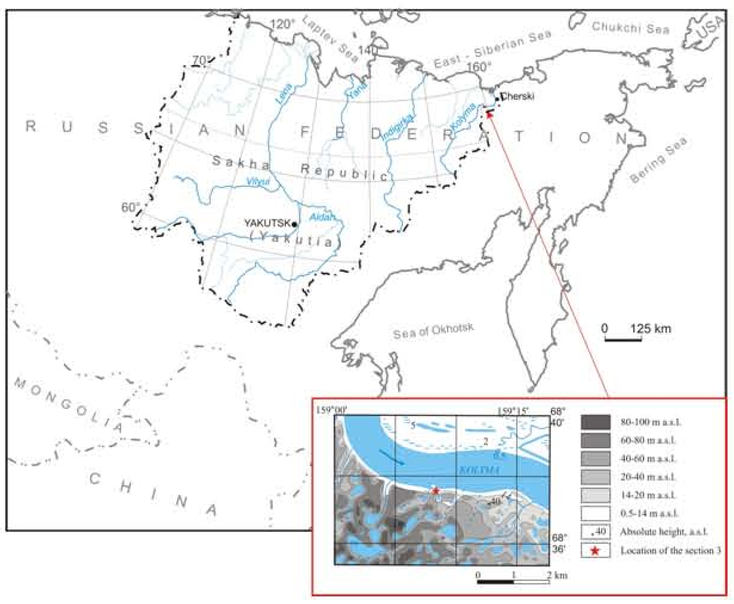

Fig. 1. Location of the Duvanny Yar exposure (regional map) and Section 3 (cut-in map).

Aim

For better understanding linkages between yedoma, as one of the main sources of organic matter, and modern content of organic in the Lower Kolyma, as well as to precise paleoclimate and geodynamics history of the region, new radiocarbon data were obtained on the upper yedoma part from the stratotype exposure Duvanny Yar, situated on the Kolyma River right bank, 40 km downstream of the Omolon River mouth (Fig.2, 3).

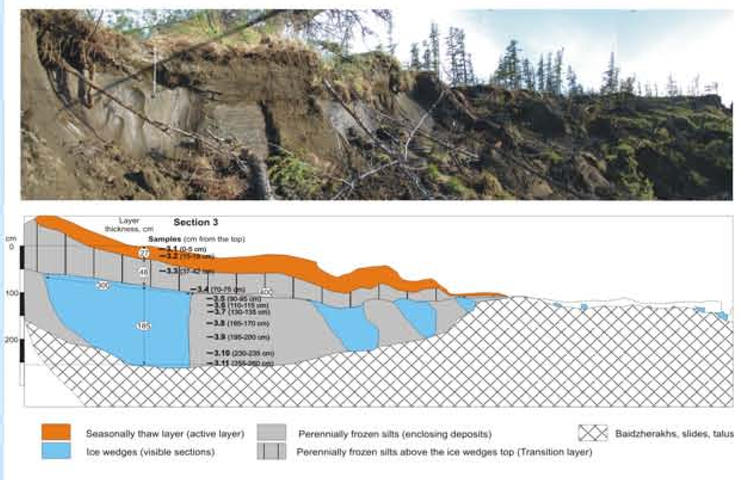

Fig. 3. Thermokarst circus with the exposing ice wedges and enclosing silt deposits at the Duvanny Yar, Section 3.

Materials and Results

The studied section (N68 37.8' E159 08.6') is located on the eastern end of a big thermokarst circus which had formed at the margin part of the gently sloping accumulative plain cut by the Kolyma River (Fig. 3). Here, from the edge of slope (32-35 m a.s.l.) downward to the depth of 70 cm, a soil layer of brownish silt with relatively low ice content is distributed (Fig.4) . Downward, in the interval 70-75 cm, a transfer layer of ice-rich dark-grey silt pinching out in this section is observed. The transfer layer is underlain at the depth of 75 cm by Ice complex, composed of ice wedges and enclosing dark grey silts.

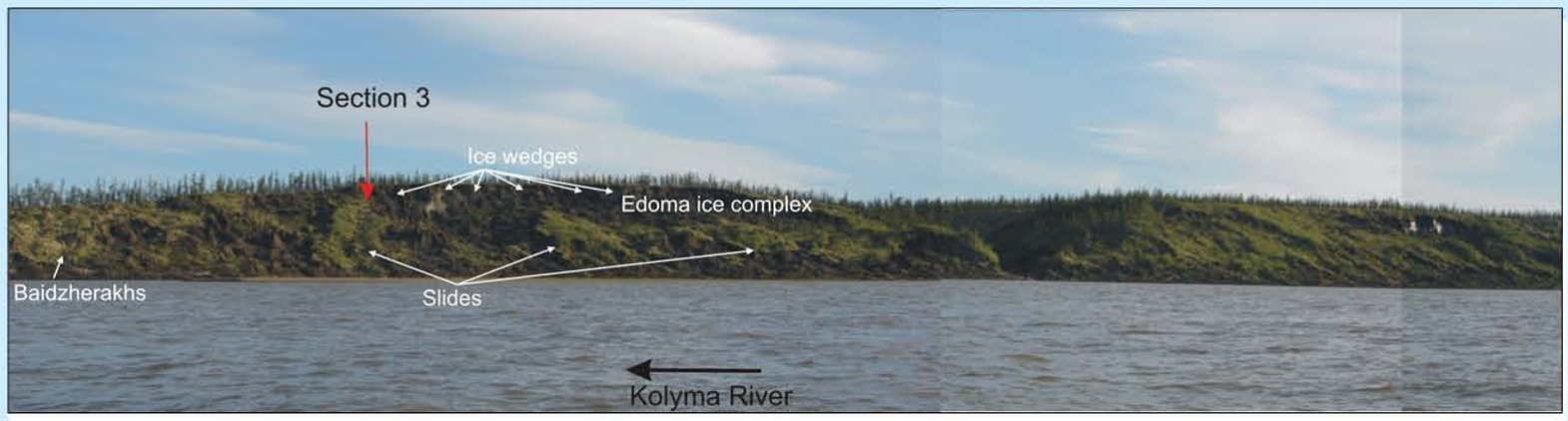

Fig. 2. Edoma (ice complex) exposure Duvanny Yar and the location of the Section 3.

Results

Samples of organic matter (thread-like roots in situ) were collected from frozen silts above an ice wedge head and from enclosing silts. AMS 14C analysis was performed in the National Ocean Science AMS laboratory. The dates are presented in the table below.

Interval, cm from the top	Field #	NOSAMS #	14C Age	Age Error
70	3.4	OS-72599	260	30
90-95	3.5	OS-72594	29500	200
90-95	3.5	OS-72593	26600	170
130-135	3.7	OS-72598	32600	230
165-170	3.8	OS-72597	32600	220
195-200	3.9	OS-72596	33400	240
230-235	3.10	OS-72854	32900	310
255-260	3.11	OS-72595	27900	270

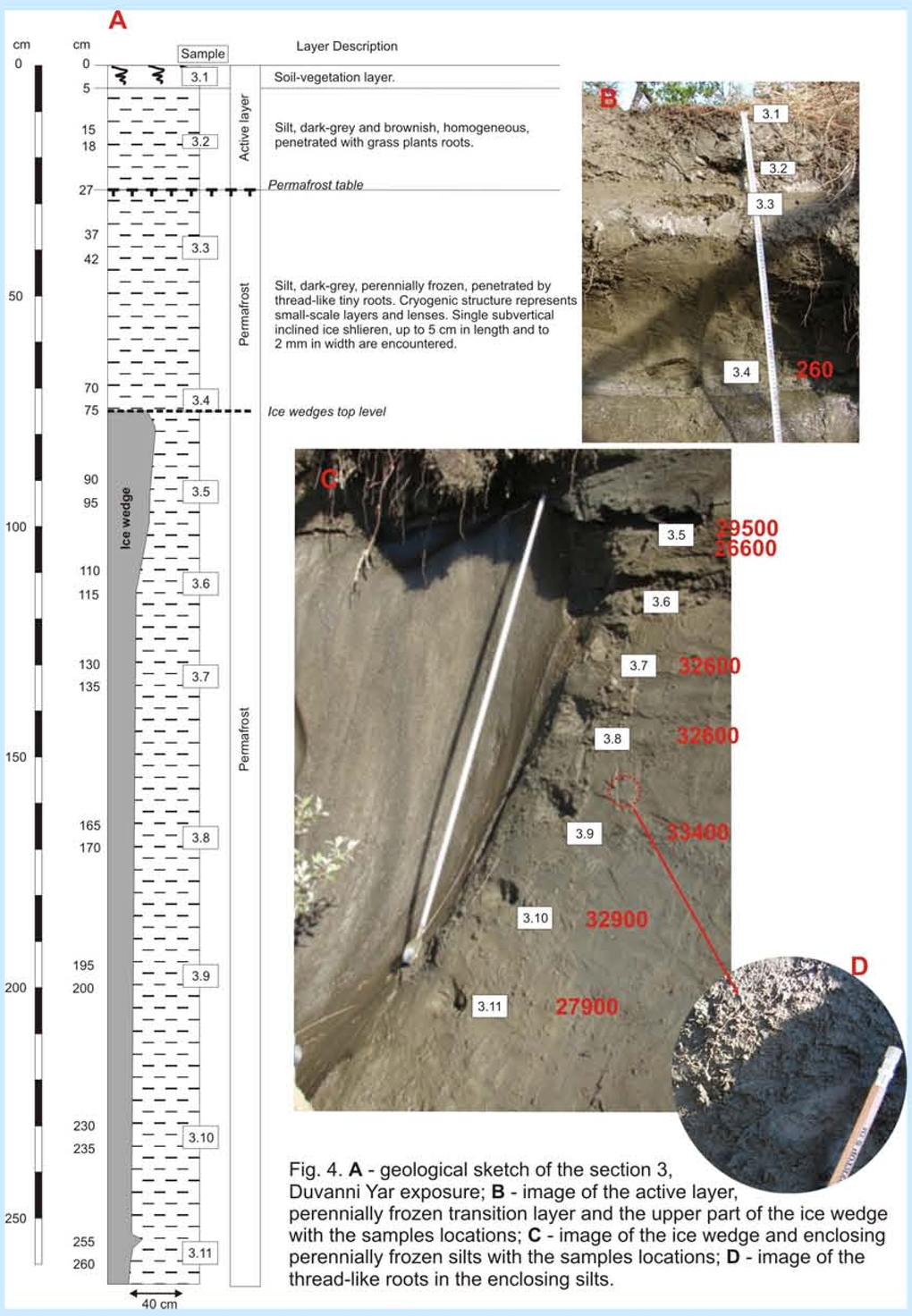

Fig. 4. **A** - geological sketch of the section 3, Duvanni Yar exposure; **B** - image of the active layer, perennially frozen transition layer and the upper part of the ice wedge with the samples locations; **C** - image of the ice wedge and enclosing perennially frozen silts with the samples locations; **D** - image of the thread-like roots in the enclosing silts.

Discussion

The obtained data indicate that the accumulation of the Ice complex upper part took place during MIS3 (Karginsky interglacial period; Arkhipov et al., 1997). The age inversions observed in the section in such a close range (2 m) attest to redeposition of the material downslope, supporting a deluvial-solifluction hypothesis of the Yedoma formation (Konischev, 1983). The lack of dates referred to MIS2 (Sartan glacial period) assumes erosion of yedoma which began in the end of MIS3. It could be supposed that the recognized erosion is explained by an uplift of the territory. Thus, an input of organic matter to rivers began, presumably, as early as the end of Late Pleistocene due to erosion and increased in Holocene in the result of thermokarst processes induced by global warming. Radiocarbon dating results clearly show a zone of interaction between the ancient permafrost carbon and the active layer of modern landscapes, where organic matter of Late Pleistocene Age actively enters into the modern carbon cycle of Siberian Arctic.

Literature Cited

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