CRYOFACIES OF MASSIVE ICE OF THE WESTERN SECTOR OF RUSSIAN ARCTIC

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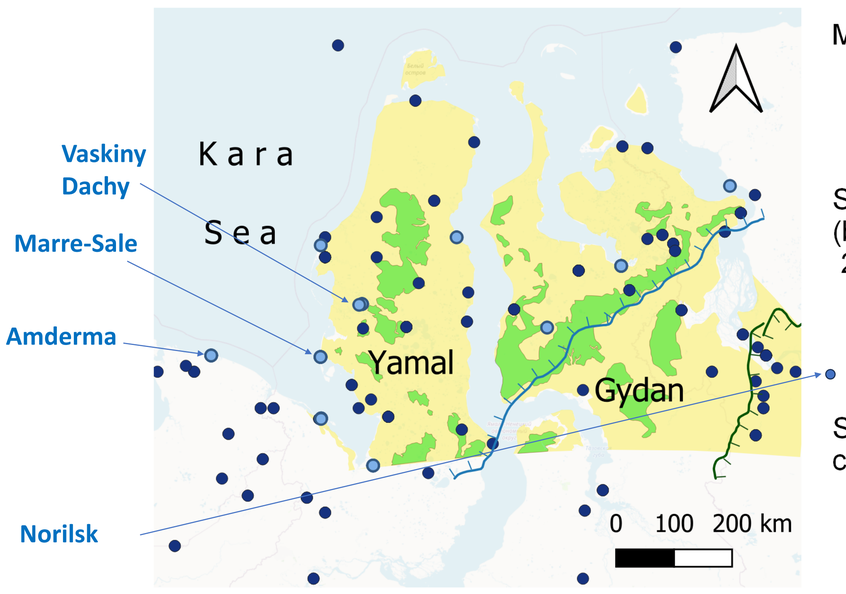
Key sites of massive ice beds investigations in the north of West Siberia



Massive ice beds studies

- 2002-2020
- Prior to 2002 (Streletskaya et al., 2001)

Suppositional limits of Quaternary glaciations (based on State geological maps 1:1 000 000; 2015, 2018)

- Kara Sea Ice Sheet, QIII2 (MIS 5b-d)
- Putorana Plateau ice cap, QIII2 (MIS 5 b-d)

Suppositional age of sediments, non-glacial conception (Trofimov et al., 1982), gerenalised

- QIII
- QII

The "upper" massive ice from the Marre-Sale area, western Yamal

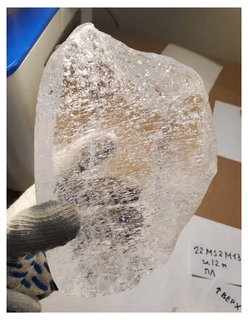
Syngenetic wedge ice

Massive ice

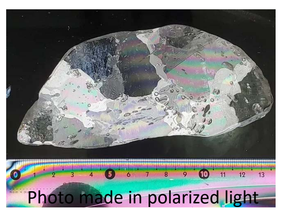
22MS2M10

22MS2M13

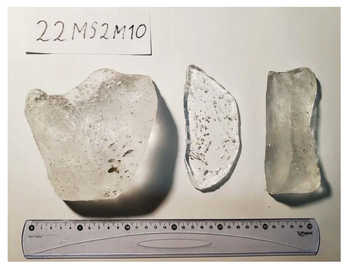
Lenses of pure bubbly ice 1 m thick in athe sediment strata with transition from marine to continental conditions



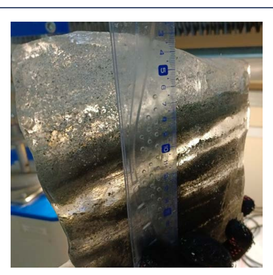
Pure ice with flat oriented bubbles. Large ice crystal more than 10 cm in height



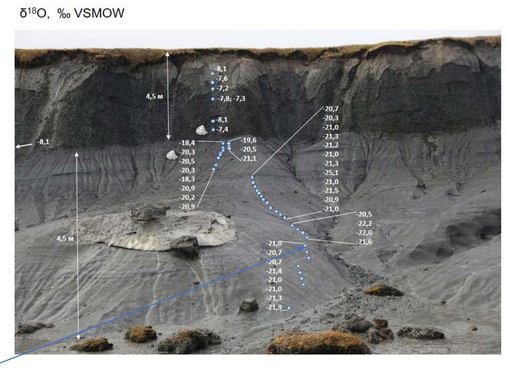
Pure ice with flat bubbles.
Ice crystals from 1 to 3-4 cm in size

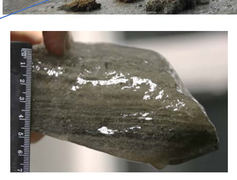


Layered massive ice near Amderma, Yugorsky Peninsula



δ¹⁸O, ‰ VSMOW





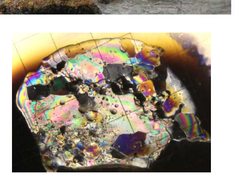


Photo made in polarized light

Massive ice near the Vaskiny Dachi research station in Central Yamal

Vertically oriented ice lenses – sign of intrasedimental freezing

West Siberian North during Mid-Late Pleistocene: Kara Sea Ice Sheet or marine conditions?

The north of Western Siberia is the main area of massive ice bed distribution in the Russian Arctic. Their origin is most often associated with permafrost aggradation in the Pleistocene. This aggradation could be either a result of the Barents-Kara Ice Sheet recession in MIS 5-4 (Svendsen et al., 2004; Astakhov, 2013; State geol.map, 2015, 2018, etc.) or a result of the freezing of marine sediments after sea level drop in MIS 3-2.

Massive ice beds: buried basal glacier ice (or ice formed from meltwater during deglaciation) or ice formed in marine deposits during permafrost aggragation?

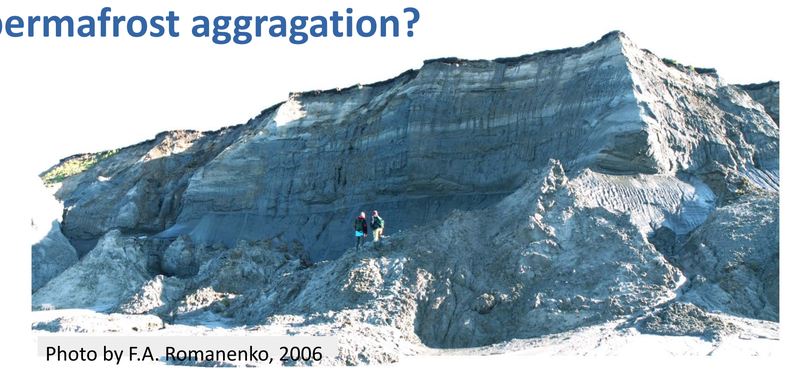


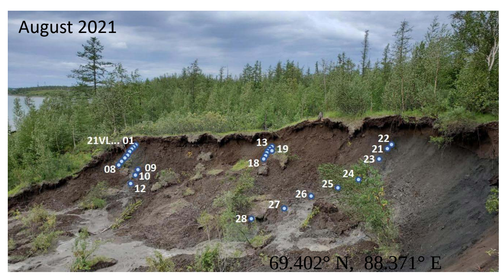
Photo by F.A. Romanenko, 2006

Massive ice bed in sandy sediments on the western coast of the Baydarata Bay, Kara Sea. Cliff height 25 m. According to D.V. Nazarov — stratotype of the Tambinskaya Mid.Pleistocene glaciofluvial strata (Shishkin et al., 2015). N.G. Belova and Prof. V.I. Solomatin for scale

Despite numerous and effective geochemical methods for studying massive ice, the reconstruction of freezing conditions and ice formation mechanisms requires, first of all, a detailed description of both the macrostructure of ice bodies and ice cryofacies.

Here we present typical cryofacies of massive ice beds, studied in thin sections of ice monoliths in the cold laboratory of the Faculty of Geography, MSU.

Massive ice in lake sediments, Norilskaya River



Valek lake clays – the sediments of large pra-Pyasino ice-dammed lake. Massive ice with large crystals (5 cm) and suspended clays were formed after the lake drinage

The "upper" massive ice from the Marre-Sale area, western Yamal, has cryofacies similar to those in **massive ice in lake sediments on the right bank of the Norilskaya River**. Large ice crystals (up to 10 cm) and a few suspensions of fine debris (but with large blocks of clay at Norilskaya River) can indicate ice formation during the slow freezing of the enclosing deposits under stable freezing conditions.

Layered massive ice near Amderma, Yugorsky Peninsula (>4.5 m thick, overlayed by marine clays), and **massive ice near the Vaskiny Dachi research station in Central Yamal** (>3 m thick, overlayed by continental sediments) are characterized by a large variety of cryofacies. Crystal size depends on the content of mineral inclusions. A variety of cryofacies indicates the formation of these massive ice beds in changing freezing conditions.

Acknowledgements

The work has been supported by RSF project 23-27-00218