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ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR- UND MEERESFORSCHUNG

Grosse, G.[1], Schirrmeister, L.[1], Wetterich, S.[1], Strauss, J.[1], Meyer, H.[1], Opel, T.[1], Siegert, C.[1], Windirsch, T.[1], Jongejans, L.[1], Laboor, S.[1], Diekmann, B.[1], Andreev, A.A.[1], Hubberten, H.-W.[1], Kunitsky, V.V.[2], Fedorov, A.N.[2], Grigoriev, M.N.[2], Derevyagin, A.[3], Tumskoy, V.[3], Kuznetsova, T.V.[3], Kienast, F.[4], Ulrich, M.[5]

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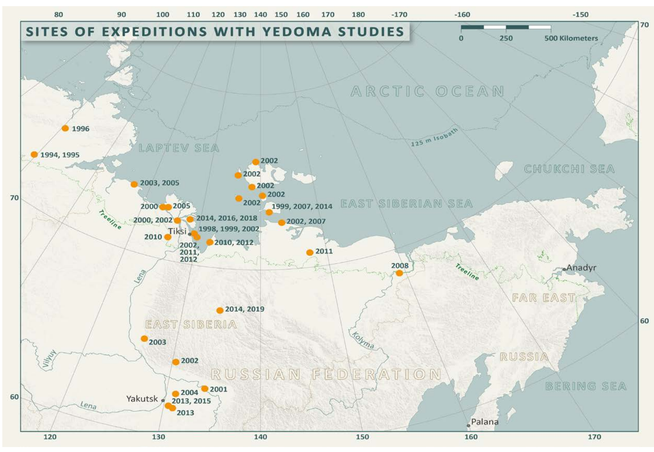
25 YEARS OF JOINT YEDOMA ICE COMPLEX STUDIES IN ARCTIC RUSSIA, ESPECIALLY IN SAKHA/YAKUTIA

Background

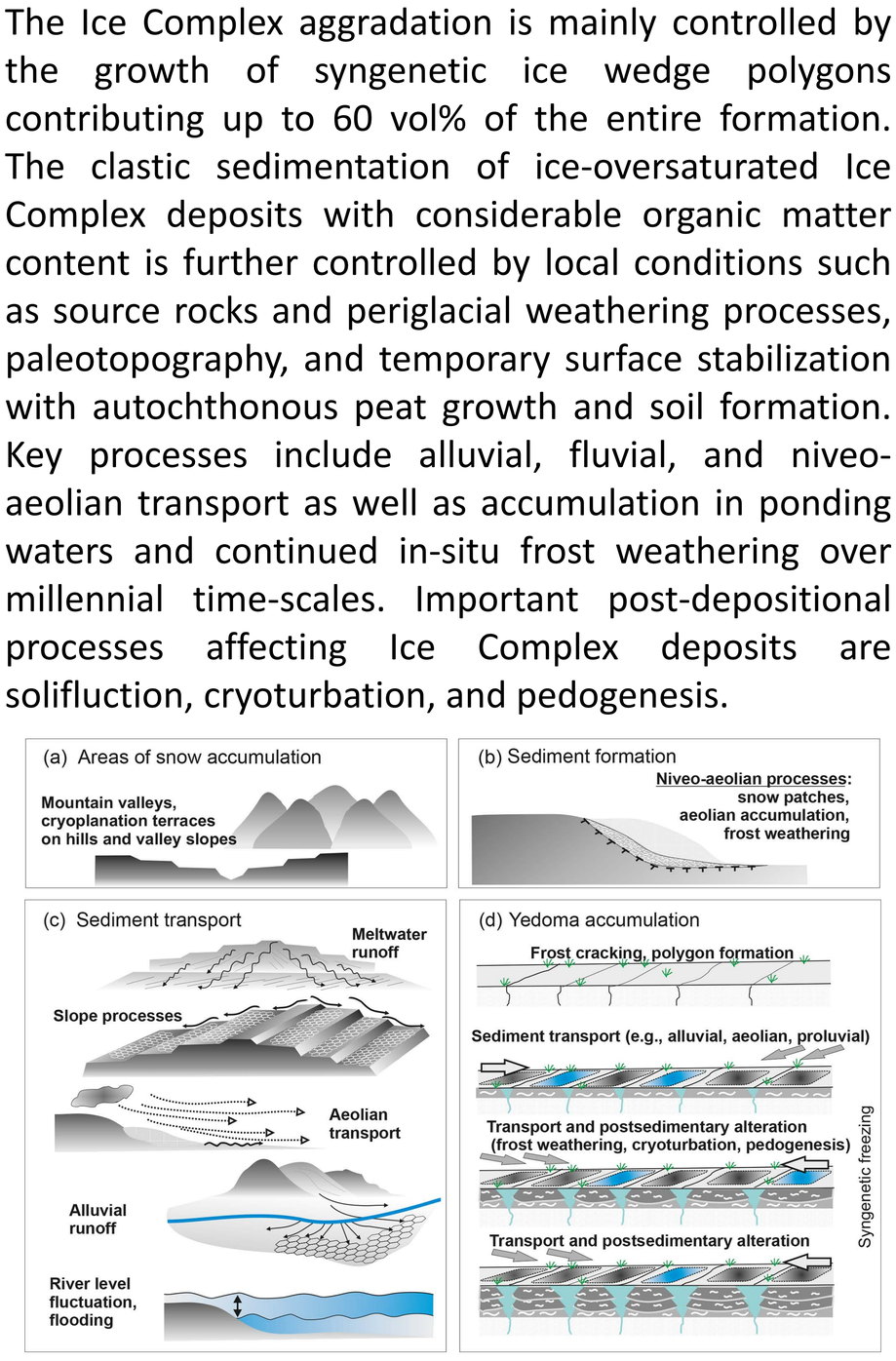
Since 1994, permafrost deposits of the Siberian Yedoma region have been in the focus of the joint Russian-German scientific cooperation in terrestrial Polar Research. These studies focused on cryostratigraphic, geochemical, geochronological, and paleontological characteristics at more than 25 individual study sites of the late Pleistocene Yedoma Ice Complex in Siberia and provided a detailed insight into paleoenvironments and paleoclimate for the westernmost part of Beringia. The multidisciplinary investigations resulted in new ideas and discussions in the ongoing scientific debate on the origin of Yedoma Ice Complex and the main periglacial processes involved in its formation.



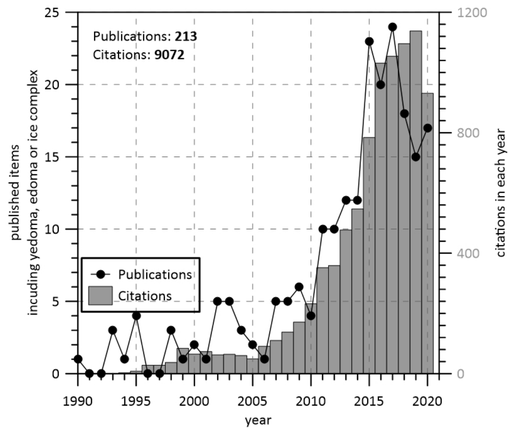
Russian-German expeditions to investigate Yedoma Ice Complex

Yedoma Ice Complex

The Yedoma Ice Complex is an ice-rich type of permafrost deposit widely distributed across Beringia. The Ice Complex aggradation is mainly controlled by the growth of syngenetic ice wedge polygons contributing up to 60 vol% of the entire formation. The clastic sedimentation of ice-oversaturated Ice Complex deposits with considerable organic matter content is further controlled by local conditions such as source rocks and periglacial weathering processes, paleotopography, and temporary surface stabilization with autochthonous peat growth and soil formation. Key processes include alluvial, fluvial, and niveo-aeolian transport as well as accumulation in ponding waters and continued in-situ frost weathering over millennial time-scales. Important post-depositional processes affecting Ice Complex deposits are solifluction, cryoturbation, and pedogenesis.



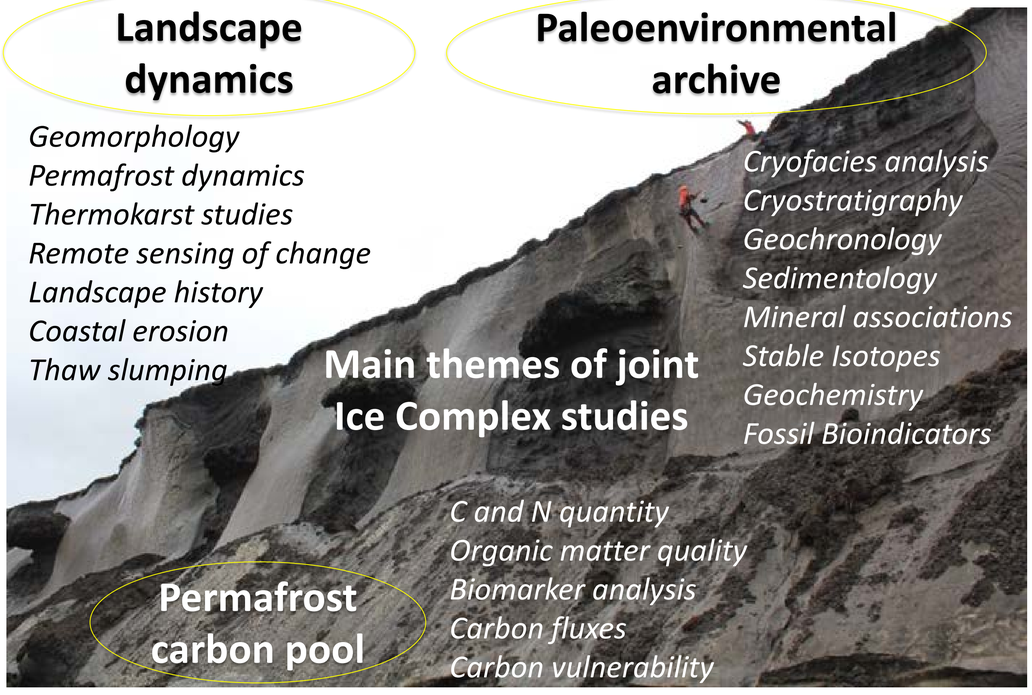
Schirrmeister et al. (2020): The genesis of Yedoma Ice Complex permafrost – grain-size endmember modeling analysis from Siberia and Alaska , E&G Quaternary Sci. J., 69 , pp. 33-53 . doi: 10.5194/egqsj-69-33-2020



Growing literature on Yedoma Ice Complex literature shows increased scientific interest

Selected Publication Highlights

- Kunitsky et al. (2002): Snow patches in nival landscapes and their role for the Ice Complex formation in the Laptev Sea coastal lowlands. Polarforschung, 70, 53-67.
- Kunitsky et al. (2013): Ice-rich Permafrost and thermal denudation in the Batagay area (Yana Upland, East Siberia), Kriosfera Zemli, 17(1), 56-58.
- Schirrmeister et al. (2002): Paleoenvironmental and paleoclimatic records from permafrost deposits in the Arctic region of Northern Siberia. Quaternary International, 89, 97-118.
- Schirrmeister et al. (2011): Sedimentary characteristics and origin of the Late Pleistocene Ice Complex on North-East Siberian Arctic coastal lowlands and islands - a review. Quaternary International, 241 (1-2), 3-25.
- Strauss et al. (2017): Deep Yedoma permafrost: A synthesis of depositional characteristics and carbon vulnerability. Earth-Science Reviews, 172, 75-86.
- Wetterich et al. (2019): Ice Complex formation on Bol'shoy Lyakhovsky Island (New Siberian Archipelago, East Siberian Arctic) since about 200 ka. Quaternary Research, 92(2), 530-548.



*Strauss J, Laboor S, Fedorov AN, Fortier D, Froese D, Fuchs M, Grosse G, Günther F, Harden JW, Hugelius G, Kanevskiy MZ, Kholodov AL, Kunitsky VV, Kraev G, Lapointe-Elmrabti L, Lozhkin AV, Rivkina E, Robinson J, Schirrmeister L, Shmelev D, Shur Y, Siegert C, Spektor V, Ulrich M, Vartanyan SL, Veremeeva A, Walter Anthony KM, Zimov SA (2016): **Database of Ice-Rich Yedoma Permafrost (IRYP)**. PANGAEA, https://doi.org/10.1594/PANGAEA.861733*

Conclusions

The rich body of scientific data and literature produced in Russian-German co-authorship within the more than 25 years of joint research on Yedoma Ice Complex represents an important cornerstone for understanding the Late Quaternary evolution of the Siberian Yedoma region, its role in the Earth System, and its feedbacks with climate and ecosystems. It is an example of very successful Russian-German cooperation in permafrost research.

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