

Post-Little Ice Age Evolution of Moraine-controlled Paraglacial Lagoons in Svalbard – Rates, Landforms and Geoecological Significance

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Abstract

Often overlooked, Arctic lagoons are the silent guardians of a rapidly changing polar world. These dynamic coastal ecosystems are crucial conduits between land, sea, and atmosphere. They are facing significant threats due to climate change. Their stability is closely linked to the interplay of storm waves, ocean currents, sediment supply, and fluctuating sea levels. However, a significant knowledge gap remains: the processes that shape their evolution in the Arctic are largely unknown (Owczarek 2025).

Satellite imagery, alongside the 1930s aerial photographs and orthophotographs, was used in our groundbreaking study to address this critical knowledge gap. This comprehensive approach enabled us to comprehensively map the formation of lagoons and systematically classify their typologies across Svalbard. Our database covers over 430 lagoons, revealing a geomorphological transformation. Since the end of the Little Ice Age, an astonishing 98 new lagoons have been formed, contributing to Svalbard's current coastal landscape of 434 lagoons, spanning an impressive 147 km². A particularly compelling discovery is the emergence of the “moraine-controlled paraglacial lagoon” – a new lagoon type, spreading rapidly across the archipelago. These distinctive formations are a direct consequence of glacial retreat, as the sea inundates the terrain that has been newly exposed between moraines and the ice cliffs of retreating glaciers.

Despite exposure to Arctic storms, a considerable number of lagoon barriers on Svalbard have demonstrated remarkable resilience, thereby indicating that their formation is the consequence of protracted and stable geomorphological processes. This finding provides novel insights into the rapid and substantial changes occurring in the Arctic, while establishing urgent research directions to understand the fundamental processes governing these critical yet enigmatic polar ecosystems.

Keywords: paraglacial lagoons, coastal changes, glacier retreat, Arctic.

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Reference

Owczarek, Z. (2025), Spatio-temporal changes of Svalbard lagoon systems in the post-Little-Ice-Age period, *Permafr. Periglac. Process.* **36**, 2, 284–301, DOI: 10.1002/ppp.2270.

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