



## **Reaction of a polar gravel-spit system to atmospheric warming and glacier retreat (South Shetland Islands, Antarctica)**

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A new concept for the interplay of polar gravel-spit progradation and glacio-isostatic adjustment is presented, allowing for the prediction of future coastal evolution in comparable polar settings. Sedimentary architecture and morphogenetic evolution of a polar bay-mouth gravel-spit system are revealed based on ground-penetrating radar investigations, radiocarbon dating and sedimentological information. The studied spit is about 350 m wide and 280 m long, and located at the mouth of Potter Cove, a tributary fjord of Maxwell Bay situated in the SW of King George Island. The spit comprises two terrace levels, located around 3.5 m and 0.8 m amsl, respectively. Terraces are characterized by a shallow ridge and swale morphology and are connected by a north-facing slope with superimposed beach ridges. Beach sediments are well-stratified gravel deposits, with a thickness of 1 to 3.5 m.

Data document changes in the rate of spit progradation in reaction to atmospheric warming concurrent with the termination of the last glacial re-advance (LGR, 0.45-0.25 ka BP), the southern hemisphere equivalent of the Little Ice Age cooling period. Spit progradation was interrupted contemporaneous with a period of accelerated post-LGR isostatic rebound, but resumed in the late 19th century after the rate of isostatic rebound decreased. The direction of modern spit progradation, however, is rotated northwards compared to the growth axis of the early post-LGR spit. This is interpreted to reflect the shift and strengthening in the regional wind field during the last century.

The progradation of polar gravel spits as exemplarily observed in the Potter Cove spit system, is bound to phases of comparable low rates of glacio-isostatic uplift and relative sea-level fall. In this context, the morphology of the Potter Cove spit system is seen to archive two phases of coastal progradation separated by an abrupt increase in the rate of local glacio-isostatic uplift in reaction to deglaciation after the last glacial re-advance.

In the next decades, accelerated glacier retreat and ongoing reduction in ice volume of inland ice shields is expected to cause a significant increase in the rate of isostatic uplift and relative sea-level fall. The current phase of coastal progradation is therefore expected to terminate in the near future and to be replaced by the development of steep slopes with superimposed amalgamated ridges due to the reduction in accommodation space.