future ocean
KIEL MARINE SCIENCES

HIGH-RESOLUTION BATHYMETRY OF DISKO-BAY AND ILULISSAT-ICEFJORD, GREENLAND

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Ilulissat Icefjord in West-Greenland is the fastest and most productive iceberg calving area outside Antarctica. Changes in climate exert a first-order control on the recession of the icefront and the calving of icebergs. Glacial and geological processes related to iceberg calving and transport shape the morphology of the seafloor in the area characteristically. Revealing the morphology by high-resolution bathymetric mapping helps to understand these processes. Aim of the project "Iceflow Activity" was to map the bathymetry of Ilulissat Icefjord using a portable multibeam system onboard a small local vessel. Thus it was possible to survey areas inside the Icefjord which are inaccessible to large research vessels. A considerable area could be mapped in summer 2008 and complemented the data set acquired during a cruise with RV Maria S. Merian in 2007. A comprehensive image of the morphology of the area of the mouth of Ilulissat Icefjord was achieved which will help to understand glacial geological processes and will give indications on temporal changes of the iceflow activity.

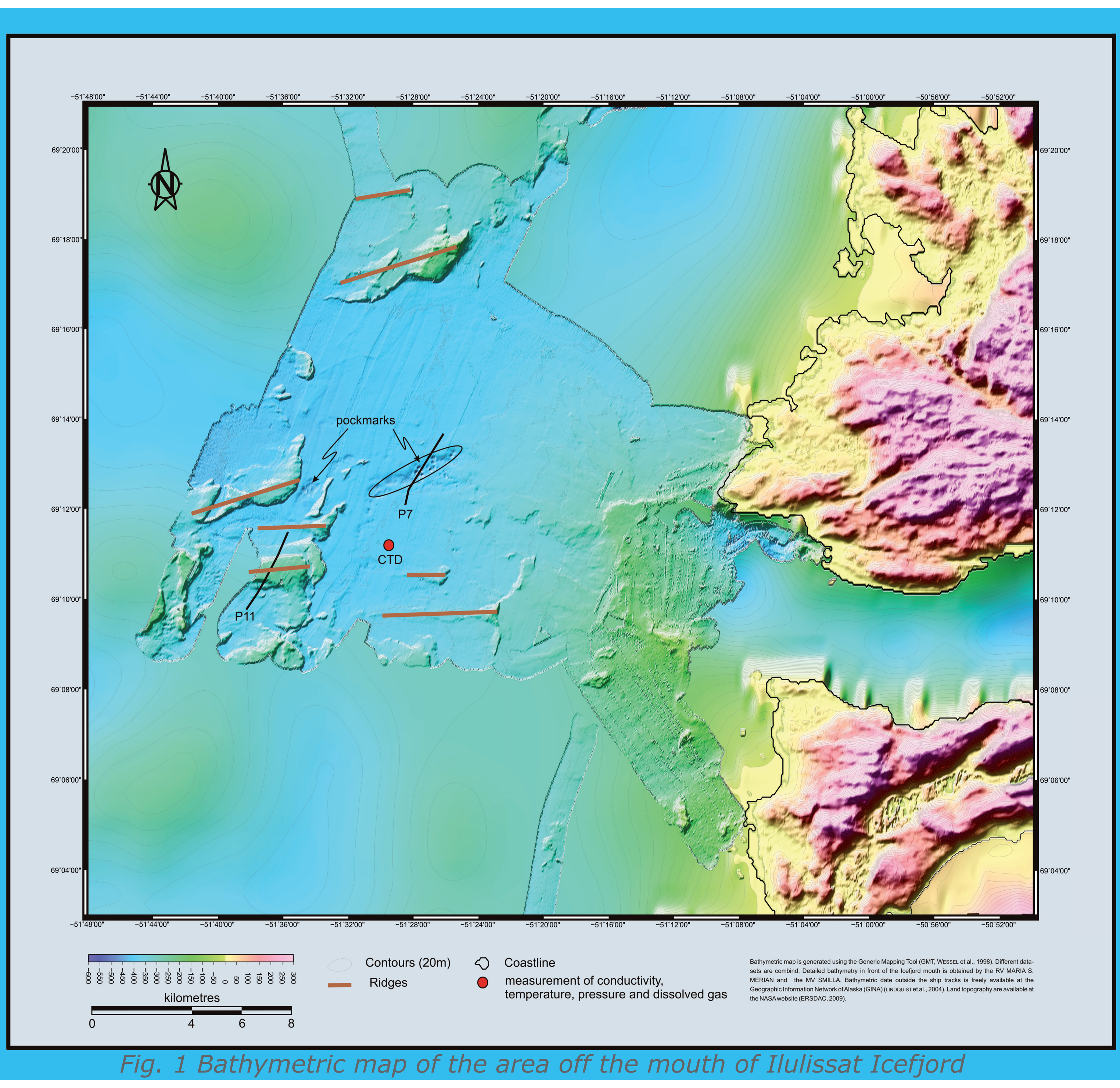

Fig. 1 Bathymetric map of the area off the mouth of Ilulissat Icefjord

A parasound profile across one of the pockmarks documents the absence of the upper sedimentary unit inside (fig. 3). Furthermore, a blank zone in the central part indicates uprising fluids or gas. The northeast – southwest alignment of the pockmarks points to a formation related to slides, faults, and iceberg furrows. The depth of their occurrence indicates a formation by dissociating gas hydrates. The most recent active pockmarks are located in the centre and the northeastern end of the depression in a depth of 395 m. The gas hydrate stability zone in arctic regions tapers out at around 400 m at 3° bottom water temperature which coincides with the values measured with a CTD during the Merian cruise quite close to this position. The decreasing age from southwest to northeast could be explained by changing water temperature coupled to sea level rises. The gas hydrate stability zone would migrate upward with rising sea level. Coupled to climate warning, the upward migration of the gas hydrate stability zone would be retarded (fig. 5).

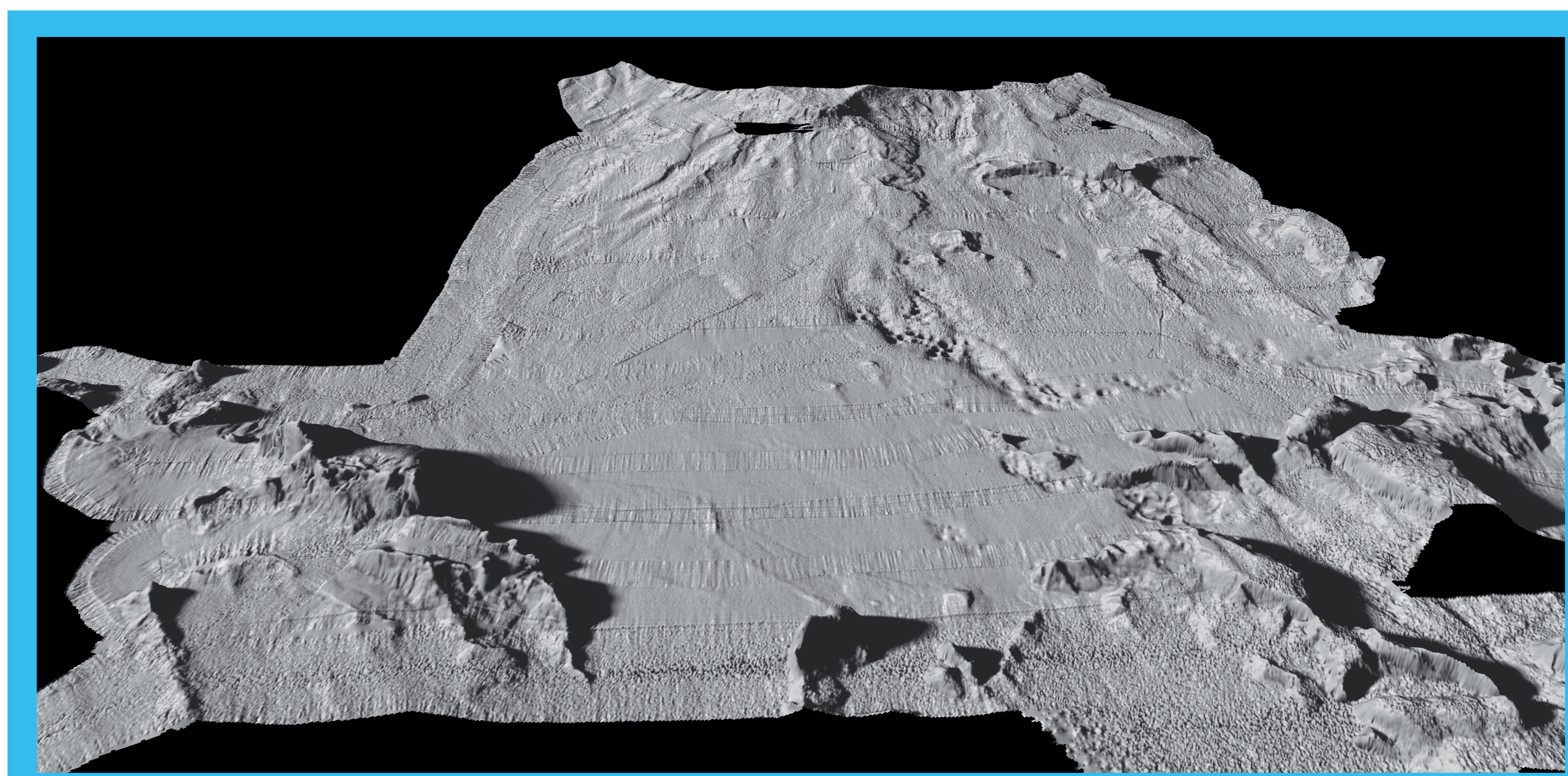

Fig. 2 Perspective view of the morphology, view from west showing the central depression with pockmarks

Different morphological features such as ridges, shaped like drumlins and valleys which could be connected to channel systems, directing debris flows to a deposition centre characterize the central part of the survey area (figs. 1, 2). Here, a series of prominent circular features 80 m to 150 m in diameter and up to 30 m deep have been found and are interpreted as pockmarks.

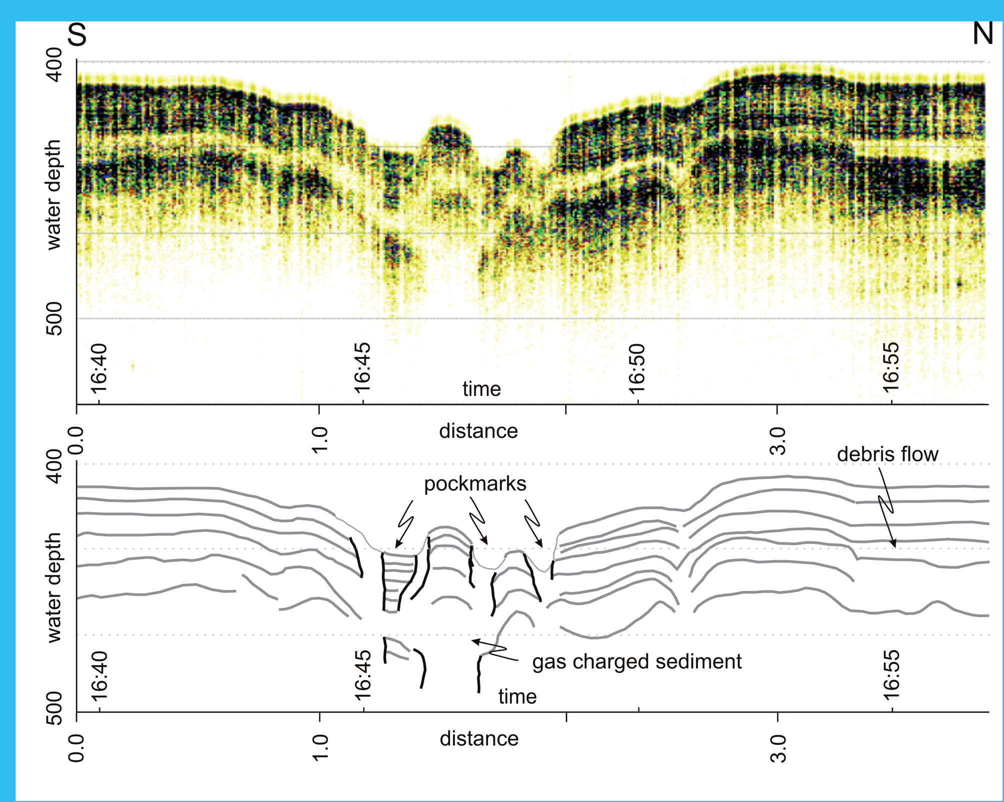

Fig. 3
Parasound profile of a composite pockmark in the central part of the mapping area. The upper sedimentary unit is clearly missing in the pockmark. An acoustical blanked area is visible in the central part beneath the composite pockmark. This might be the pathway for fluids.

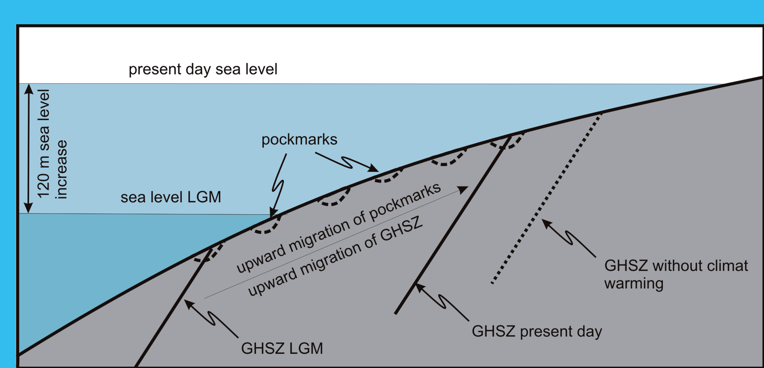

Fig. 4
Upward migration of the gas hydrate stability zone (GHSZ) due to sea level rise after the last glacial maximum (LGM), retarded by climate change. Pockmarks do also migrate upward, coupled to the migration of the GHSZ.

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