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Short Note

Sedimentation Processes along the Bellingshausen Sea Continental Margin

F.O. NITSCHE[1] & K. GOHL[1,2]

[1]Alfred Wegener Institute for Polar and Marine Research, Columbusstr, 27568 Bremerhaven - Germany
[2]Now at: Macquarie University, Sydney, NSW 2109 - Australia

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INTRODUCTION

Glacial-interglacial cycles have strongly influenced the sedimentation on the continental slope and rise of the Antarctic continental margin. These cycles can be reconstructed from sediment cores taken from the continental rise and the deep sea area. For the interpretation of these core data the understanding of the sedimentation and resedimentation processes is important. The processes on the shelf are extensively studied by now and several models have been developed (e.g. Alley et al., 1989; Hambrey et al., 1992; Vanneste & Larter, 1995). Fewer studies have been carried out for the lower continental slope and rise area.

The processes which act along the slope and rise seem to differ from region to region depending on local factors such as sediment supply, pre-existing topography and bottom current regime. E.g. the main processes that build up the Crary fan in the Weddell Sea (Melles & Kuhn, 1993) are different from those described by Rebesco et al. (1996) along the Antarctic Peninsula continental rise.

The region of the Bellingshausen and the Amundsen Seas is rather poorly investigated. Due to the lack of data it is unclear whether the processes active in this area are similar to those described for the Antarctic Peninsula area or whether the area is dominated by canyon-fan sedimentation processes as in the Weddell Sea.

SEISMIC DATA

During two cruises of the Alfred Wegener Institute for Polar and Marine Research in 1994 and 1995 with the RV *Polarstern* several multichannel seismic lines were shot running from the outer shelf across the continental slope and rise into the deep sea (Fig. 1). In addition, swath bathymetry (Hydrosweep) and sediment echosounding data (Parasound) were recorded almost continuously during the cruises. These data provide some information on the nature of the youngest sediments between the seismic lines. Additionally, the British Antarctic Survey (BAS) collected multichannel seismic and 3.5 kHz data in this area on RRS *James Clark Ross* in 1993 (Cunningham et al., 1994).

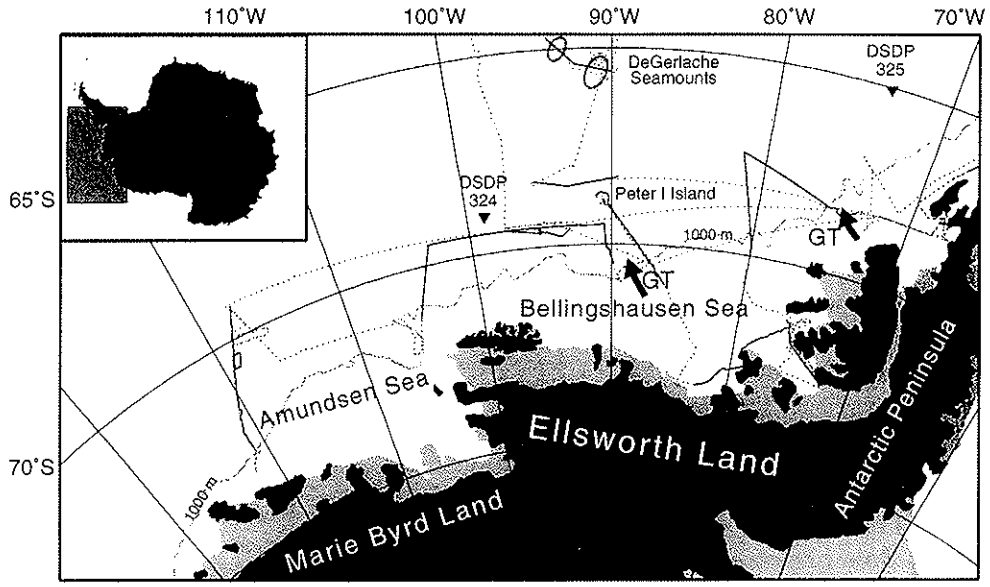

Fig. 1 - Location of the seismic lines shot by the Alfred Wegener Institute during two cruises in 1994 and 1995 (black lines). The cruise tracks with additional swath bathymetry and sediment echo sounding data are shown by the dotted lines. The extent of the shelf is indicated approximated by the GEBCO 1000 m isobath. Two glacial troughs (GT) revealed by new bathymetry data are marked by arrows.

RESULTS

On the continental slope and rise indications of different sedimentary processes can be seen in the seismic and bathymetry data. The seismic sections covering the upper slope show steps in the recent and buried slope morphology as well as reflections interpreted to be caused by sliding planes. We interpret these features as evidence that gravitational processes such as debris flows or slumps transported material downslope leaving these marks behind. The corresponding material can be found on the lower slope where the data show isolated masses with chaotic or no internal reflections. We interpret these features as debris flows or slumps.

The data from the continental rise show many channels as well as several mound-like features, similar to those described by McGinnis & Hayes (1995) and Rebesco et al. (1996) along the Antarctic Peninsula. Some of the mounds show clearly developed sediment waves in the upper part. Hence, bottom currents probably played a major role during the formation of the mounds. The mounds are associated with channels. In most cases the channels are located on the eastern side of the larger mounds. Smaller and less developed mounds can be seen on the western side of some channels. The low seismic reflectivity of the mounds and their association with the channels suggest that they are built up from overspill material of turbidity currents which flow down the channels. On the other hand the pronounced asymmetric shape and the sediment waves imply the influence of a westward flowing current as suggested by McGinnis & Hayes (1995) and Rebesco et al. (1996) for the generation of the mounds along the Antarctic Peninsula margin.

Bathymetric and Parasound data show that the channels on the continental rise are evenly distributed over the area. We have found no evidence for a canyon or for larger channels on the continental slope. Bathymetry data only show two troughs in the region of the outer shelf that are probably related to large ice streams during glacial times. However, these troughs do not seem to continue as canyons on the slope.

SEDIMENTATION MODEL

The observations can be explained by a simple model (Fig. 2). Multichannel seismic lines crossing the outer shelf of the investigated region show prograding sequences (Nitsche et al., in press), which we interpret as evidence that a grounded ice sheet reached the shelf break during times of maximum glaciation. This has probably caused a high rate of supply of terrigenous material to the upper slope during those periods. This material is transported downwards to the lower slope by gravity flows. During this process some of the coarser fraction settles on the lower slope, while the rest develops into turbidity currents which follow the channels on the continental rise towards the abyssal plains. The overspill of these turbidity currents is settling mainly on the western bank of the channels under the influence of a westward flowing current and Coriolis force.

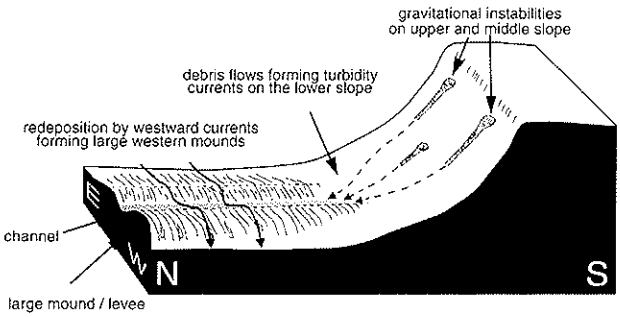

Fig. 2 - Simple model to explain the main sedimentation processes which are active in the investigated area. Details are described in the text.

There are still many uncertainties. Because of the sparse data distribution in the investigated area, the distribution of mounds and channels is only partly known and the existence of major channels or canyons on the continental slope in this region cannot be fully excluded.

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