# Variation of sedimentary structures and grainsize over sandwaves

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Abstract

Sedimentary structures and grainsizes on sandwaves in the Flemish Bank area are studied in relation to the morphology of the sandwaves. There is a difference between sandwaves in deeper water and sandwaves on top of a sand bank. The trough of the sandwaves in deeper water shows bioturbated structures, indicating a less dynamic environment than the top of the sandwaves, which is characterised by migrating megaripples. The sandwaves on top of the bank do not show bioturbation, but primary structures generated by migrating megaripples. In general the grainsize increases from the troughs towards the crests of the sandwaves.

## Introduction

Within the framework of the MAST I Resecused project and the MAST II Starfish project an intensive study is done on the sedimentology of a linear sandbank in the southern North Sea. The study concentrates on the Middelkerke Bank in the Flemish Bank area off the Belgian coast.

On top of the Middelkerke Bank and near the northern end of the bank sandwaves are present. The sedimentological structures and the grainsize of the surficial sediments on these sandwaves are studied in relation to the morphology. The determination of the relation between the morphology and the structure and grainsize is important for the interpretation of sediment transport models based on grainsize variations. It is also necessary for the development of good sampling schemes for future sampling programs.

## 1 Field data

During cruises with RV Mitra and RV Zirfaea in August and October 1993 boxcores (Reineck) and grabsamples (Van Veen) were taken in the sandwave area.

Boxcores were taken on the top, on the steep slope and in the sandwave trough. Lacquer peels were made of the boxcore samples to study the sedimentary structures. In addition to the study of the sedimentary structures over the sandwaves, a detailed grabsampling is carried out along two profiles in the northern part of the Middelkerke Bank area. Along a 1.5 km long profile perpendicular to the sandwave crests (profile Z1, fig.1) 60 samples were taken on a constant distance of 25 metres. Along a 1.5 km long profile in the direction of the maxium current velocities, perpendicular to the megaripples, 22 samples are taken on a constant distance of 50 metres. The grabsamples were usedfor grainsize determination.

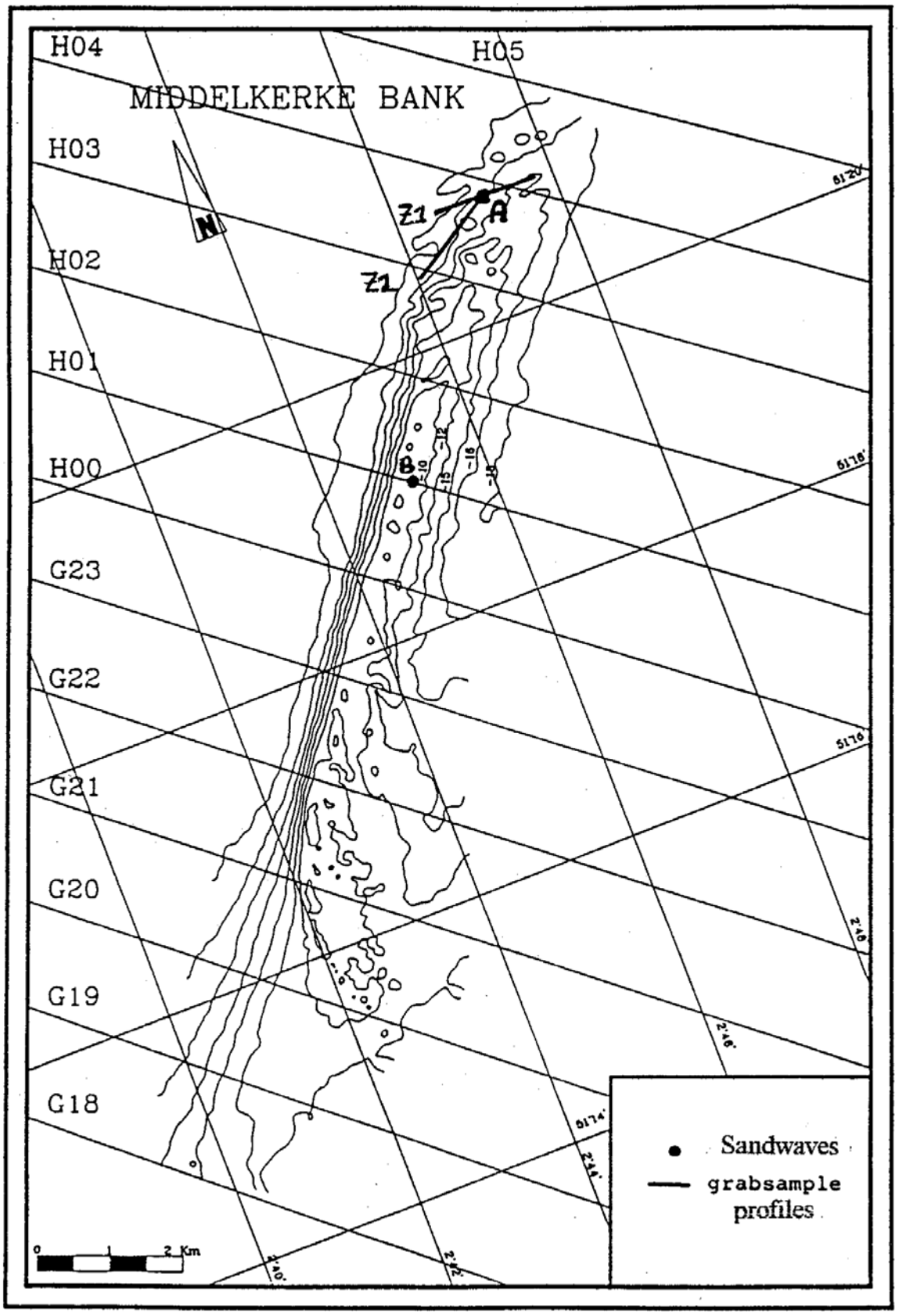
## 2 Sedimentary structures

To investigate the relation between morphology and sedimentary structures over a sandwave, detailed boxcore sampling is carried out on two sandwaves (fig.1). One sandwave (A) is situated in an area with large sandwaves

adjacent to the northern end of the Middelkerke Bank at a water depth of 18 metres (MLLWS). The other sandwave (B) is situated at the top of the bank at a water depth of 7.5 metres (MLLWS). The sandwave in the north (fig.2) shows primary structures due to migrating megaripples on the top. The megaripples on the gentle slope are well developed and reach heights of 90 cm. In the trough of the sandwave the sediments are highly bioturbated. The upper layer on the steep slope show both primary and bioturbated facies. The sand on top of the sandwave is coarser than in the trough. The height difference between the top and the trough is 5 metres. This difference seems enough to have a dynamic local environment at the top and a less dynamic environment in the trough.

Another reason for the difference can be that the sandwave is situated around a depth of 16 m (MLLWS). This depth is considered to be the boundary between the dynamic and less dynamic environment on the Middelkerke Bank

(Stolk, 1993). The 1.3 m high large sandwave on the top of the bank (fig.3) does not show these differences in structure between top and trough. On both places primary structures are present, indicating that the whole sandwave is part of a highly dynamic environment.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Sandwaves
grabsample profiles

Fig.1 Location of studied sandwaves and grabsample profiles

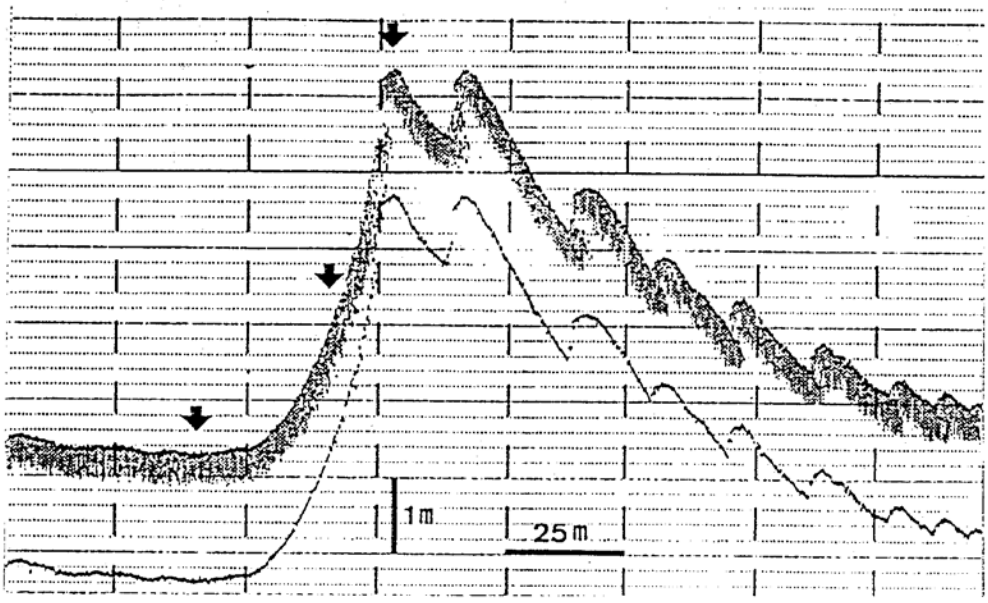


Fig.2 Echosounding of sandwave A, arrows show location of boxcores

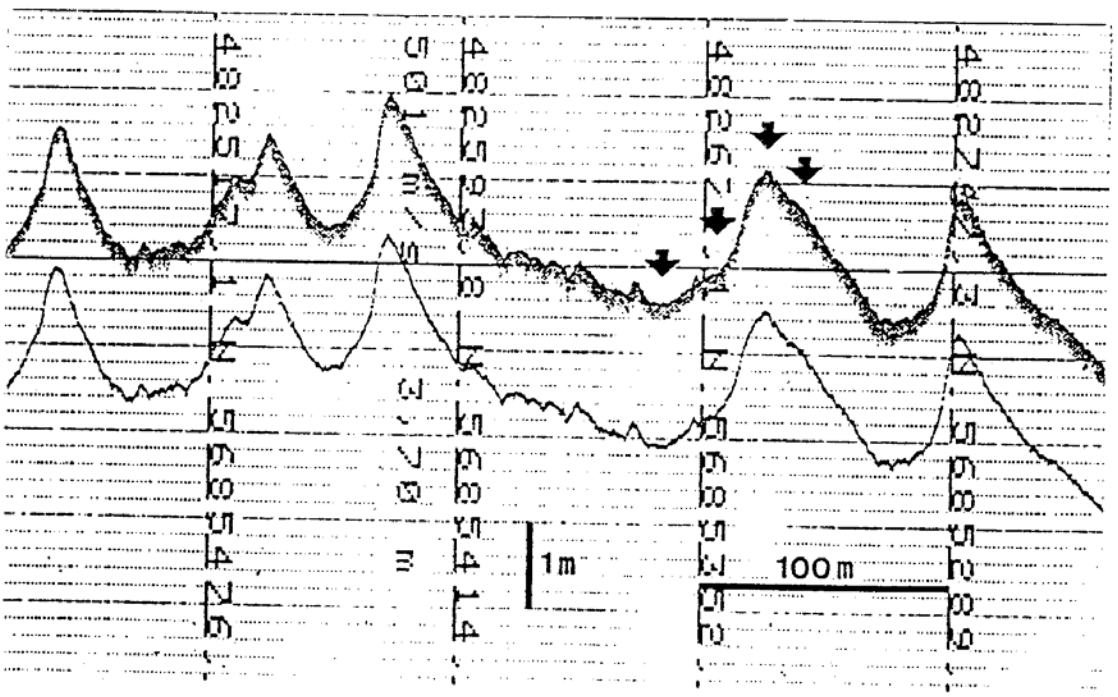


Fig.3 Echosounding of sandwave B, arrows show location of boxcores

3 Grainsize variation

In addition to the study of the sedimentary structures over the sandwaves, a detailed grabsampling is carried out along two profiles in the northern part of the Middelkerke Bank area. Profile Z1 (fig.1) is perpendicular to the crestlines of the sandwaves. Profile Z2 is oriented at an angle of 30 degrees with profile Z1 and perpendicular to the crestlines of the megaripples. The grainsizes of the sand fraction of the samples are determined by settling tube (D50 st) and by laser diffraction (D50 ld). Because of the coarseness of the sand the settling tube values are less reliable.

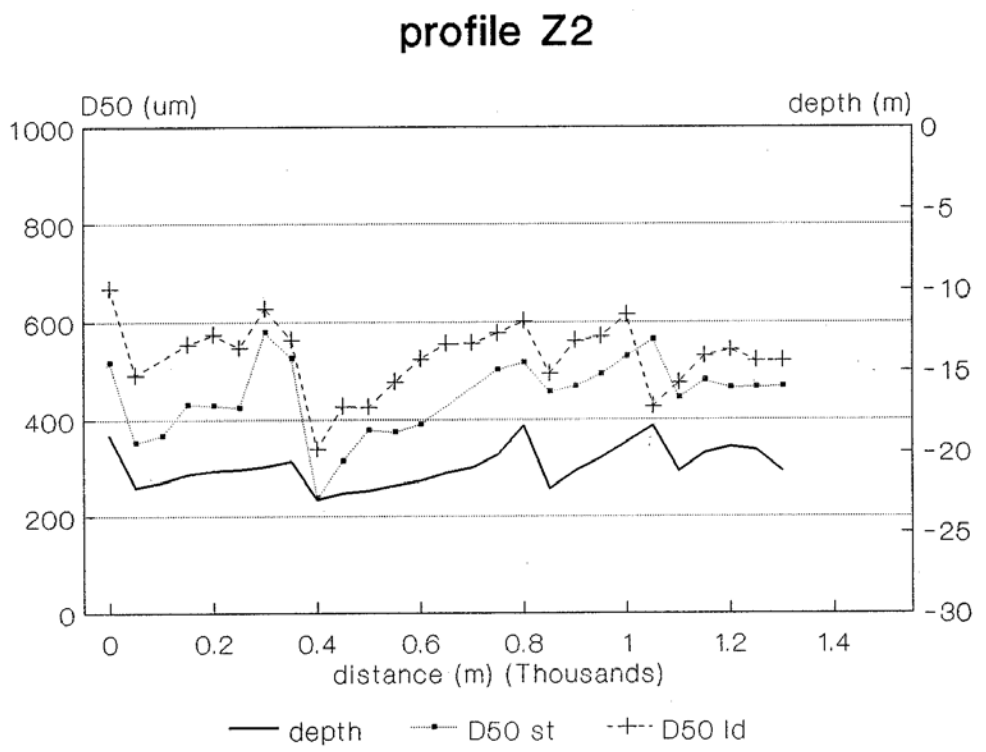


Fig.4 Morphology and grainsize of profile Z2. Grainsize is determined by settling tube (D50 st) and by laser diffraction (D50 ld)

In figure 4 both the morphology and the grainsize of the sand fraction along profile Z2 are shown. Going from SW to NE there is a clear increase in grainsize from the troughs towards the crests of the sandwaves. The same relation is found in the western part of profile Z1 (fig.5). The grainsizes are highly influenced by shell fragments. Remarkable is that on some sandwaves the largest grainsizes are found just below the top at the gentle slope and the smallest values at the top or just below the top at the steep slope. In general this difference in grainsize over sandwaves is also found on the Oostdijk Bank (Houthuys, 1990) and outside the bank area in the southern North Sea (Terwindt, 1971; Cameron et al., 1989). In the western part of profile Z1 the morphology is determined by a complex of sandwaves in the swale. The morphology of the eastern part is determined by the northern end of the Middelkerke Bank, where sandwaves are superpositioned on the bank. This morphological difference is also expressed in the grainsize. The median grainsize in the sandwave field is around 515 (m. On the bank it drops to 420 (m.

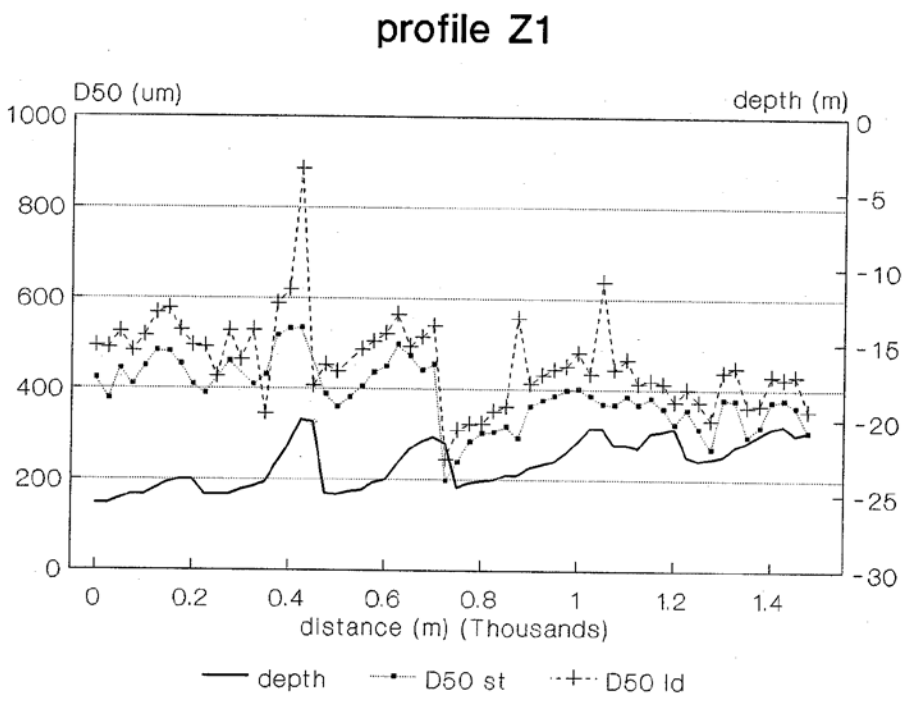


Fig.5 Morphology and grainsize of profile Z1. Grainsize is determined by settling tube (D50 st) and by laser diffraction (D50 ld)

Within the area of sandwaves (profile Z2 and the western part of profile Z1) there is a slight trend towards a finer grainsize in deeper water, but there is no significant correlation. Also no correlation is found between grainsize and sandwave height.

## Conclusion

The sedimentary structures and the grainsize on sandwaves are related to the morphology. However, the location of the sandwave itself is also an important factor. In deeper water, near the nothern end of the bank, the sandwaves show primary, megaripple related structures on the top and bioturbated structures in the trough. This indicates a difference in a dynamic environment on the top and a less dynamic environment in the trough. It is not clear if this difference is a pure local sandwave feature or related to a more general feature in the sand bank area. Sandwaves on top of the sand bank show only primary structures, indicating a highly dynamic environment both on the top and in the trough of the sandwave. In general the grainsize increases from the troughs towards the crests of the sandwaves. Clear correlation between grainsize and water depth or sandwave height are not found.

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