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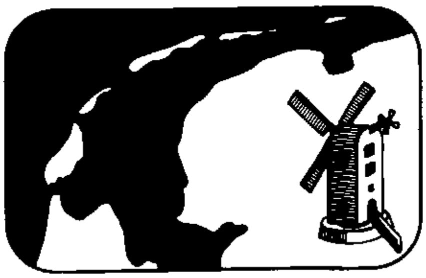
Conference Reports



International Meeting on Holocene Marine Sedimentation in the North Sea Basin

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Some two hundred geologists from all over northwest Europe gathered at the Netherlands Institute for Sea Research on the island of Texel, September 17th to 21st, to discuss modern sedimentation and Holocene sea level fluctuations in the North Sea. Field trips in the Netherlands before and after the meeting were also well attended. The conference attracted not only those working in the North Sea itself, but also a substantial group of workers interested in analogues elsewhere, and a special theme was established to accommodate this group. The meeting was organized by the International Association of Sedimentologists, and was (I believe) the first IAS meeting attended by a delegation from the Peoples Republic of China.

Why should a conference in Holland on the North Sea be of interest to Canadian geologists? There are two reasons: First, The North Sea is the best known example of a continental shelf dominated by strong tidal currents (0.5 to 1.0 m/sec in speed). The investigations by McCave, Stride, Terwindt and others have revealed a fascinating pattern of subtidal sand ridges, 10 to 30 m high, 1 to 4 km wide and up to 60 kms long, elongate roughly parallel to the dominant tidal currents. On a smaller scale, there are areas of gravel lag partly covered by thin sand ribbons a few metres wide but several hundred metres long, and a great variety of transverse "sand waves" (many of them superimposed on the surface of sand ridges) which reach heights of 10 m and wavelengths of 500 m. These subtidal sands pose interesting scientific questions, about the movement of sediment on tidal shelves and the origin and classification of large bed forms, and suggest a model for the interpretation of ancient marine sands, which might have great value in exploration for oil and gas. Besides the shelf itself, the coastline of the North Sea displays a wide range of features typical of both mesotidal and macrotidal coasts, and has been the subject of classic investigations by Eisma, Postma, Tooley, Van Straaten and others. All of those named above were on hand to give papers, keynote addresses, and (in the case of Van Straaten) to lead excursions.

The second reason for Canadian interest in this conference is that Canadian contributions, based on studies recently completed by workers at McMaster University and Bedford Institute of Oceanography, made a substantial impact, and were much discussed by those attending the conference. In particular, Dalrymple, Knight and Lambiase (1978) have recently suggested that in the Minas Basin the large scale bed forms can be subdivided into three main groups, each characterised by its own scale, morphology, and range of occurrence as defined by grain size, maximum mean current speed, and water depth. Although the areas studied in the Bay of Fundy are intertidal, the tidal range is such that the depth at the time of maximum tidal flow (4 to 10 m) is not very greatly different from depths covering the North Sea "sand waves" (generally 15 to 40 m). Workers from Holland and the United Kingdom presented papers that described bed forms from intertidal areas that were certainly very similar to those described from the Bay of Fundy.

In Dalrymple *et al.* (1978) two classes of megaripples were distinguished on the basis of morphology (Type 1 is relatively straight crested and lacks scours in the trough, Type 2 has more sinuous crests and prominent scoured troughs). Megaripples are distinguished from sand waves, which are generally larger, differ in details of morphology (though they are somewhat similar to Type 1 megaripples) and frequently have megaripples superimposed on their backs. Sand waves seem to be formed only in water deeper than two to three metres, and in sand coarser than about 0.3 mm, but they do not seem to be characteristic of much higher speeds than the smaller megaripples (contrary to what might, perhaps, be expected). The very fact that these different forms plot consistently in different areas of a mean size – maximum mean speed diagram (Fig. 1) suggests that they are not disequilibrium forms, and that the morphological distinctions made are real and significant.

Needless to say, not all workers were in agreement with the proposed "Canadian classification": British workers from the Institute of Oceanographic Sciences prefer to recognize only one class of large bed forms, which they call Sand Waves. Other workers had reservations about the "Canadian" nomenclature, or about the significance of the distinction (for example) between megaripples and sand waves.

On a field trip to the Oosterschelde Estuary, and in papers read at the conference, Dutch workers were able to demonstrate the unique opportunities for the investigation of tidal sediments that they enjoy as a result of the excavation (as part of the continuing "Delta Project") of huge pits in modern intertidal and subtidal sediments. The purpose of excavating these pits, which are a kilometre across and extend as deep as 20 metres below sea level, is to permit the construction of a section of dyke which will later be floated into place to control flow into the estuary. The sites of the construction pit were until recently areas of active tidal sediment movement, and the exact pattern of erosion and sediment deposition at the sites can be established for several centuries back by reference to detailed government charts. Therefore the time and environment in which the different stratigraphic units seen in the pits were formed can be established with considerable confidence. The exposures themselves are large, and oriented in more than one direction, so that they reveal the lateral as well as vertical facies sequences.

Among the spectacular exposures seen in the pits is a unit (more than 3 metres thick) composed of large tabular sets of planar cross-bedding, deposited by the migration in the ebb direction of large Type 1 megaripples (to use the classification of Dalrymple *et al.*: the Dutch workers refer in the guidebook to "sand waves" but the difference in interpretation appears to be nomenclatural rather than substantive). This unit was deposited between 1600 and 1750 A.D., and the speed with which it was deposited can be further documented by study of the details of the cross-lamination. The cross-lamination shows rhythms consisting of 27 foreset "bundles", each a few cms thick, and each composed of a unit of faintly laminated sand (deposited during the dominant ebb phase of the tide) followed by a mm thick clay lamina (low tide slack water), a very thin sand lamina (deposited during the subordinate flood phase), and capped by another thin mud lamina deposited at high tide slack water. The fortnightly tidal cycle is revealed by the much smaller thickness of the "bundles" formed at neap tides, compared with those formed at spring tides. It seems unlikely that any rock units in the geological column can be interpreted with greater precision than is possible in these unique exposures.

Almost 100 papers and poster exhibits were presented at the meeting on six main themes, so this report can touch briefly on only a few of the topics covered. Most papers dealt with nearshore sedimentation. Only 17 papers described phenomena on the open shelf, and these presented little material that was completely new. One might have expected that, as a by-product of drilling activity in the North Sea, there would have been a considerable increase in knowledge of the nature and origin of tidal sand ridges, but such does not seem to be the case. Interesting new data on the Zeeland ridges (close to the Dutch coast), including seismic profiles and borings, were presented in a poster by C. Laban and R. T. Schüttenhelm, but the ultimate origin of the ridges still seems to be in doubt. The only consensus seemed to be that the old "spiral flow" hypothesis of Houboldt is not supported by existing data. Most ridges seem to lie at a slight angle to the dominant tidal flows, rather than exactly parallel with them.

The conference was organized for IAS by Dr. Nio (State University of Utrecht), Dr. Schüttenhelm (Geological Survey of the Netherlands) and Dr. Van Weering (Netherlands Institute for Sea Research). The weather cooperated beautifully: it was fine for pre- and post-conference field trips but rained steadily all during the meeting itself, thus suppressing any tendancy delegates might otherwise have had to explore the beauties of Texel (a fine sea-side resort, which lists nude bathing among its many other attractions). The local organization was exceptionally efficient, and a symposium volume will be published soon as an IAS Special Publication.

Reference

Dalrymple, R. W., R. J. Knight and J. J. Lambiase, 1978, Bedforms and their hydraulic stability relationships in a tidal environment, Bay of Fundy, Canada: Nature, v. 275, p. 100–104.

MS received November 30, 1979

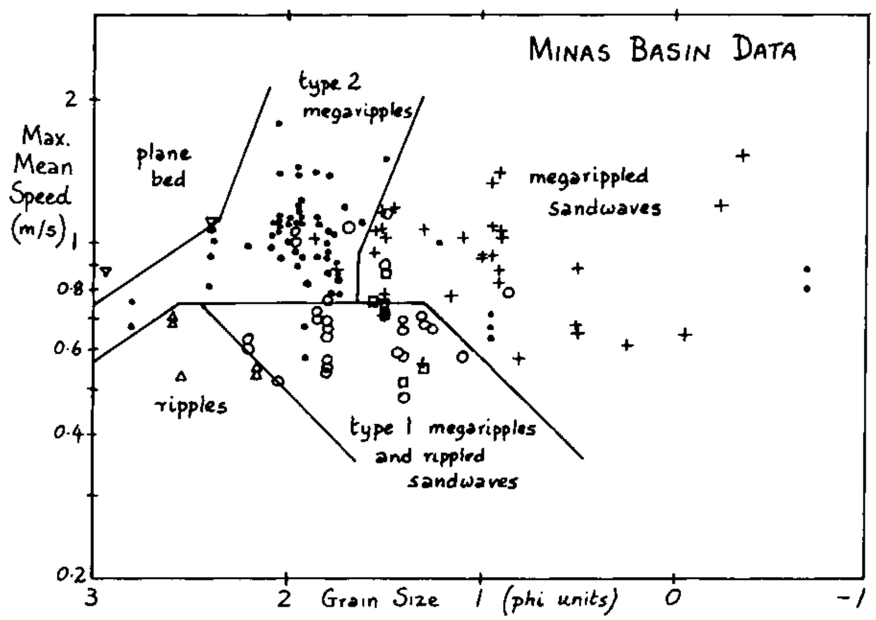

Figure 1 *Bed form phase diagram, showing fields of occurrence of morphologically distinct bed forms on a mean grain size – maximum mean speed diagram. Based on Dalrymple* et al. *(1978) which should be consulted for detailed definitions of the bed forms and measurement techniques.*