Formation of Coastal and Continental Shelf Mud Deposits and Environmental Records

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Introduction

Mud deposits are found in estuarine and coastal mudflats, on continental shelf areas with weak tidal currents; and over sub-aqueous deltas on the inner shelf. These deposits may contain high resolution environmental records, but an understanding of the modern processes that are responsible for the formation of the deposits is required in order to analyse the records. The purpose of the present study is to investigate into the processes and products of the three mud deposits, and discuss a number of issues associated with the information on the environmental evolution.

1. Estuarine and Coastal Mudflats

Mudflats are formed in the areas where tidal processes dominate and there is abundant supply of fine-grained sediment. The mud deposit is normally several metres in thickness, with the upper part being covered with salt marsh plants.

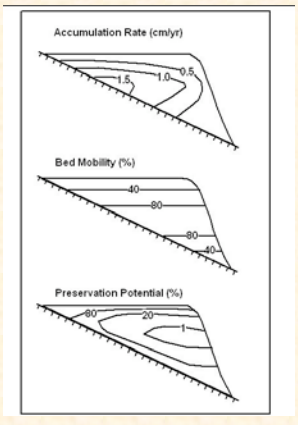
In response to tidal action, tidal creeks may form on the flat. The sedimentary sequence of the creek is complex, causing discontinuity of sedimentary records. On the flat without creeks the sequence is characterised by, from top to bottom, clay-silt, silty and silt-sand layers. Calculations using a "forward modeling" approach indicate that sediment accumulation rates, seabed mobility and potential of preservation of the sedimentary structure vary over the three parts. For high resolution studies of environmental evolution, sampling on the upper part is recommended. Short cores may be collected along a transect perpendicular to the shoreline; these cores can be connected to formulate long time series records.

Upper part of mudflat

Middle par of mudflat

Measurements of tidal current velocity and suspended sediment concentration

Sediment sampling on the mudflat

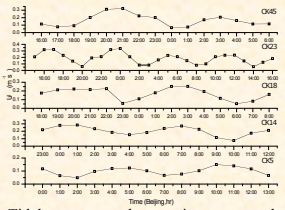


Modeling results of sediment accumulation rates, seabed mobility and potential of preservation of the sedimentary structure for the mudflat sedimentary sequence

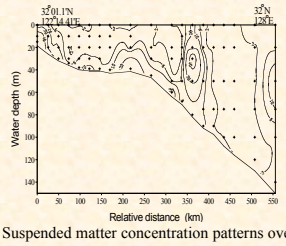
2. Weak Current Mud Areas on the Shelf

On the shelf areas where the tidal current is weak, very fine materials (consisting of mineral sedimentary grains, particulate matter generated by geochemical processes and organic particles by biological activities) can accumulate. The presence of an upwelling system may enhance the accretion.

This type of mud deposit is characterised by small thickness, low accumulation rate, and high degree of continuity in sedimentation. For the study of environmental evolution, it is recommended that cores should be collected from the central part of the mud deposit, especially for the upwelling areas.



Tidal current speeds on springs measured from the Central Yellow Sea Mud Area (they are generally below the threshold for initial sediment motion



Suspended matter concentration patterns over the mud area to the southwest of Cheju Island, southern Yellow Sea, showing the effect of upwelling on the enrichment of suspended matter

3. Sub-aqueous Delta Mud Deposits

In addition to the sub-aqueous delta near river mouths, such deposits can be formed in the "far field" on the inner shelf. For instance, remotely located sub-aqueous delta mud deposits are found for the Yellow and Changjiang Rivers. The diagram shown below indicate the internal sedimentary structure of this type of mud, as revealed by sub-bottom profiler records. This mud deposit is located at southeastern Bohai Strait, some 300 km away from the Yellow River mouth.

This type of mud deposit is characterised by spatial variations in deposition rate and the degree of continuity. For environmental studies, it is recommended that cores should be collected from appropriate part of the mud deposit, which can be determined by sedimentary facies analysis.

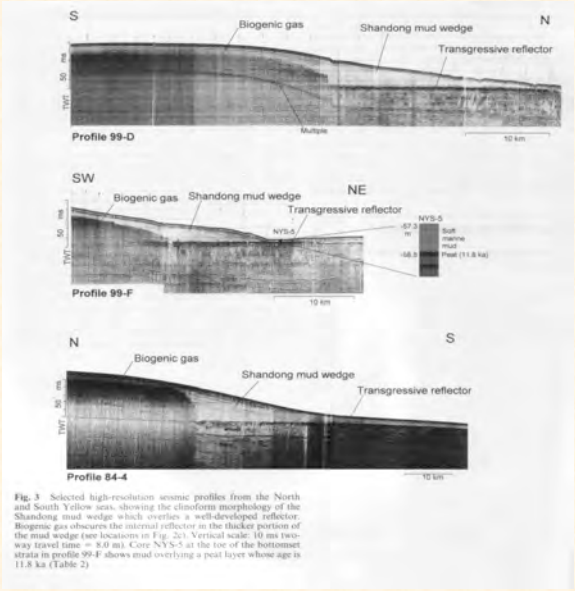


Fig. 3 Selected high-resolution seismic profiles from the North and South Yellow seas, showing the clinoform morphology of the Shandong mud wedge which overlies a well-developed reflector. Biogenic gas obscures the internal reflector in the thicker portion of the mud wedge (see locations in Fig. 2c). Vertical scale: 10 ms two-way travel time ≈ 8.0 m). Core NYS-5 at the toe of the bottomset strata in profile 99-F shows mud overlying a peat layer whose age is 11.8 ka (Table 2)