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GEOMORPHOLOGY AND SEDIMENTS OF WESTERN SURINAM SHELF; A PRELIMINARY NOTE*)

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The continental shelf of Surinam is characterized by a rather smooth seafloor, which gently slopes seaward in the direction of the continental slope. The shelf declines 1:1,600 on the average, which corresponds to a seaward slope of 0°02′. The width of the shelf is about 80 nautical miles, which is above the worldwide average of 40 nautical miles. The depth of the shelf break, that is the depth at which the greatest change of slope occurs at the shelf margin is about 95 metres. The flattest portion of the shelf lies between 30 and 40 metres. The location of the area of investigation is shown in figure 1).

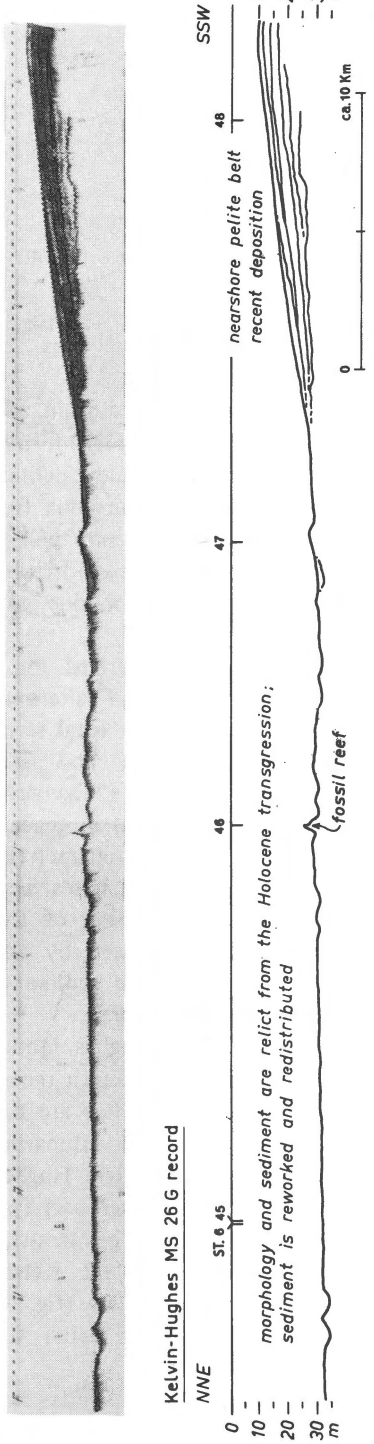
A smooth shoreline with marked interruptions formed by funnelshaped rivermouths (Corentyn-, Coppename- and Suriname River) separates the continental shelf from the adjacent land area. The sediments of a relatively narrow coastal plain – about 150 km wide in western Surinam and only about 40 km in the eastern part of the country – are deposited as a strip on the northern border of the crystalline basement of the hilly prae-palaeozoic Guiana Shield. The strip forms part of the extensive chenier plain between the deltas of the Amazon and Orinoco rivers. Within the plain differentiation is made between the Zanderij-formation (late-Tertiary coarse sands and sandy pelites, probably of terrigenous origin), the Coropina formation (late-Pleistocene fine sands and silty pelites of marine origin) and the Demerara formation (Holocene fine sands and pelites of marine and fluvial origin).

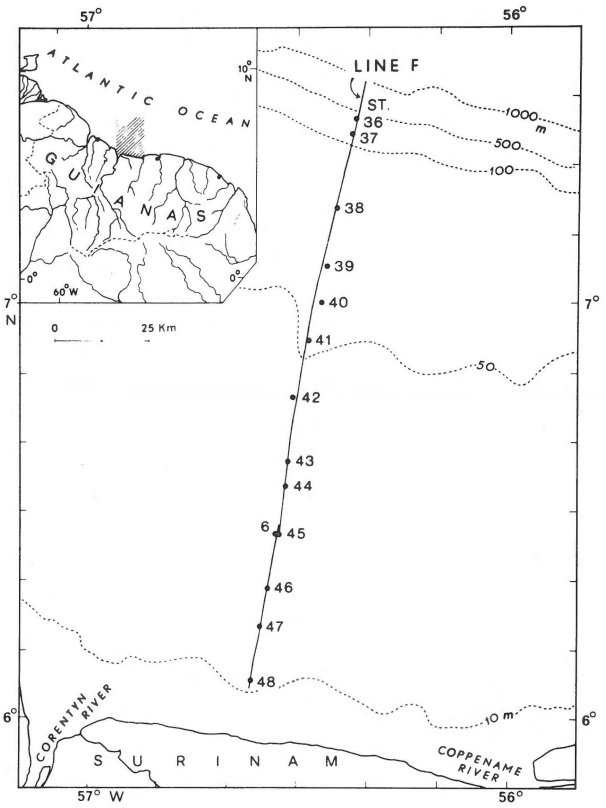
The Demerara landscape is characterized by a belted ridge and marsh topography of alternate pelite (pelite is the collective name for total terrigenous material smaller than 0.05 mm) and sand deposits. The low sandy beach ridges ("cheniers" on the Gulf coast, "ritsen" in Surinam) in general run parallel to the shoreline, and they characteristically rest on marsh pelite with their bases near sea level. It is presumed that deposition of the Demerara sediments is greatly influenced by the North Equatorial current and that the sediments mainly originate from the Amazon River.

Echograms taken with a Kelvin Hughes Model MS 26G echosounder and a precision depth recorder (PDR) installed on H.NL.M.S. Snellius are the main sources of information on the submarine morphology of the shelf area. The Kelvin Hughes sounder was used only for the shallower part (up to about 40 metres) of the shelf. The acoustic reflection profiles from the PDR and the Kelvin Hughes sounder are represented separately (fig. 1) because the resolution of the bottom relief for these sounders is different.

A study of the acoustic reflection profiles has revealed the presence of a series of irregularities in the seaward slope of the shelf profile. The general morphology of the shelf profile will be discussed on the basis of one of the traverse lines (Line F)

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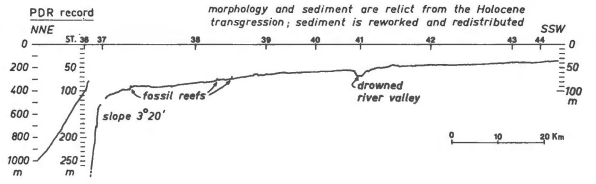


Fig. 1

Accoustic reflection records across the western shelf; see text.

which were run across the shelf (see fig.1). The irregularities in the shelf profile concern undulations, submarine ridges, isolated topographic highs and depressions in the sea floor. The features appear across the entire shelf, but it is possible to distinguish certain levels in their occurrence. One such level or terrace is clearly developed between 26 and 30 m. This terrace extends over a width of about 30 km across the shelf and it shows a number of undulations, ridges and at least one topographic high relatively steep slopes (station 46). A second terrace occurs between 36 and 38 metres; it shows some undulations in the bottom profile and its width measures about 10 km. A third level is found at about 45 metres; this terrace is smooth, is about 20 km wide and shows only minor irregularities. A well developed depression is met with at station 41. This depression is considered to represent a submerged river valley, a remnant from a drainage system that probably was developed at the time that the submarine terrace that can be distinguished at about 60 metres, was formed. It is tentatively suggested that the pronounced ridge at the seaward side of the submerged valley is a depositional feature, formed during the stage that the river existed; the irregular topography on the landward side of the valley seems rather erosional than depositional. The presence of another series of irregularities in the shelf profile is conspicious at a depth between 65 and 80 metres. The distribution of these features over such a depth range seems to indicate that at that level no standstill lasted long enough for a distinct marine terrace to form. Finally there is a fairly well developed terrace level at about 90 metres. The above morphologic expression on the shelf could have been formed either during the transgressive period that started at the end of the Pleistocene or during earlier Pleistocene regressions. The latter possibility seems not great because it is improbable that so many features would have survived the erosional and depositional processes of the postglacial rise of sea level. Hence it is assumed that most of the present morphology is relict from the Holocene transgression of the sea across the shelf off Surinam.

The location of the sampling stations was primarily based on the submarine morphology. The sampling was carried out with a Van Veen bottom grab, with piston or punch corers and with a box sampler. The distribution of the surface sediments was found to be fairly regular.

In the nearshore area (as far as approximately the 25 metre contour line) a belt of pelite deposits is found (station 48). The pelite deposits are practically free of sandsize particles but at some places show silt laminae. The pelites are very soft and dark greenish-grey in colour (5GY4/1); they are the sediments currently being supplied and deposited. The seaward margin of this zone of present active deposition is clearly indicated on the echogram and lies between stations 48 and 47. The subbottom reflections in the prograding belt mark different stages in deposition. The acoustical discontinuities may refer to differences in compaction or may be related to textural differences (e.g. intercalated sandy layers or layers with abundant shell remains).

The deeper part of the shelf is characterized by a very sandy surface sediment, with an admixture of varying amounts of pelite and water worn calcareous fragments of marine organisms. Most of these sediments are bimodal, composed of a mixture of poorly sorted coarse to medium grained sand size material (2 – 0,125 mm) and pelite. The bimodal character of these sediments indicates that the processes by which the coarser (sandy) part and the finer (pelite) one are introduced must be different. It is believed that during calm weather conditions fine-grained pelite material will be deposited, while when the water is more agitated, varying quantities of both sand and calcarenite material may be set in motion and are redistributed (bottom current velocities up to 60 cm/sec. have been measured at a depth of 35 metres; cf Eisma, 1967. The mixing of the pelite with the sand-size particles results from burrowing organisms. Thus, the pelite component is presently being supplied in suspension, while the sand-size material is old and only set in motion periodically. The sand was left during the Pleistocene lowered sea levels in a nearshore or fluvial environment (cf Nota, 1958, p. 61).

The sediments from the area near the shelf edge are very calcareous and often contain appreciable amounts of reworked reef material. The presence of fossil reefs is not only based on petrographical but also on morphological data. Relatively steep-sided limestone bodies have been found in the vicinity of the shelf break along most of the

traverses over the shelf. The topographic elevations are often isolated, may rise 5 to 10 metres above their surroundings, while their diameter ranges between 60 and 200 metres. The presence of the fossil reefs on the Surinam shelf is of special interest because similar reef bodies have been found along the edge of the western Guiana shelf (Nota, 1958). Radiocarbon dates of material from the western Guiana shelf edge reefs were found to vary between 12000 and 17000 years. On the basis of the similar occurrence of the Surinam shelf edge reefs they are considered as of Pleistocene age. Apparently a fringe of reefs extended over several hundreds of kilometres along the continental shelf which was then dry. Sea level was at that stage between 80 and 90 metres below present.

The presence of fossil reefs was also noted in shallower water, e.g. between stations 37 and 38 at a depth of approximately 70 metres and at station 46 in a water depth of 26 metres. These reefs are tentatively considered to be younger than the shelf edge reefs. Further investigation will be necessary to arrive at a definete conclusion.

The majority of the cores obtained in the area with a sandy bottom (i.e. on line F between stations 47 and 39) shows a conspicuous twofold zonation. Underneath the pelitic calcarenitic sand, which is the surface sediment, occurs a stiff brownish coloured pelite (often laminated). The lithological break is sharp and indicates a pronounced change in environmental conditions. This twofold zonation was found to be characteristic for a large part of the shelf. The brownish colour, the stiffness and the presence of small iron concretions in the pelite strongly suggests that it is a fossil latosol. Small pebbles of iron concretions have been found in many of the sandy calcarenitic pelitic surface sediments; their presence points to erosion of the stiff pelite during the stage that the sandy toplayer veneered the underlying pelite. It is presumed that the sandy sediments veneered the stiff pelite during the Holocene transgression. The extensive pelite deposits must have formed during the Pleistocene, probably under marine conditions during a regression period. They may have developed through the sedimentation of pelite on the original shallow sea-bed off the coast, as it occurs to-day (cf. fig. 24, between stations 48 and 47). The lowering of the sea level during the marine regression caused that the mud flats became dry; soil formation then started, leading to the present stiffness, brownish colour and finally the iron concretions in the pelites. Stratigraphically the stiff brownish pelite is considered to have been developed during the last glacial regression and accordingly should be correlated with the Coropina formation (cf Pons, 1966). The interpretation of the events is tentative because the data are inadequate.

The geomorphological and sedimentological conclusions can be summarized in the following:

1. Recent deposition on the western Surinam shelf is largely confined to the nearshore pelite belt, which is approximately bounded by the 25 m depth contour.
2. The morphologic expression as well as the sediment distribution on the remainder of the shelf, i.e. the extensive shelf area with sandy bottom sediments, should be considered as a relic of the late-Pleistocene and Holocene transgression; these features have not been buried because this shelf is largely non-depositional.
3. The postglacial transgressive sands form a thin veneer (usually not more than 1 metre) over the underlying pelite, which was deposited during the preceding glacial regression.

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