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## Ocean-Bottom Topography: The Divide between the Sohm and Hatteras Abyssal Plains


Abstract. *A compilation of precision echo soundings has delineated the complex topography between the Sohm and Hatteras abyssal plains off the Atlantic coast of the United States. At present the divide between the two plains is a broad, flat area about 4950 meters deep; however, the configuration of channels and depressions suggests spillage of turbidity currents from the Sohm Plain into the Hatteras Plain and a shifting of the divide toward the northeast. Hudson Canyon terminates in the divide area and has probably fed sediment into both plains.*


A recent compilation of precision echo soundings off the East Coast of the United States has delineated reasonably well the area of complex topography between the Sohm and Hatteras abyssal plains (Fig. 1). Sounding lines used in compiling the topographic map (Fig. 2) are entirely those of Woods Hole Oceanographic Institution ships. They have a depth accuracy of within 10 meters, although in some instances the position of the lines may be in error by as much as 18 kilometers. The map is contoured in meters from original data compiled in fathoms and corrected for the velocity of sound in water.

Sohm Abyssal Plain extends eastward from the base of the continental rise and generally occupies the deep basin between Canada and Bermuda. Its western end is partially ponded by the New England Seamounts and consequently exhibits very gentle gradients, as shown in the northeast corner of Fig. 2. It is now generally recognized that the abyssal plains are formed largely of terrigenous or land-derived sediment transported to the ocean floor by turbidity currents. The sediment in the Sohm Abyssal Plain appears to be derived mainly through the submarine canyons along the slope off New England.

The Hatteras Abyssal Plain occupies the deep basin between southeastern United States and Bermuda. The plain deepens gradually to the south, indicating that the principal source of the sediment deposited is at the north. The northernmost end of the Hatteras Plain terminates in a series of deep-sea channels shown in the southwest corner of the map area.

The largest submarine canyon on the East Coast is Hudson Canyon. During the Pleistocene epoch, when the Hudson River was a major outlet for the Great Lakes and the shore line was at the outer edge of the shelf, the Hudson Canyon was probably a major channel for turbidity currents. At present it appears to be inactive. The canyon has been traced as a well-defined gorge down the continental slope and across the continental rise. Originally it was thought to terminate by merging with the western end of the Sohm Abyssal Plain in the vicinity of Caryn Seamount (*1*). However, recent echo soundings indicate that a series of shallow distributaries radiate from the canyon on a broad apron called the Hudson submarine fan, and longitudinal profiles of the canyon and adjacent sea floor show that the shortest path with the steepest gradient is now south, along the western edge of the fan, into the north end of the Hatteras Abyssal Plain.

At present the actual divide between Sohm and Hatteras abyssal plains is the broad flat area at 37°N, 65°30′W defined by the 4950-meter contour lines. Turbidity currents flowing down the continental rise in this area could flow east into the Sohm Plain or southwest through a broad channel into the Hatteras Plain. It is unlikely that they flow southeast because of a gentle rise in the bottom beyond which are unfilled depressions. The possibility that turbidity currents spilled from the Sohm Plain into the Hatteras Plain in a number of places is suggested by the relief of the low ridge at the south side of the Sohm Plain, extending over 200 miles east from the divide. Turbidity-current floods on the Sohm Plain overflowing into the depression area to the south might then flow on into the Hatteras Plain through the gap at 34°30′N, 64°W.

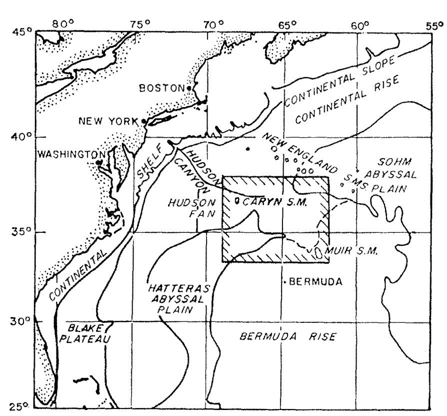


Fig. 1. Position of the area of complex topography between the Hatteras and Sohm abyssal plains. The dashed line represents the seaward limit of deposition of terrigenous sediment between the two plains.

The origin of the depressions in the central part of the map area is uncertain. Three explanations for them are (i) recent tectonic features; (ii) areas of nondeposition, out of reach of turbidity currents; and (iii) scour depressions formed by the actual removal of material by turbidity currents. Perusal of the chart gives the impression that the larger depressions owe their existence to nondeposition: these depressions lie in the shadow zone of the low ridge to the north and west and are thus protected from direct filling by turbidity currents. However, some of the smaller, closed depressions appear to be associated with the gap that connects the large depressions with the northern end of the Hatteras Plain (34°30′N, 64° to 65°W) and they may be partly scoured out by turbidity currents in the gap. The echo-sounding records show clearly that these smaller depressions do not join to form a continuous, well-defined channel through the gap but are part of a zone of relatively rough topography. These depressions are often associated with hills that could be natural levees.

The topography of the ocean floor off the northeast coast of the United States reflects the general features of a vast basin of sedimentation. To be consistent with this regional picture the topography portrayed in Fig. 2 must be interpreted as primarily sedimentary in origin. Large percentages of sand and silt in available cores (*2*), subbottom echoes, and minor topographic features indicative of small channels and natural levees are evid-

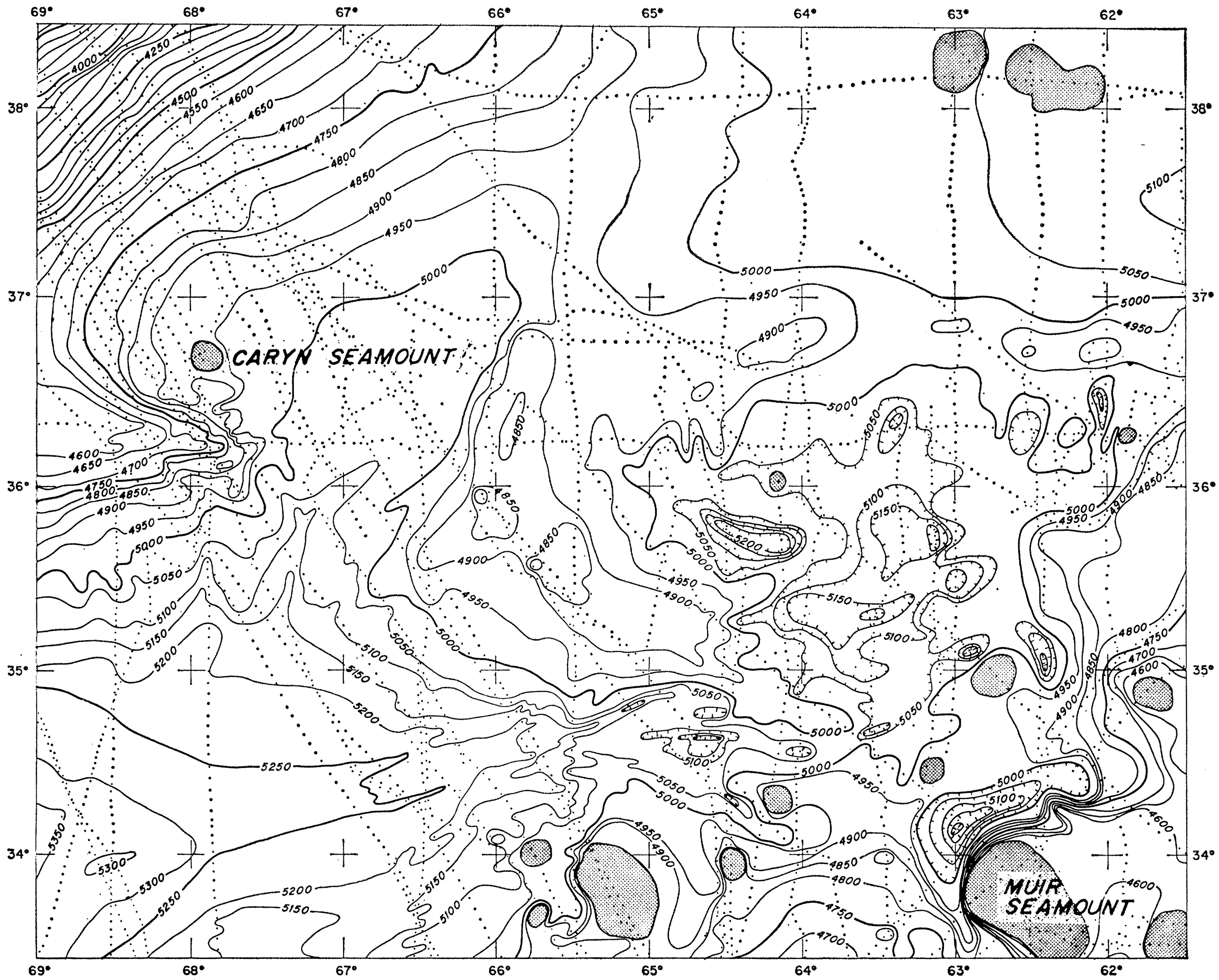


Fig. 2. Divide between the Sohm and Hatteras abyssal plains. Dotted lines show the sounding-line control; shaded areas are seamounts rising abruptly above the general level of the bottom. Contour interval, 50 meters.

ence that terrigenous sediments extend into the depression area. It is noteworthy that some of the highest sand contents were obtained from cores on the crest of ridge features, indicating that these are depositional rather than tectonic in nature. These criteria and the gross topography indicate that the limits of terrigenous sedimentation can be drawn at the eastern side of the depression area (Fig. 1).

Terrigenous sediments transported into the deep sea by way of the Hudson and New England submarine canyons probably extend all the way to Muir Seamount (Fig. 1). The resulting sediment fan is complex, with depositional-type ridges and levee features reaching 200 meters in height, and depressions of nondeposition reaching 200 meters in depth. During Pleistocene or earlier times sediment from the area of the Hudson submarine fan may have flowed into either the Sohm Abyssal Plain to the north or the Hatteras Abyssal Plain to the south. However, relatively greater accumulations in the Sohm Abyssal Plain have raised its general level, so that at present it exhibits very flat topography some 200 meters above the level of the Hatteras Plain. Consequently, sediment is now being diverted southward through a series of channels into the Hatteras Plain, leaving the present sediment divide relatively far to the northeast. It is conceivable that the outflow of sediment from Hudson Canyon has alternated between the Sohm and Hatteras abyssal plains several times in the past as the plains have been gradually built up. In this respect the history may be analogous to a similar situation in the Mississippi Delta complex (*3*). The sedimentary picture is, of course, superimposed on the basic structural framework of the ocean basin, changes of which are still poorly understood.

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