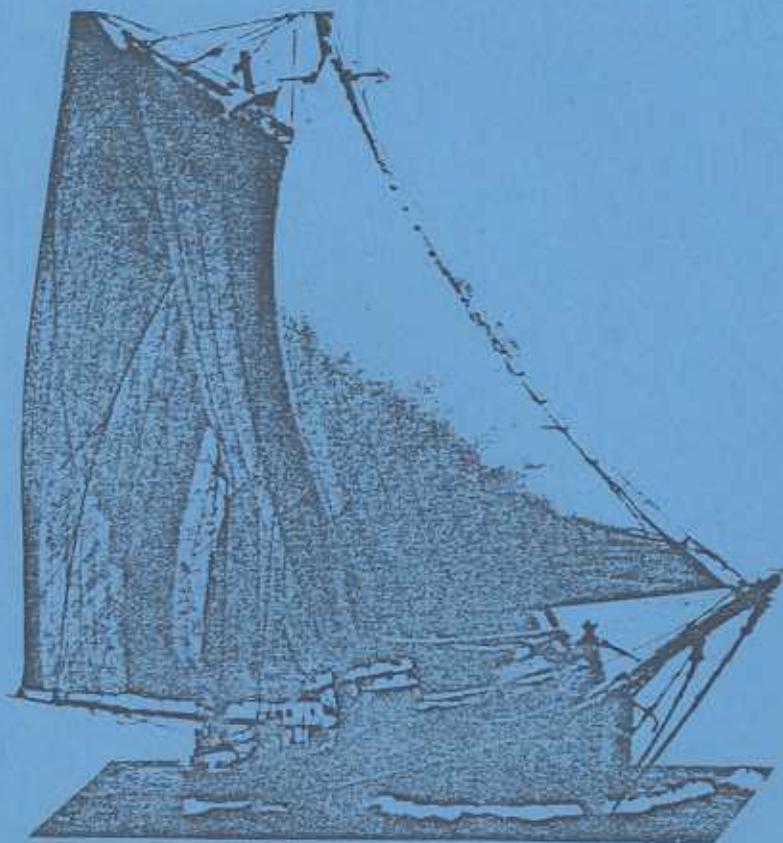


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UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SAND RESOURCES STUDY - PHASE I REPORT



CHARLES W. HOLMES
DECEMBER, 1977

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NOT BEEN EDITED OR REVIEWED FOR
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Virgin Island Sand Resources - Phase I

Introduction

The cessation of sand imports from Puerto Rico has caused a critical shortage of fine aggregate needed for maintenance and new construction in the U.S. Virgin Islands. In an attempt to discover an alternate source, a survey of the submerged lands surrounding the islands of St. Thomas and St. John was undertaken by the U.S. Geological Survey in cooperation with the Department of Conservation and Cultural Affairs, U.S. Virgin Islands, and the Island Resource Foundation. This investigation, divided into three parts, has as its goals, to locate and define the composition of fine aggregate deposits on the insular shelf and determine the rate at which such deposition is taking place. It is this information which is required to formulate sound management policies which will allow for the recovery of fine aggregate without significant environmental damage.

Phase I - High Resolution Reconnaissance Survey

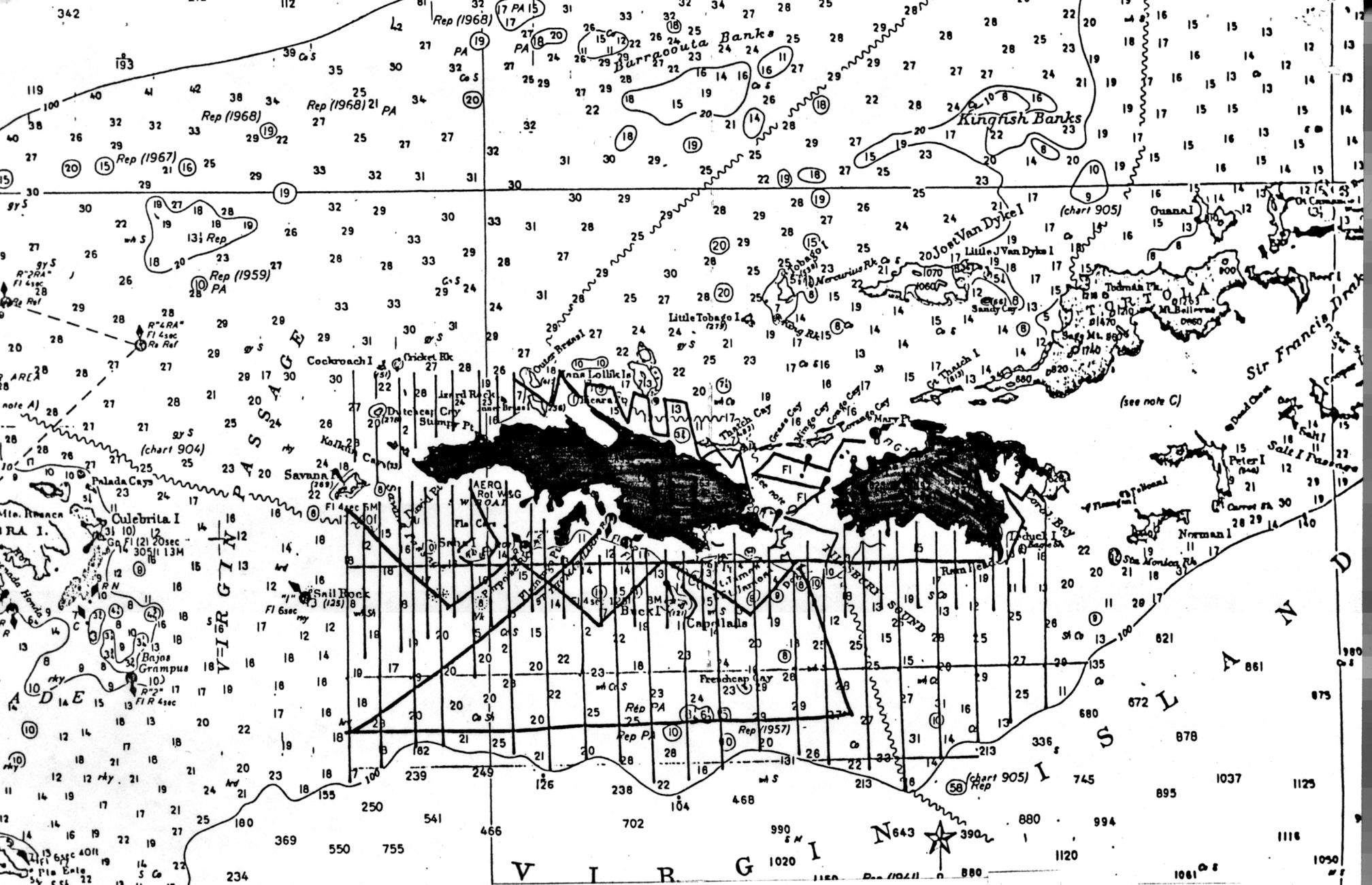
Phase I, begun in September 1977, was the reconnaissance phase of the program. During this survey, reflection geophysical profiles were made across the breadth of the southern shelf at a spacing of 1.5 kilometers and normal to the coasts of St. Thomas and St. John. Between these traverses, short profiles, extending from the shore seaward to the 40 meter isobath, were also made. This scheme gave an effective line spacing of 0.75 kilometers on the inner shelf.

Similar line spacing was employed north of St. Thomas west of Hans Lollik Island. In addition to these traverses, zig-zag lines were made in the narrow passes to the north of St. Thomas and in Pillsbury Sound. Tie lines were also made. In all, these traverses comprise some 1260 kilometers of high resolution geophysical data (Fig. 1).

The data were obtained with a Del Norte minisparker system with the analog record reproduced on a E.P.C. recorder. These records were made from the S.S. ALIANORA. The active unit, a 24 tip sparker array, was towed on the port side of the vessel. The hydrophone, a 24-element system, was towed approximately 30 meters astern of the starboard side. Both sparker and hydrophone were submerged about 3 meters below the surface and separated by 5 meters. The spark was ignited at 0.5-second intervals with the analog recorder programed to sweep at 0.25 seconds, recording on the alternate sweep coinciding with the spark. The incoming signal was passed through a signal processor with a filter band pass of 500 to 1200 hertz. These conditions permitted up to 0.01 seconds of unincumbered record; a depth equivalent to 75 meters assuming the velocity of sound in water. Navigation was made with a Motorola miniranger with an obtainable precision of +2 meters.

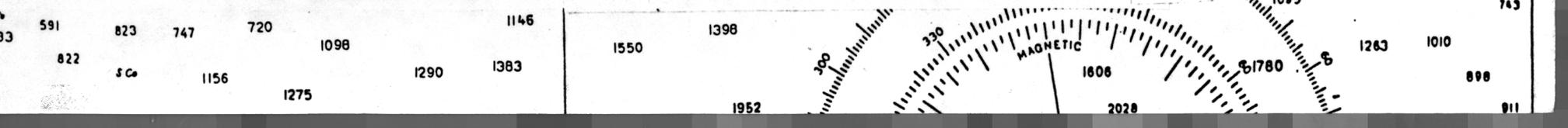
Surface and Near Surface Geology

Three distinct stratigraphic units were recognized in the profiles; 1) Unit A, a sequence of internally parallel reflectors which are present immediately below the bubble pulse; 2) Unit B, discordant reflectors disconformally overlain by unit A; and 3) recent sediment,



SEISMIC LINES - PHASE I

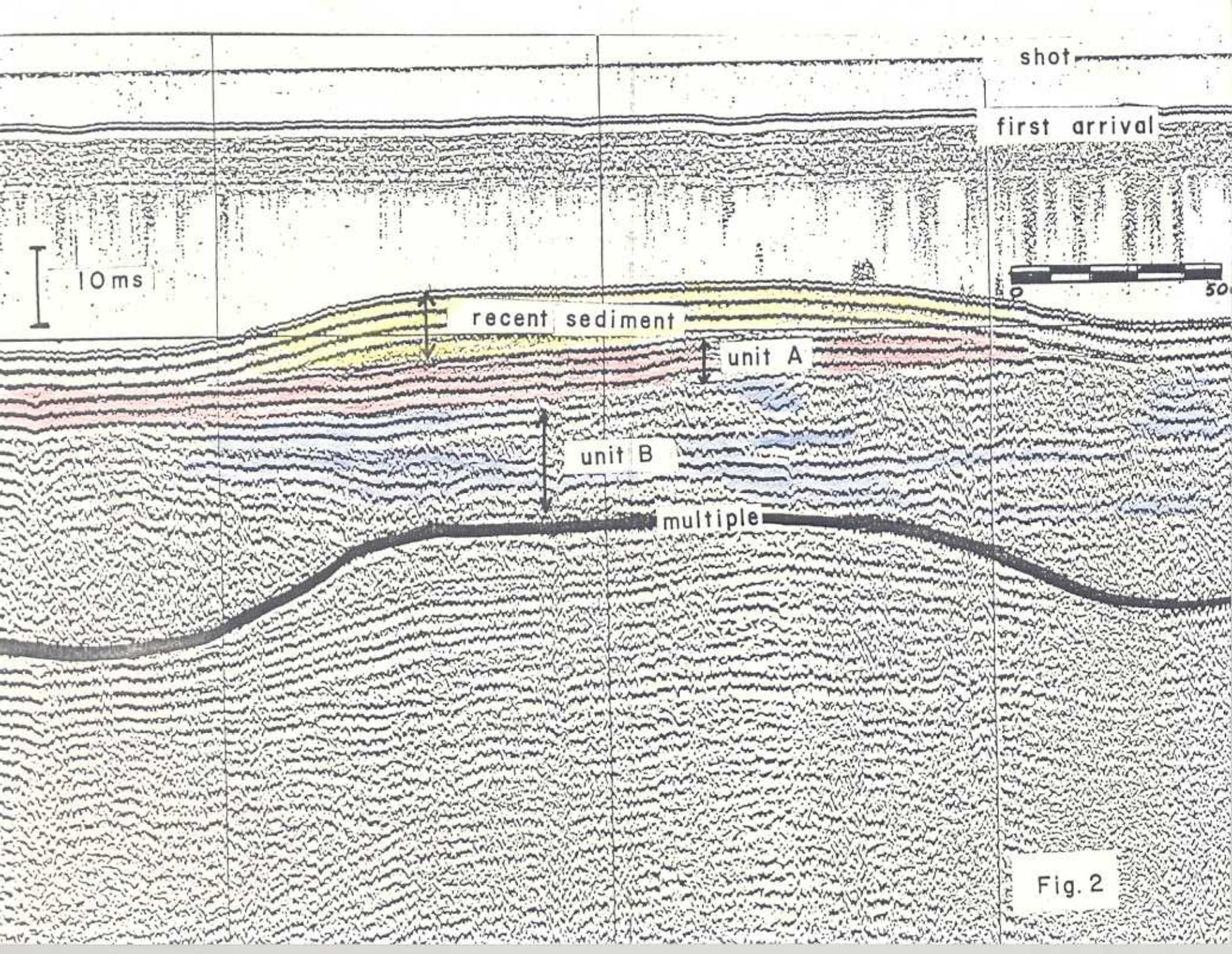
Fig. 1



an internally transparent unit which occasionally is present between unit A and the bubble pulse. Figure 2 is a section of the analog record from line four in the Saba Island area which demonstrates the relationship of these units. Unit A is interpreted to be the carbonate cap overlying Unit B, the rocks which form the core of the platform. Other features recognized were 1) an acoustical transparent mass lying at depth south of St. John; 2) a deep stratigraphic unit truncated by a steeply dipping unit B; only recognized in the records south of St. Thomas, and 3) numerous faults. Three terracelike features were also recognized, a 52 meter, a 64 meter, and an extensive 75 meter terrace. All these data are portrayed in map form in figure 3 and in cross section in figures 5 and 6. Figure 4 is a location map of the six sections presented in the report.

Ten areas were mapped which were interpreted to have significant recent sediment accumulation. Five of those appear to be extensive enough to warrant detailed investigations and will be the targets for phase two (Fig. 4). All of these lie in less than 40 meters of water and are near shore making them more attractive as potential aggregate sources.

The most extensive deposit appears to be near the western end of St. Thomas, between Saba and Savanna Islands. Although it is premature to detail this area, it appears that the accumulation of material in this region is in the lee of a topographic ridge which extends from Saba Island westward. The strong currents which flow in the region create eddies which aid in producing secondary accumu-



shot

first arrival

10ms

50

recent sediment

unit A

unit B

multiple

Fig. 2

CROSS SECTIONS ACROSS THE INSULAR SHELF

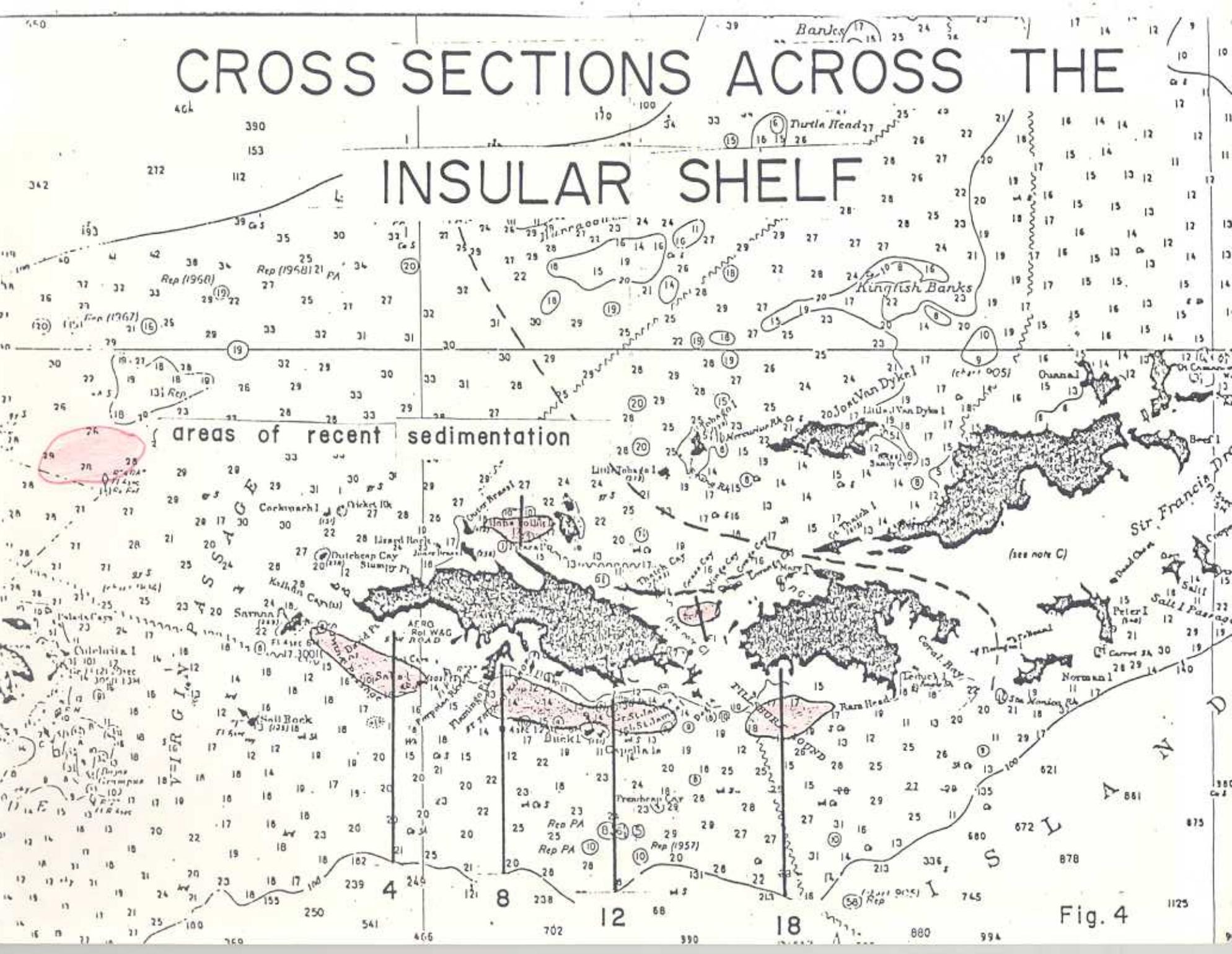
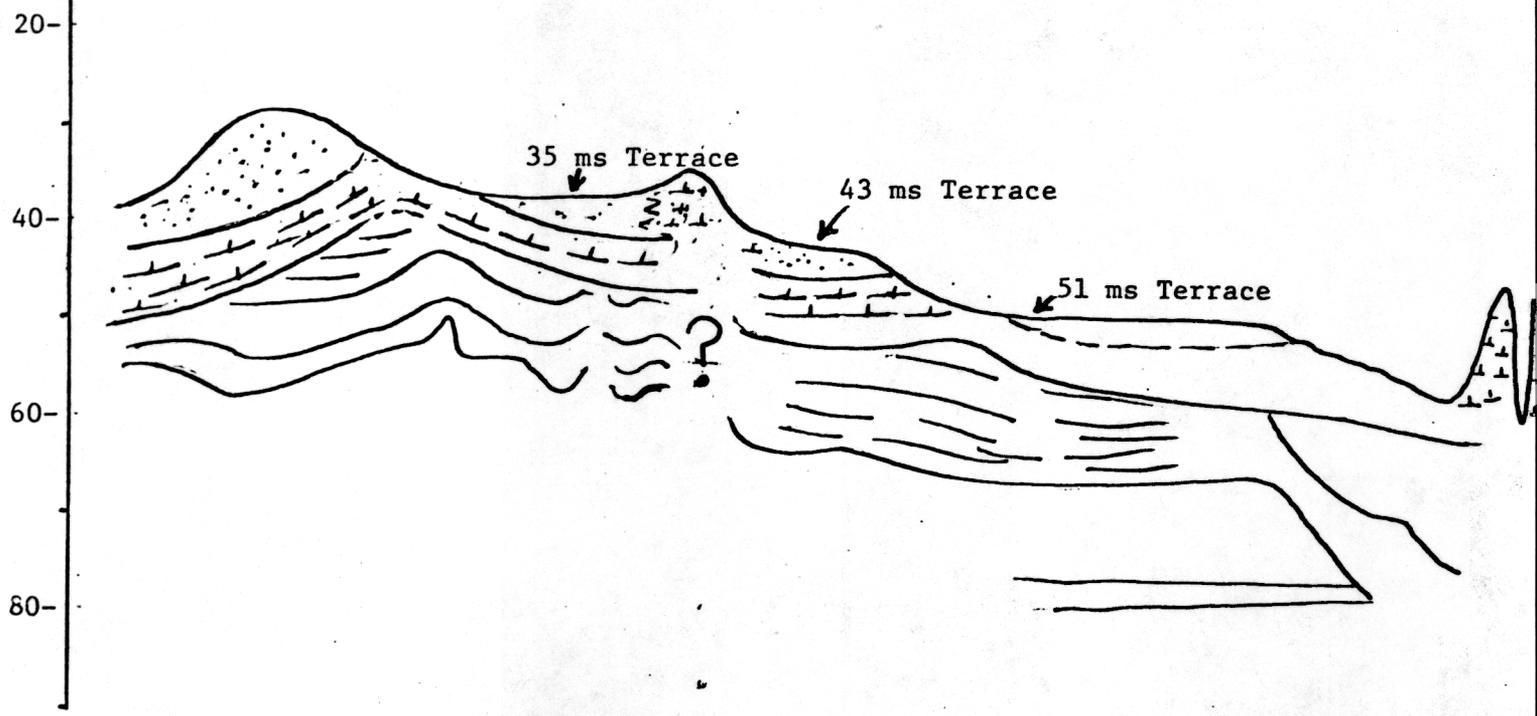


Fig. 4

LINE FOUR



LINE EIGHT

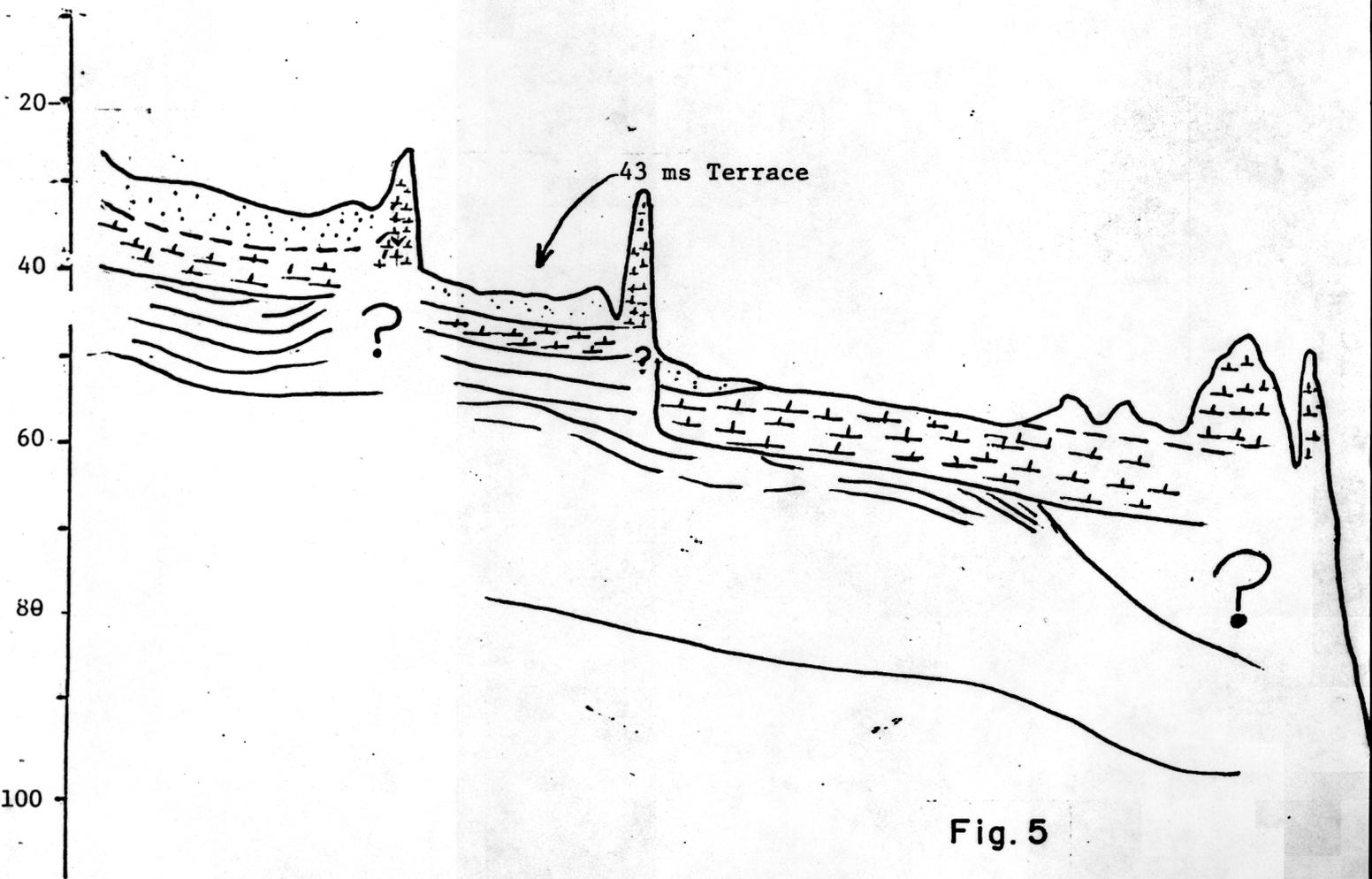
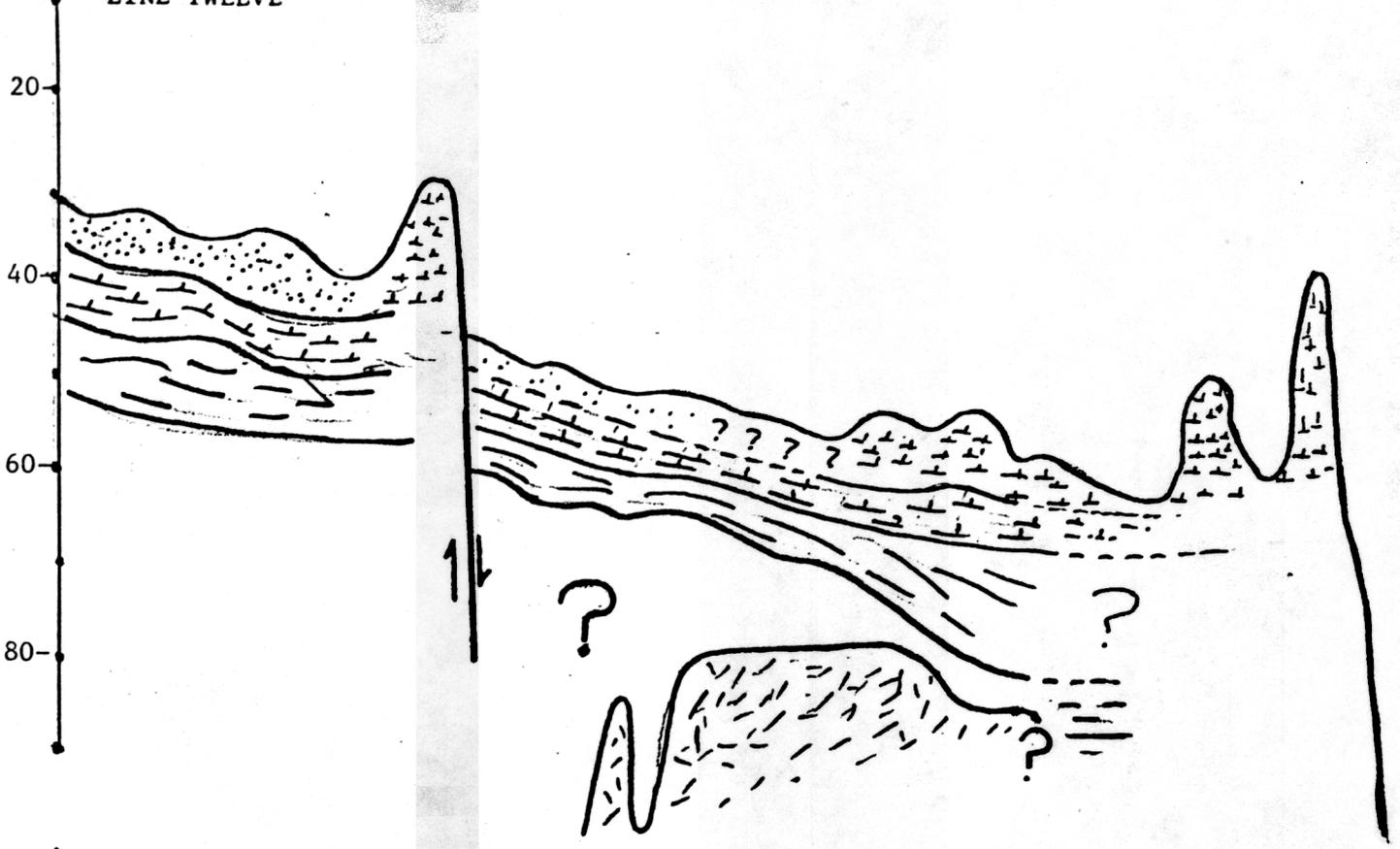


Fig. 5

LINE TWELVE



LINE EIGHTEEN

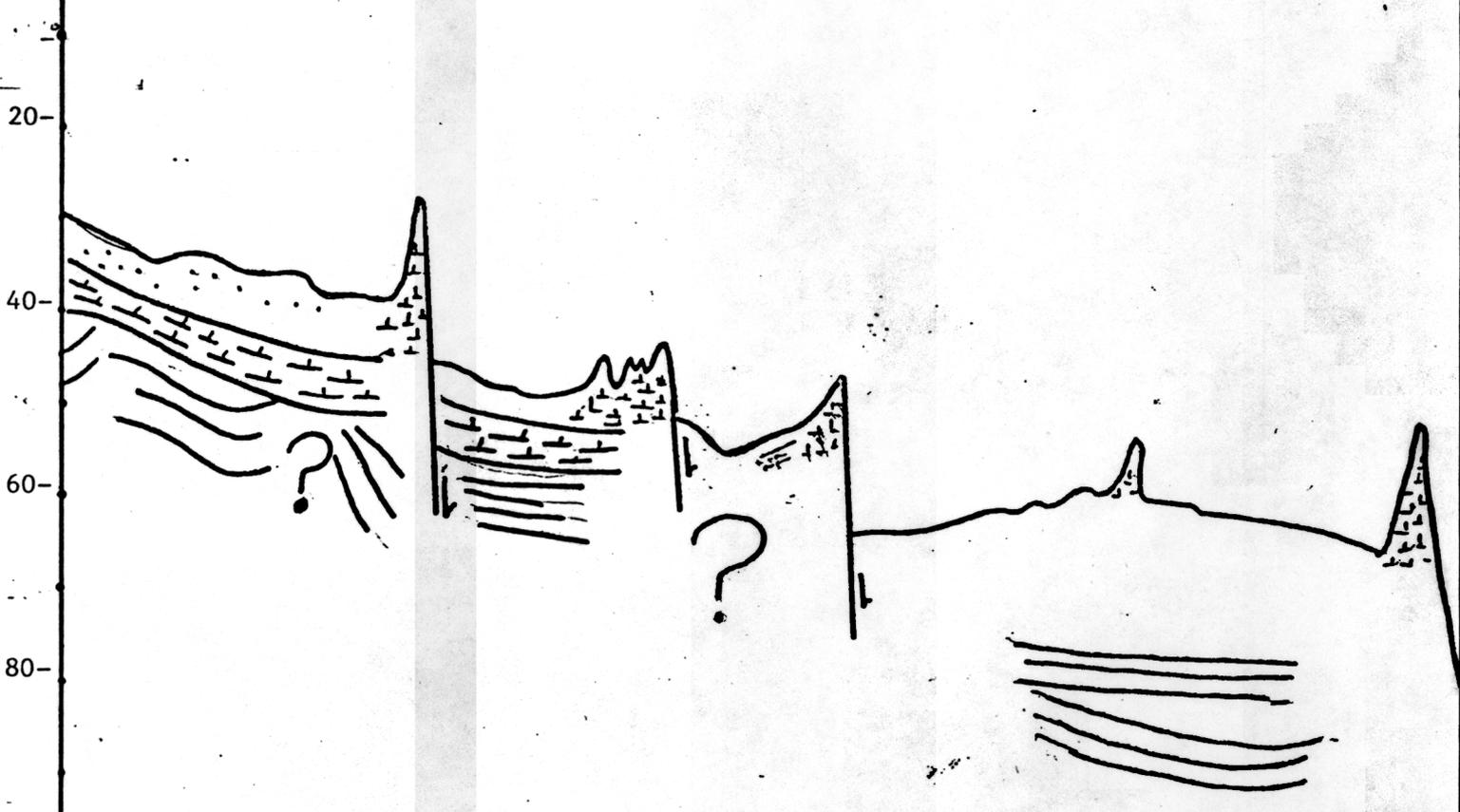


Fig. 6



lations in the Brewers Bay area. In area one, there are numerous pockets of sediment with thicknesses greater than 10 milliseconds. The most extensive of these is the deposit on the inner or lee side of the ridge. Diagrammatically the relation of this deposit to the underlying rock is shown in line 4 (Fig. 5).

The next region of significant sediment accumulation is the area bounded by the southern coast of eastern St. Thomas, Buck-Capella Islands, Dog rocks, and Water Island. This region is marked by numerous deposits which when mapped appear to be present in bands of aggregate lying on the inshore side of topographic highs, eg. Buck-Capella Islands. These deposits are shown in cross section in line 8 and 12 (Figs. 5-6).

The third area of accumulation is south of the western end of St. John. This deposit, like those already mentioned, lies shoreward of a topographic high, a reef. However, unlike area 1 and 2, there is evidence that some portion of the accumulation may have a land source. Verification of this must be delayed until the end of Phase II when more information is available.

The fourth site is the thick accumulation in the north central sector of Pillsbury Sound. This accumulation forms a topographically positive mound (Fig. 7). It is likely that this deposit is formed by eddies in the rather strong currents which have been reported to exist in the area. This deposit may be the most dynamic and able to be formed over a very short time. If so, this site may prove to be a valuable renewable source of fine aggregate. It is also the shallowest of the deposits which adds to its attractiveness. ✓

PILLSBURY SOUND



meters

shot

first arrival

10ms

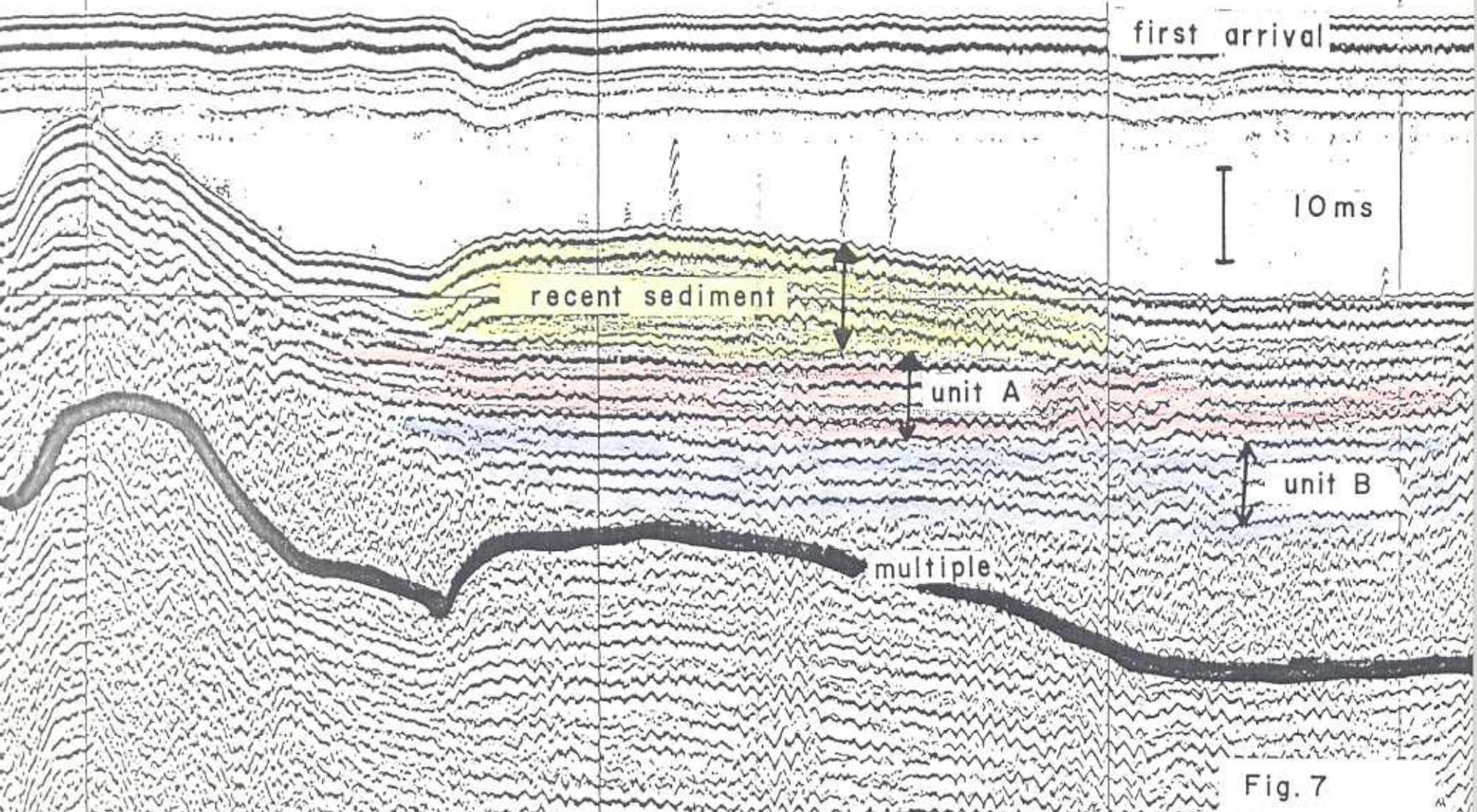
recent sediment

unit A

unit B

multiple

Fig. 7



The fifth site is the "perched" accumulation north of Magens Bay on the north side of St. Thomas. The source of the material deposited at this location appears to be accumulated in the lee of a topographic ridge that trends east-west between Hans Lollick and Outer Bass Islands. Material also may be transported up the Leeward passage with the topographic ridge acting as a barrier to the transport of material to the deeper portion of the shelf.

The remaining five sites are located either in the deeper portion of the shelf or lack extensive areal extent. One site, south of Coral Bay at the eastern end of St. John was originally thought to contain a significant deposit. However, close examination of the data indicates that this deposit is not quite as extensive as previously thought.

OCEANUS Cruise and Phase II

Beginning on or about February 9, 1978, a high resolution reflection survey will be run in the Virgin Passage and the extensive shelf north of St. Thomas. (Fig. 9). In addition to the same equipment used in the previous survey, a 7-3.5 kHz subbottom profile, a 1.5 kHz profiler and over some areas, particularly the banks on the outer edge, side scan sonar will be employed. Samples will also be taken at selected sites to obtain some sample material on the northern shelf and of the outer edge of the southern shelf. This survey will complete the plan for Phase I, which had to be curtailed in October due to the ship's schedule and weather.

Immediately following the OCEANUS cruise, the detailed surveys of the five sites will be made. For these surveys, a high resolution

MAGENS BAY AREA

shot

first arrival

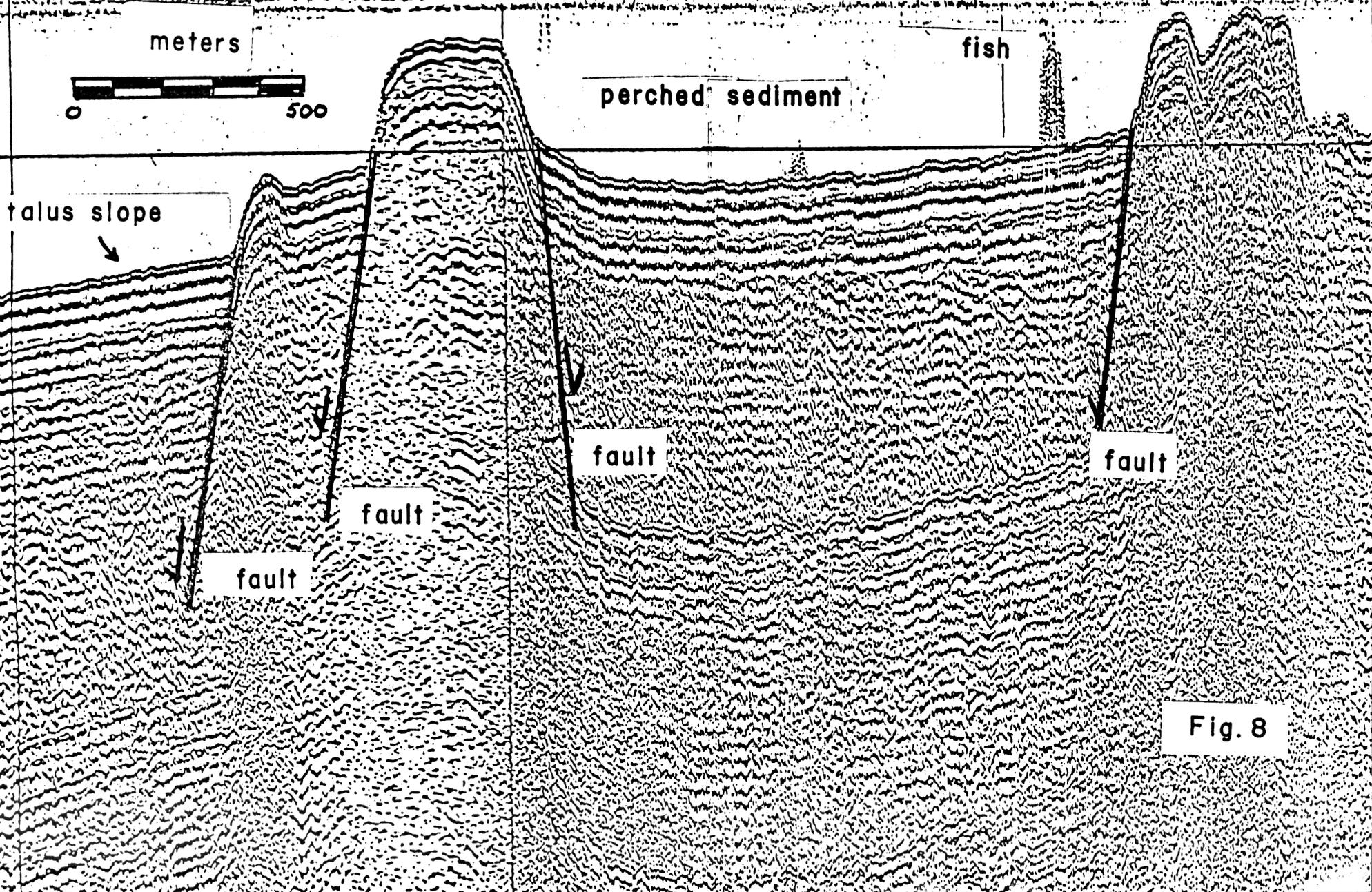


Fig. 8

system capable of defining the thickness of the recent sediment will be used along with side scan sonar. This part of the program will run from February 15 to February 26, 1978. The sampling part of this program will commence on March 15, 1978. At this time, cores to twenty feet long will be taken by a vibracore at sites selected based on analysis of all the data previously obtained.

Cruise Report

U.S.G.S. - Virgin Islands

1. Ship: S.S. ALIANORA
2. Cruise No.:
3. Area of Operation: Virgin Island Platform of St. Thomas and St. John
4. Dates of Operation: 9/13/77-10/1/77
5. Personnel:
 - Mike Tate (Master)
 - Charles W. Holmes - Project Chief 9/13/77-9/21/77
 - Henry L. Berryhill, Jr. - Project Chief 9/22/77-9/24/77
 - Ray G. Martin - Project Chief 9/26/77-10/1/77
 - Ronald Miller
 - Timothy Martin
 - Neal Lillard
 - Kenneth Parolski
6. Purpose: The objective of the cruise was to obtain geologic information in order to map and define sand deposits in the territorial waters of the U.S. Virgin Islands.
7. Equipment: Del Norte Minisparker
8. Navigation: Motorola miniranger
9. Data Acquired: Approximately 1260 km of minisparker profiles
10. Comments: The active element was towed on the port side of the vessel with the hydrophone 100' astern on the starboard side; both were towed about 15' below the water surface. The pulse generator was fired at a 0.5 sec. rep. rate, with the recorded gated at a 0.25 sec. sweep. The records obtained were good to excellent. The upper 10 feet of the sediment column is blocked by the arrival of the bubble pulse. The surface of the platform is sand and carbonate rock from which a multiple reflection is produced. However, the depth of water was such that at least 100 ms of good record was obtained.
11. Tabulated Information:
 - a) Number of days at sea: 18
 - b) Number of working days: 16
 - c) Total ship track: 1400 km
 - d) Km of continuous data: 1270
 - e) Total No. of stations: N/A
 - f) Type of each sample: N/A