FAUNA OF SHELF-EDGE SUBMARINE BANKS IN THE NORTHWESTERN GULF OF MEXICO

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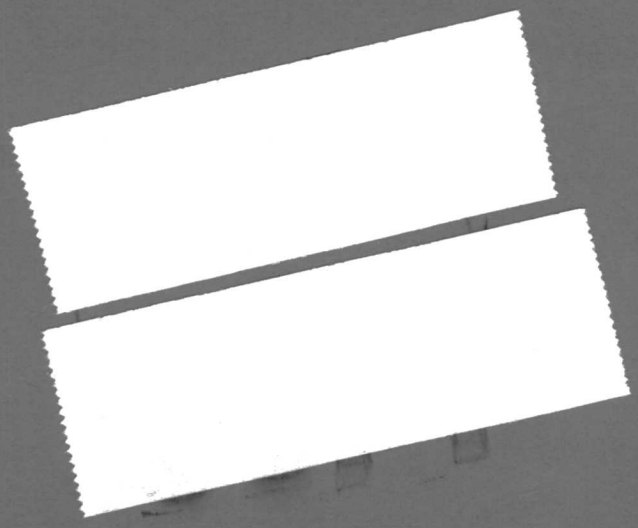

FAUNA OF SHELF-EDGE SUBMARINE BANKS IN THE NORTHWESTERN GULF OF MEXICO

A report to the U.S. Geological Survey,
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CONTENTS

	Page
Introduction	1
Objectives	1
Study site	2
Previous studies	2
Materials and methods	5
Acknowledgements	8
Results and discussion	8
Composition and morphology of banks	8
Analysis of bank photographs	10
Fauna of submarine banks	27
Comparative studies and zoogeography	43
Paleoecology	45
Literature cited	47
Appendix	49

ILLUSTRATIONS

		Page
Figure 1.	Map of study area and sample stations	2a
2.	Bank morphology at Station VIII-1	11
3.	Bank morphology at Station VIII-2	12
4.	Bank morphology at Station VIII-4	13
5.	Bank morphology at Station VIII-A-1b	14
6.	Bank morphology at Station VIII-A-Z	15
7.	Bank morphology at Station VIII-A-3	16
8.	Bank morphology at Station VIII-A-4	17
9.	Bank morphology at Station IX-1	18
10.	Bank morphology at Station IX-2	19
11.	Bank morphology at Station IX-3	20
12.	Bank morphology at Station X-1	21
13.	Bank morphology at Station X-2	22
14.	Bank morphology at Station XII-2	23

TABLES

		Page
Table 1.	Station location, depth, and relief of shelf-edge submarine banks	9
2.	Substrate description and volume of sediment examined for benthic fauna	24
3.	Systematic list of species collected on shelf-edge submarine banks	28
4.	Numbers of species and individuals at each station within each group	40

INTRODUCTION

The existence of submerged coral-algal reefs along the outer portion of the continental shelf in the northwestern Gulf of Mexico has been known for over 40 years. However, comprehensive biological investigations of benthic communities endemic to submarine banks east of the Flower Garden Banks are scarce. Considering the apparent lack of knowledge concerning epibenthic and endobenthic fauna associated with additional shelf-edge banks, the U.S. Geological Survey, Office of Marine Geology, Corpus Christi, Texas, subcontracted with Corpus Christi State University to provide faunal "baseline" information required to establish a more comprehensive survey of the outer continental shelf, as a part of the Environmental studies program sponsored by the Bureau of Land Management.

Scientists from Corpus Christi State University were asked to examine the benthic faunal populations associated with the sampled submarine banks and to compare biotic relationships between these banks and those previously studied on the Texas-Louisiana continental shelves. Morphological characteristics and surface substrate composition of each sampled bank were also of prime importance.

OBJECTIVES

The objectives of the project were: 1) to determine the fauna in "reef samples" collected on shelf-edge submarine banks in the northwestern Gulf of Mexico during the Spring of 1976, 2) to correlate the distributions of the "reef samples" with bathymetry maps of the U.S. Geological Survey, 3) to examine bottom photographs for information concerning available

habitats, 4) to determine the zoogeographic affinity of the organisms collected, 5) to compare the fauna of these banks to those previously studied on the Texas-Louisiana continental shelves, and 6) to determine possible past histories of these banks by age-dating coral and molluscan shell remains and by noting the paleoecology of individual species.

STUDY SITE

The study site is a portion of the outer shelf and upper slope designated by the U.S. Geological Survey for extensive investigation of possible geologic hazards related to the recovery of petroleum reserves. The sampled submarine banks are situated between 27^{o} 54.2' and 28^{o} 00.6' north latitude and 90^{o} 57.6' and 93^{o} 39.5' west longitude. Figure 1 shows the locations of the sampled submarine banks on the outer shelf and upper slope in the northwestern Gulf of Mexico.

PREVIOUS STUDIES

The possibilities of extensive domestic oil reserves on the upper continental slope have spawned anincreasing interest in the biological and geological processes endemic to such environments. This interest has lead to extensive investigations designed to accumulate environmental base-line data which can be used to monitor with future operations.

The geology of submarine banks in the northwestern Gulf of Mexico has been investigated for over 40 years. Trowbridge (1930) published the first geologic record of a submarine prominence with 33m relief off Southwest Pass of the Mississippi River, the top of which was covered by coarse sediments. The distribution of other similar prominences located on the

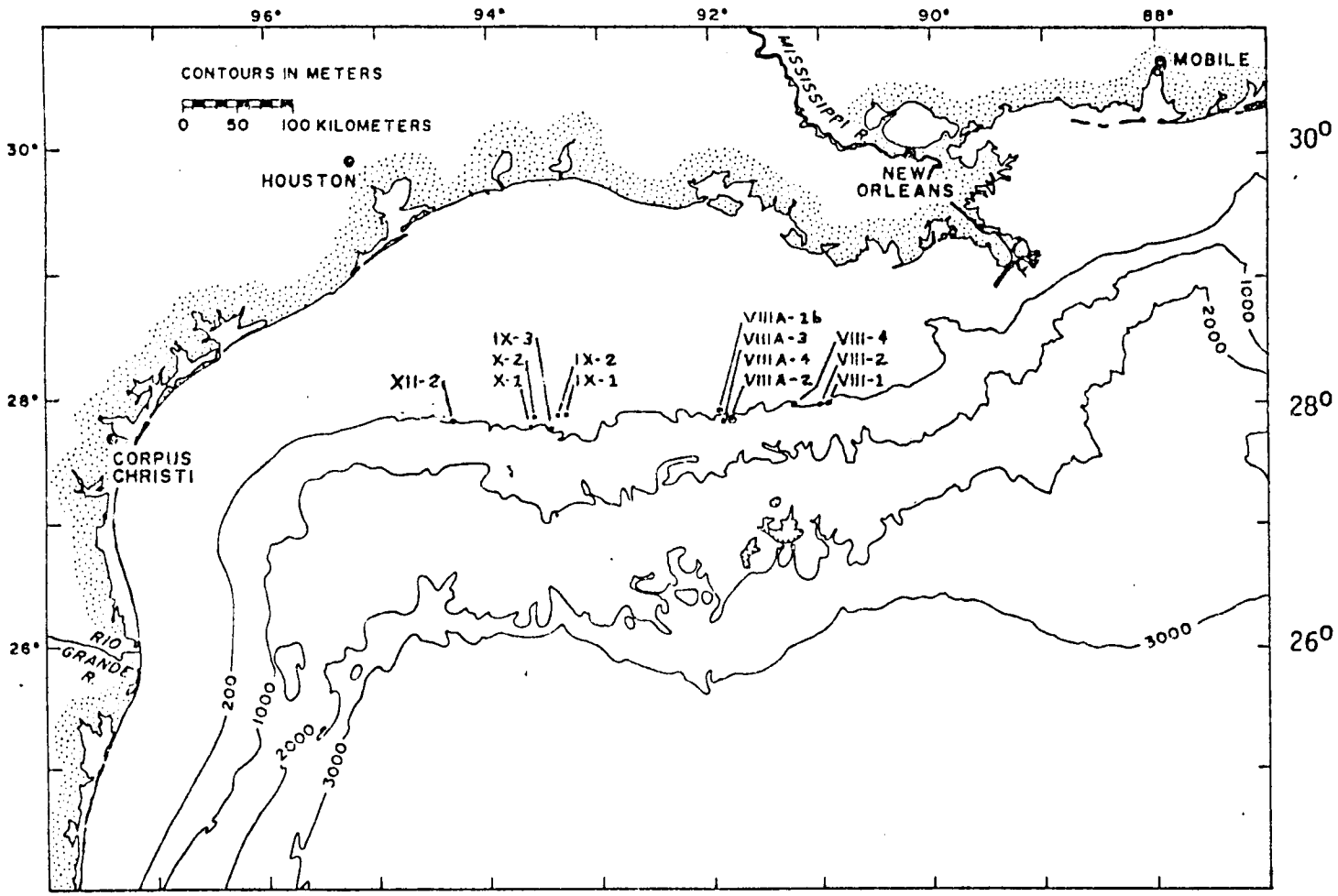

Fig. 1. Map of study area and sample stations.

outer continental shelf has been discussed by Shepard (1937), Carsey (1950), and Rezak and Edwards (1972). Rezak and Edwards (1972) stated that "over 40 nonemergent coral-algal reefs are growing on pre-existing highs along the outer portion of the shelf" in the northwestern Gulf of Mexico.

The geological origin of shelf-edge banks has been discussed by various investigators (Shepard, 1937; Carsey, 1950; Stetson, 1953; Geodicke, 1955; Ludwick and Walton, 1957; Curray, 1960; Edwards, 1971). Shepard (1937) suggested that some of the shelf-edged banks represent the surface expression of salt domes. Carsey (1950) also speculated that the topographic domes on the continental shelf may be underlain by salt plugs because of the great number of salt domes in the Louisiana-Texas land area. Geodicke (1955) concluded that the pinnacles are mainly due to tectonic activity and partially due to differential erosion. Ludwick and Walton (1957) suggested that the pinnacles were of reef origin, not salt domes, and had formed during a time of lowered sea level and warmer water temperatures when the shoreline was near the present 60m bathymetric contour.

Curray (1960) discussed the origin of shelf-edge banks, assigning them to two categories based on the amount of relief. Banks with more than 6 to 9m relief were believed to be of salt dome origin, modified by erosion during a period when sea level was lower, and by growth of an organic calcareous cap. Those banks with less than 6 to 9m relief were believed to be cemented remnants of lower Holocene or Pleistocene shoreline deposits.

Geophysical profiles taken by the U.S. Geological Survey, Office of Marine Geology, Corpus Christi, Texas, support the fact that the majority of shelf-edge submarine banks in the northern Gulf of Mexico are direct results

of salt uplifts with subsequent growth of an organic calcareous cap and possible modification during lowered sea level. Those on the continental shelf off Texas from Baker Bank south are not associated with salt diapirs.

Biological investigations of outer-shelf and upper-slope submarine banks in the northwestern Gulf of Mexico have been primarily concerned with both living and dead foraminiferal assemblages (Phleger, 1951; Loep, 1965; Ludwick and Walton; 1957; Poag, 1972; Poag and Sweet, 1972; Tresslar and Poag, 1972). Species identification of foraminifera was not included as part of this study because of the overwhelming abundance of other phyla: chiefly molluscs, polychaetes, arthropods, and corals.

Molluscan faunal investigations of submarine banks in the northwestern Gulf of Mexico began in the mid-1950's. Parker and Curray (1956) presented the first compilation of bathymetric and faunal data concerning banks located on the continental shelf in the northwestern Gulf of Mexico. They compiled a histogram of the depth in fathoms to the tops of 130 banks and reported on the fauna of four prominences: Baker Banks, Big Southern Bank, and East and West Flower Garden Banks. From these four banks they recovered 137 species of molluscs, five species of coral, and one species of echinoderm. Parker and Curray (1956) stated that "the faunal evidence on the banks studied intensively suggests that at one time the tops of the banks were in very shallow, almost intertidal water, at a time when the over-all average water temperature was considerably warmer than at present".

Tunnell (1969) studied the distribution and ecology of 169 species of molluscs associated with Seven and One-Half Fathom Reef, 37 of which had not been previously reported as occurring along the Texas coast. Additional information pertaining to Seven and One-Half Fathom Reef has been published by Tunnell (1972, 1973) and Tunnell and Chaney (1970).

Bright, et. al., (1974) comprehensively described the biota of the West Flower Garden Bank, noting a distinct pattern of biotic zonation of benthic communities with respect to depth. The West Flower Garden Bank, coupled with East Flower Garden Bank, represents the most extensively developed reef and hard-bank assemblage on the Texas-Louisiana outer continental shelf. Bright and Rezak (1976) have recently published biological and geological data on the South Texas outer continental shelf banks. The reader is referred to these two publications for a bibliography of additional papers dealing with northwestern Gulf of Mexico submarine banks.

MATERIALS AND METHODS

The R/V H.J.W. FAY served as the primary research vessel and was leased by the U.S. Geological Survey from Tracor Marine Corporation. The R/V FAY, 56m long, was well equipped for marine biological and geological bottom sampling. There were accommodations for a scientific team of 16 persons. Use of the R/V FAY covered a three-month period beginning February 26, 1976, and ending on May 26, 1976. The base ports of operation during the study were New Orleans, Louisiana, and Corpus Christi, Texas.

Navigation was accomplished with systems which integrate Loran C with satellite navigation. These systems provided an accuracy of $\pm$ 60 meters. The navigation system had the capability to plot the ship's track, while underway, by interfacing with a calcomp plotter.

During the data collection phase of the Upper Continental Slope Project, the U.S. Geological Survey obtained sediment samples from 84 locations, bottom photographs at 40 locations, and approximately 22,500 km

of high-resolution seismic profiles.

A seismic survey, using a 1000 Joule sparker and a 3.5 Khz Edo, was performed in each area. The seismic records and real-time plots enabled U.S. Geological Survey geologists to prepare geologic maps on board ship as soon as each seismic grid was completed. Bottom sampling stations were determined immediately afterwards.

A Smith-MacIntyre grab sampler (0.0125 m^3) was employed at each station designated for biological sampling. The grab sample was gently washed into a nylon "saran" bag (0.5 mm mesh). Mud and clay sediments were generally removed in the washing process to facilitate the withdrawal of organisms from the remaining course substrate.

The sample (bag and sample) was placed in a 0.15% solution of propylene phenoxetol and sea water for narcotization (McKay and Hartzband, 1970). After 15 minutes the sample was placed in a 10% buffered formalin solution. Twenty-four hours later, the sample was removed from the formalin and placed into a glass jar containing a 45% isopropyl alcohol solution and rose bengal employed as a staining agent for live organisms. Labels were put inside each bag, and each jar, and the outside of the jar was properly labeled. In the event large fragments of "reef rock" were obtained, 7.6 liter plastic buckets with lids were used to store the sample. Significant remarks about the sample were entered into the bio-log book. Upon completion of the cruise, the biological samples were transferred from the ship to the laboratory.

Sediment samples from 13 shelf-edge submarine banks were analyzed and interpreted in order to describe faunal assemblages. Each entire

sample was washed for removal of fine sediments and then picked for live organisms representing assemblages of corals, polychaetous annelids, molluscs, and crustaceans. A 1000 ml subsample, determined by water displacement, was picked for macromollusc shells (greater than 7mm). A subsequent 50 ml subsample was picked for micromollusc shells (less than 7 mm). Following the initial picking and sorting, final (species) sorting and identifications were completed. All doubtful identifications were submitted to qualified authorities for verification.

The zoogeographic affinity of each species of mollusc was determined by examing the distribution records available in the current literature. The principal works used to establish species distribution were Abbot (1974) and Andrews (1977).

Bottom photographs at each station were obtained by using a Benthos underwater camera and strobe. The negatives were developed on board the vessel. Positive prints were made with an Omega enlarger in the laboratory. Close examination of the positive prints yielded additional information concerning indigenous benthic organisms, substrate type, and topographic features.

The collected fauna of these banks were compared to faunal data available on banks previously studied on the Texas-Louisiana continental shelves; similarities and differences were noted. The principal previous publications employed in this capacity were Parker and Curray (1956), Bright, et. al. (1974), and Abbott and Bright (1975).

ACKNOWLEDGEMENTS

We would like to graciously acknowledge Dr. Louis Garrison, Geologist-in-charge of the U.S. Geological Survey marine geology office at Corpus Christi, Texas, and Project Officer for this grant, for his assistance in making various charts, maps, and other information available. Also, we thank Mr. Henry Berryhill of the same office for his guidance and consultation.

We acknowledge also the specialists of certain taxonomic groups who aided in verifying certain difficult species: H.W. Harry, Texas A&M University; D.R. Moore, University of Miami; R. Robertson, Academy of Natural Sciences, Philadelphia; and F.M. Bayer, H.A. Rehder, T.R. Waller, and Anders Warén (visiting), all of the National Museum of Natural History. All verifications were not received by the time of the writing of this manuscript, and the authors, therefore, take full responsibility for any discrepancies. Nevertheless, we do graciously thank these gentlemen for their time and efforts.

The funds for the study were provided by the Bureau of Land Management through the U.S. Geological Survey office at Corpus Christi.

RESULTS AND DISCUSSION

Data analysis revealed a wealth of biological information concerning the present fauna inhabiting the shelf-edge submarine banks in the northwestern Gulf of Mexico, as well as general geological information about the banks.

Composition and Morphology of Banks

Thirteen shelf-edge submarine bank samples were analyzed for this project. Table 1 gives the location and depth of each station and the maximum relief of each bank. It also includes a figure reference

TABLE 1. Station location, depth, and relief of shelf-edge submerged banks

Station	Location	Figure	Station Depth (meters)	Maximum Relief (meters)
VIII-1	28°00.6'N, 90° 57.6'W	2	128	11
VIII-2	27°59.3'N, 91° 04.9'W	3	137	21
VIII-4	28°00.5'N, 91° 14.3'W	4	130	17
VIII A-1b	27°57.1'N, 91° 57.6'W	5	99	34
VIII A-2	27°52.4'N, 91° 50.9'W	6	175	56
VIII A-3	27°49.5'N, 91°53.8'W	7	114	373
VIII A-4	27°49.9'N, 91° 52.2'W	8	244	
IX-1	27°54.5'N, 93° 18.0'W	9	61	62
IX-2	27°53.2'N, 93° 23.9'W	10	99	14
IX-3	27°47.6'N, 93° 26.9'W	11	79	91
X-1	27°49.1'N, 93° 39.5'W	12	114	32
X-2	27°53.7'N, 93° 37.7'W	13	104	12
XII-2	27°50.8'N, 94° 20.6'W	14	143	82

(Figures 2-14) indicating a seismic record and the morphology of each bank.

A general description of the seived substrate at each station is presented in Table 2 along with data on the size of each sample and the amount of sediment examined for biota.

Most of the banks had a fairly large amount of coarse sediment, except stations VIII-1 and VIII-2. Station VIII-2 did contain several large rocks, however. The samples from several stations were made up of quantities of dead coralline algal rubble, and Station IX-1, the shallowest station, was completely composed of live coralline algal nodules. Station IX-1 was very similar biologically and geologically to the biostromal bank described by Bright, et. al. (1974) and Abbott and Bright (1975).

Three other banks had a notably different composition from most of the others: Station IX-3, which was composed of a fluvial-type coarse sand and gravel; Station XII-2, which had several moderate to small-sized, iron-like rocks; and, Station XII-3, which contained some small sandstone rocks.

Analysis of Bank Photographs

The photographs taken with the Benthos underwater camera and strobe served two purposes. First, the photos provided insight into some of the geologic and biologic features of the banks which could not be determined simply by use of the Smith-MacIntyre grab sampler, and secondly, they reinforced or confirmed the general observations of the substrate which were made in the laboratory (Table 2). One roll of film was taken for each bank.

Six of the rolls of film were good to excellent and produced a

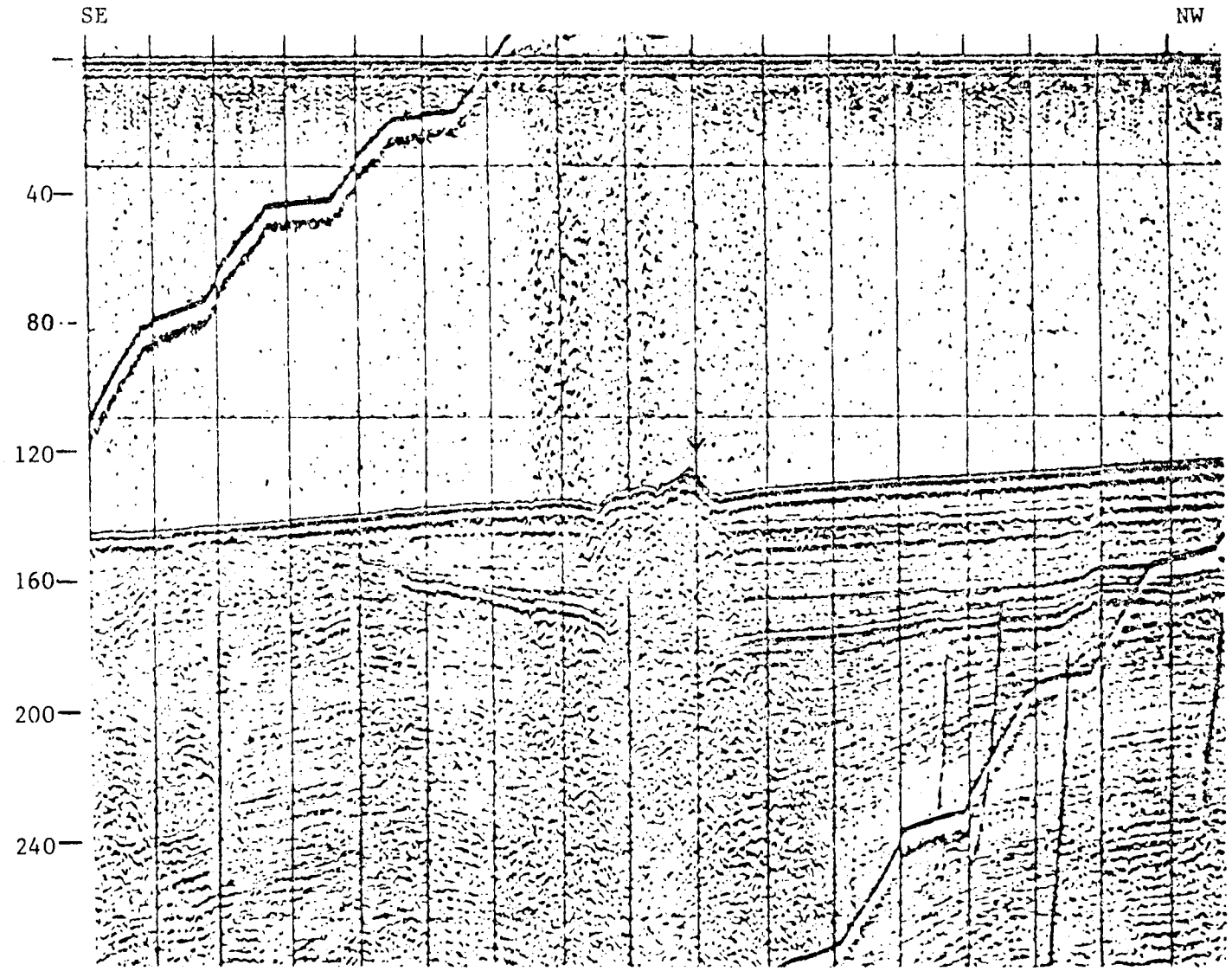

Fig. 2. Bank morphology at Station VII-1. 1,000 joule sparker profile. (Arrow indicates sample location)

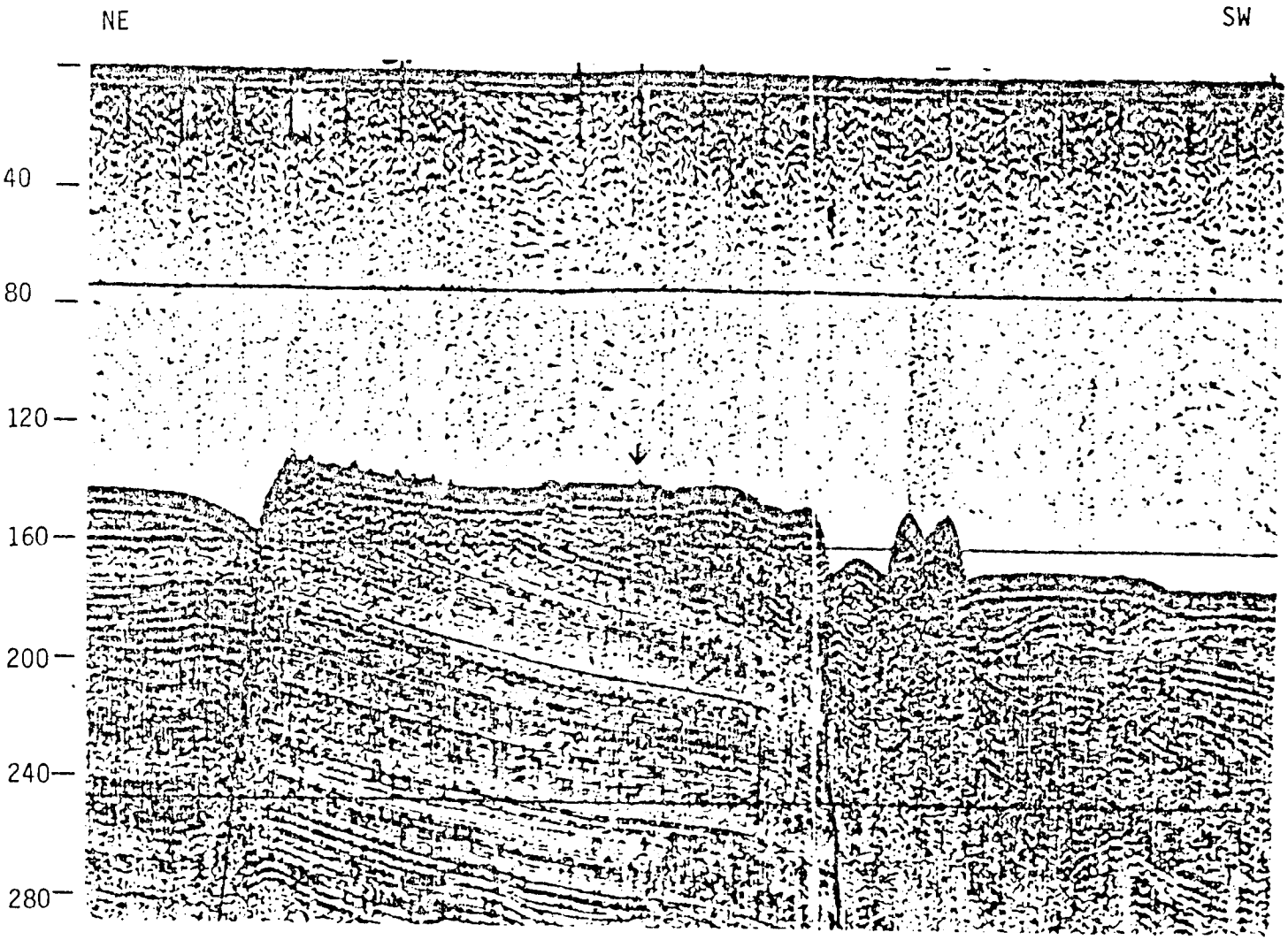

Fig. 3. Bank morphology at Station VIII-2. 1,000 joule sparker profile. (Arrow indicates sample location)

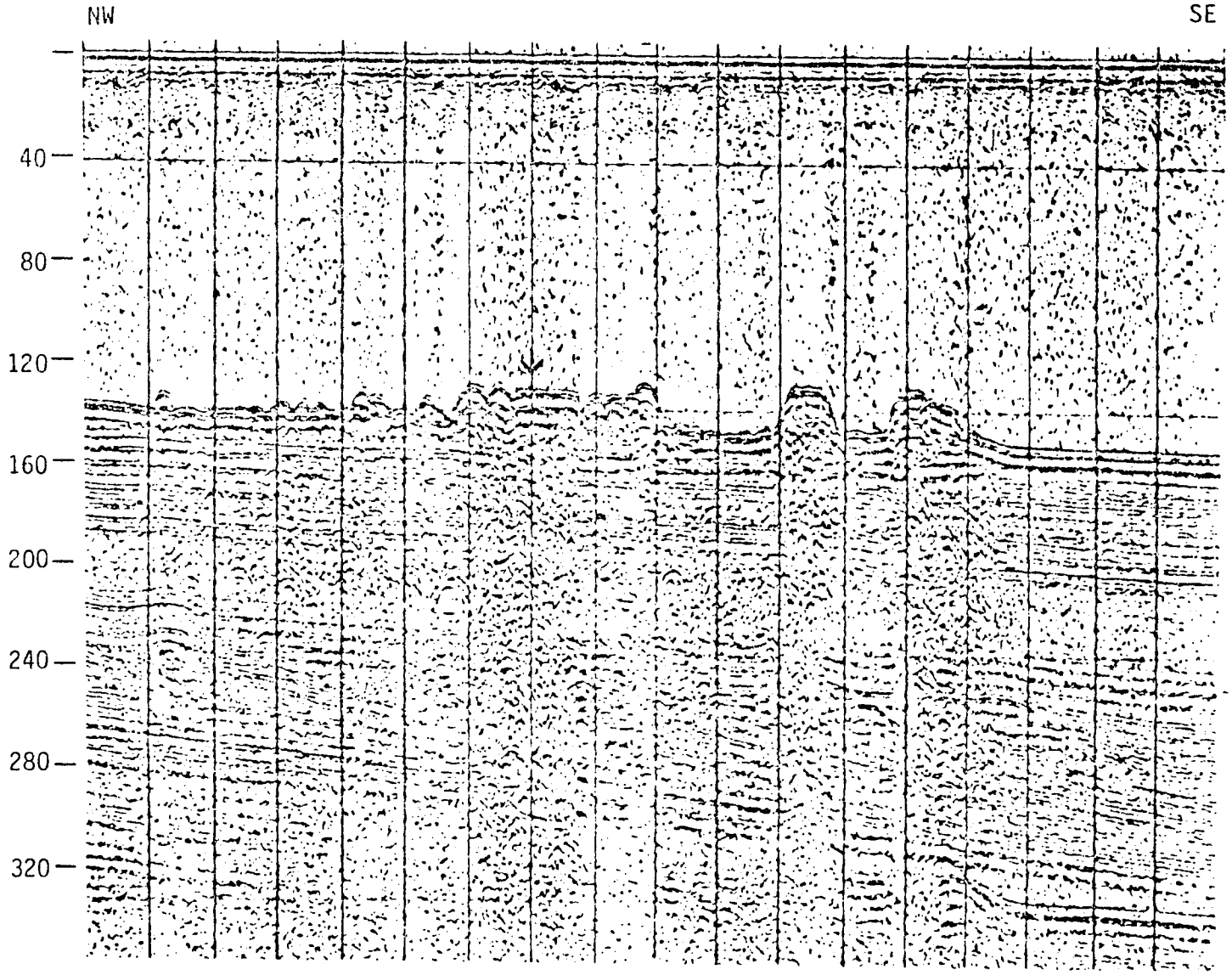

Fig. 4. Bank morphology at Station VIII-4. 1,000 joule sparker profile. (Arrow indicates sample location)

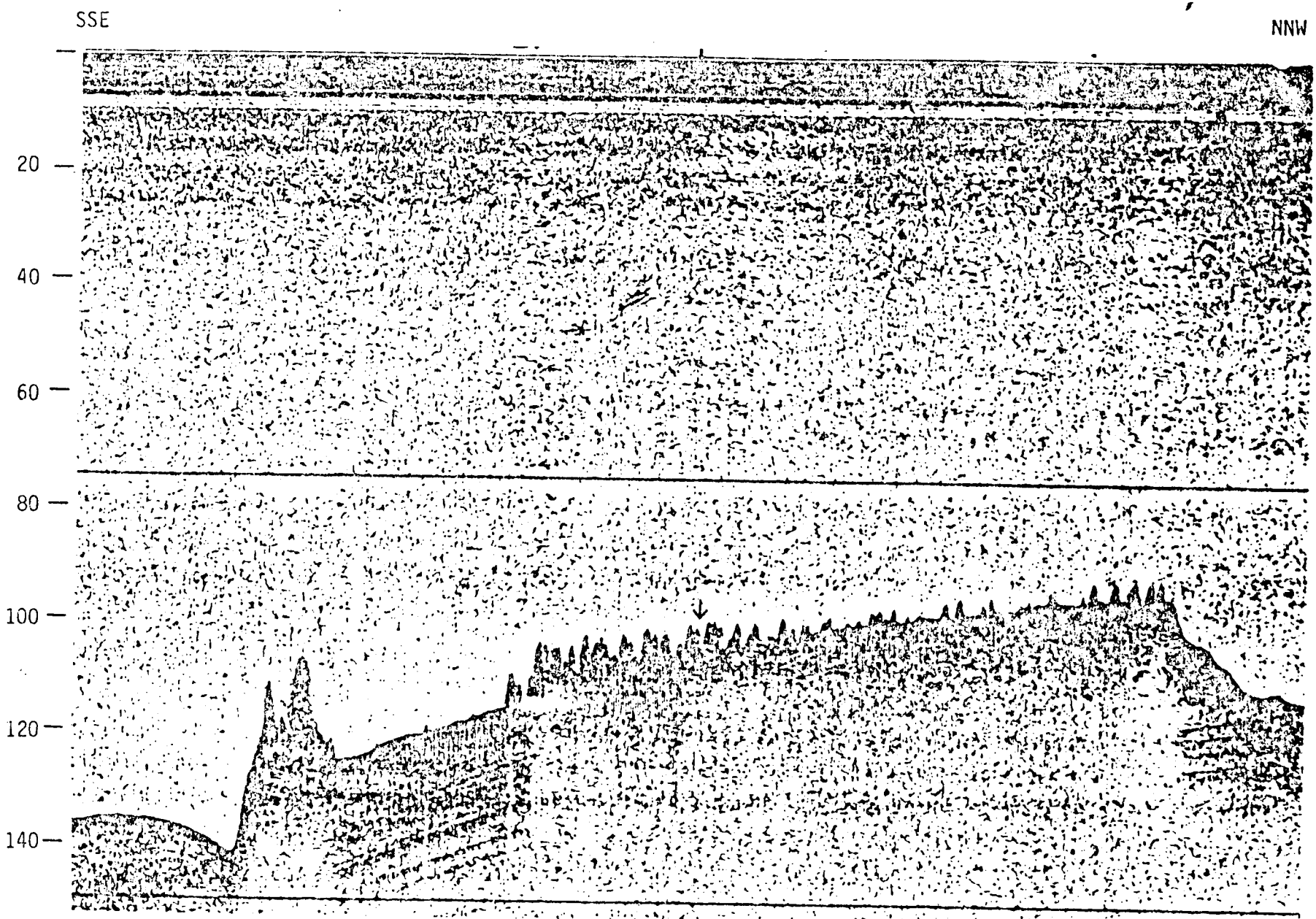

Fig. 5. Bank morphology at Station VIII-A-1b. 3.5 kHz profile.
(Arrow indicates sample location)

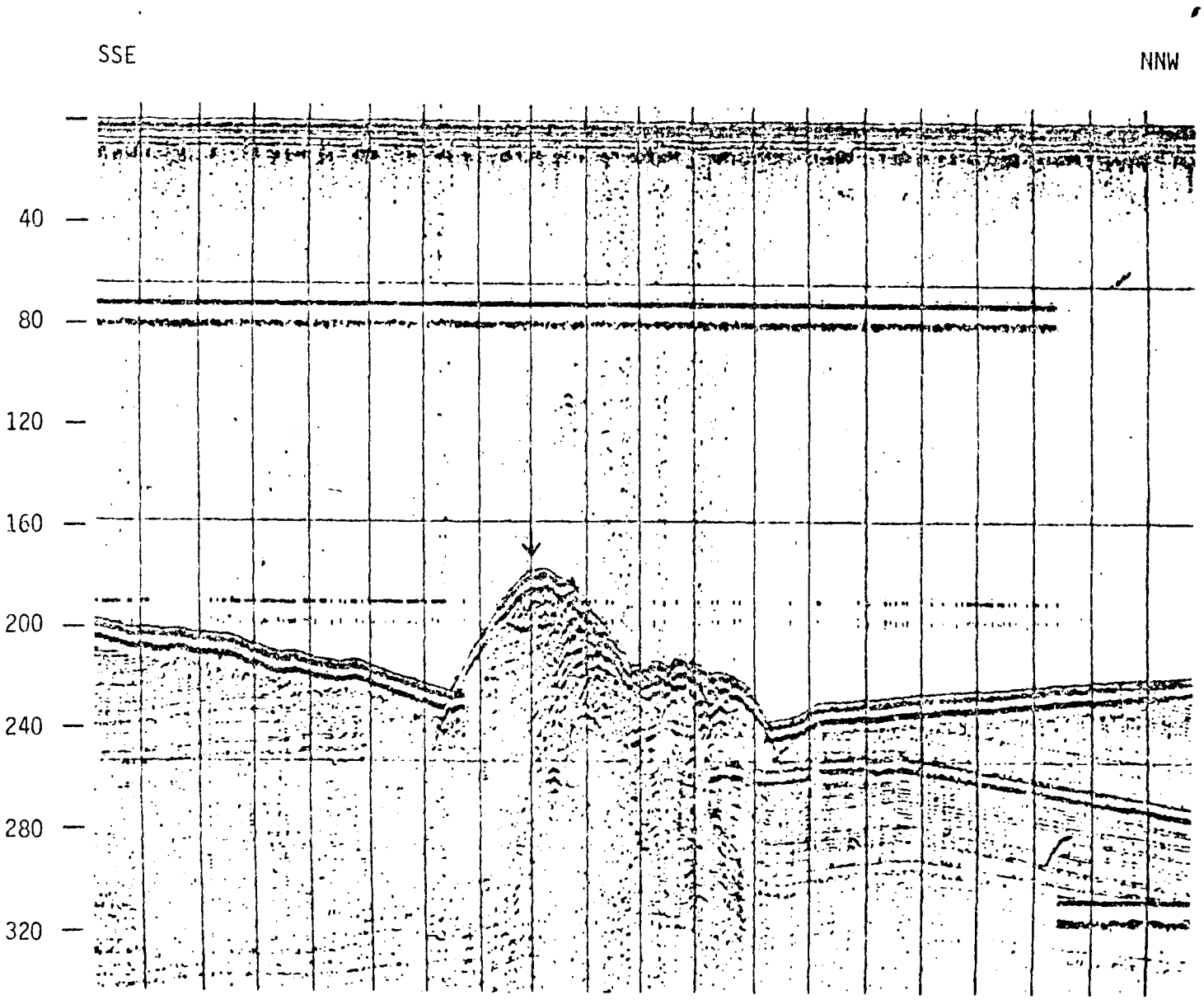

Fig. 6. Bank morphology at Station VIII-A-2. 1,000 joule sparker profile. (Arrow indicates sample location)

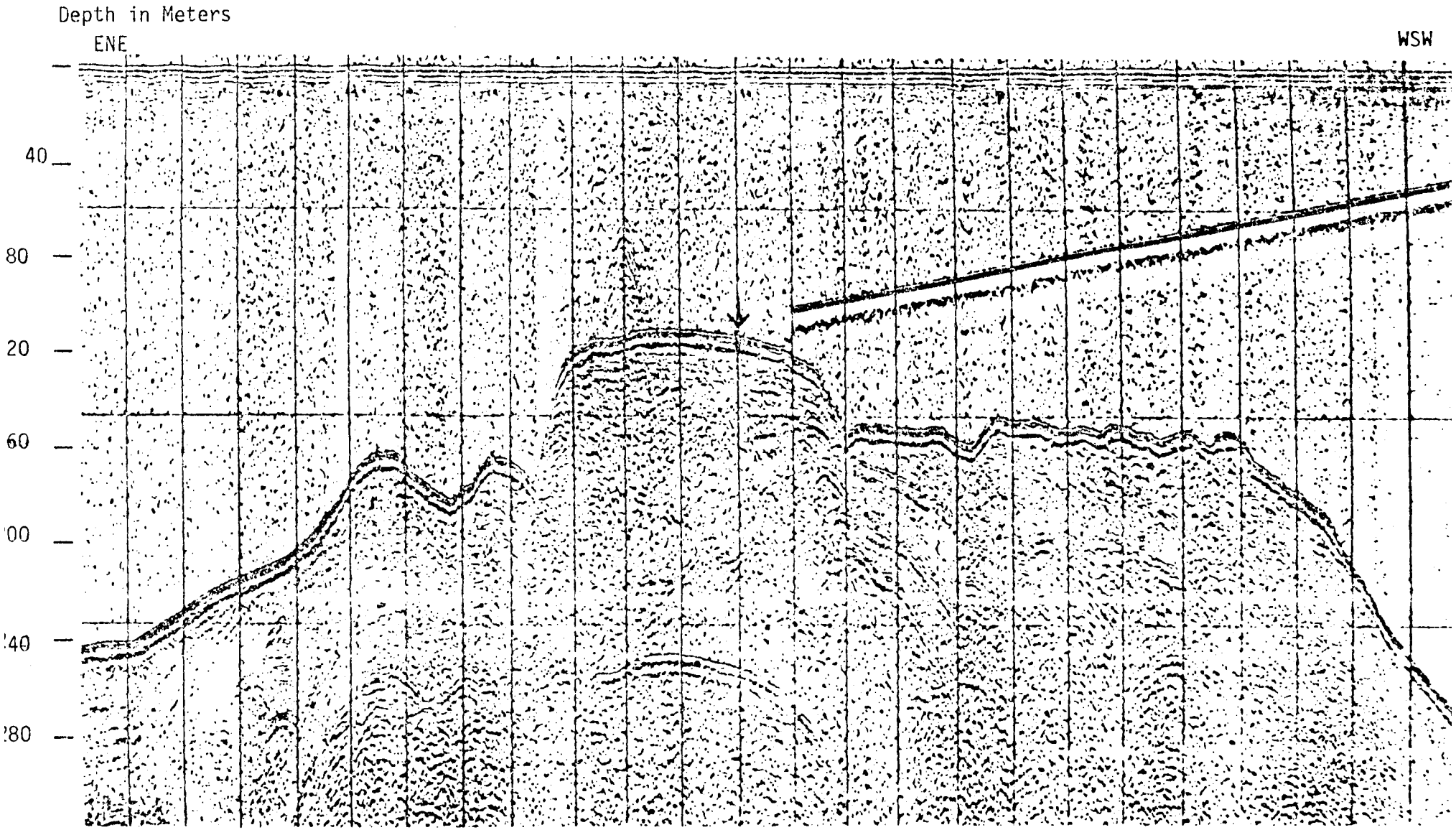

Fig. 7. Bank morphology at Station VII A-3. 1,000 joule sparker profile.
(Arrow indicates sample location)

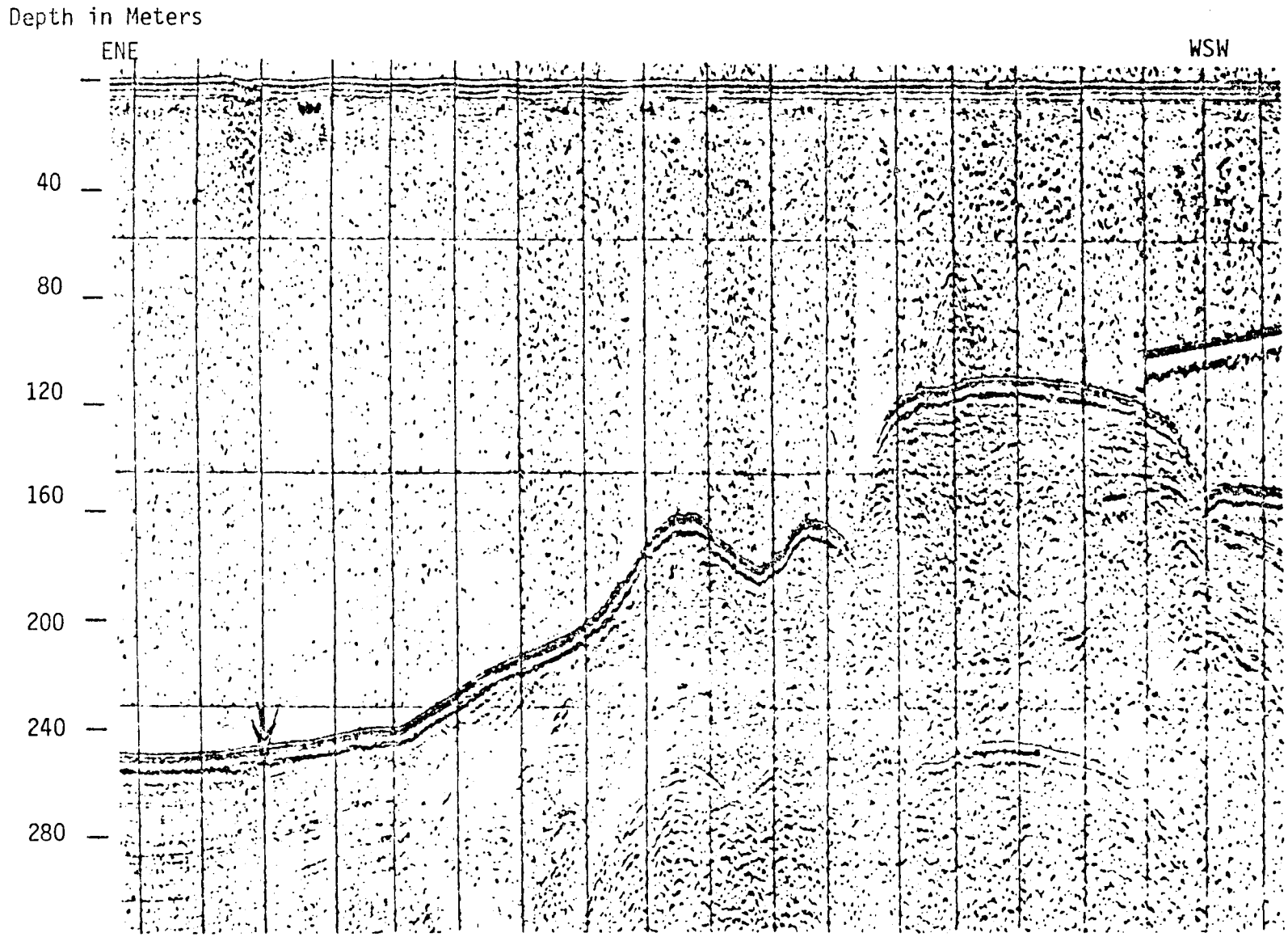

Fig. 8. Bank morphology at Station VIII A-4. 1,000 joule sparker profile. (Arrow indicates sample location)

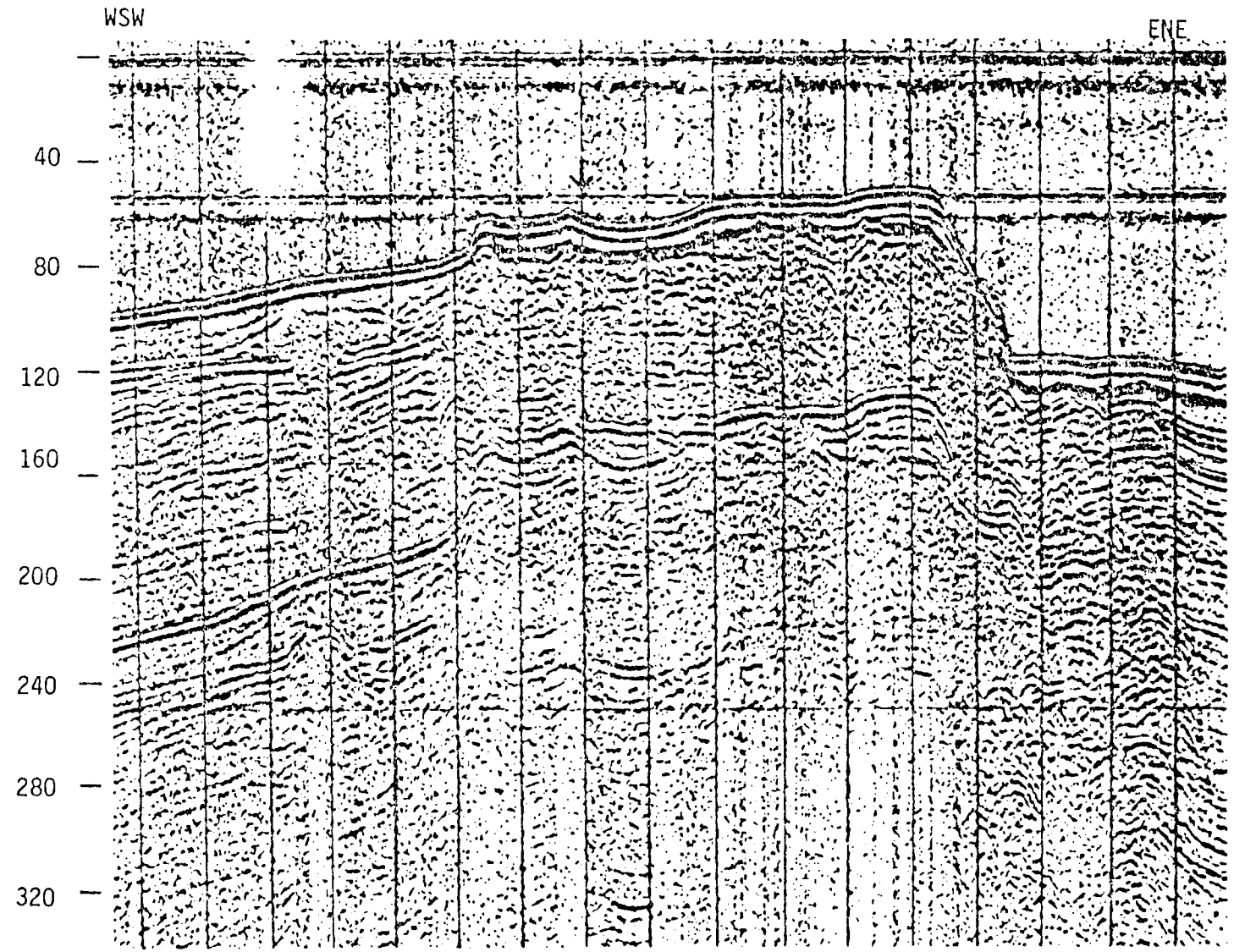

Fig. 9. Bank morphology at Station IX-1. 1,000 joule sparker profile. (Arrow indicates sample location)

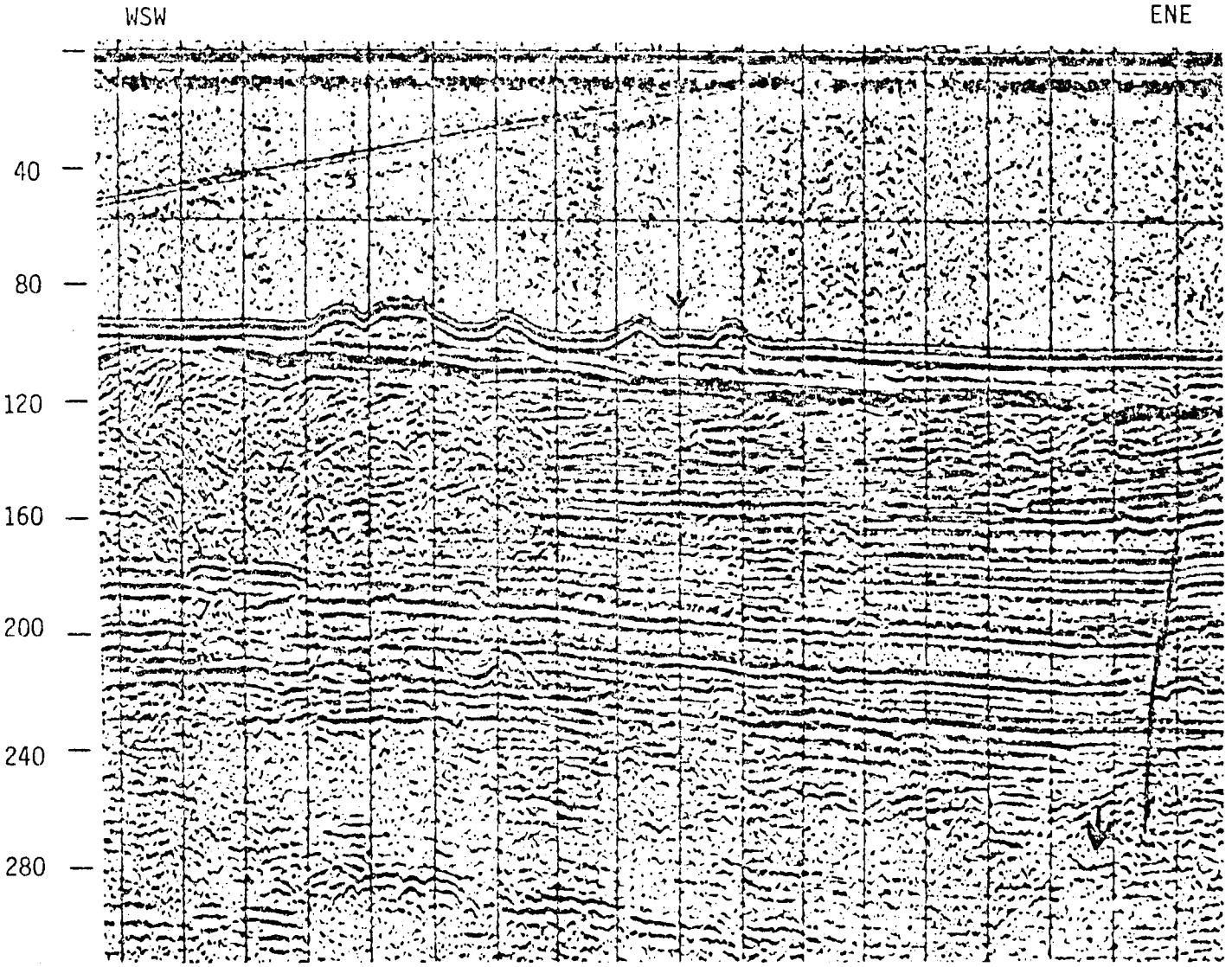

Fig. 10. Bank morphology at Station IX-2. 1,000 joule sparker profile. (Arrow indicates sample location)

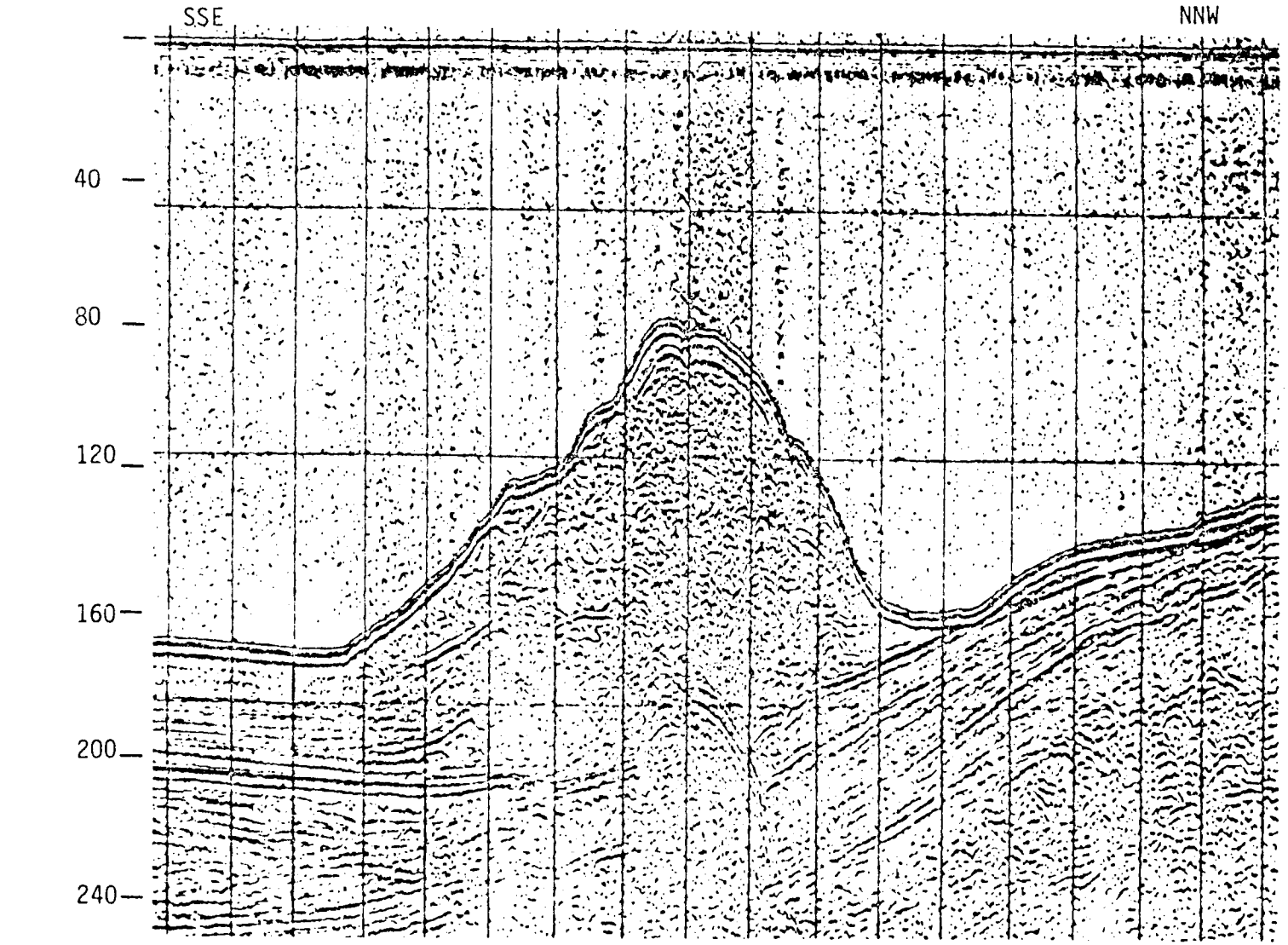

Fig. 11. Bank morphology at Station IX-3. 1,000 joule sparker profile. (Arrow indicates sample location)

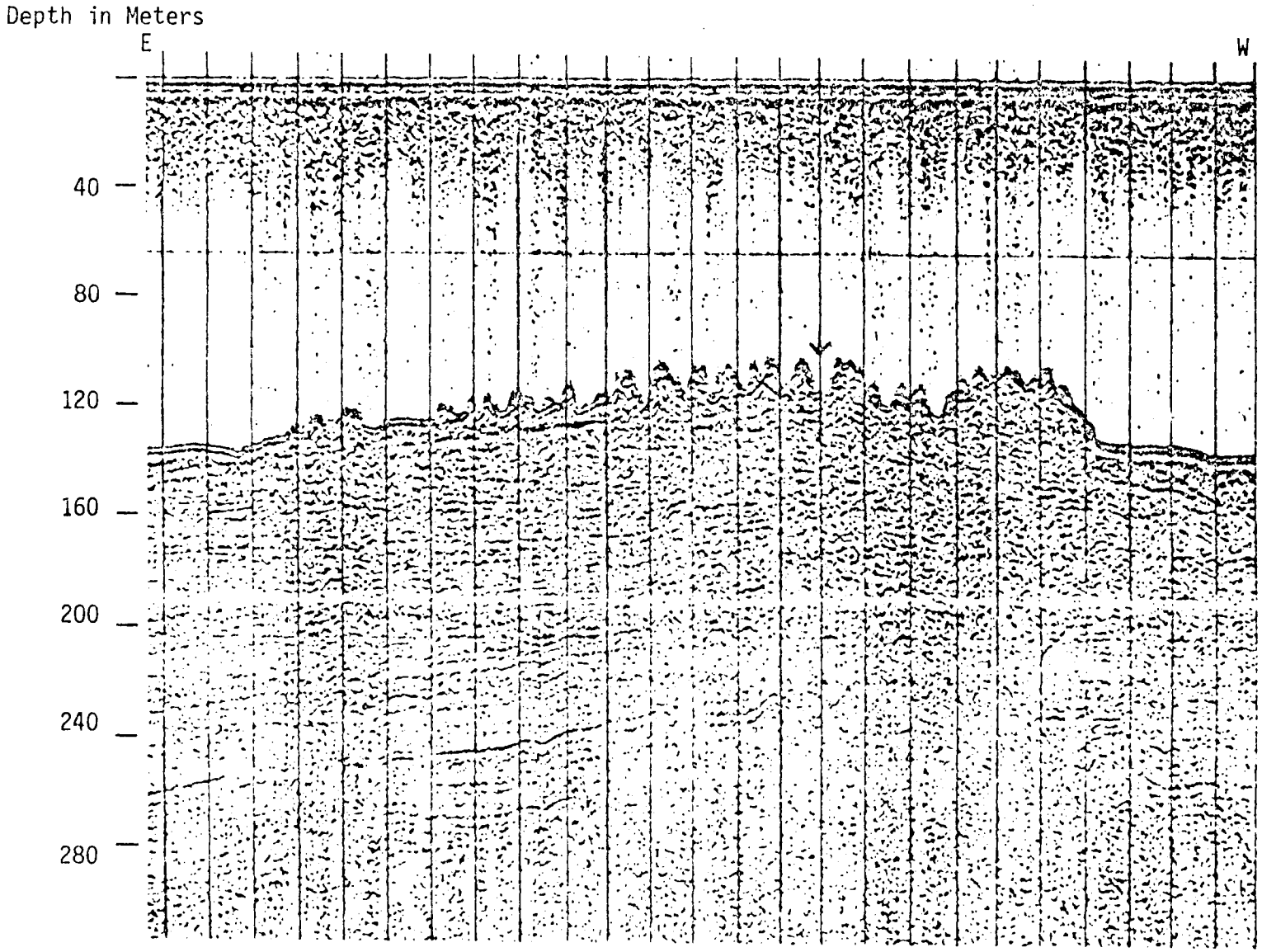

Fig. 12. Bank morphology at Station X-1. 1,000 joule sparker profile. (Arrow indicates sample location)

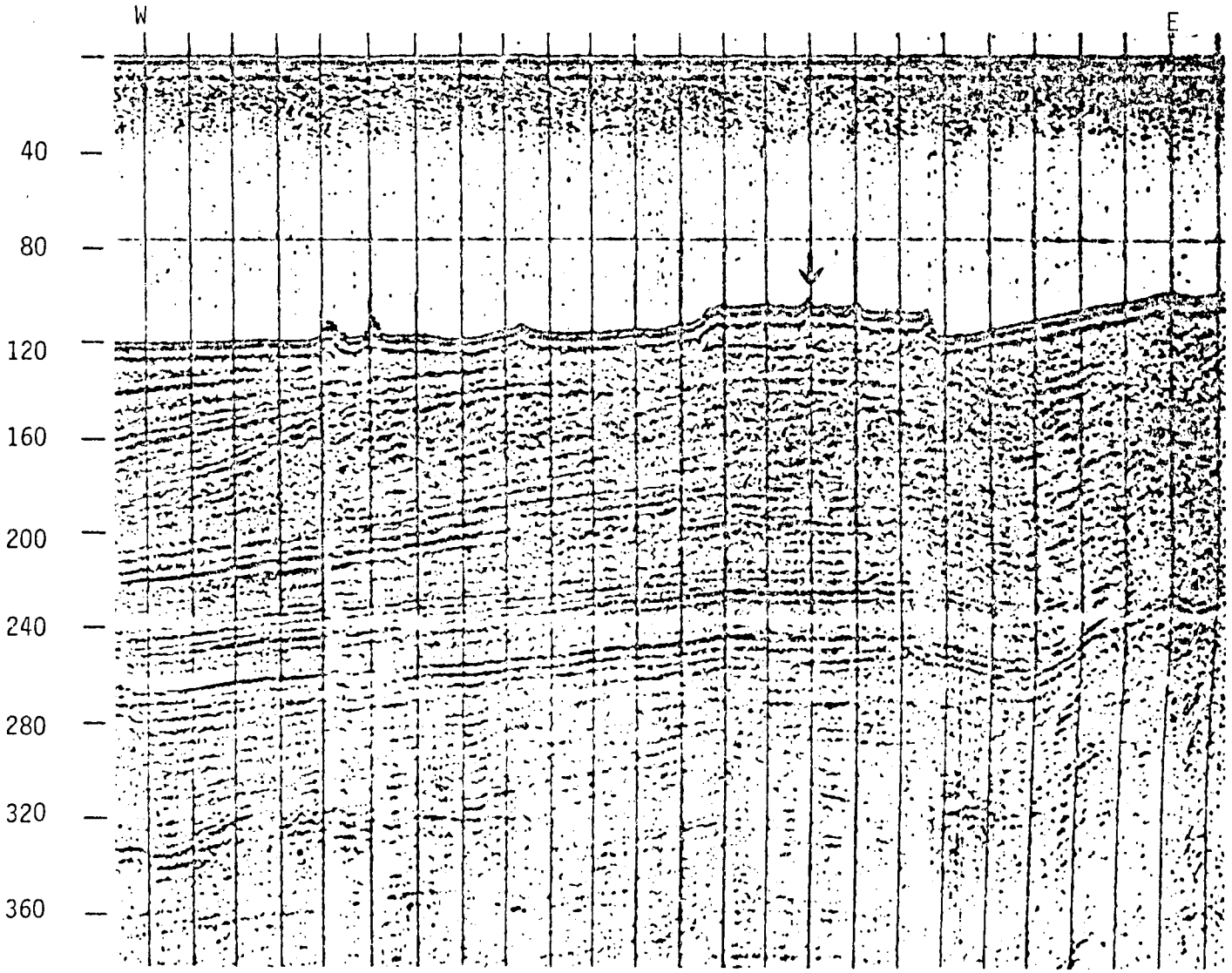

Fig. 13. Bank morphology at Station X-2. 1,000 joule sparker profile. (Arrow indicates sample location)

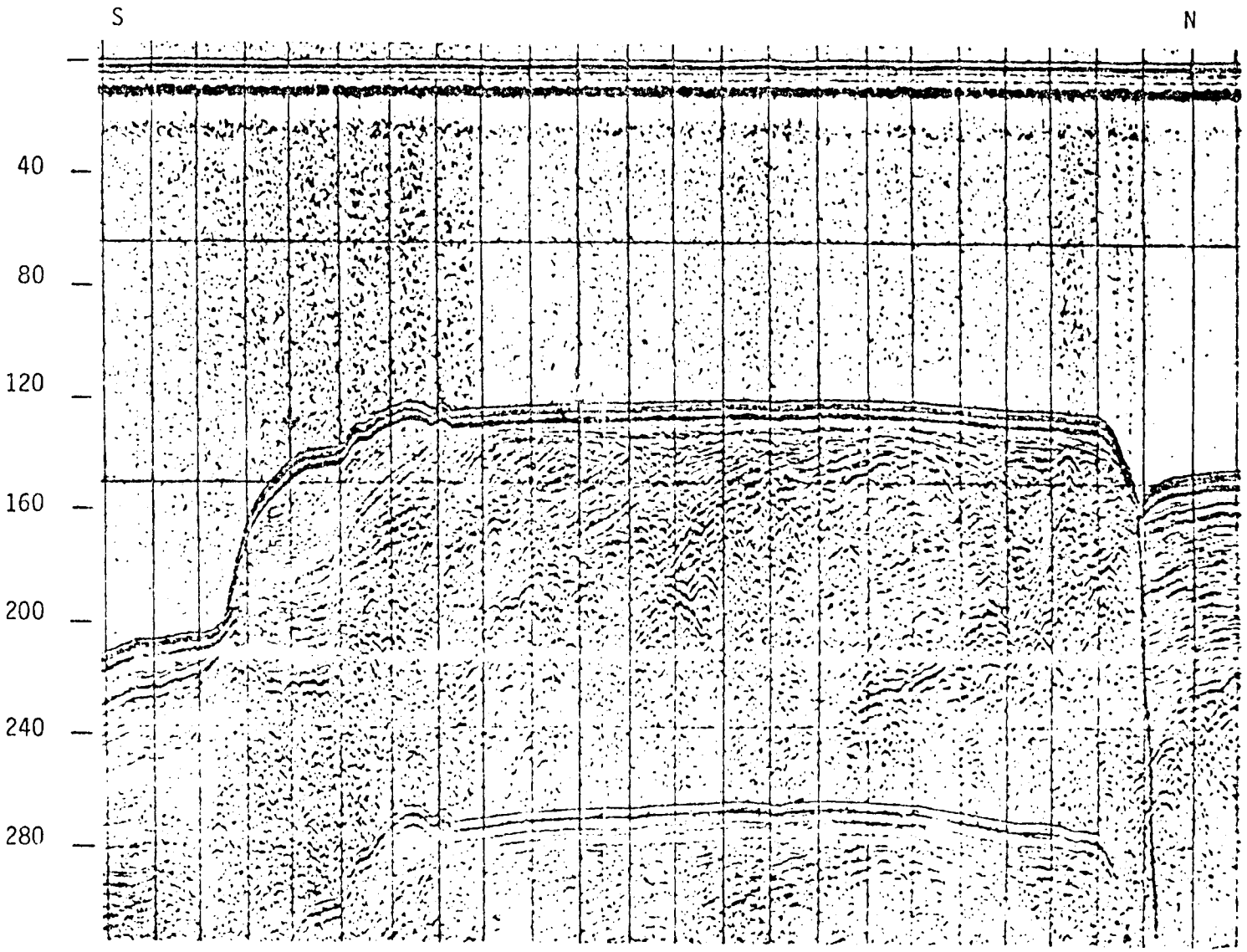

Fig. 14. Bank morphology at Station XII-2. 1,000 joule sparker profile. (Arrow indicates sample location)

TABLE 2. Substrate description and volume of sediment examined for benthic fauna

Station	Total volume of seived substrate (ml)	Volume examined for: Live organisms (ml)	micro-molluscs (ml)	macro-molluscs (ml)	Substrate description
VIII-1	85	85	85	85	Chiefly composed of very fine shell fragments; lesser amounts of foraminifera, broken echinoid tests, and coarse sand.
VIII-2	95	95	95	95	Fine shell hash with numerous bryozoan branches; some foraminifera; few alcyonarian spicules; small amount of coarse sand, and 2 large rocks.
VIII-4	870	870	63	630	Principally consisted of dead coralline algal rubble and several large "coral" rocks; a moderate amount of coarse sediment composed of algal fragments, shell fragments, and foraminifera tests.
VIIIA-1b	2425	2425	50	2425	Dead coralline algal fragments; a moderate amount of shell hash; some foraminifera; few alcyonarian spicules.
VIIIA-2	1800	1800	50	1800	Approximately 1/2 dead coralline algal nodules and encrusted coral branches; 1/2 coarse sediment consisting of algal and shell fragments, foraminifera, echinoid spines, and alcyonarian spicules.
VIIIA-3	2590	2590	50	1000	About 1/4 coralline algal nodules; 3/4 coarse sediment composed primarily of algal fragments and Amphistegina tests.
VIIIA-4	900	900	50	1000	Predominately foraminifera tests and very fine shell fragments.
IX-1	2245	2245	0	2245	Live coralline algal nodules and rubble; a lesser amount of coarse calcareous sand composed of algal fragments and Amphistegina tests.
IX-2	1580	1580	50	1000	Approximately 2/3 coarse sediment consisting of algal fragments, shell fragments, foraminifera, and alcyonarian spicules; 1/3 dead coralline algal nodules and encrusted coral branches
IX-3	620	620	50	620	Composed of coarse fluvial sand and small gravel; some shell fragments.
X-1	2850	2850	50	1000	Coarse sediment chiefly composed of coralline algal fragments; a moderate amount of large and small shell fragments; few foraminifera tests and alcyonarian spicules.
X-2	2955	2955	50	1000	Principally consisted of coralline algal fragments; lesser amounts of shell fragments, foraminifera tests, and alcyonarian spicules.
XII-2	540	540	50	470	Coarse sediment composed mainly of shell fragments with some foraminifera tests and alcyonarian spicules; several small "iron-like" rocks and fragments.

considerable amount of information on the substrate and topography of the banks. Five rolls were poor, because of murky water or poor developing, but did reveal some information about the bottom type. Two rolls of film did not turn out.

Station VIII-1. Part of the photographic series revealed soft substrate with crater-like burrows. Another part of the series indicated that there was some relief in the area. In the areas of relief, there was apparently a thin veneer of sediment overlying hard substrate, as indicated by living alcyonarians protruding through the sediment. A turrid (Polystira sp.) was observed on the bottom in one frame.

Station VIII-2. The bottom at this station was very rough. Small rocky areas protruded through a thin veneer of coarse sediment. Exposed rocky areas were very heavily encrusted with several species of hydroids and what appeared to be bryozoans. Also observable were two colonies of one species of hydroid, both of which had an ophiuroid lying in their branches, a few alcyonarians and antipatharians, solitary small white anemones protruding through the sediment, and what appeared to be the egg cases of a large gastropod.

Station VIII-4. None of the photographs of this location were good enough for analysis. The water was apparently very murky and consequently, visibility was greatly impaired. One frame very indistinctly revealed a rough bottom.

Station VIII A-1b. No Photos.

Station VIII A-2. Soft, coarse sediments apparently overlying hard substrate. Several species of alcyonarians were observable in each

frame. One frame revealed 3 crinoids and a small branching scleractinian coral, possibly Madracis sp.

Station VIII A-3. The photographs from this station were overexposed but vaguely revealed that the bottom there was composed of a very coarse sediment and rubble.

Station A-4. No Photos.

Station IX-1. The negatives at this location were damaged by the developer. However, the entire bottom was covered with coralline algal nodules. Other fauna could not be verified, but it appeared that there might have been some fleshy algae, some Madracis sp., and one softball-sized black sponge.

Station IX-2. All photographs at this locality were poor. The clear frame revealed that the bottom was apparently composed of coarse sediment and rubble.

Station IX-3. Most photographs at this location were good. The bottom was composed of coarse sediment and rubble in most of the frames. Most frames showed hydroids and alcyonarians protruding through the sediment, and a few frames showed the branching coral Madracis sp.

Station X-1. There were many good photographs from this locality. The bottom was composed of coarse sediment. Numerous crater-like burrows were seen in several frames. There was no other sign of life.

Station X-2. The photographs were good at this station. A uniform, coarse sediment covered the bottom. One antipitharian was observed in one frame; otherwise no sign of life was noted.

Station XII-2. Visibility was very poor at this station and consequently none of the photographs were good enough to see the bottom.

Fauna of the Banks

A total of 411 species of organisms representing 4 major groups were identified from the submarine bank samples: 7 corals, 102 polychaetes, 265 molluscs, and 37 arthropods. Table 3 is a systematic list of all the species collected, and Appendix Tables 1-4 give the numbers of individuals and species at each station.

Table 4 shows the numbers of species and individuals at each station within each group of organisms. Since the type of bottom varied so greatly between banks (Table 2) and because the volumes of sample seived and analyzed were considerably different, direct comparisons of the numbers of species and individuals between banks was not possible. However, the figures do indicate the relative diversity and approximate population levels on each bank.

Molluscs

Overall the molluscs were the most diverse group of organisms collected on the banks; however, only 29 species of the 265 identified were collected alive. Many more of the species were more than likely also living on the banks as indicated by the freshness of many shells and the large number of individuals of certain species.

Of the 265 species and 88 families collected, there were 175 gastropods, 84 bivalves, 4 chitons, and 2(or possibly 3) scaphopods. One hundred and seventy-five of the species were micromolluscs.

The gastropod families having the most species represented on the banks were Turridae with 22 species; Pyramidellidae with 20; Vitrinellidae, Cerithiidae, and Cuvieridae (planktonic) with 9; and Fissurellidae with 8. The most common bivalve families were Arcidae with 9 species, Veneridae with 7.

TABLE 3. Systematic list of species collected on shelf-edge submarine banks

Phylum Cnidaria	
Class Anthozoa	
Order Scleractinia	
Family Seriatoporidae	
Madracis mirabilis (Duschassaing and Michelotti, 1861)	A[#]
M. asperula Milne-Edwards and Haime, 1850	D
M. spp. (possibly several spp; worn, could not be differentiated)	D
Family Oculinidae	
?Schlerhelia formosa (Alcock,	D
Family Caryophyllidae	
Desmophyllum sp.	D
caryophyllid A	A
caryophyllid B	A
Phylum Annelida	
Class Polychaeta	
Order Phyllodocida	
Family Phyllodicidae	
Anaitides madeirensis (Langerhans, 1880)	
Family Polynoidae	
Harmothoe gilchristi Day, 1960	
H. sp. *	
polynoid B*	
polynoid C*	
Family Sigalionidae	
Euleanira sp.	
Pholoe sp.	
Psammolyce sp.	
Sthenelais boa (Johnston, 1839)	
S. sp. *	
Sthenolepis sp. A	
S. sp. B	
Family Chrysopetalidae	
Bhawania goodei Webster, 1884	
Paleonotus heteroseta Hartman, 1945	
chrysopetalid A	
Family Nephtyidae	
Aglaophamus sp.	
nephtyid A *	
Family Syllidae	
Exogone sp. A	
E. sp. B	
E. sp. C	

[#] A = alive, D = dead (skeleton only)

* Partial specimens, no further identification possible.

Odontosyllis enopla Verrill, 1900
Sphaerosyllis cf. fortuita Webster, 1879
S. sp.
Syllis cf. cornuta Rathke, 1843
S. hyalina Grube, 1863
S. spongicola Grube, 1855
S. sp. A
S. sp. B
S. sp. C
Family Hesionidae
Gyptis cf. vittata Webster and Benedict, 1887 (juvenile)
Kefersteinia sp.
Podarke obscura Verrill, 1873
P. sp.
hesionid A *
Family Pilargidae
Synelmis albini (Langerhans, 1881)
Family Nereidae
Ceratonereis sp.
Order Capitellida
Family Capitellidae
Notomastus hemipodus Hartman 1947
N. latericeus Sars 1851
capitellid A*
Family Maldanidae
maldanid A*
maldanid B*
Family Opheliidae
Polyophthalmus pinetus (Dujardin, 1839)
opheliid A
Order Spionida
Family Spionidae
Malacoceros sp. *
Paraprionospio pinnata (Ehlers, 1901)
Prionospio cirrifera Wiren 1883
P. cf. cirrobranchiata * Day 1961
spionid A *
spionid B *
spionid C *
Family Trochochaetidae
trochochaetid A *
trochochaetid B *
Family Paraonidae
Aricidea suecica Hartman, 1957
Paraonis gracilis (Tauber, 1879)
paraonid A *
Family Chaetopteridae
chaetopterid *
Order Eunicida
Family Onuphidae
Onuphis peruana Hartman, 1944

O. sp. A
O. sp. B (juvenile)
Rhamphobrachium agassizi Ehlers, 1887
Family Eunicidae
Eunice cf. antennata * (Monro, 1928)
E. longicirrata Webster, 1884
E. mutilata Webster, 1884
E. sp.
Lysidice sp.
Marphysa cf. aransensis *
Nematonereis cf. unicernis Schmarda, 1861
Palola siciliensis (Grube, 1840)
eunicid A *
Family Lumbrineridae
Lumbrineris cf. crassicephala Hartman, 1965
L. sp.
Family Arabellidae
Arabella iricolor (Montagu, 1804)
Family Dorvilleidae
Dorvillea sociabilis (Webster, 1879)
Schistomeringas rudolphi (delle Chiaje, 1828)
dorvelleid A
Order Amphinomida
Family Amphinomidae
Chloeia viridis Schmarda, 1861
Paramphinome jeffreysii (McIntosh, 1872)
Order Magelonida
Family Magelonidae
Magelona cf. filiformis Wilson, 1959
M. pettiboneae Jones 1963
M. sp.
Order Cirratulida
Family Cirratulidae
Dodecaceria sp.
cirratulid A
cirratulid B
cirratulid C
Family Cossuridae
Cossura longocirrata Webster and Benedict, 1887
Order Oweniida
Family Oweniidae
oweniid A
Order Terebellida
Family Ampharetidae
?Samythella sp.
ampharetid A *
Family Terebellidae
terebellid A *
terebellid B *
terebellid D *
terebellid E *
terebellid F *

Order Sabellida	
Family Sabellidae	
Potamilla reniformis (Leuckart, 1849)	
sabellid A *	
sabellid B *	
Family Serpulidae	
Hydroides cf. crucigera Morch, 1863	
Serpula vermicularis Linnaeus, 1767	
Vermiliopsis cf. annulata (Schmarda, 1861)	
V. sp. A	
serpulid A	
Phylum Mollusca	
Class Gastropoda	
Subclass Prosobranchia	
Order Archaeogastropoda	
Family Scissurellidae	
Scissurella crispata (Fleming, 1828)	D
S. sp.	A
Family Haliotidae	
Haliotis pourtalesii Dall, 1881	D
Family Fissurellidae	
Zeidora bigelowii Farfante, 1947	A
Emarginula phrixoides Dall, 1927	D
E. tuberculosa Libassi, 1859	D
Rimula aequisculpta Dall, 1927	D
Diodora cayenensis (Lamarck, 1822)	D
D. sp. A	D
D. sp. B	D
D. sp. C	D
?Family Cocculinidae	
?Cocculina sp.	D
Family Trochidae	
Sequenzia sp.	D
Euchelus corbis (Dall, 1889)	D
Solariella sp. A	
S. sp. B	D
S. sp. C	D
Calliostoma fascianus Schwengel and McGinty, 1942	D
Family Cyclostrematidae	
Arene bairdii (Dall, 1889)	D
A. tricarinata (Stearns, 1872)	A
A. variabilis (Dall, 1889)	D
Family Phasianellidae	
Tricolia cf. thalassicola Robertson, 1958	D
Order Caenogastropoda	
Family Rissoidae	
Alvania acuticostata (Dall, 1889)	D
A. precipitata (Dall, 1889)	D
A. sp.	D
Family Rissoinidae	
Rissoina cancellata Philippi, 1847	D
R. decussata (Montagu, 1803)	D
Family Vitrinellidae	
Vitrinella floridana Pilsbry and McGinty, 1946	D

V. helicoidea C.B. Adams, 1850	D
Cyclostremiscus pentagonus (Gabb, 1873)	
?Episcynia inornata (d'Orbigny, 1842)	A
?Solariorbis sp.	D
Teinostoma biscaynenses Pilsbry and McGinty, 1945	
T. goniogyrus Pilsbry and McGinty, 1945	D
T. cf. incertum Pilsbry and McGinty, 1945	D
T. cf. solida (Dall, 1889)	D
Family Turritellidae	
Turritella exoleta (Linne, 1758)	D
Vermicularia knorri (Deshayes, 1843)	D
Family Siliquariidae	
Siliquaria squamata Blainville, 1827	D
S. modesta Dall, 1881	D
Family Mathildidae	
Mathilda barbadensis Dall, 1889	D
Family Architectonicidae	
Heliacus bisulcatus (d'Orbigny, 1842)	D
Family Modulidae	
Modulus modulus (Linne, 1758)	D
Family Cerithiidae	
Cerithium litteratum (Born, 1778)	A
Finella dubia (d'Orbigny, 1842)	D
Cerithiopsis cf. pupa Dall and Simpson, 1901	D
C. sp. A	D
C. sp. B	D
C. sp. C	D
C. sp. D	D
C. sp. E	D
Seila adamsi (H.C. Lea, 1845)	D
Family Triphoridae	
Triphora sp. A	D
T. sp. B	D
T. sp. C	D
T. sp. D	D
T. sp. E	D
Family Epitoniidae	
Opalia abbotti Clench and Turner, 1952	D
Epitonium candeanum (d'Orbigny, 1842)	D
E. multistriatum (Say, 1826)	D
E. novangliae (Couthouy, 1838)	D
?E. sp.	
Nystiella atlantis Clench and Turner, 1952	D
Family Melanellidae	
Melanella conoidea Kurtz and Stimpson, 1851	D
M. intermedia (Cantraine, 1835)	D
M. jamaicensis (C.B. Adams, 1845)	D
Strombiformis auricinctus Abbott, 1958	A
S. bilineatus Alder, 1848	D
?Scalenostoma sp.	D
Niso aeglees Bush, 1885	D
Family Aclididae	
Aclis sp.	

Family Atlantidae	
Atlanta sp.	D
Family Capulidae	
Capulus incurvatus (Gmelin, 1791)	D
Family Crepidulidae	
Calyptraea centralis (Conrad, 1841)	D
Chelia equestris (Linne, 1758)	A
Crepidula plana Say, 1822	D
Family Eratoidae	
Trivia candidula Gaskoin, 1835	D
T. sp.	D
Family Ovulidae	
Primovula carnea (Poiret, 1789)	D
Family Naticidae	
Sinum minor (Dall, 1889)	D
Natica perlineata Dall, 1889	D
N. pusilla Say, 1822	D
N. sp.	D
Family Cymatidae	
Distorsio sp.	D
Family Bursidae	
Bursa sp.	D
Family Muricidae	
Murex sp.	D
Morula didyma (Schwengel, 1943)	D
Family Coralliophilidae	
Coralliophila caribaea Abbott, 1958	D
C. lamellosa (Philippi, 1836)	D
Family Columbellidae	
Anachis lafresnayi (Fischer and Bernardi, 1856)	D
A. sp.	D
Mitrella profundi (Dall, 1889)	D
Family Buccinidae	
Antillophos candei (d'Orbigny, 1842)	D
Family Nassariidae	
Nassarius sp. A	D
N. sp. B	D
Family Fasciolariidae	
Fusinus cf. dowianus Olsson, 1954	D
Family Olividae	
Olivella watermani McGinty, 1940	D
Family Mitridae	
Mitra swainsonii antillensis Dall, 1889	D
Vexillum sp. A	D
V. sp. B	A
Family Marginellidae	
Marginella cf. fusina Dall, 1881	D
Hyalina sp.	D
Granulina ovuliformis (d'Orbigny, 1841)	D
Family Conidae	
Conus stimpsoni Dall, 1902	D
Family Terebridae	
Terebra protexta Conrad, 1845	D

Family Turridae	
Polystira albida (Perry, 1811)	D
Mitrolumna biplicata Dall, 1889	D
Compsodrilla haliostrephis (Dall, 1889)	D
Daphnella sp.	D
Species A	D
Sp. B	D
Sp. C	D
Sp. D	D
Sp. E	D
Sp. F	D
Sp. G	D
Sp. H	D
Sp. I	D
Sp. J	D
Sp. K	D
Sp. L	D
Sp. M	D
Sp. N	D
Sp. O	D
Sp. P	D
Sp. Q	D
Sp. R	D
Subclass Opisthobranchia	
Order Pyramidelloidea	
Family Pyramidellidae	
?Pramidella sp. A	D
P. sp. B	D
Odostomia laevigata (d'Orbigny, 1842)	D
O. sp. A	D
O. sp. B	D
O. sp. C	D
O. sp. E	D
?O. sp. F	D
?Cingulina babylonia (C.B. Adams, 1845)	D
Turbonilla cf. portoricana Dall and Simpson, 1901	D
T. sp. A	D
T. sp. B	D
T. sp. C	D
T. sp. E	D
T. sp. F	D
T. sp. G	D
T. sp. H	D
T. sp. I	D
T. sp. J	D
T. sp. K	D
Order Cephalaspidea	
Family Acteonidae	
Acteon punctostriatus (C.B. Adams, 1840)	D
A. sp.	A
Family Ringiculidae	
Ringicula semistriata d'Orbigny, 1842	D

Family Cylichnidae	
Cylichna verrillii Dall, 1889	D
C. sp.	D
Scaphander watsoni Dall, 1881	D
Family Bullidae	
Bulla sp.	D
B. cf. eburnea Dall, 1881	D
Family Haminoeidae	
Atys sp.	D
Family Retusidae	
Retusa sulcata (d'Orbigny, 1842)	D
Pyrunculus caelatus (Bush, 1885)	D
Volvulella persimilis (Morch, 1875)	D
V. recta (Morch, 1875)	D
Order Thecosomata	
Family Limacinidae	
Limacina bulimnoides (d'Orbigny, 1836)	D
Family Cuvieridae	
Cresis acicula (Rang, 1828)	D
Clio pyramidata Linne, 1767	D
C. recurva (Children, 1823)	D
Diacria quadridentata (Blainville, 1821)	D
D. trispinosa (Blainville, 1821)	D
Cavolina inflexa (Lesueur, 1813)	D
C. longirostris (Blainville, 1821)	D
C. tridentata (Niebuhr, 1775)	D
C. uncinata (Rang, 1829)	D
Subclass Pulmonata	
Order Basommatophora	
Family Siphonariidae	
Williamia krebsii (Morch, 1877)	A
Class Scaphopoda	
Family Dentaliidae	
Dentalium sp.	D
Class Polyplacophora	
Family Acanthochitonidae	
Acanthochitona sp.	A
Unknown family	
Species A	A
Sp. B	A
Sp. C	A
Class Bivalvia	
Subclass Palaeotaxodonta	
Order Nuculoida	
Family Nuculidae	
Nucula cf. aegeensis Jeffrey, 1879	D
N. sp.	D
Family Nuculanidae	
Nuculana acuta (Conrad, 1831)	D
N. bipinnis (Dall, 1927)	D
N. concentrica (Say, 1824)	D

N. sp. A	A
N. sp. B	D
Yoldia solenoides Dall, 1884	D
Subclass Pteriomorphia	
Order Arcoidea	
Family Arcidae	
Arca imbricata Bruguiere, 1789	D
A. zebra (Swainson, 1883)	D
Barbatia candida (Helbling, 1779)	D
B. domingensis Lamarck, 1819	A
Anadara cf. baughmani Hertlein, 1951	D
Bathyarca glomerula (Dall, 1881)	D
B. cf. inaequalis (Dall, 1927)	D
Bentharca cf. sagrinata (Dall, 1886)	D
Arcopsis adamsi (Dall, 1886)	A
Family Limopsidae	
Limopsis antillensis Dall, 1881	A
L. minuta Philippi, 1836	D
Family Glycymeridae	
Glycymeris pectinata (Gmelin, 1791)	A
Order Mytiloida	
Family Mytilidae	
Crenella divaricata (d'Orbigny, 1845)	A
Gregariella coralliophaga (Gmelin, 1791)	A
Botula fusca (Gmelin, 1791)	D
Dacrydium sp.	A
Order Pterioida	
Family Pteriidae	
Pinctada imbricata Roding, 1798	D
Family Pectinidae	
Chlamys benedicti (Verrill and Bush, 1897)	D
Aequipecten cf. muscosus (Wood, 1828)	D
Family Propeamussiidae	
?Cyclopecten sp.	A
Family Plicatulidae	
Plicatula gibbosa Lamarck, 1801	D
Family Spondylidae	
Spondylus sp.	D
Family Dimyidae	
Dimya tigrina Bayer, 1971	D
Family Limidae	
Lima albicoma Dall, 1886	D
L. tenera Sowerby, 1843	D
Limatula cf. subauriculata (Montagu, 1808)	D
L. sp.	
Limea browniana Dall, 1886	
Family Ostreidae	
?Ostrea sp.	D
Subclass Heterodonta	
Order Veneroida	
Family Lucinidae	
Linga amiantus (Dall, 1901)	D

Parvilucina multilineata Tuomey and Holmes, 1857	D
Family Thyasiridae	
Thyasira cf. granulosa (Monterosato, 1874)	D
Family Ungulinidae	
Diplodonta sp.	D
Family chamidae	
Chama cf. macerophylla (Gmelin, 1791)	D
Family Carditidae	
?Glans domingensis (d'Orbigny, 1845)	D
Pleuromeris tridentata (Say, 1826)	D
Family Astartidae	
Astarte nana Dall, 1886	D
Family Crassatellidae	
Crassinella lunulata (Conrad, 1834)	D
C. martinicensis (d'Orbigny, 1842)	D
Family Cardiidae	
Americardia media (Linne, 1758)	D
Nemocardium permabile (Dall, 1881)	D
N. tinctum (Dall, 1881)	D
Laevicardium sp.	D
Family Mactridae	
Mulinia lateralis (Say, 1822)	D
Family Tellinidae	
Tellina aequistrata Say, 1824	D
T. texana Dall, 1900	D
Tellidora cristata (Recluz, 1842)	D
Family Semelidae	
Semele bellastriata (Conrad, 1837)	D
Abra lioica (Dall, 1881)	A
Family Solecurtidae	
Solecurtis cumingianus Dunker, 1861	D
Family Trapeziidae	
Coralliophaga coralliophaga (Gmelin, 1791)	D
Family Vesicomyidae	
Vesicomya vesica (Dall, 1886)	D
V. sp.	
Family Veneridae	
Ventricolaria rugatina (Heilprin, 1887)	D
?V. sp.	A
Chione grus (Holmes, 1858)	D
C. sp.	D
Gouldia cerina (C.B. Adams, 1845)	D
Pitar sp.	A
?venerid sp.	A

Order Myoida	
Family Corbulidae	
Varicorbula operculata (Philippi, 1848)	D
Corbula cf. cymella Dall, 1881	D
C. cf. swiftiana C.B. Adams, 1852	D
Family Pholadidae	
Xylophaga sp.	D
Subclass Anomalodesmata	
Order Septibranchoidea	
Family Poromyidae	
Poromya rostrata Rehder, 1943	D
Family Verticordiidae	
Verticordia fisheriana Dall, 1881	D
V. ornata (d'Orbigny, 1842)	D
V. sp.	D
Family Cuspidariidae	
Cuspidaria obesa (Loven, 1846)	A
C. sp. A	A
C. sp. B	D
Cardiomya perrostrata (Dall, 1881)	D
Plectodon granulatus (Dall, 1881)	D
Phylum Arthropoda	
Subphylum Pycnogonida	
Class Pantopoda	
Family Nymphonidae	
Nymphon sp.	
Subphylum Mandibulata	
Class Crustacea	
Subclass Ostracoda	
Order Myodocopa	
ostracod A	
ostracod B	
ostracod C	
Subclass Malacostraca	
Order Nebaliacea	
Nebalia sp.	
Order Stomatopoda	
Family Gonodactylidae	
Gonodactylus bredini Manning, 1969	
Order Cumacea	
Family Diastylidae	
Diastylis sp.	
Order Tanaidacea	
Family Tanaidae	
Tanais sp.	
tanaid A	
tanaid B	
tanaid C	
Order Isopoda	
Family Gnathiidae	
Gnathia sp.	
Family Anthuridae	
Apanthura cf. magnifica (Menzies and Frankenberg)	

Horoloanthura sp.
?Paranthura sp. *
anthurid A
Family Cirolanidae
Cirolana cf. albida (Richardson,
C. sp.
isopod A
Order Amphipoda
Suborder Gammaridea
Family Ampeliscidae
ampeliseid A *
Family Corophiidae
corophiid A *
Family Gammaridae
gammarid A *
Family Lysianassidae
lysianassid A
Family Oedicerotidae
oedicerotid A *
oedicerotid B *
Family Phoxocephalidae
phoxocephaliid A
Family Pleustidae
Stenopleustes sp.
Family Pontogeneiidae
pontogeneiid A
Suborder Caprellidea
Family Caprellidae
Aeginina sp. *
Order Decapoda
Suborder Natantia
Section Caridea
Family Alpheidae
alpheid A *
Family Pasiphaeidae
Leptochela serratorbita Bate
natant A *
natant B *
Suborder Reptantia
Section Anomura
Family Axiidae
Axius sp.
Family Galatheidae
Munida iris Milne-Edwards
Family Paguridae
pagurid A
pagurid B
Section Brachyura
Family Goneplacidae
?Speocarcinus sp. (juv.) *
goneplacid A *
goneplacid B *
Family Pinnotheridae
Parapinnixa sp. *
brachyurid A (juv.) *

TABLE 4. NUMBERS OF SPECIES AND INDIVIDUALS AT EACH STATION WITHIN EACH GROUP

Taxa	Station Number																						Total No. Individua all Statio
	VIII - 1		VIII - 2		VIII - 4		VIII-A-1b		VIII-A-2		VIII-A-3		VIII-A-4		IX - 1		IX - 2		IX - 3		X - 1		X - 2		XII - 2		
	S[1]	I[2]	S	I	S	I	S	I	S	I	S	I	S	I	S	I	S	I	S	I	S	I	S	I	S	I	
Corals	0	-[3]	3	-	2	-	2	-	6	-	2	-	0	-	1	-	2	-	1	-	2	-	1	-	1	-		
Polychaetes	3	3	10	12	19	28	11	21	18	25	19	52	7	10	21	93	13	29	4	8	14	36	4	5	15	41	363	
Molluscs	80	281	76	631	53	355	84	401	61	238	49	227	41	305	20	102	58	208	41	114	85	347	66	210	80	518	3937	
Arthropods	2	2	3	5	7	15	3	4	2	4	9	21	2	2	15	77	1	1	2	2	1	1	1	1	3	5	140	
Totals	85	286	92	648	91	398	100	426	87	267	79	300	50	317	57	272	74	238	48	124	102	384	72	216	99	564	4440	

[1] S indicates number of species

[2] I indicates number of individuals

[3] - The corals were not counted because most specimens consisted of broken fragments of branching coral species.

Nuculanidae 6, and Limidae and Cuspidariidae 5.

The most diverse gastropod genera in terms of numbers of species were Turbonilla, 11; Cerithiopsis and Odostomia, 6; Triphora, 5; and Diodora, Teinostoma, and Cavolina (planktonic), 4. The best represented bivalve genera were Nuculana with 5 species, and Verticordia and Cuspidaria with 3.

None of the species of molluscs were collected on all 13 of the sampled submerged banks; however, 3 species of bivalves were found on 12 of the banks: Arcopsis adamsi, Plicatula gibbosa, and Crassinella martinicensis. Limopsis antillensis, Arene variabilis, and Vermicularia knorri were collected on 11 banks, and Dimya tigrina, Alvania acuticostata, A. sp., and Granulina ovuliformis were found on 10. Other common species included the bivalves Nuculana acuta, N. sp. A, Barbatia domingensis, Glycymeris pectinata, Gregariella coralliophaga, Ostrea(?) sp., Chama cf. macerophylla, Abra lioica, Gouldia cerina, Pitar sp., Verticordia ornata, and Cuspidaria sp. A, and the gastropods Nassarius sp. A, turrid sp. C, Cingulina babylonia (?), Turbonilla sp. A, Pyrunculus caelatus, Cavolina longirostris, and Diacria quadridentata.

Concerning the numbers of individuals of certain species sampled, some species were collected in considerably high densities. For instance, a small white unidentified venerid ranged in numbers of individuals from 30-300 valves between 4 different stations. Other bivalves found in relatively high numbers include Nuculana acuta, N. sp. A, Limopsis antillensis, Dimya tigrina, Crassinella martinicensis, and Cuspidaria sp. A. The most abundant gastropod was Alvania acuticostata. Other relatively abundant gastropods included Rissoina cancellata, turrid sp. H, and the two planktonic pteropods Clio pyramidata and Cavolina longirostris.

POLYCHAETES

One hundred and two species of polychaetes representing 30 families were collected on the submerged banks. They were the second most diverse group in terms of total numbers of species, but they comprised the most diverse group in terms of living organisms collected. Many species, however, were not identified to species for several possible reasons: 1) poor literature for deeper water polychaetes; 2) many specimens were damaged in the collecting and washing stages; and 3) several species were represented only by juvenile specimens.

Polychaete families containing the most species were Syllidae with 12, Eunicidae with 9, and Sigalionidae and Spionidae with 7. The most diverse genera in terms of numbers of species were Syllis, 6; Onuphis and Eunice, 4; and Exogone, 3.

None of the polychaetes collected were found on all of the submerged banks sampled. Exogone sp. B was found on 9 of the 13 banks and Bhawania goodei and Onuphis peruana were found on 6 banks. These 3 species were the most widely distributed over the study area. Most of the other species were represented on only 1 to 3 of the sampled banks and in most cases by very few individuals. The living carbonate bank, Station IX-1, had the highest number of species and individuals.

ARTHROPODS

Thirty-seven species of arthropods were collected on the shelf-edge submarine banks. Thirty-six of these were crustaceans and one was a pycnogonid, Nymphon sp.,which was only found at Station IX-1. Of the crustaceans, the isopods, amphipods, and reptants were the best represented groups with 8, 10, and 9 species, respectively. Species identification was very difficult among all the crustaceans because the washing technique apparently damaged

or removed many of the appendages which are essential in most cases for accurate identification. Also, the taxonomic literature for the deeper water, small crustaceans is quite sparse.

Most of the crustaceans were collected on only one or two banks. As with the polychaetes, Station IX-1 had the largest number of species and individuals of crustaceans with 15 and 77, respectively. Most of the crustaceans were represented by only one to several individuals in most of the samples. However, Station IX-1 had fairly high numbers of 2 species. 26 individuals of the shrimp Leptochela serratorbita, and 15 specimens of tanaid B.

CORALS

The scleractinan corals were represented by 7 species from 3 families. The families Seriatoporidae and Caryophyllidae both contained 3 species. The genus Madracis had 3 species within it.

Madracis sp. and ?Schlerhelia formosa were the most widespread throughout the study area, being found on 6 and 5 banks, respectively. Station VII-A-2 was the most diverse, containing 6 of the 7 species collected. Most of the other banks had 0-2 species.

One or two species of alcyonarians and one antipitharian were observed in the underwater bank photographs but none were collected.

Comparative Studies and Zoogeography

At present, only a fraction of the total fauna of shelf-edge submarine banks in the northwestern Gulf of Mexico has been reported (Parker and Curray, 1956; Bright, et al., 1974; Bright and Pequegnat, 1974; Abbott and Bright, 1975; Bright and Rezak, 1976). As in the present study, the previously

reported faunal assemblages of shelf-edge banks are comprised chiefly of molluscs. Therefore, to facilitate more extensive comparisons with previous works, molluscan faunal assemblages were used exclusively. It should be noted that the majority of molluscs previously reported as occurring on shelf-edge banks are of the macro size (greater than 7mm), and that micromolluscs (less than 7mm) constituted 66% of the total number of molluscs identified in this study. Considering this inconsistency, the faunal comparisons are not extremely conclusive, although general trends can be identified.

A total of 265 (29 alive) species of molluscs were identified from the collected samples. Of the 265 species identified, 36 (14 alive) have been reported from the West Flower Garden Bank by Bright, et al. (1974). Abbott and Bright (1975) reported a total of 61 species from the algal nodule zone of the Flower Garden Banks. Twenty-four (10 alive) of these species were found on the banks sampled in this report. Parker and Curray's (1956) species list of Texas outer continental shelf banks compares in a similar manner. Of the 265 species collected, 30 (3 alive) were found on Baker Bank, and 23 (4 alive) on Big Southern Bank.

Considering the variability in sampling and analytical techniques employed in the various studies, more species are probably common to the submarine banks than the data indicates. Additional sampling for micromolluscs on Texas outer continental shelf banks would probably support this line of thought.

Of the 265 species collected during this investigation, distributional records of 159 species were obtained. The zoogeographic records indicate that the majority of the molluscan fauna present on northwestern Gulf of Mexico shelf-edge banks are composed of species which normally inhabit temperate waters of the North Atlantic and Gulf of Mexico, although many range into the tropical Caribbean Province.

An interesting point evident from the distributional patterns is that over 30 of the species collected on these banks are often found in shallow depths in warm tropical waters. One proposed explanation is Parker and Curray's (1956) hypothesis of a past ecological connection with the Carribbean Province before the last transgression of the sea, but this seems rather doubtful, since temperatures were most likely cooler then, rather than warmer as suggested. However, warm tropical water and its associated fauna (including larvae) are currently present in the offshore, surface layers of the northwestern Gulf of Mexico (Flower Garden Banks). Considering the presence of this water mass, the occasional settlement of species in deeper water, and the fact that most of the tropical species are wide ranging eurythermic forms, it is not unreasonable to expect the presence of tropical species in the northwestern Gulf of Mexico.

Paleoecology

Nine species of bivalves and over 20 species of gastropods collected from the shelf-edge submarine banks were indicative of past shallow to moderately shallow-water environments. Most of them are represented by only one to several shells from one or more of the banks; however, a few species, such as, Arcopsis adamsi and Gregariella coralliophaga were quite common and alive at the shallowest station, Station IX-1, the living carbonate bank.

The shells of the shallow-water species were probably buried below the overlying sediments and subsequently brought to the sediment surface by either bioturbation, differential erosion, or uplift of the bank structure, or a combination of these. A subsurface core would probably reveal more substantial data concerning the past faunal assemblages than the surface grab utilized in

collecting the present samples.

Species of bivalves found on the shelf-edge banks that are commonly found in shallow waters included Nuculana concentrica, Botula fusca, Pinctada imbricata, and Tellidora cristata.

Two gastropods, Rissoina cancellata and Modulus modulus, are commonly found in seagrass beds in shallow coastal waters. Four others, Vitrinella floridana, V. helicoidea, Capulus incurvatus, and Chelia equestris, are generally found in rocky habitats from intertidal to shallow depths. Other common shallow-water gastropods included Diodora cayenensis, Teinostoma biscaynense, Vermicularia knorri, Melanella conoidea, M. intermedia, Strombiformis bilineatus, Calyptrea centralis, and Granulina ovuliformis.

None of the shells were large enough or numerous enough to allow for age-dating, and without knowing dates or vertical distance of "shell-travel" through the substrate, predictions of bank heights to sea-stand level cannot be made.

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Appendix

TABLE 1. Species and numbers of corals collected at each station

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
SCLERACTINIA													
Seriatoporidae													
Madracis mirabilis		X *	X		X			X					
M. asperula				X	X	X							
M. sp.			X		X				X	X	X		X
Oculinidae													
Sclerhelia formosa		X		X	X				X		X		
Caryophyllidae													
Desmophyllum sp.					X							X	
caryophyllid A					X								
caryophyllid B		X				X							

* X denotes presence of coral species at a station; valid counts of specimens collected could not be made, because most samples were of fragments of branching corals.

TABLE 2. Species and numbers of polychaetes collected at each station.

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Phylodocidae							1						
Anaitides madeirensis (Langerhans, 1880)					2			3					
Polynoidae													
Harmothoe gilchristi Day, 1960		1			1								
H. sp.								2					
polynoid B			1										
polynoid C					1								
Sigalionidae													
Euleanira sp.				1								1	
Pholoe sp.		1							1				
Psammolyce sp.						1							
Sthenelais boa (Johnston, 1839)			1										
S. sp.											1		
S. sp. A													
S. sp. B									2				2
Chrysopetalidae													
Bhawania goodei Webster, 1884		2	3		2	1		6					1
Paleonotus heteroseta Hartman, 1945								1					
chrysopetalid A								2					
Nephtyidae													
Aglaophamus sp.													1
nephtyid A											1		
Syllidae													
Exogone sp. A					1	1							
E. sp. B			1	6	3	11	2		2	3		16	1
E. sp. C						2						1	
Odontosyllis enopla Verrill, 1900								9					
Sphaerosyllis cf. fortuita Webster, 1879		1											
S. sp.					1			2					
Syllis cf. cornuta Rathke, 1843											1		
S. hyalina Grube, 1863			1										
S. spongicola Grube, 1855			1		2			18					
S. sp. A			3		1	5							
S. sp. B													
S. sp. C													
Hesionidae													
Gyptis cf. vittata Webster and Benedict, 1887			1					2					
Kefersteinia sp.								4					
Podarke obscura Verrill, 1873								9					
P. sp.													
hesionid A		1											

TABLE 2 (cont.)

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Pilargidae													
Synelmis albini (Langerhans, 1881)					1								
Nereidae													
Ceratonereis sp.			4					4			1		
Capitellidae													
Notomastus hemipodus Hartman, 1947													
N. latericeus Sars, 1851			1										
capitellid A					2	1						1	1
Maldanidae													
maldanid A		1											
maldanid B									9				
Opheliidae													
Polyophthalmus pinctus (Dujardin, 1839)								5					
ophelíid A			2										
Spionidae													
Malacoceros sp.							3						
Paraprionospio pinnata (Ehlers, 1901)											1	2	7
Prionospio cirrifera Wiren, 1883			1			1							
P. cf. cirrobranchiata Day, 1961											2		
spionid A					2						1		
spionid B							1						
spionid C						2							
Trochochaetidae													
trochochaetid A											1		
trochochaetid B													1
Paraonidae													
Aricidea suecica Hartman, 1957				1									
Paraonis gracilis (Tauber, 1879)						4							1
paraonid A													1
Chaetopteridae													
chaetopterid				2									
Onuphidae													
Onuphis peruana Hartman, 1944					1				2	2	1	1	3
O. cf. peruana (juvenile) Hartman, 1944			2	1		4				1			
O. sp. A									2	3			
O. sp. B (juvenile)									2				1
Rhamphobrachium agassizi Ehlers, 1887									1				
Eunicidae													
Eunice cf. antennata (Monro, 1928)						2							
E. longicirrata Webster, 1884									1				
E. sp.			1	3	1				4		1		

TABLE 2 (cont.)

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Lysidice sp.								1					
Marphysa cf. aransensis				1									
Nematonereis cf. unicornis Schmarda, 1861					1								
Palola siciliensis (Grube, 1840)						1		2					
eunicid A						1							
Lumbrineridae													
Lumbrineris cf. crassicephala Hartman,			1				1						
L. sp. 1956							1		1				
Arabellidae													
Arabella iricolor (Montagu, 1804)									1				
Dorvilleidae													
Dorvillea sociabilis (Webster, 1879)								4	1				
Schistomeringos rucolphi (delle chiaje,													
dorvilleid A 1828)					1								
Amphinomidae													
Chloeia viridis Schmarda, 1861								1					
Paramphinome jeffreysii (McIntosh, 1872)										2	2		
Magelonidae													
Magelona cf. filiformis Wilson, 1959													
M. pettiboneae Jones, 1963		1				9							
M. sp.				1			1						
Cirratulidae													
Dodecaceria sp.	1												
cirratulid A						1							
cirratulid B						1					1		
cirratulid C													1
Cossuridae													
Cossura longocirrata Webster and Benedict,	1			1									
Oweniidae 1887													
owenild A													1
Ampharetidae													
?Samythella sp.				3									
ampharetid A					1								
Terebellidae													
terebellid A	1												
terebellid B			1										
terebellid D				1									
terebellid E						1							
terebellid F							5						

TABLE 2 (cont.)

SPECIES	STATION NUMBER											
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Sabellidae													
Potamilla reniformis (Leuckart, 1849)		1											
sabellid A				1									
Serpulidae													
Hydroides cf. *crucigera* Morch, 1863								1					
Serpula vermicularis Linnaeus, 1767		2	1										
Vermiliopsis cf. *annulata* (Schmarda, 1861)			1					1					
V. sp. A								11					
serpulid A			1										

TABLE 3. Species and numbers of molluscs collected at each station.

Explanation: Numbers listed for bivalves are numbers of valves, unless noted with pr. which indicates cojoined valves. Numbers which appear in parentheses indicate macromolluscs (i.e. greater than 7mm) and numbers not in parentheses indicate micromolluscs (i.e. less than 7mm). Numbers which are underlined indicate specimens collected alive.

Species	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
BIVALVIA													
Nuculidae													
Nucula cf. aegeensis Jeffreys, 1879												2	
N. sp	1												
Nuculanidae													
Nuculana acuta (Conrad, 1831)	48,1pr.	6	2	22,7pr			2,3pr.				6	7	27
N. bipunnis (Dall, 1927)							1						2
N. concentrica (Say, 1824)	1			2								(2)	
N. sp. A													
N. sp. B													
Yoldia solenoides Dall, 1884	1											(5)	
Arcidae													
Arca imbricata Bruguiere, 1789												(2)	
A. zebra (Swainson, 1883)									(6)	(4)	(1)	(2)	
Barbatia candida (Helbling, 1779)			7	(1)					(5)	(6)	(3)	(4) 7	(2),2
B. domingensis Lamarck, 1819			12	(4)	(1)	2		2	(5),1		(20)	(12,4	
Anadara cf. banghmani Hertlein, 1951												(3)	
Bathyarca glomerula (Dall, 1881)							48						
B. cf. inaequalis (Dall, 1927)		1	19	1	1							1	
Bentharca cf. sagrinata (Dall, 1886)			1						1		(3)		
Arcopsis adamsi (Dall, 1886)	17	56	18,1pr	23	4		4	6	10	1	42	(2),20	6
Limopsidae													
Limopsis antillensis Dall, 1881		20	145,12	62	36	45,1	5, 4		123,1pr.1	1pr.1	140	19	30
L. minuta Philippi, 1836					1		27			(5),1		1	
Glycymerididae													
Glycymeris pectinata (Gmelin, 1791)		2		(1),1	(2)	(3),5			(3),1,1		(5),13	1	(2),1

TABLE 3 (cont.)

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Mytilidae													
Crenella divaricata (d'Orbigny, 1845)				1		2	3	1	4		4		
Gregariella coralliophaga (Gmelin, 1791)	1	3	1	4	1	4	7	(12,3pr)1					
Botula fusca (Gmelin, 1791)								(17,5 pr)					
Dacrydium sp.			1			1							
Pteriidae													
Pinctada imbricata Roding, 1798		1		(2)	(1)								
Pectenidae													
Chlamys benedicti (Verrill and Bush, 1897)			2	(1)					(1)				
Aequipecten cf. muscosus (Wood, 1828)											(2)	2	
Argopecten cf. gibbus (Linne, 1758)											(1)		
Propeamussiidae													
?Cyclopecten sp.		4	21,2		5		6		1				
Plicatulidae													
Plicarula gibbosa Lamarck, 1801		1,1pr.	1,1pr.	(5),6	(1),1	(3),1	1	(2,1pr)	(22),2	(2)	(34,½pr)	(15),3	(6),1
Spondylidae													
Spondylus sp.									(1)				(1)
Dimyidae													
Dimya tigrina Bayer, 1971	1	22	23	18	2	4,1pr.			2		9	2	5
Limidae													
Lima albicoma Dall, 1886			3										
L. tenera Sowerby, 1843			4	(2)					(2)		(6)		
Limatula cf. subauriculata (Montagu, 1808)				1									
L. sp.							2						
Limea browniana Dall, 1886					3	2	2		1				
Ostreidae													
?Ostrea sp.			3	(2),3			3		(4)	(5)	(2),2	(4),3	1
Lucinidae													
Linga amiantus (Dall, 1901)	4												
Parvilucina multilineata (Tuomey and Holmes, 1857)	1												
Thyasiridae													
Thyasira cf. granulosa Monterosato, 1874		1											
Ungulinidae													
Diplodonta sp.												(1)	
Chamidae													
Chama cf. macerophylla (Gmelin, 1791)		4	10	(4),7	(2)	(1)			(7),3	(3)	(4),1	(6),4	

TABLE 3 (cont.)

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Carditidae													
?Glans domingensis (d'Orbigny, 1845)	1			12						4	2		
Pleuromeris tridentata (Say, 1826)	5	1					10,1pr.					4	
Astartidae													
Astarte nana Dall, 1886							8			1			
Crassatellidae													
Crassinella lunulata (Conrad, 1834)	5			4							2		
C. martinicensis (d'Ordigny, 1842)	15	115,4pr	11	121,7pr.	7,3pr.	5	28		22,3pr	8,2pr	120,3pr	53	35,1pr
Cardudae													
Americardia media (Linne, 1758)								(1)					
Nemocardium permabile (Dall, 1881)		1	5	(5),6			1		(2)		(1),1	(1)	
N. tinctum (Dall, 1881)											(2)	(2)	
Laevicardium sp.												(2)	
Mactridae													
Mulinia lateralis (Say, 1822)	1												
Tellinidae													
Tellina sequistrata Say, 1824												(1)	
T. texana Dall, 1900													3
Tellidora cristata (Recluz, 1842)	1												
Macoma tenta (Say, 1834)					(1)								
Semelidae													
Semele bellastriata (Conrad, 1837)											(2)		
Abra lioica (Dall, 1881)	4	4,1pr	1	9,2	1	3			2				(15)14
Solecurtidae													
Solecurtis cumingianus Dunker, 1861				(3)									
Trapezidae													
Coralliophaga coralliophaga (Gmelin, 1791)				(1)									
Vesicomyidae													
Vesicomya vesica (Dall, 1886)	5												
V. sp.	5												
Glossidae													
Mejocardia agassizii Dall, 1886			1pr.,4						(2)		(1)		
Veneridae													
Ventricolaria rugatina (Heilprin, 1887)		3		(1),2					(1),1	1	(3)	(5),1	

TABLE 3 (cont.)

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
?V. sp.	4			7			1				5	(4),45	
Chione grus (Holmes, 1858)	5												
C. sp.	8	22	1	7,1pr.		1	1		4		(3),9	(3),7,1pr	
Gouldia cerina (C.B. Adams, 1845)			1	(12),8	(1)	(1)			(9),1	(1),1,1	(5),2	(11),6	(1)
Pitar sp.		75,5pr		40,1pr	3		300	2			3		30
?Venerid sp.													
Corbulidae													
Varicorbula operculata (Philippi, 1848)	1												
Corbula cf. cymella Dall, 1881									(4)	(1)	(1)	(7)	(1)
C. cf. swiftiana C.B. Adams, 1852	5	6		3								(5),6	
Phaladidae													
Xylophaga sp.							1						
Poromyidae													
Poromya rostrata Rehder, 1943	1	1		6			3			1		1	
Verticordiidae													
Verticordia fisheriana Dall, 1881		1					3						
V. ornata (d'Orbigny, 1842)	1	9,1pr		2		1pr.	6,1pr			1		1	4
V. sp.				1									
Cuspidariidae													
Cuspidaria obesa (Loven, 1846)						1							
C. sp. A		44,3pr,2	2	19	2		1			7	3,1pr		6
C. sp. B											(1)		
Cardiomya perrostrata (Dall, 1881)	2						2						
Plectodon granulatus (Dall, 1881)											(1)	(1)	(1)
GASTROPODA													
Scissurellidae													
Scissurella crispata (Fleming, 1828)					4		1						
S. sp.			2,2										
Haliotidae													
Haliotis pourtalesii Dall, 1881									(1)				
Fissurellidae													
Zeidora bigelowii Farfante, 1947								4	1				
Emarginula phrixoides Dall, 1927	1				1								
E. tuberculosa Libassi, 1859			6		1				(1)		5		
Rimula aequisculpta Dall, 1927			2										
Diodora cayenensis (Lamarck, 1822)		3											(1)
D. sp. A									1				
D sp. B		1											
D sp. C			1							(2)			

TABLE 3 (cont.)

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
?Cocculinidae													
?Cocculina sp.			5		1				1				1
Trochidae													
Sequenzia sp.		2											
Euchelus corbis (Dall,1889)										1	1		
Solariella sp. A		6	10		6	4			2	2	1		
S. sp. B					7								1
S. sp. C							7						3
Calliostoma fascinans Schwengel and McGinty, 1942		2								1			4
Cylostrematidae													
Arene bairdii (Dall, 1889)	1	1	8	2	3		1				4		
A. tricarinata (Stearns, 1872)	1					11		1					
A. variabilis (Dall, 1889)	1	10	1	8	2	3	10		3		4	1	10
Phasianellidae													
Tricolia cf. thalassicola Robertson,1958				4		1							
Rissoidae													
Alvania acuticostata (Dall, 1889)	17	125	21	23	32	1	13		2		15		53
A. precipitata (Dall, 1889)		12	2	6	4				13		14		4
A. sp.	1	10	8	7	10	12			8		5	2	1
Rissoinidae													
Rissoina cancellata Philippi. 1847	1	13		18									40
R. decussata (Montagu, 1803)				1									
Vitrinellidae													
Vitrinella floridana Pilsbry and McGinty, 1946	2												
V. helicoidea C.B. Adams, 1850	4	2	1			2						2	
Cyclostremiscus pentagonus (Gabb, 1873)	3												
?Episcynia inornata (d'Orbigny, 1842)	1												
?Solariorbis sp.	1												
Teinostoma biscaynensis Pilsbry and McGinty, 1945	26												
T. goniogyrus Pilsbry and McGinty,1945		1											
T. cf. incertum Pilsbry and McGinty,1945				1									
T. cf. solida (Dall, 1889)													
Turritellidae													
Turritella exoleta (Linne, 1758)				(2)	(1)				(3)	(13)	(5)	(4)	(5)
Vermicularia kenorri (Deshayes, 1843)	3	3	2	6	2	6		(1),2	1	(1),6	16		9

TABLE 3 (cont.)

SPECIES	STATION NUMBER											
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Siliquariidae													
Siliquaria squamata Blainville, 1827			1	(1)	(1)				(1)		(1)		
S. modesta Dall, 1881								(25)					
Mathildidae													
Mathilda barbadensis Dall, 1889		3	2			2			2	2	2		12
Architectonicidae													
Heliacus bisulcatus (d'Orbigny, 1842)		3	1										2
Modulidae													
Modulus modulus (Linne, 1758)	1												
Cerithiidae													
Finella dubia (d'Orbigny, 1842)	4			1							2	1	
Cerithium litteratum (Born, 1778)								1					
Cerithiopsis cf. pupa Dall and Simpson, 1901													
C. sp. A		1		1							1	1	1
C. sp. B											1		
C. sp. C				4	2				1		5		
C. sp. D						1						1	
C. sp. E			1		2						1	5	
Seila adamsi (H.C. Lea 1845)												1	
Triphoridae													
Triphora sp. A	1	4		2							2	2	2
T. sp. B		1		1	1				2		1	2	
T. sp. C			1						1			2	
T. sp. D												(2)	(1)
T. sp. E												1	
Epitoniidae													
Opalia abbotti Clench and Turner, 1952				6							2		
Epitonium candeanum (d'Orbigny, 1842)													1
E. multistriatum (Say, 1826)	1												
E. novangliae (Couthouy, 1838)				1									
? E. sp.											1		
Nystiella atlantis Clench and Turner, 1952					1								
Melanellidae													
Melanella conoidea Kurtz and Stimpson, 1851		1							1				
M. intermedia (Cantraine, 1835)				1									
M. jamaicensis (C.B. Adams, 1845)											1		
Stromboliformis auriciatus Abbott, 1958		7	1,1		7								1
S. bilineatus Alder, 1848												1	
?Scalenostoma sp.											1		
Niso aeglees Bush, 1835												1	

TABLE 3 (cont.)

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Aclididae													
Aclis sp.	1												
Atlantidae													
Atlanta sp.					7		4						
Capulidae													
Capulus incurvatus (Gmelin, 1791)		2											
Crepidulidae													
Calyptraea centralis (Conrad, 1841)											2		
Cheilea equestris (Linne, 1758)			18,3			(3)			(3)		(3)		(1)
Crepidula plana Say, 1822												(1)	
Eratoidae													
Trivia candidula Gaskoin, 1835			3			2			(1)		1		
T. sp.											(1)		
Ovulidae													
Primovula carnea (Poiret, 1789)													(3)
Naticidae													
Sinum minor													(1)
Natica perlineata Dall, 1889						(1)							
N. pusilla Say, 1822	36						5						1
N. sp.	3												
Cymatidae													
Distorsio sp.											(1)		
Bursidae													
Bursa sp.			1										
Muricidae													
Murex sp.	3												
Morula didyma (Schwengel, 1943)										(1)			
Coralliophilidae													
Coralliophila caribaea Abbott, 1958			1										
C. lamellosa (Philippi, 1836)					(2)								
Columbellidae													
Anachis lafresnayi (Fischer and Bernardi, 1856)		1											
A. sp.	7												(1),1
Nitrella profundi (Dall, 1889)	2	3							2		1	5	
Buccinidae													
Antillophos candei (d'Orbigny, 1842)	(5)		(1)	(10)						(1)	(6)		(3)
Nassariidae													
Nassarius sp. A	14(2)		1			1			(1)	(4),11	(1),1	(1),2	2
N.sp. B		1				1							

TABLE 3 (cont.)

SPECIES	STATION NUMBER												
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Fasciolariidae													
Fusinus cf. *dowianus* Olsson, 1954					(1)								
Olividae													
Olivella watermani McGinty, 1940									(1)	(1)	(1)		
Mitridae													
Mitra swainsonii antillensis Dall, 1889			(1)	(1)		(1)							(1)
Vexillum sp. A										(2),1			
V. sp. B								1					
Marginellidae													
Marginella cf. *fusina* Dall, 1881				2					1		3		3
Hyalina sp.		2											
Granulina ovuliformis (d'Orbigny, 1841)		6		1	8	8	1		1	2	4	1	3
Conidae													
Conus stimpsoni Dall, 1902				(1)						(8)			
Terebridae													
Terebra protexta Conrad, 1845						(1)			(1)	(3)	(1)	(1)	(1)
Turridae													
Polystira albida (Perry, 1811)				(5)									
Mitrolumma biplicata Dall, 1889					1	2				(1),1			
Compsodrilla haliostrephis (Dall, 1889)				(2)						(1)	(1),1		(2),1
Daphnella sp.			1								(1)		
Species A		4											
Sp. B	2	2		2					1				2
Sp. C	4	12	1	3	(2),1				7	(2),10	(2),1		(1),3
Sp. D	1	5				(1)				2			
Sp. E	2			4							1		3
Sp. F	2	12	3	2	(1),2		1						6
Sp. G	7	1											
Sp. H	1	2											
Sp. I						1							
Sp. J		1		1									
Sp. K				2									
Sp. L					1								
Sp. M					(1)								
Sp. N						1							
Sp. O										(1),1	(1)		
Sp. P												(1)	
Sp. Q												(1)	
Sp. R													1

TABLE 3. (cont.)

SPECIES	STATION NUMBER											
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Pyramidellidae													
?Pyramidella sp. A					(2),1								1
?P. sp. B													2
Odostomia laevigata (d'Orgigny, 1842		3											1
O. sp. A	1	1											
O. sp. B		3		3	2				2		2		1
O. sp. C	2	2	1	1	2								1
O. sp. D				2							1		
O. sp. E					1								
O. sp. F	2												
?Cingulina babylonia (C.B. Adams, 1845)		17	1	3	1				2	1	5	1	2
Turbonilla cf. portoricana Dall and Simpson,		1									1		
1901													
T. sp. A	1	10		4	1	3	1				3	1	(1),2
T. sp. B	2	2							3				
T. sp. C	1												
T. sp. D	1	10			1							1	
T. sp. E	1												
T. sp. F			2								1	1	
T. sp. G											1		
T. sp. H												1	28
T. sp. I													1
T. sp. J		1		2									
T. sp. K												1	
Acteonidae													
Acteon punctostriatus (C.B. Adams, 1840)	1												
A. sp.									1				
Ringiculidae													
Ringicula semistriata d'Orbigny, 1842				5							1		
Cylichnidae													
Cylichna verrilli Dall, 1889						4							
C. sp.	1				1								1
Scaphander watsoni Dall, 1881	1			(1)									
Bullidae													
Bulla sp.										(1)			
B. cf. eburnea Dall, 1881												1	
Haminoeidae													
Atys sp.	1			1									
Retusidae													
Retusa sulcata (d'Orbigny, 1842)	1												
Pyrunculus caelatus (Bush, 1885)		3	1	4	3		2			1	1	7	2

TABLE 3 (cont.)

SPECIES	STATION NUMBER											
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Volvulella persimilis (Morch, 1875)												1	
V. recta (Morch, 1875)	1	1		2			1						1
Limacinidae													
Limacina bulimoides (d'Orbigny, 1836)						8							
Cuvieridae													
Creseis acicula (Rang, 1828)		3	6	4	11	6							1
Clio pyramidata Linne, 1767		3	3	2	22	2							(55)
C. recurva (Children, 1823)													3
Diacria quadridentata (Blainville, 1821)	3	4	1	2	1	3					1		1
D. trispinosa (Blainville, 1821)	1					4				(1)			
Cavolina inflexa (Lesueur, 1813)						1							
C. longirostris (Blainville, 1821)	10	12	7	5	8	73				3	14		(65)
C. tridentata (Niebuhr, 1775)						(2)							
C. uncinata (Rang, 1829)	3				1	7				1	1		
Siphonariidae													
Williamia krebsii (Morch, 1877)					3		6	9			1		
SCAPHAPODA													
Dentaliidae													
Dentalium sp.	6	4	2	3	1					(1)	(4)	(4)	22
POLYPLACOPHORA													
Acanthochitonidae													
Acanthochitona sp.								4					
Unknown family													
chiton sp. A								2					
chiton sp. B								1					
chiton sp. C								13					

TABLE 4. Species and numbers of arthropods collected at each station

SPECIES	STATION NUMBER											
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	LX-1	IX-2	XX-3	X-1	X-2	XII-2
PYCNOGONIDA													
Nymphonidae													
Nymphon sp.								1					
CRUSTACEA													
OSTRACODA													
Myodocopa													
ostracod A				1	2	1							
ostracod B						2							
ostracod C						3	1						
NEBALIACEA													
Nebalia sp.								1					
STOMATOPODA													
Gonodactylidae													
Gonodactylus bredini Manning, 1969								1					
CUMACEA													
Diastylidae													
Diastylis sp.						1			1				
TANAIDACEA													
Tanaidae													
Tanais sp.		1											
tanaid A								5					
tanaid B			5					15					
tanaid C			1					1					
ISOPODA													
Gnathiidae													
Gnathia sp.			3										
Anthuridae													
Apanthura cf. magnifica (Menzies and Frankenberg)			1							1			
Heteroanthura sp.						6							
?Paranthura sp.								1					
anthurid A							1						
Cirolanidae													
Cirolana cf. albida (Richardson,)		2											
Cirolana sp.								6					
isopod A						1							
AMPHIPODA													
Ampeliscidae													
ampeliscid A												1	

TABLE 4 (cont.)

SPECIES	STATION NUMBER											
	VIII-1	VIII-2	VIII-4	VIII-A-1b	VIII-A-2	VIII-A-3	VIII-A-4	IX-1	IX-2	IX-3	X-1	X-2	XII-2
Corophiidae													
corophiid A				2								3	
Gammaridae													
gammarid A						2							
Lysianassidae													
lysianassid A						4							
Oedicerotidae													
oedicerotid A	1												
oedicerotid B						1							
Phoxocephalidae													
phoxocephalid A			1										
Pleustidae													
Stenopleustes sp.								3					
Pontogeniidae													
pontogeneiid A								6					
Caprellidae													
Aeginina sp.								2					
NATANTIA													
Alpheidae													
alpheid A								1				1	
Pasiphaeidae													
Leptochela serratorbita								26					
natant A			3										
natant B											1		
REPTANTIA													
Axiidae													
Axius sp.		2											
Galatheidae													
Munida iris								6					
Paguridae													
pagurid A				2									
pagurid B										1			
Goneplacidae													
?Speocarcinus sp.			1	1									
goneplacid A	1												
goneplacid B								2					
Pinnotheridae													
Parapinnixa sp.								1					
brachyurid A													1

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.