BL-GM77

29000

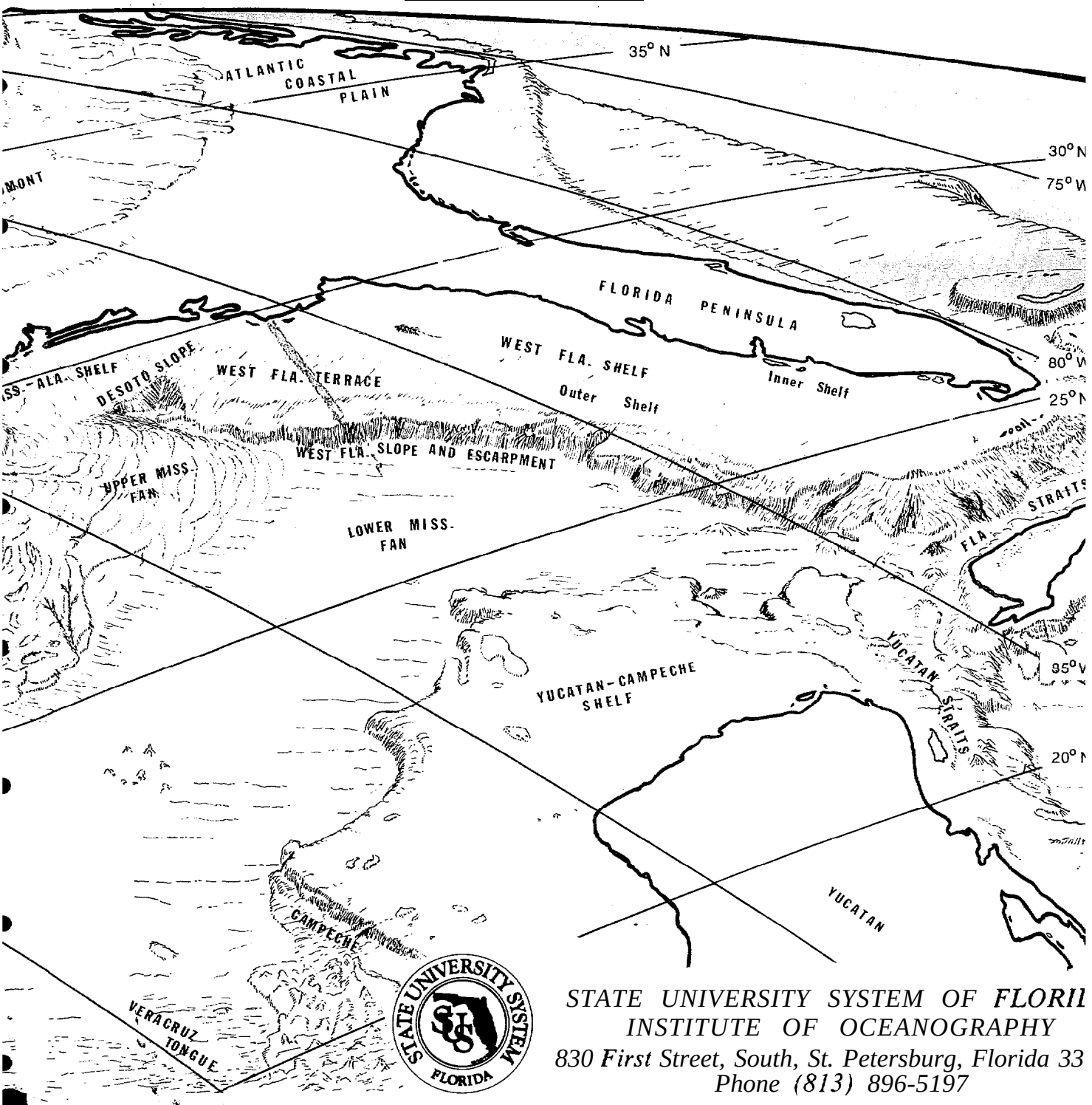
BASELINE MONITORING STUDIES, MISSISSIPPI ,

ALABAMA, FLORIDA OUTER CONTINENTAL SHELF, 1975-1976

BLM CONTRACT NO. 08550-CT5-30

VOLUME VII

HISTOPATHOLOGY ATLAS



STATE UNIVERSITY SYSTEM OF FLORI
INSTITUTE OF OCEANOGRAPHY
830 First Street, South, St. Petersburg, Florida 33
Phone (813) 896-5197

University of Florida, Gainesville . Florida State University, Tallahassee , Florida A.&M. University, Tallahassee , University of South Florida, Tampa . Florida Atlantic Unit, Boca Raton

University of West Florida, Pensacola , Florida Technological University, Orlando . University of North Florida, Jacksonville . Florida International University, Miami

BASELINE MONITORING STUDIES

MISSISSIPPI, ALABAMA, FLORIDA,

OUTER CONTINENTAL SHELF, 1975-1976

HISTOPATHOLOGICAL ATLAS

MACROEPIFAUNAL INVERTEBRATES OF THE EASTERN GULF OF MEXICO

A Report to the Bureau of Land Management

in fulfillment of

Contract No. 08550-CT5-30

Submitted by

State University System of Florida

Institute of Oceanography

Program Manager
James E. Alexander, SUSIO

Technical Coordinators:
Theodore T. White, SUSIO
Kenneth W. Turgeon, SUSIO
Alpheus W. Blizzard, SUSIO

Compiled by: Norman J. Blake
Doranne J. Borsay

INTRODUCTION

Histopathology can serve as a sensitive ecological tool for bridging the gap between the observed accumulation of potentially toxic chemicals such as hydrocarbons and trace metals in the environment and alterations of populations or communities. Although cause and effect relationships can not be adequately substantiated with field data, correlative data between accumulation levels and degree of pathology may prove valuable in any decision-making process. The histopathology of macroepifaunal invertebrates of the MAFLA study area represents the first large scale effort to determine levels of pathology prior to the potential increase in the levels of hydrocarbons and trace metals resulting from oil exploration and exploitation.

Methods

Samples for histopathological analyses were collected during the June 1975, September 1975, and January 1976 cruises from the 18 dredge/trawl stations and eight dive stations (Figure 1). An attempt was made to collect a minimum of three to five individuals (maximum 50) of one to three species at each station; however, low numbers of individuals of most epifaunal invertebrates, especially those characteristic of subtropical or tropical environments, within the MAFLA area often made collection not practical within time limitations.

Tissues were cut into small pieces (1.0 cm thick) and placed in perforated plastic bags. The plastic bags were then immersed in Dietrich's fixative until further processing in the laboratory.

In the laboratory, processing of tissues was as follows:

1. Carbonate-containing organisms were decalcified for 12-24 hr in "D-Cal".

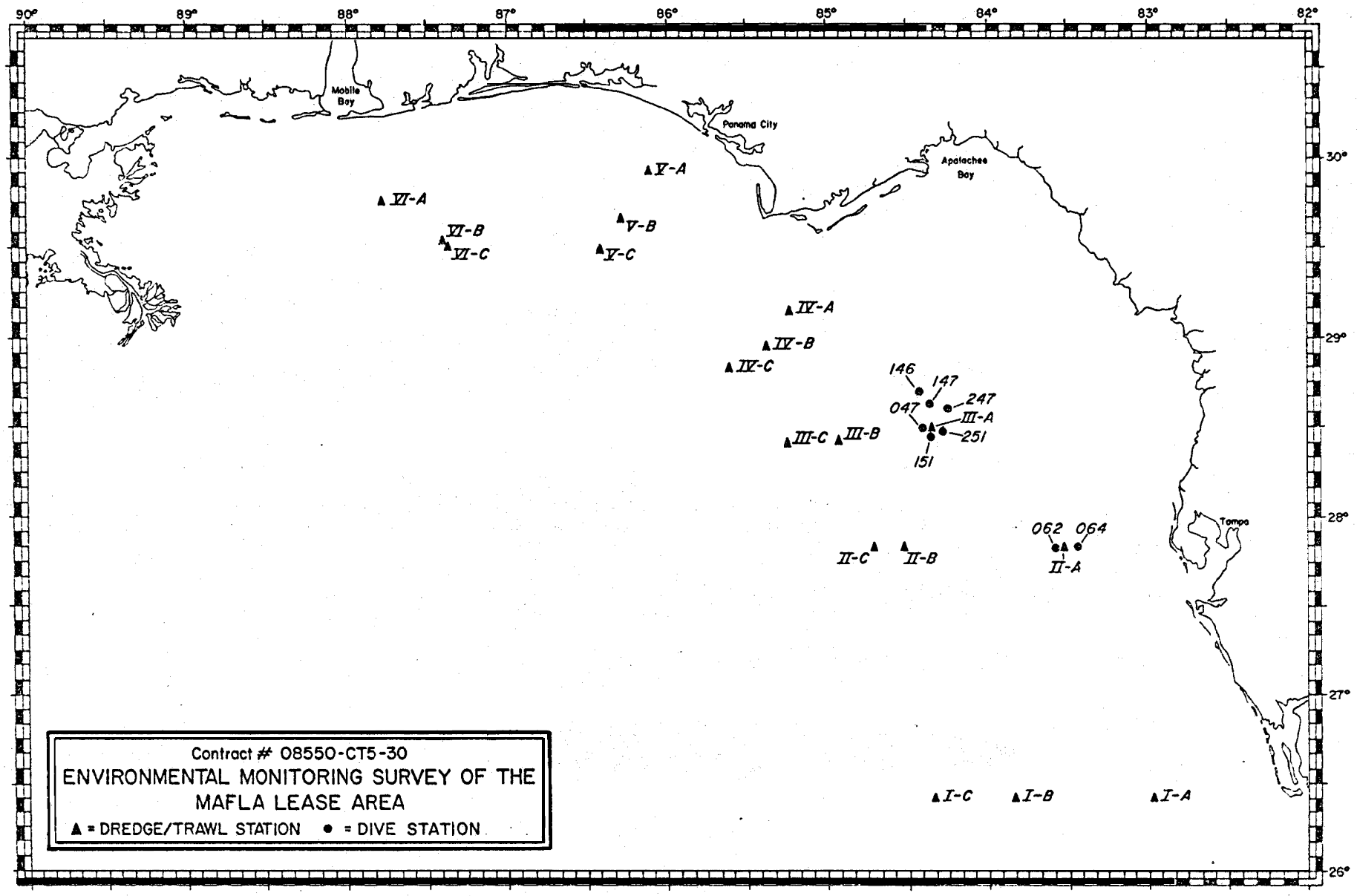


Figure 1. Location of sampling si es

2. All tissues (decalcified or otherwise) were trimmed, pl.aced in cassettes, and washed for 12 hr in a self-siphoning freshwater bath.
3. Tissues were processed on an Autotechnicon Tissue Processor using the 15 hr S29-UC670 Paraplast technique.
4. Tissues were embedded in Paraplast, sectioned at 6 μm, and stained with Harris hematoxylin-eosin (Luna, 1.968).

B

Results

The species collected during the course of the study are shown in Table 1. A total of 5457 slides were prepared and analyzed for pathology.

Pathological conditions, such as tumors, hyperplasia, and necrosis, commonly associated with increased levels of hydrocarbons or trace metal% were completely absent from all of the invertebrates analyzed. Parasites and their associated tissue responses were observed, especially in the bivalves and crustaceans, but levels of infestation did not show any correlation to sampling location or time of year. The general histological condition of the macroepifaunal invertebrates of the Eastern Gulf of Mexico is exceptionally good compared to more coastal environments (Paul Yevich, personal communication).

The photomicrographs shown in Plates 1 thru 22 are representative tissues displaying normal. histology. The species selected are those most commonly collected. Most of the tissues shown in the photomicrographs are considered to be the most likely areas to show the effect of chemical contamination; the rationale for their selection is as follows:

1. Hepatopancreas or digestive diverticula - this tissue is present in both molluscs and crustaceans and plays an important role in the

Table 1. Species collected from the MAFLA area during 1975-1976 for histopathological analyses

MOLLUSCS		Summer		Fall		Winter	
Species	Station	Number of Animals	Number of Slides	Number of Animals	Number of Slides	Number of Animals	Number of Slides
Aequipecten sp.							
Argopecten gibbus	VI-A	7	14	4	10		
	V-A					7	12
Aequipecten glyptus	III-C			3	12		
	V-C			8	28		
Aequipecten muscosus	062	7	14			3	6
	064			6	12		
	II-A			6	20		
	J.-A			6	12	8	22
Arca zebra	062	3	6				
	146			2	10		
	151			5	30		
Chione latilerata	IV-A			5	12		
Glycymeris americanus	V-A			3	14		
Laevicardium pictum	II-A					9	18
Mercenaria campechiensis	V-B	4	10	5	22	5	12

Table 1 - continued

MOLLUSCS - continued

Species	Station	Summer		Fall		Winter	
		Number of Animals	Number of Slides	Number of Animals	Number of Slides	Number of Animals	Number of Slides
Ostrea frons	047	9	20	5	8		
	062	8	6	5	10		
	151	6	12	5	12		
	141			9	14		
Pecten raveneli	V-A	2	4				
	I-A			7	28	6	20
Pteria colymbus	147	4	8	9	18		
	047	11	48	6	16		
	251	9	18	6	20		
	2117	5	14	6	12		
	151	8	30	5	16		
	111-047			2	8		
Spondylus americanus	047	5	46	7	66	5	40
	251	7	48	5	36	5	42
	247	5	20	5	36	5	44
	151	6	46	5	40	3	20
	III-A	5	30	5	40		
	147			5	34		
	146			5	38	5	42
	III-146			1	10		

Table 1 - continued

MOLLUSCS - continued

Species	Station	Summer		Fall		Winter	
		Number of Animals	Number of Slides	Number of Animals	Number of Slides	Number of Animals	Number of Slides
Loligo pealei	V-B	5	50	2	26		
	VI-C	6	"(2				
	V-C			5	46		
	III-C			4	66		
	II-B			5	54	6	40
	VI-B			5	60		
	III-C			1	6		
	III-B			8	48		
	IV-B			4	26		
	IV-A			6	24	6	20
	IV-C			5	42	7	48
	II-C					5	36
	I -B					5	46
Murex beauii	II-C					5	12

Table 1 - continued

CORALS		Summer		Fall		Winter	
Species	Station	Number of Animals	Number of Slides	Number of Animals	Number of Slides	Number of Animals	Number of Slides
Madracis decactis	147	3	22	1	6	5	20
	047	3	26	1	8	5	14
	146	3	24	1	8	5	20
	247	3	16	3	24	5	18
	251	3	16	3	20	5	20
	151	3	18	3	24	5	20
	III-A					6	46
Porites divaricata	147	2	18	1	8	5	20
	047	4	32	1	6	5	20
	146	4	34	1	6		
	247	3	16	1	7	5	30
	251	3	16	3	22		
	151	4	16	3	22	4	16
Millipora alcicornis	147	4	30	1	6	5	20
	146	1	8	1	4	5	20
	047	2	14	1	8	5	20
	247	3	18	3	22	5	20
	151	2	12			5	20
	251	3	14	3	20	5	20
Dichocoenia stellaris	146	3	24				
Phyllangia americana	64	2	26				
	62			3	44		

Table 1 - continued

CORALS - continued

Species	Station	Summer		Fall		Winter	
		Number of Animals	Number of Slides	Number of Animals	Number of Slides	Number of Animals	Number of Slides
Siderastrea radians	64					5	20
Cladocora arbus cula	62	3	12				
	64	2	10	2	16		
Cladocora debilis	62			1	4		
Solenastrea hyades	62	4	30	2	18	3	22
	64			2	16	1	4
	II-A			2	12	3	14
Stephanocoenia michelini	64			3	22		

Table 1 - continued

CRUSTACEANS

Species	Station	Summer		Fall		Winter	
		Number of Animals	Number of Slides	Number of Animals	Number of Slides	Number of Animals	Number of Slides
Acanthocarpus alexandri	III-C!	1	12				
	IV-C	5	48				
	V-C			5	26		
Calappa angusta	I-C			5	43	5	20
Hymenopenaeus tropicalis	VI-B			8	34		
Parap andalus lon gicauda	I-C					5	18
Portunus gibbesi	II-A	5	83				
Portunus spinicarpus	VI-A	6	30	5	34		
	IV-B	6	52	11	68	5	32
	I-B	4	44				
	I-A			3	16		
	III-A			4	26		
	III-B			4	30	5	30
Sicyionia brevirostris	VI-A	10	78				
	III-A			5	42	5	18
	IV-A			6	50		
	IV-B			4	36		
	IV-A			3	22		
	V-A					5	28
	I-A					6	48

Table 1 - continued

CRUSTACEANS - continued

Species	Station	Summer		Fall		Winter	
		Number of Animals	Number of Slides	Number of Animals	Number of Slides	Number of Animals	Number of Slides
Squilla endentata	VI-C	5	46	5	44		
St enorhynchus seticornis	146	10	20	13	26	21	42
	147	9	18	19	38	15	30
	47	13	26	16	32	17	34
	247	15	38	18	36	15	30
	151	16	48	10	20		
	251	5	12	17	34	16	32
	I-A			3	6		
	I -B			4	8		
	VI-B					5	10

Table 1 - continued

Species	Station	Summer Number of Animals	Summer Number of Slides	Fall Number of Animals	Fall Number of Slides	Winter Number of Animals	Winter Number of Slides
ECHINODERMS							
Luidia alternata	064	1	4				
Nemocardium peramobile	V-C	4	8				
Brissopsis elongata	VI-C	6	44				
Ophioderma januari	V-A	5	10				
Lytechinus varie gatus	II-A			4	8		
	062					5	10
Astroporpa annulata	III-B			1	2		
	VI-B			5	10		
SPONGES							
Cinachyra sp.	146	3	16				
	147	4	20	1	6		
	047	3	12	1	4		
	062	5	28	2	12		
	064	4	18	3	18		
	II-64	2	4				
	251	3	14	3	18		
	247	3	16	3	18		
	151	3	18	3	18		
	III-A	1	6				
	III-146			3	8		
	111-047			1	4		
	II-A			2	8		

Table 1 – continued

		Summer		Fall		Winter	
		Number of Animals	Number of Slides	Number of Animals	Number of Slides	Number of Animals	Number of Slides
Cliona sp.	064	2	12	3	16		
	III-64	2	16				
Geodia gibberosa	V-A	1	6				
Guitarra sp.	VI-B			1	8		
Ircinia campana	III-A	1	6				
Pseudoceratina crassa	047	5	28				
	147	3	16				
	146	3	18	3	14		
	III-147			1	6		
	III-047			1	4		
	247			3	18		
	251			3	16		
	151			3	16		

digestive processes. It is a highly active area which at times may contain both basophilic and acidophilic secretions. Under stress conditions, the epithelial cells are often vacuolated. Couch (in Lowe, et al., 1972) reported metaplasia of epithelial cells and atrophy in oysters which indicate an irritant response. Other changes which may occur in molluscs and crustaceans are cellular degeneration including lysis and nuclear pyknosis and loss of ciliated epithelial cells. The hepatopancreas may be the most important tissue considered for histopathological changes especially in crustaceans.

2. Gills - the epitheliums of the gills of both crustaceans and molluscs may go through various hyperplastic and metaplastic changes in chronic exposures. Black particulate masses have been observed on the gills of both shrimp and oysters exposed to oil (Yevich, personal communication).

3. Gonads - the reproduction of a species is extremely sensitive to any stress condition. Of primary importance are the cancerous tumors which may develop in this highly active tissue. Yevich and Berry (1969) have reported tumors in Mercenaria mercenaria and Yevich (personal communication) has found tumors in Mya arenaria from an oil spill site. Other changes which may occur in the gonad include degeneration of oocytes, loss of nutritive material, and failure of the animals to proceed beyond the resting stage of reproduction.

4. **Cornea** - may be adversely affected by oil. Some evidence suggests that the cornea becomes whitened in the presence of oils (Yevich, personal communication),

5. Mantle - important tissue in molluscs since it is responsible for production of the shell. Hyperplasia of epithelial cells occurs as a result of toxicants. Mantle epithelioma has been reported in Crassostrea gigas from an estuary in Washington (Pauley and Sayce, 1972).

LITERATURE CITED

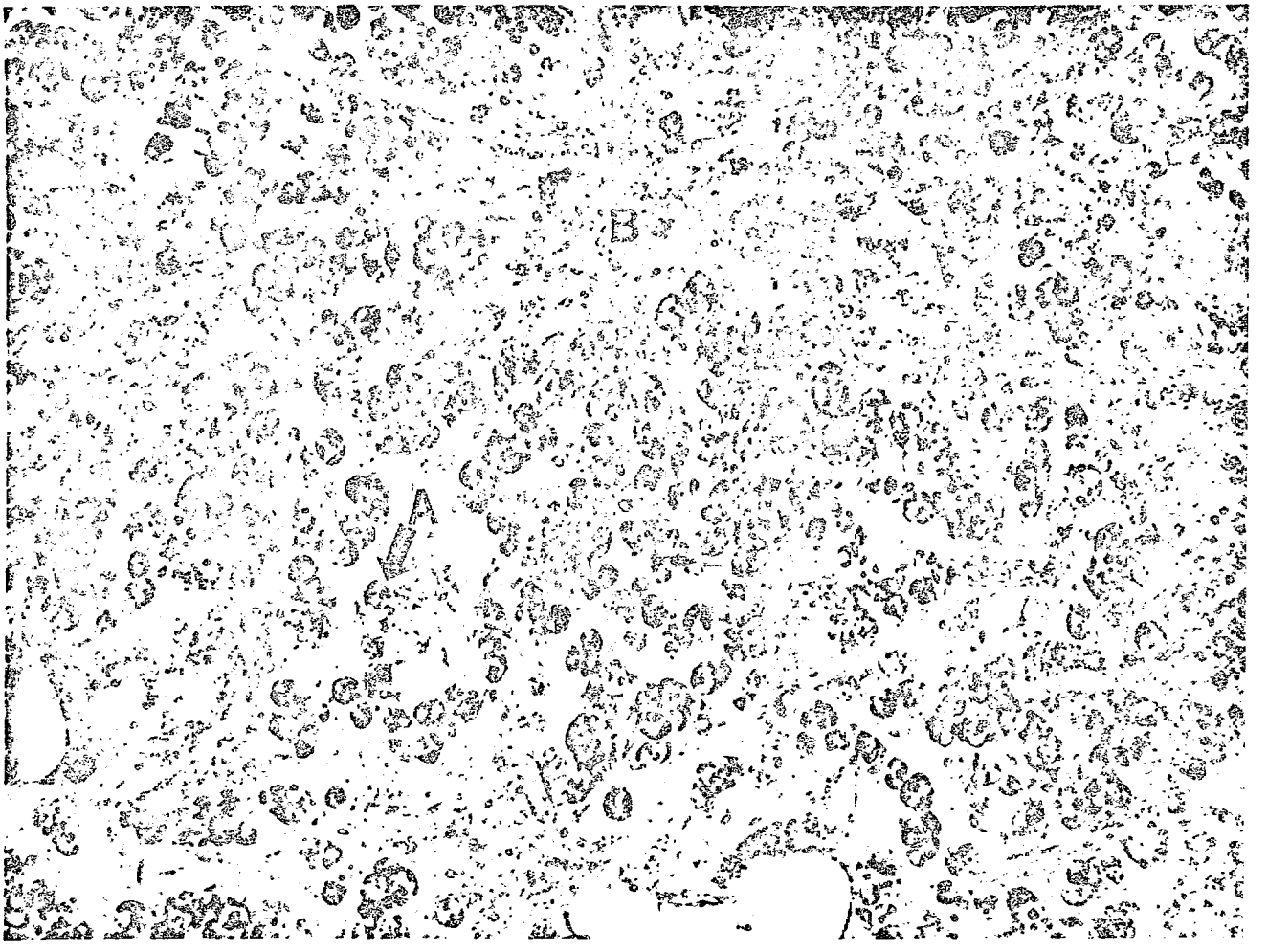
'Lowe, J., P. Parrish, J. Patrick, and J. Forester. 1972. Effects of the polychlorinated biphenyl Aroclor® 1254 on the American oyster, Crassostrea virginica. Mar. Biol., 17:209-214.

Luna, L. G. (cd). 1968. Manual of Histopathological Staining Methods of the Armed Forces Institute of Pathology. McGraw-Hill Book Co., New York. 258 pp.

Pauley, G. B. and G. S. Sayce. 1972. An invasive epithelial neoplasm in a Pacific oyster, Crassostrea gigas. J. Natl. Cancer Inst., 49(3):897-902.

Yevich, P. P. and M. M. Berry. 1969. Ovarian Tumors in the quahog, Mercenaria mercenaria. J. Inv. Path., 14:266-267.

P



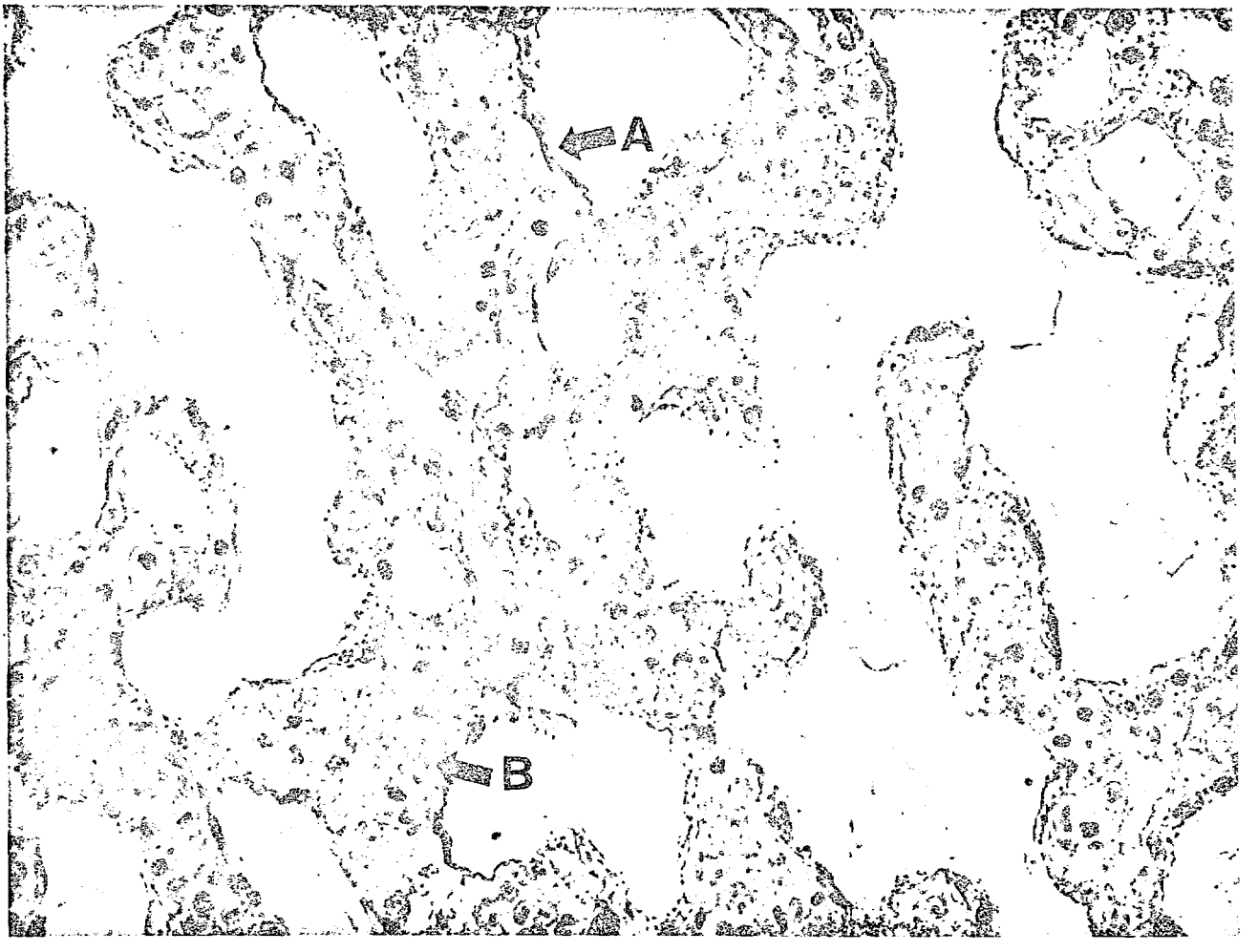
Pseudoceratina crassa - sponge *160x*

Collected 9-05-75 Station No. 146

Pathology No. 75-1319

A. Undifferentiated cells B. Ground substance containing spicules

B

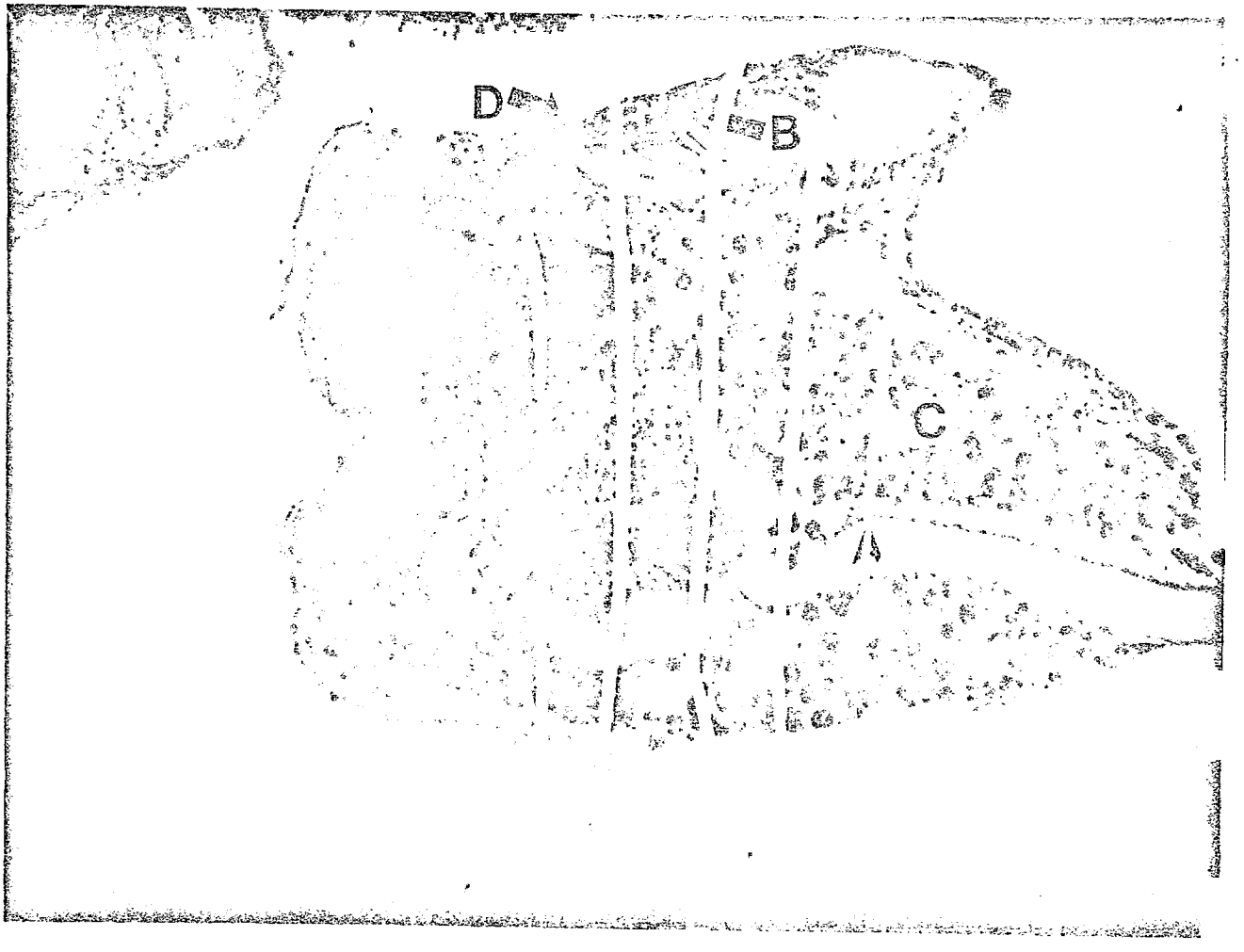


Millepora alcicornis - coral 160X

Collected 6-07-75 Station No. 147

Pathology No. 75-372

A. Squamous epithelium B. Zooxanthellae



Madracis decactis - coral 160X

Collected 6-10-75 Station No. 47

Pathology No. *75-378*

A. Connective tissue of mesoderm B. Muscle fibers

C. Zooxanthellae D. Mucosecretory cells of epitheliums

Reproductive products were not observed.

Dichocoenis stellaris-coral 160x

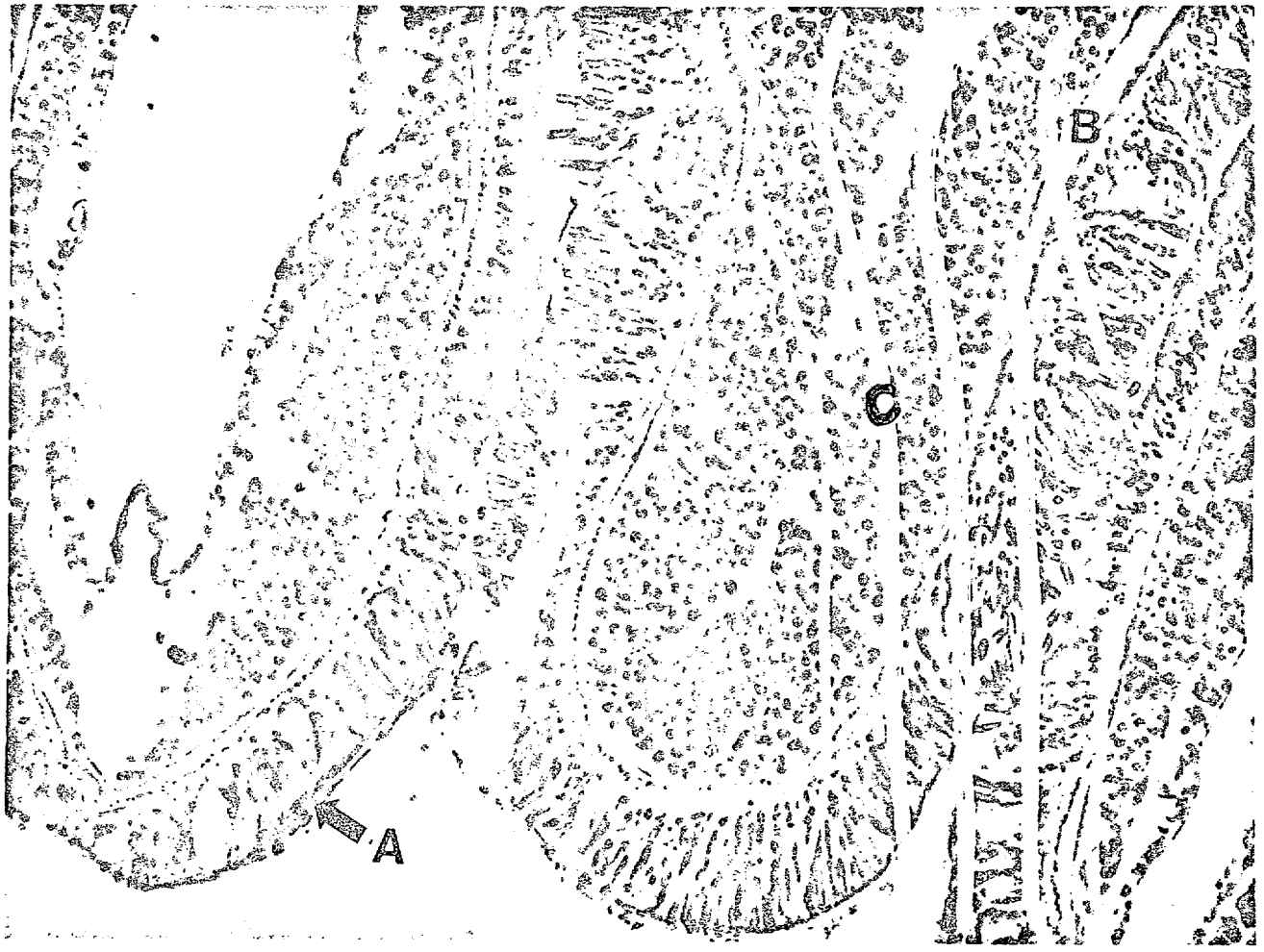
Collected 6-05-75 Station No. *146*

Pathology No. 75-384

A. Connective tissue of mesoderm B. Muscle fibers

C. Nematocyst D. Epitheliums

D



Dichocoenia stellar-is - coral *160x*

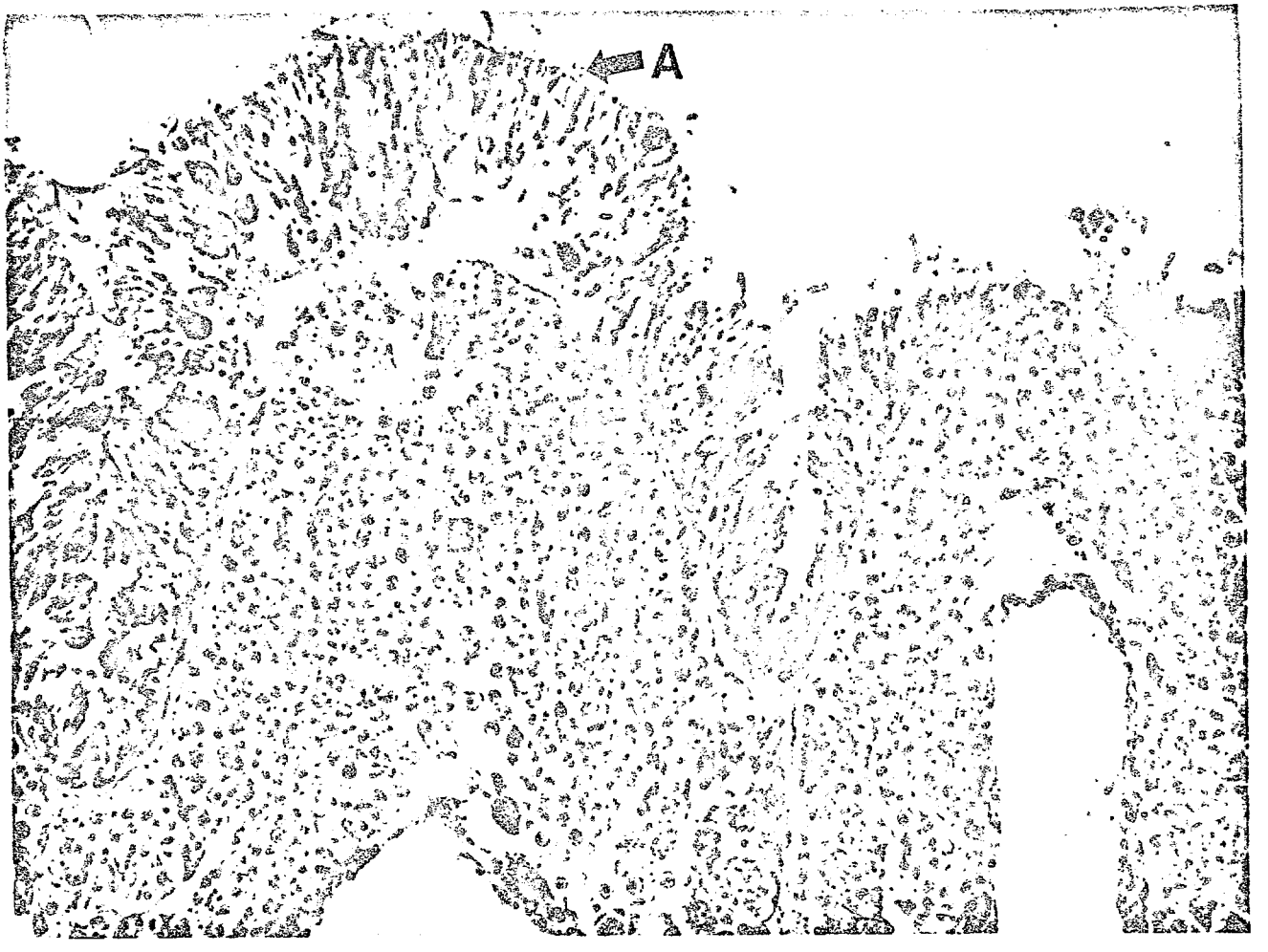
Collected *6-05-75* Station No. 146

Pathology No. 75-384

A. Epithelial cells B. Ground substance of mesoderm

C. Zooxanthellae

Reproductive products were not observed in this species.



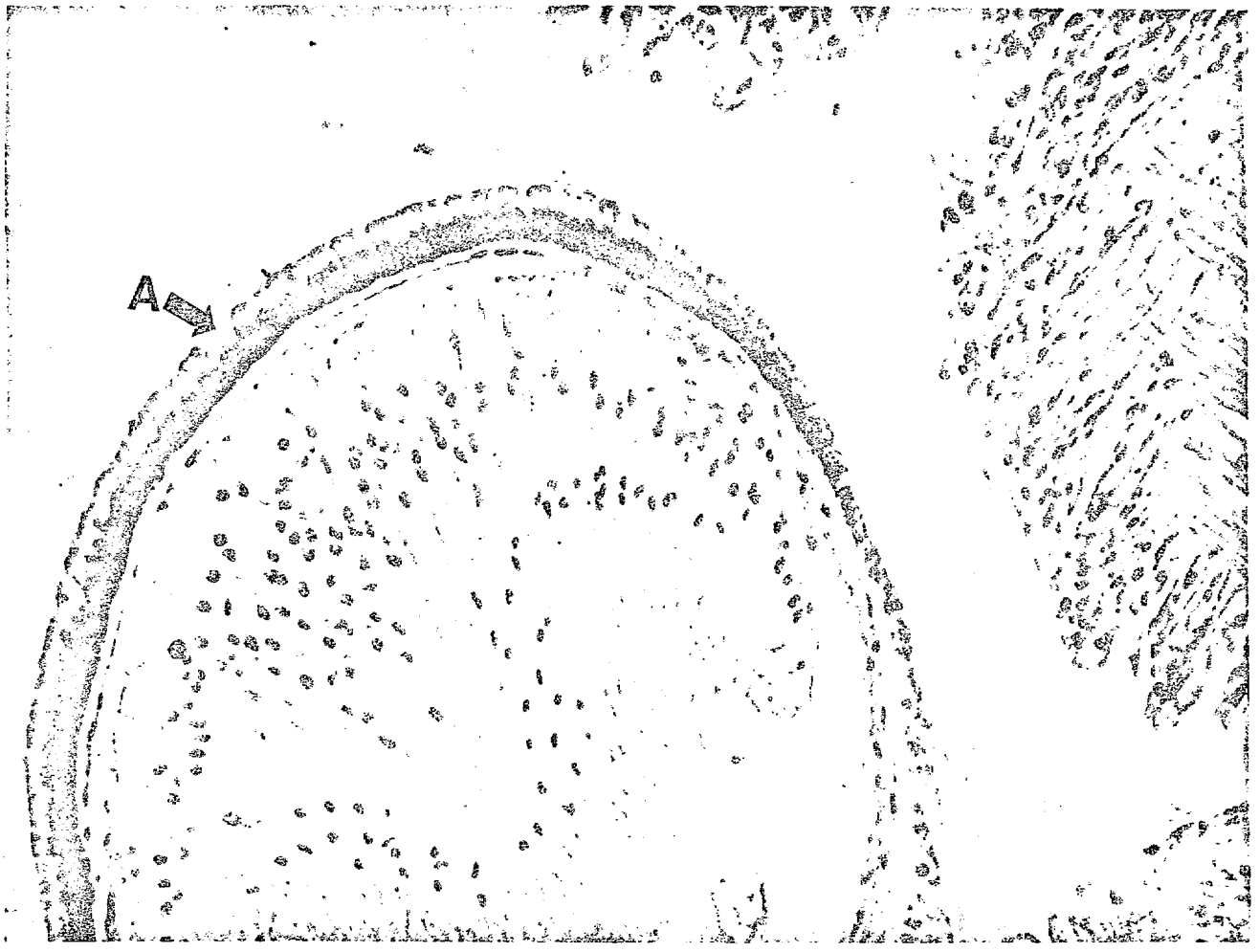
Phyllangia americana coral 160x

Collected 6-19-75 Station NO. *64*

Pathology No. *75-434*

A. Mucosecretory cells of epitheliums B. Zooxanthellae

B

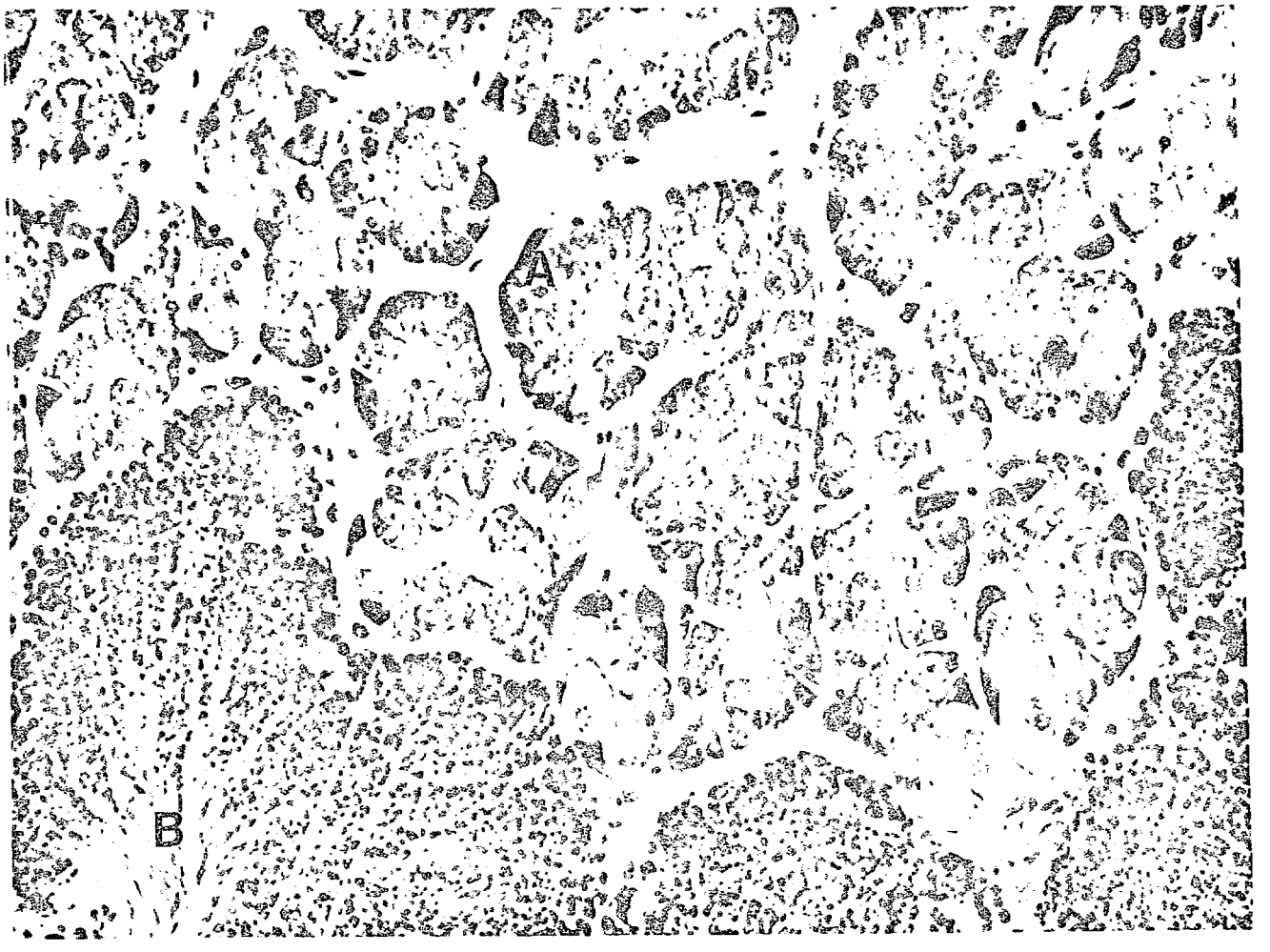


Argopecten gibbus - scallop 63x

Collected 7-19-75 Station No. VI-A

Pathology No. 75-877

A. Cornea of eye



Argopecten gibbus - scallop 160x

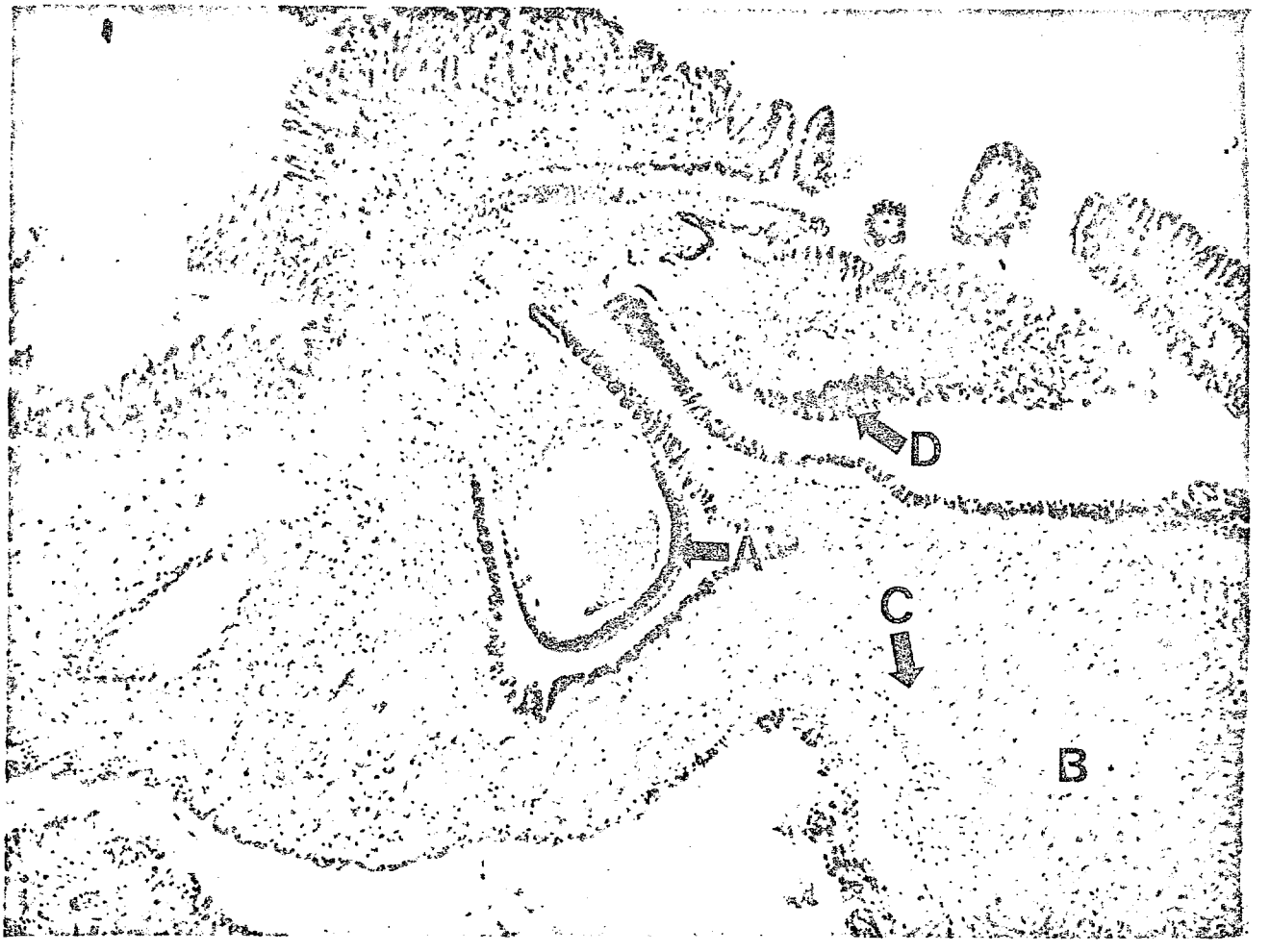
Collected 7-19-75 Station No. VI-A

Pathology No. 75-877

A. Digestive diverticula (note non-vacuolate columnar epithelium)

B. Mature Sperm

This species is a functional hermaphrodite. All individuals collected in summer contained mature gemetes indicating a late summer or fall spawning.



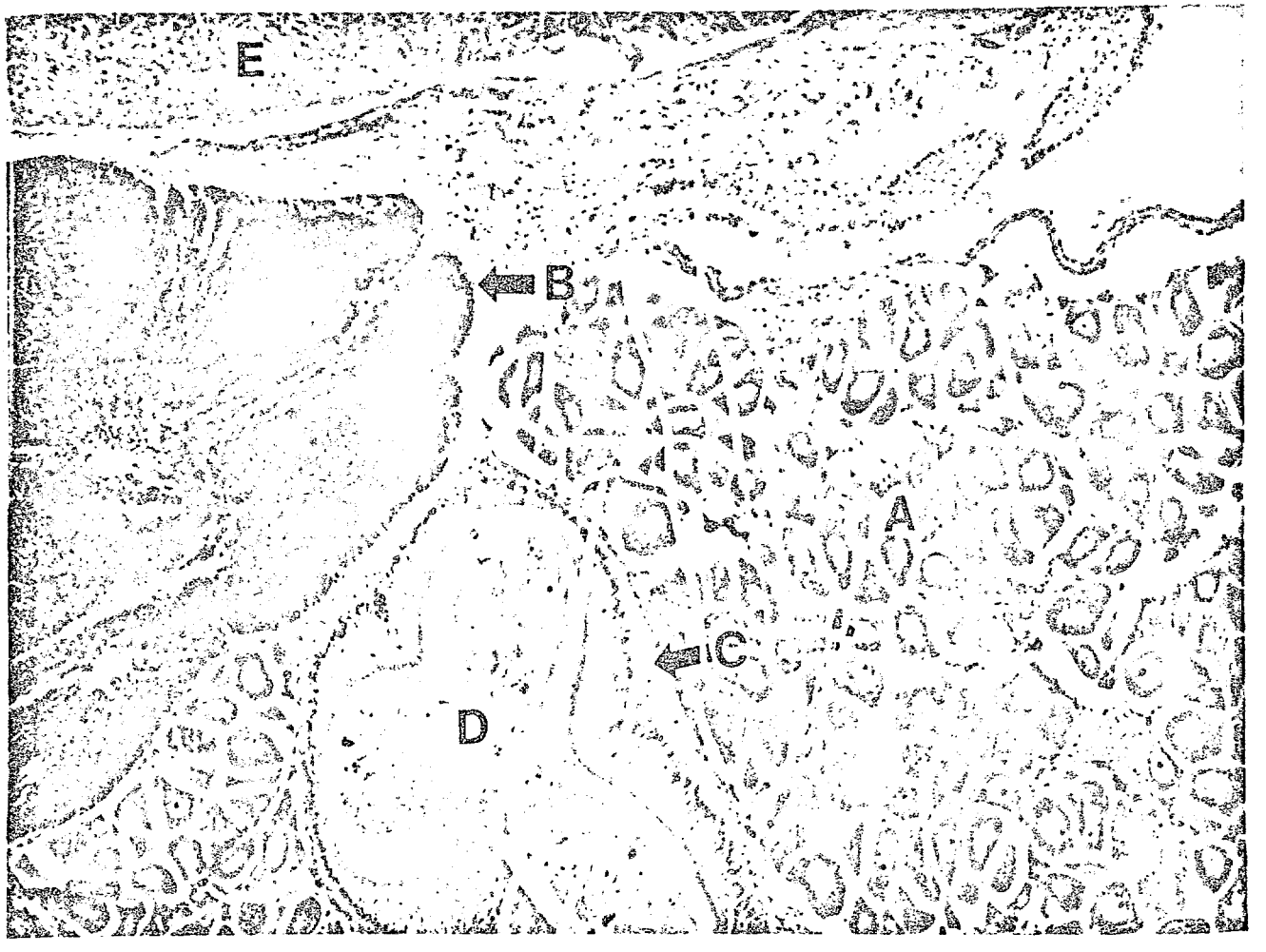
P *Aequipecten muscosus* - scallop 63X

Collected 6-17-75 Station No. 62

Pathology No. 75-510

A. Cornea of eye B. Mantle

C. Striated muscle D. Sensory tentacle with columnar epitheliums



Aequipecten muscosus - scallop 63X

Collected 6-17-75 Station No. 62

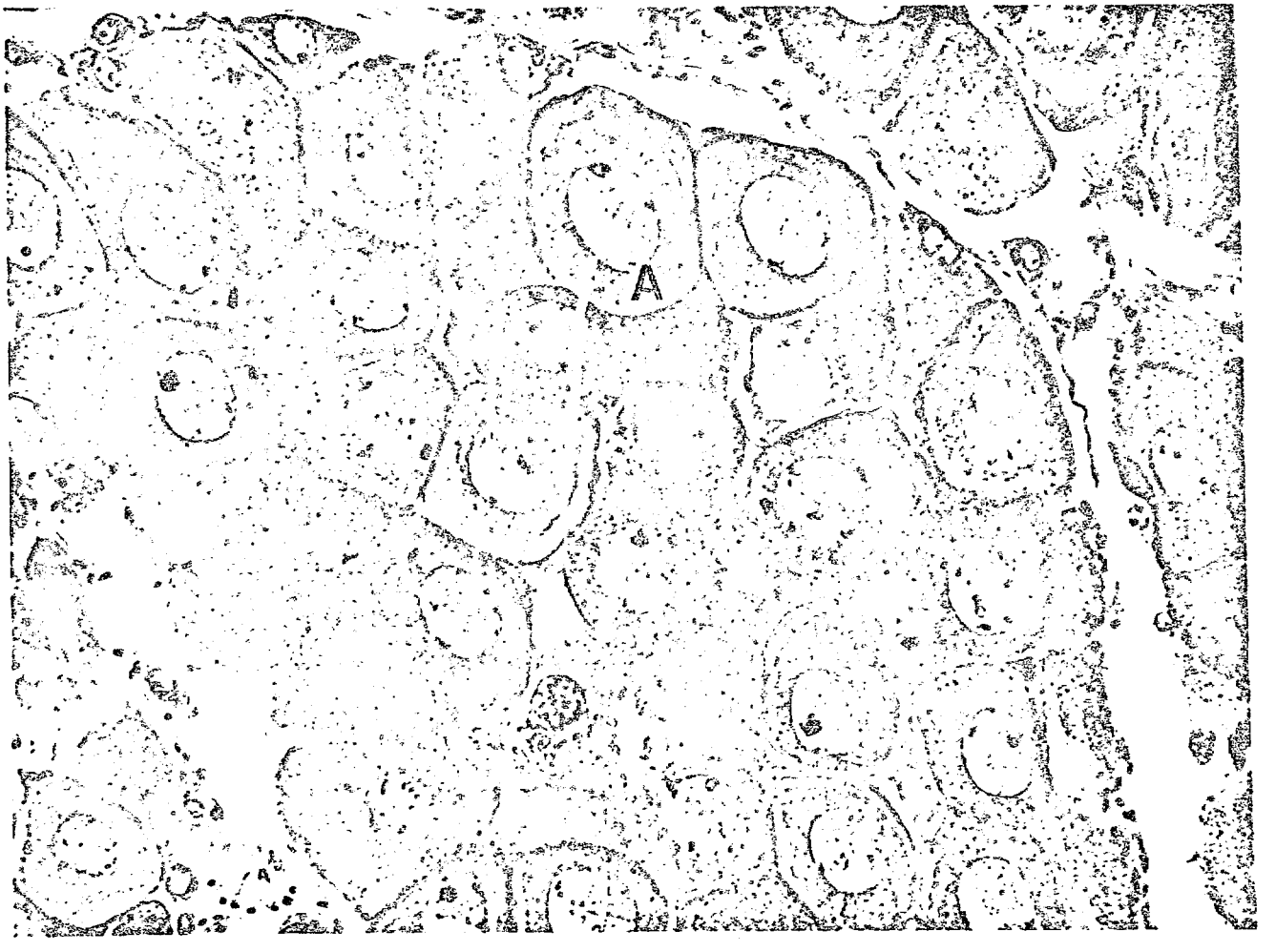
Pathology No. 75-510

A. Mature ova B. Mature sperm

C. Ciliated epitheliums of intestine D. Excretory muscle

E. Adductor muscle

This species is a functional hermaphrodite. Spawning apparently occurs in the summer or early fall.



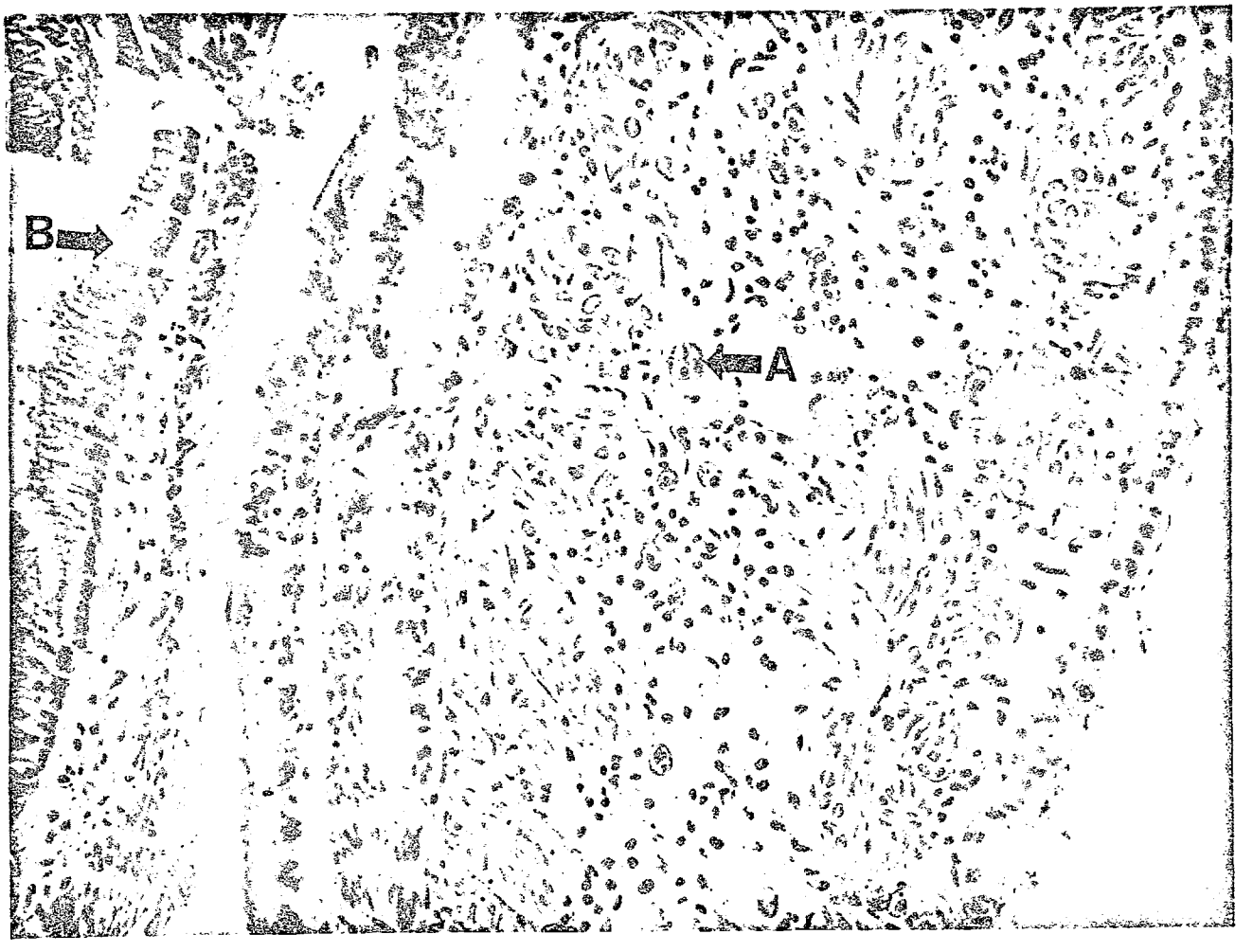
Spondylus americanus - **bivalve** 160x

Collected 6-11-75 Station lie. 47

Pathology No. 75-460

A. Mature ova

Spawning apparently occurs **in** the summer.



Area zebra - bivalve 160x

Collected 6-18-75 Station No. 62

Pathology No. 75-511

A. Red blood cell in mantle B. Ciliated epithelium

Pteria colymbus - bivalve 160X

Collected 6-29-75 Station No. 247

Pathology No. 75-563

A. Gill filament B. Frontal cilia

Pteria colymbus - bivalve 160X

Collected 6-29-75 Station No. 247

B Pathology No. 75-563

A. Mature sperm B. Digestive diverticula

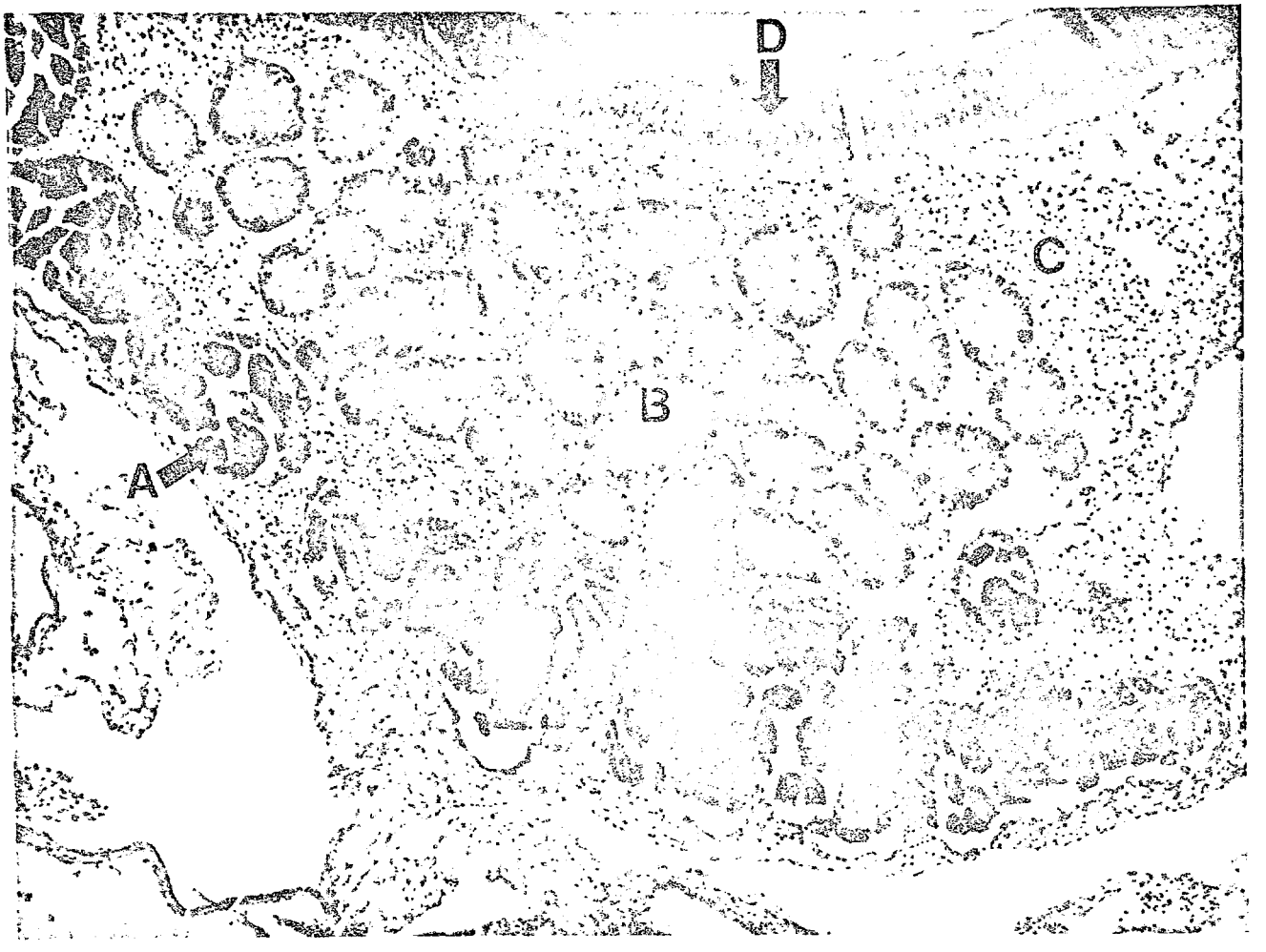
Spawning appears to occur in late summer or early fall.

Ostrea frons - bivalve 63X

Collected *7-14-75* Stations No. 47

Pathology No. 75-452

A. Ciliated epitheliums of tentacles B. Amoebocytes



Ostrea frons - bivalve 63X

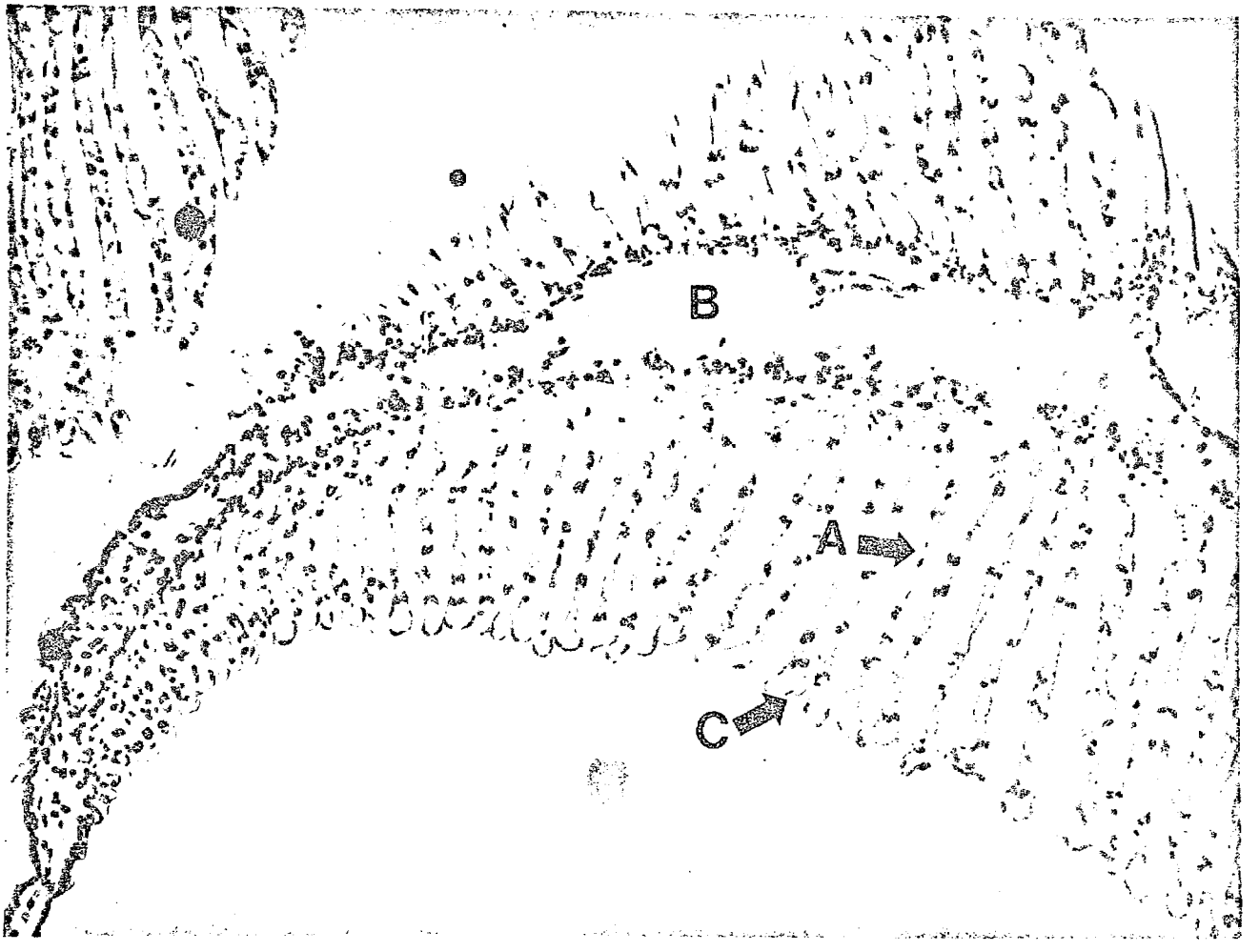
Collected 7-14-75 Station No. 47

Pathology No. 75-452

A. Mature sperm B. Digestive diverticula (note non-vacuolated columnar epitheliums)

C. Connective tissue D. Ciliated epitheliums of gut

Spawning apparently occurs during the summer although mature gemetes were observed in some fall samples.



Stenorhynchus seticornis - crab 63X

Collected 6-25-75 Station No. 146

Pathology No. 75-395

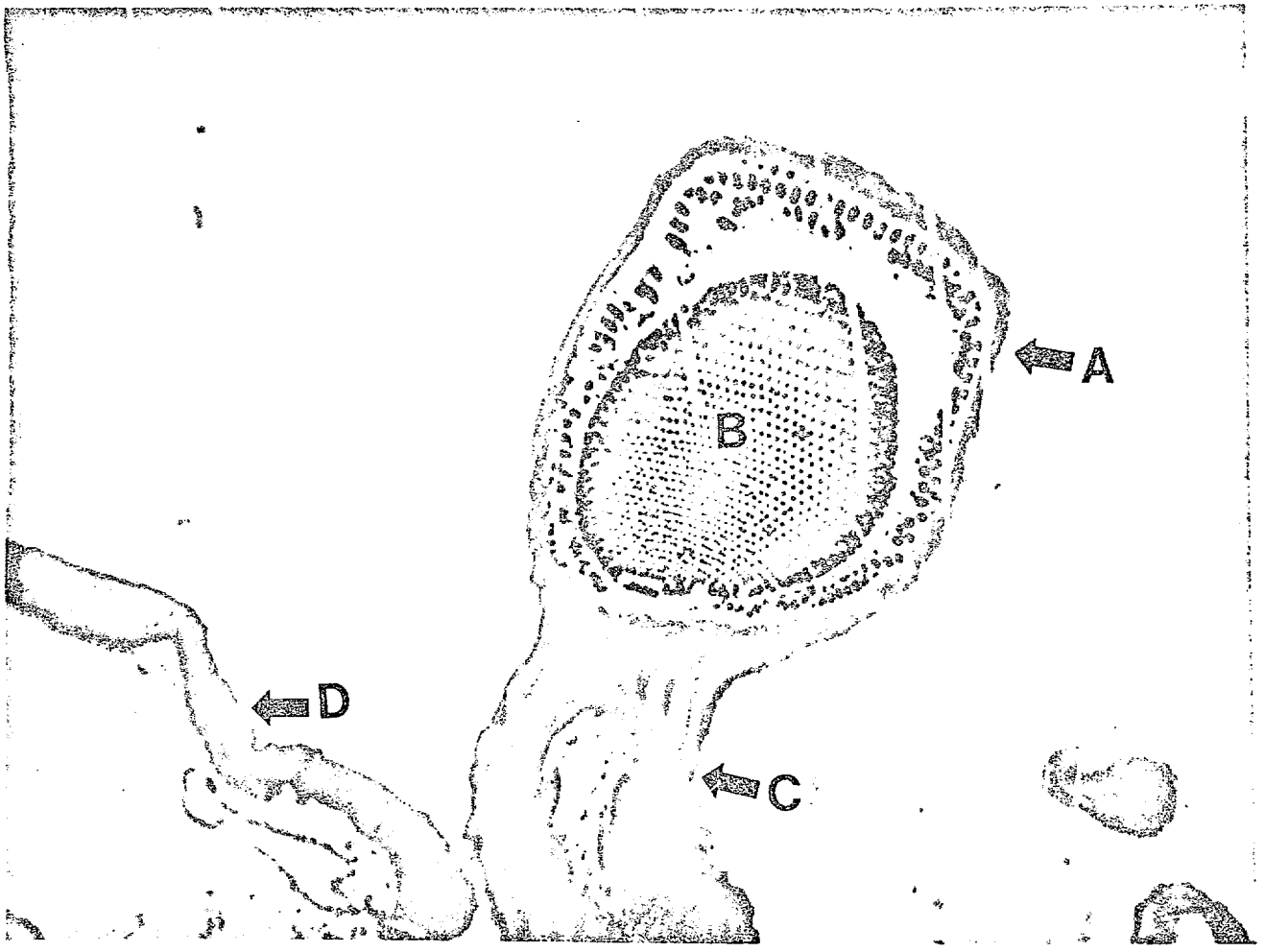
A. Lamella of gill B. Septum C. Outer lamella sinus

Stenorhynchus seticornis - c r a b 160X

Collected 10-04-75 Station No. 247

Pathology No. 75-1475

A. Hepatopancreas (vacuolated epitheliums results from fixation) B. Lumen



Stenorhynchus seticornis - crab 25X

Collected 10-04-75 Station No. 247

Pathology No. 75-1475

A. Corneal lens B. Ommatidia

C. Eyestalk D. Epicuticle

B

Stenorhynchus seticornis - c r a b 63x

Collected 10-4-75 Station No. 247

Pathology No. 75-1475

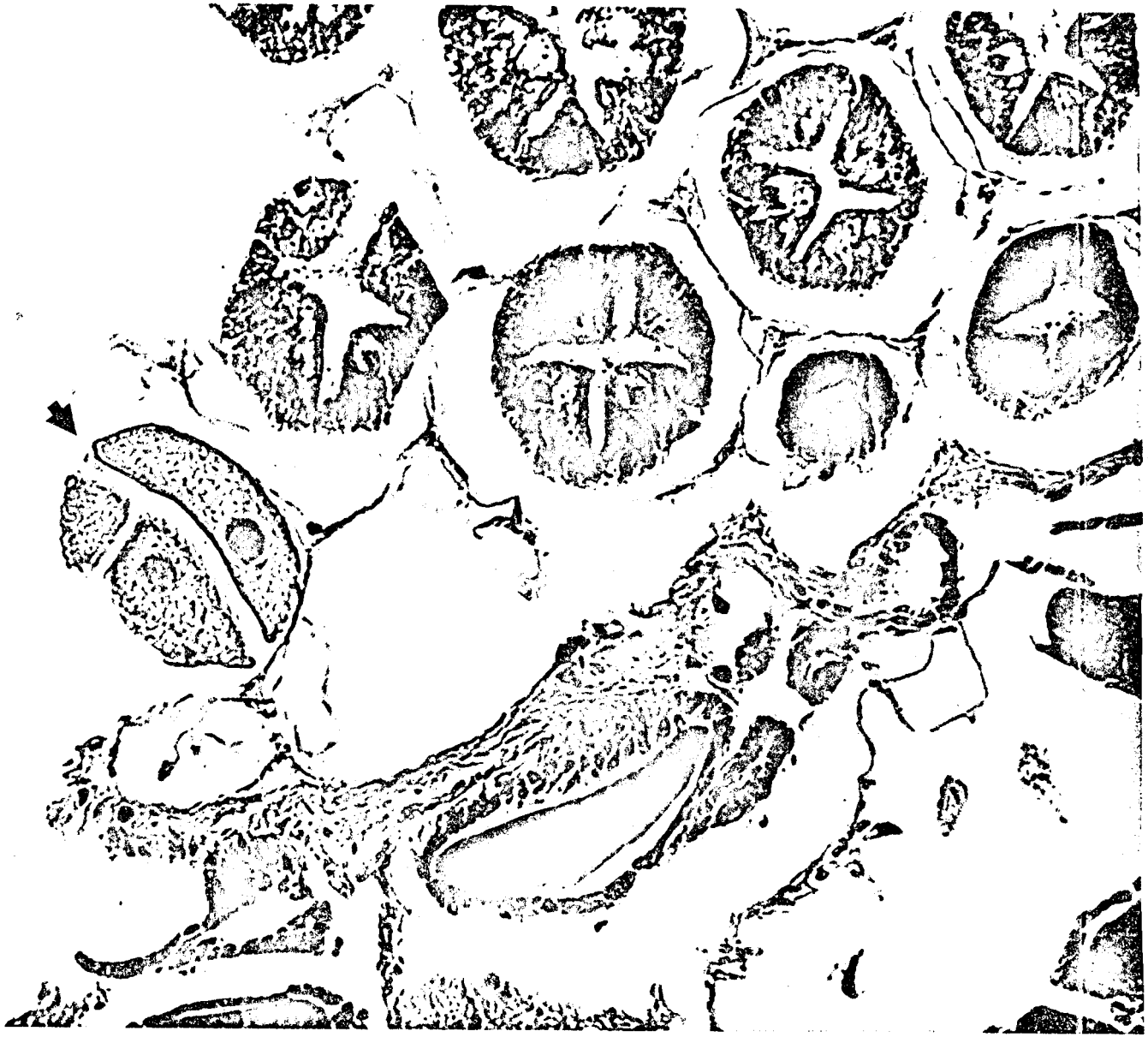
A. Corneal lens B. Ommatidia

Stenorhynchus seticornis - crab 63X

Collected 10-04-75 Station No. 247

Pathology No. 75-1475

Embryos in various stages of development. Egg bearing females were observed during all three seasons.

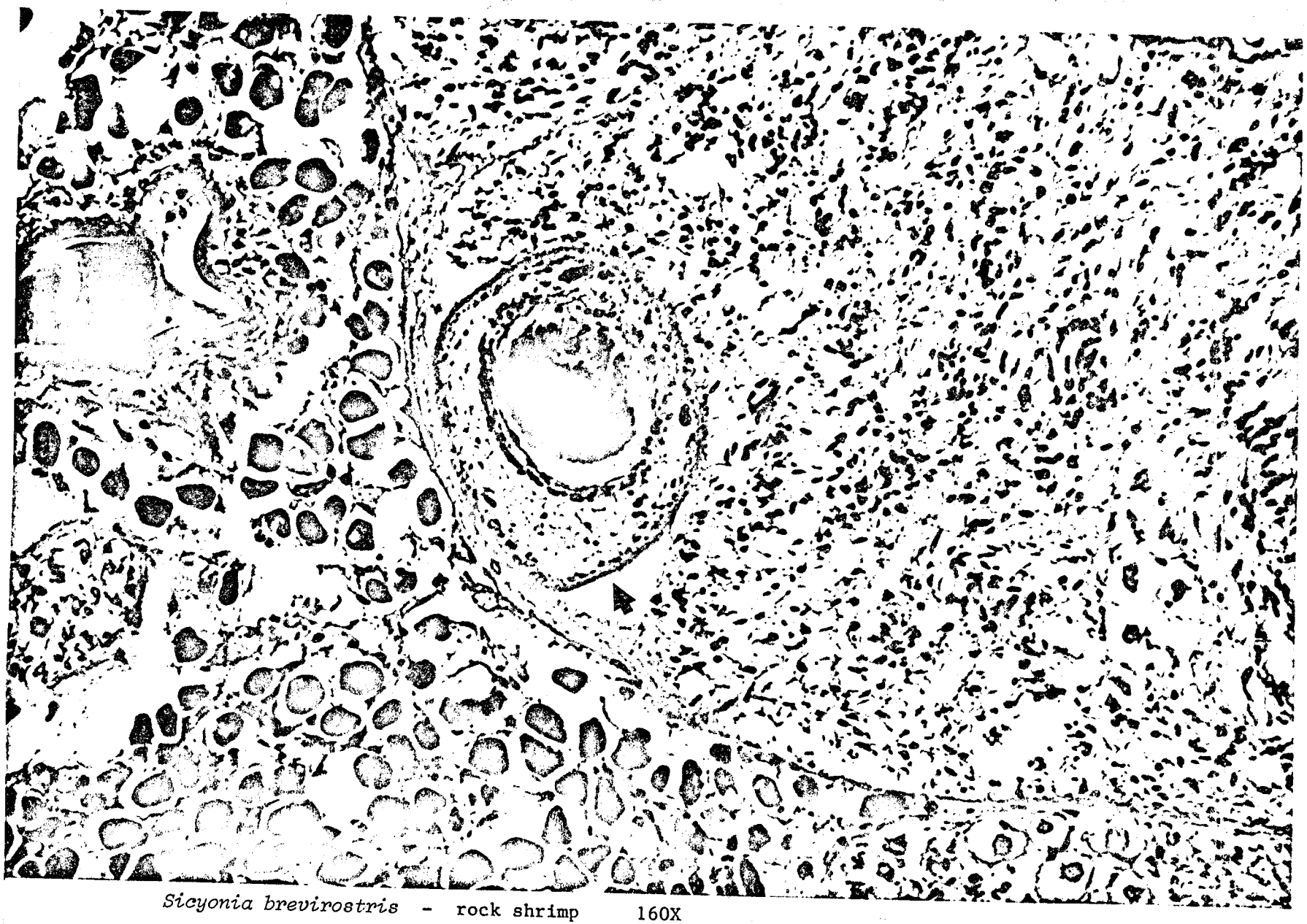


Sicyonia brevirostris - rock shrimp

Collected 7-19-75 Station No. VI A

Pathology No. 75-890

Sporozoan trophozoites possibly *Nematopsis* sp.
intertubular area of digestive diverticula



Sicyonia brevirostris - rock shrimp 160X

Collected 7-19-75 Station No. VI A

Pathology No. 75-890

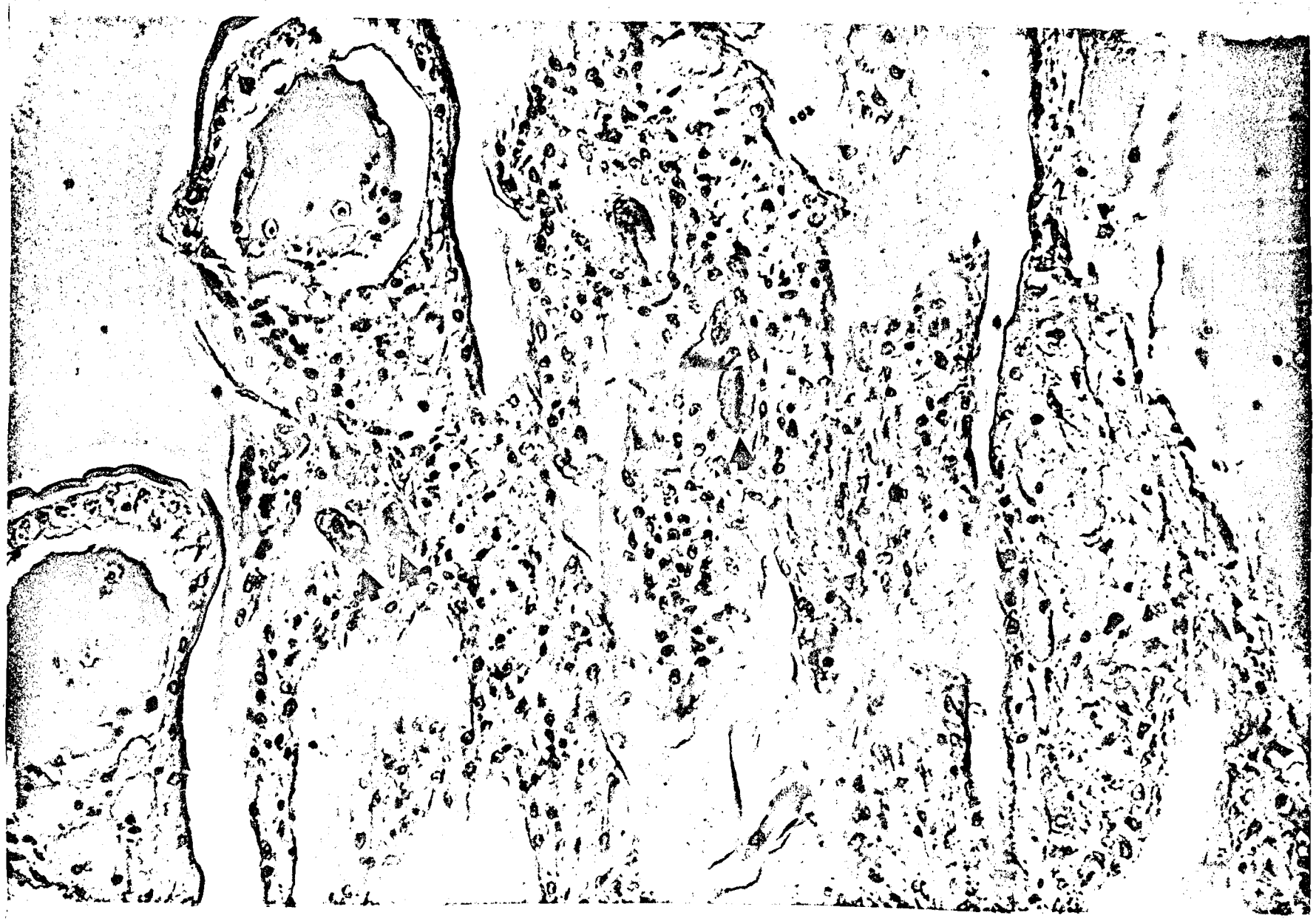
Probable metacestode (Metazoan parasite) along the reproductive tract

Penaeus setiferus - white shrimp 63X

Collected 12-3-75 Station No. 19

Pathology No. 76-156

Unidentified Helminth in the digestive tract



Sicyonia brevirostris - rock shrimp 160X

Collected 7-19-75 Station No. TI A

Pathology No. 75-890

<iliates in gills

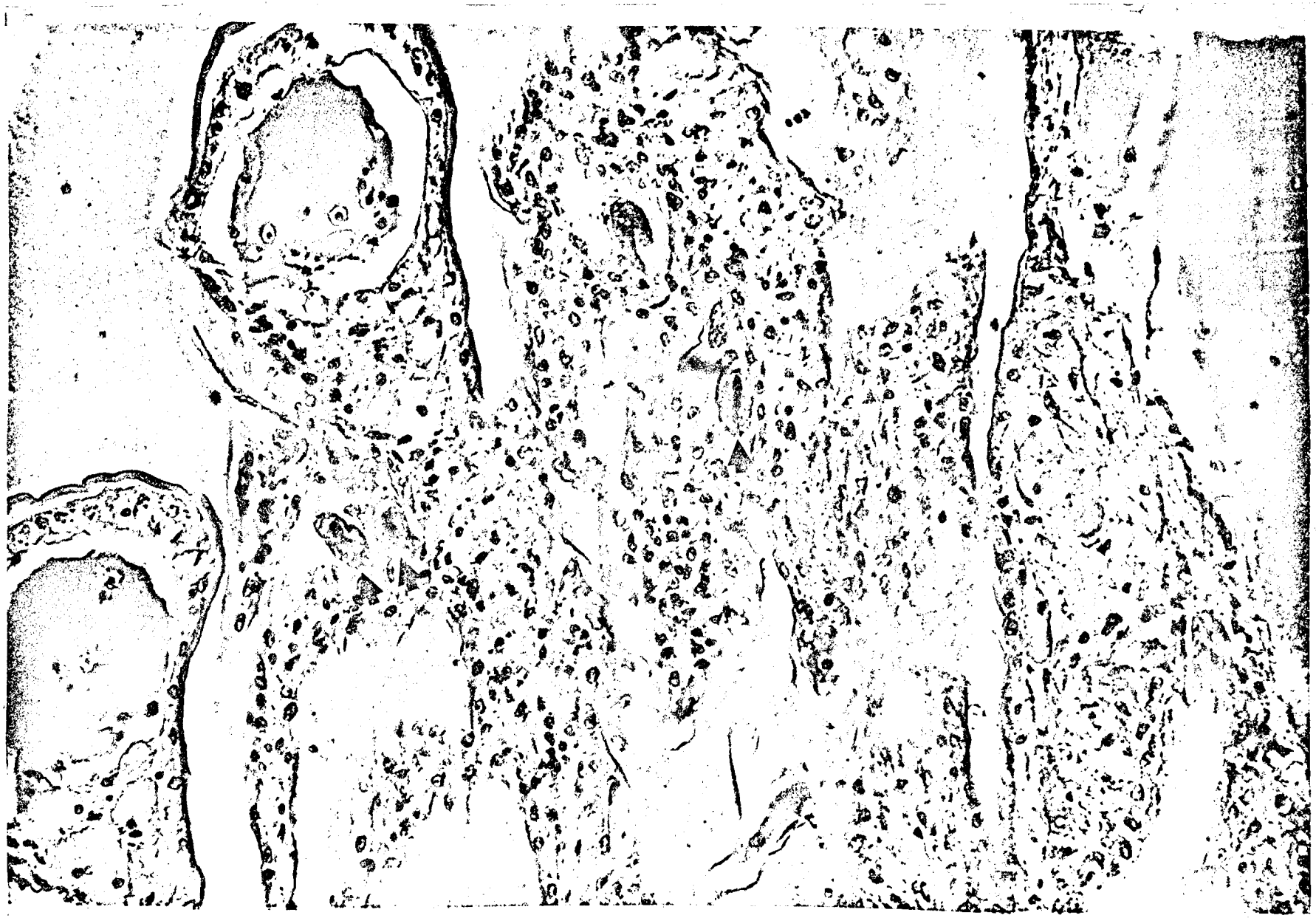
Pecten ravenli - scallop 400X

Collected 0-22-75 Station No. I A

Pathology No. 76-1743

Metacercaria of digenetic trematode, intertubular area of digestive diverticula

2



Sicyonia brevirostris - rock shrimp 160X

Collected 7-19-75 Station No VI A

Pathology No 75-89

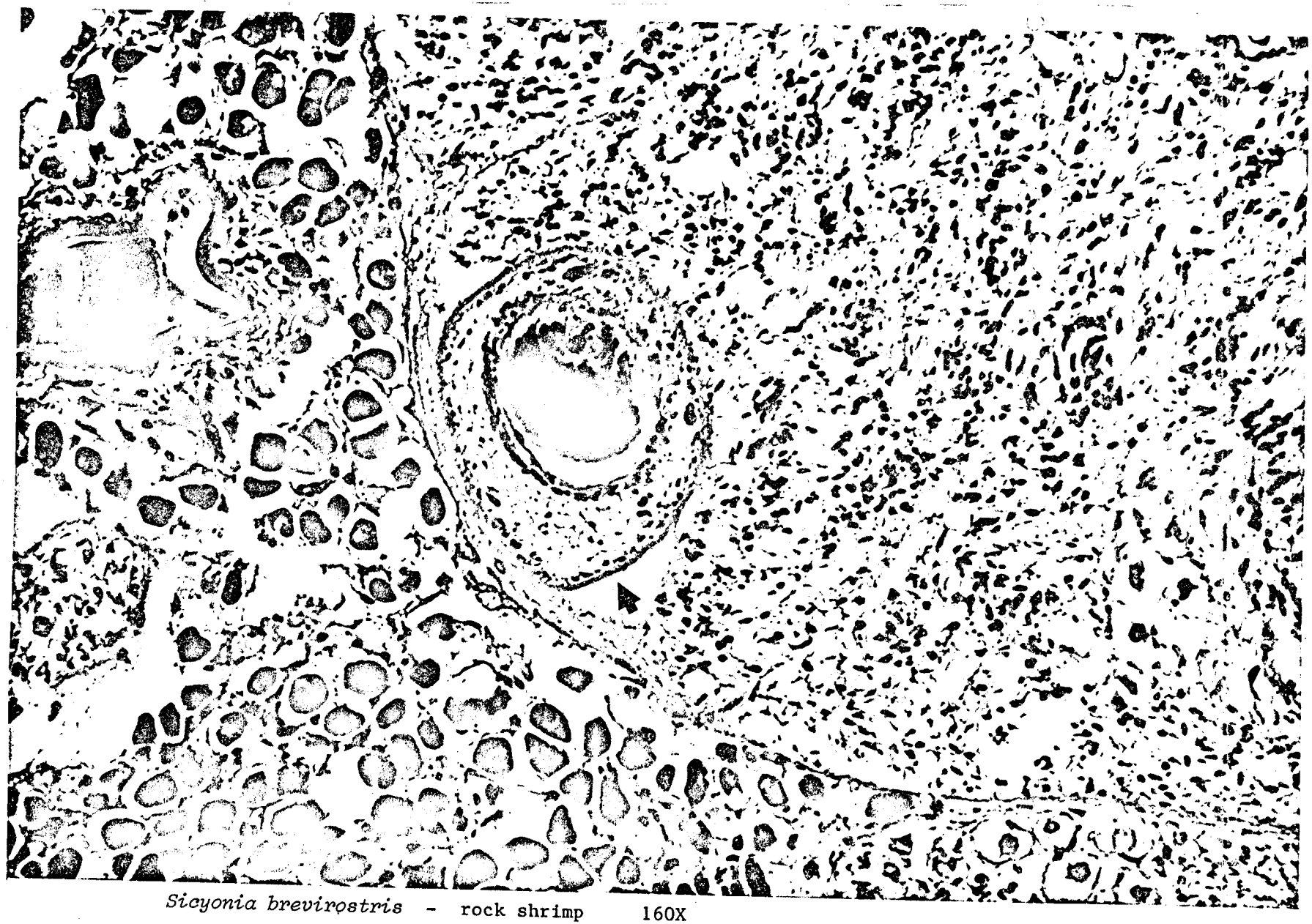
Ciliates in gills

Pecten ravenli – scallop 400X

Collected 10-22-75 Station No. = A

Pathology No. 76-1743

Metacercaria of digenetic trematode, intertubular area of digestive diverticula



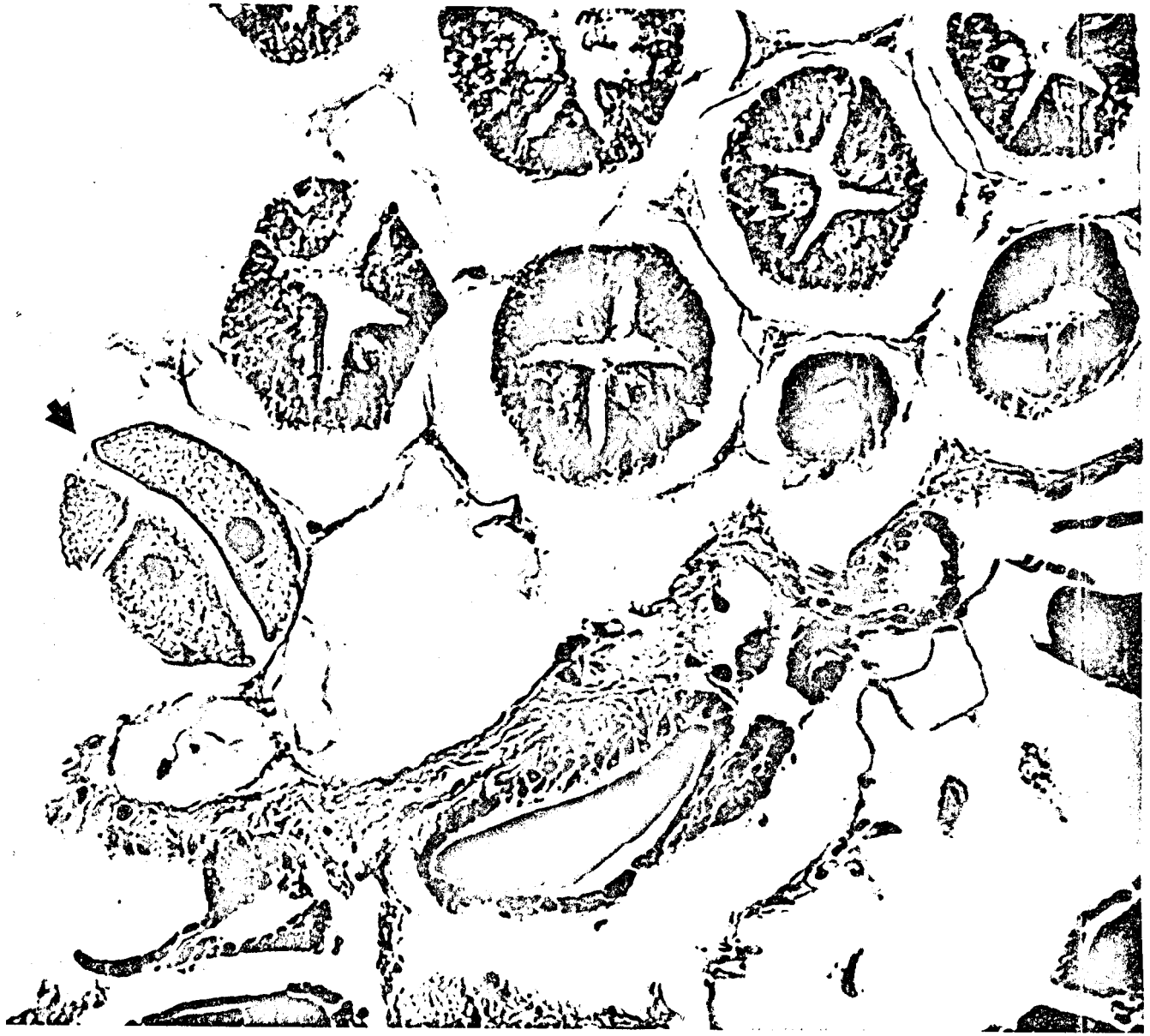
Sicyonia brevirostris - rock shrimp 160X

Collected 7-19-75 Station No. V± A

Pathology No. 75-89⊙

Probable metacestode (Metazoan parasite) along the reproductive tract

(3)



Sicyonia brevirostris - rock shrimp 160X

Collected 7-19-75 Station No. VI A

Pathology No. 75-890

Sporozoan trophozoites possibly *Nematopsis* sp.
intertubular area of digestive diverticula

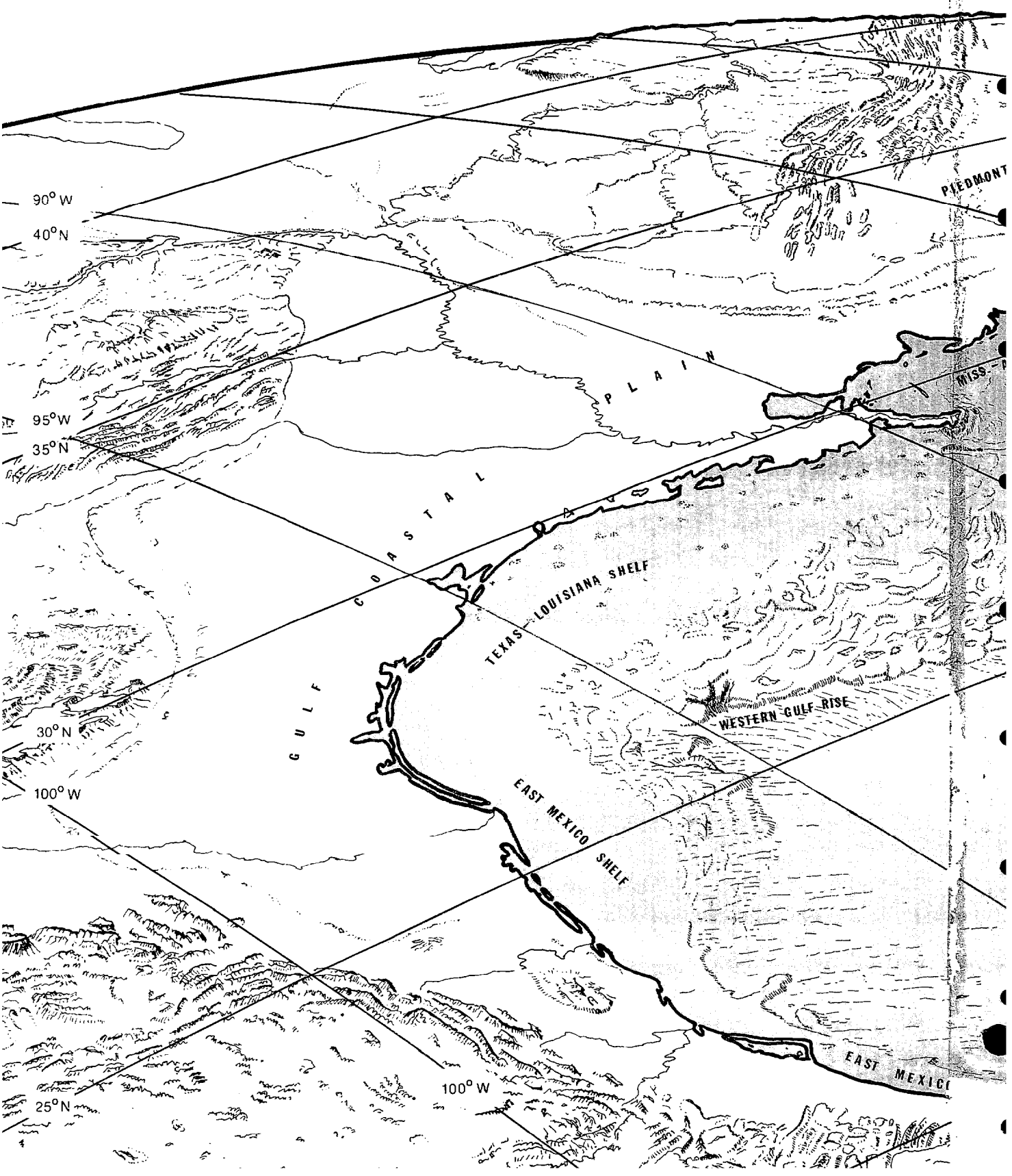
Penaeus setiferus - white shrimp 63X

Collected 12-3-75 Station No. 19

Pathology No. 76-156

Unidentified Helminth in the digestive tract

RECEIVED
DEC 20 9 55 AM '77
BUREAU OF LAND
MANAGEMENT
NEW ORLEANS OUTER CON-
TINENTAL SHELF OFFICE


90° W
40° N
95° W
35° N
30° N
100° W
25° N
100° W
PIEDMONT
PLAIN
GULF COASTAL
TEXAS-LOUISIANA SHELF
WESTERN GULF RISE
EAST MEXICO SHELF
EAST MEXICO