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AN ASSESSMENT OF BENTHIC SEDIMENTS AND AN INVENTORY OF SEWER OUTFALLS AND LAND USE FOR SELECTED CHICAGO AREA STREAMS

by Thomas E. Hill and Thomas A. Butts

Prepared for and in cooperation with
the Metropolitan Sanitary District of Greater Chicago

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INTRODUCTION

Many municipalities in Illinois are located along rivers and streams which are served by combined sewers, most of which were originally designed to collect storm and surface water runoff from residential and commercial properties for direct discharge into these rivers. They were not intended for transporting wastewater. The connection of property sewers to existing storm drainage systems became common practice with the advent of indoor plumbing. As communities expanded, separate sanitary sewers were constructed; however, the contents of these separate sewers eventually flowed into the storm sewer system in the older sections of communities. Thus the system originally conceived for handling only urban storm drainage became a dual purpose utility, conveying a combination of surface water runoff and wastewater.

Background

The Metropolitan Sanitary District of Greater Chicago (referred to in this report as the District) serves an area of approximately 872 square miles, of which 43 percent is served by combined sewers. The District estimates that any precipitation event over 0.1 inch will result in combined sewer overflows. Approximately 100 overflows occur each year. An average discharge event is equivalent to the effluent waste load from a population of almost 4 million people. Approximately once a year, flood conditions cause the waterways to backflow into Lake Michigan. These backflows, which are highly contaminated by combined sewer overflows, threaten the public water supply and recreational uses of the lake (Currie and Kendrick, 1981).

To address these problems, the District has developed the Tunnel and Reservoir Plan (TARP). The goals of the plan are: to achieve water quality standards; to provide flood control; and to prevent backflows to Lake Michigan. To achieve this, 131 miles of underground tunnels and 127,550 acre-feet of reservoir storage volume will be constructed to capture combined sewer overflows and store this water until it can be treated in the District treatment plants (Currie and Kendrick, 1981).

Purpose of Study

A portion of the Tunnel and Reservoir Project Phase I remains unfunded. The District is collecting combined sewer overflow CCSO) and water quality information from 1985 through 1987 in anticipation of additional construction funding. Preliminary, comprehensive stream surveys are needed to provide a basis for later intensive studies. Information on the benthic or bottom sediment condition is important in making an adequate assessment of the environmental impacts of CSOs on receiving streams. The Water Survey collected this information through an intergovernmental research agreement with the District.

Study Plan

The study plan was organized according to a set of specifications and procedures set forth by the District. Basically the plan called for collecting and examining bottom sediments and describing stream conditions and land use patterns at quarter-mile stream intervals, and cataloging outfall sewers along the entire length of the stream study reaches. The scope of the work was expanded somewhat beyond that desired by the District to include the collection of data specific to Water Survey research interests. During the summer of 1976, the Water Survey collected biological data at many of the locations which were visited during this study. Similar biological information was collected at these locations during this study so that short-term ecological and/or environmental changes could be examined and evaluated.

Study Area

A total of 77.75 stream miles were surveyed and sampled along seven streams located in Cook County C75.25 miles) and DuPage County (2.5 miles) as shown in figure 1. The specific stream reaches are:

1. Calumet River - 6.75 miles between Ewing Ave. and its junction with the Little Calumet River

2. Little Calumet River - 19.00 miles between the Indiana state line and its junction with the Calumet River

3. Grand Calumet River - 2.75 miles between the Indiana state line and its junction with the Calumet River

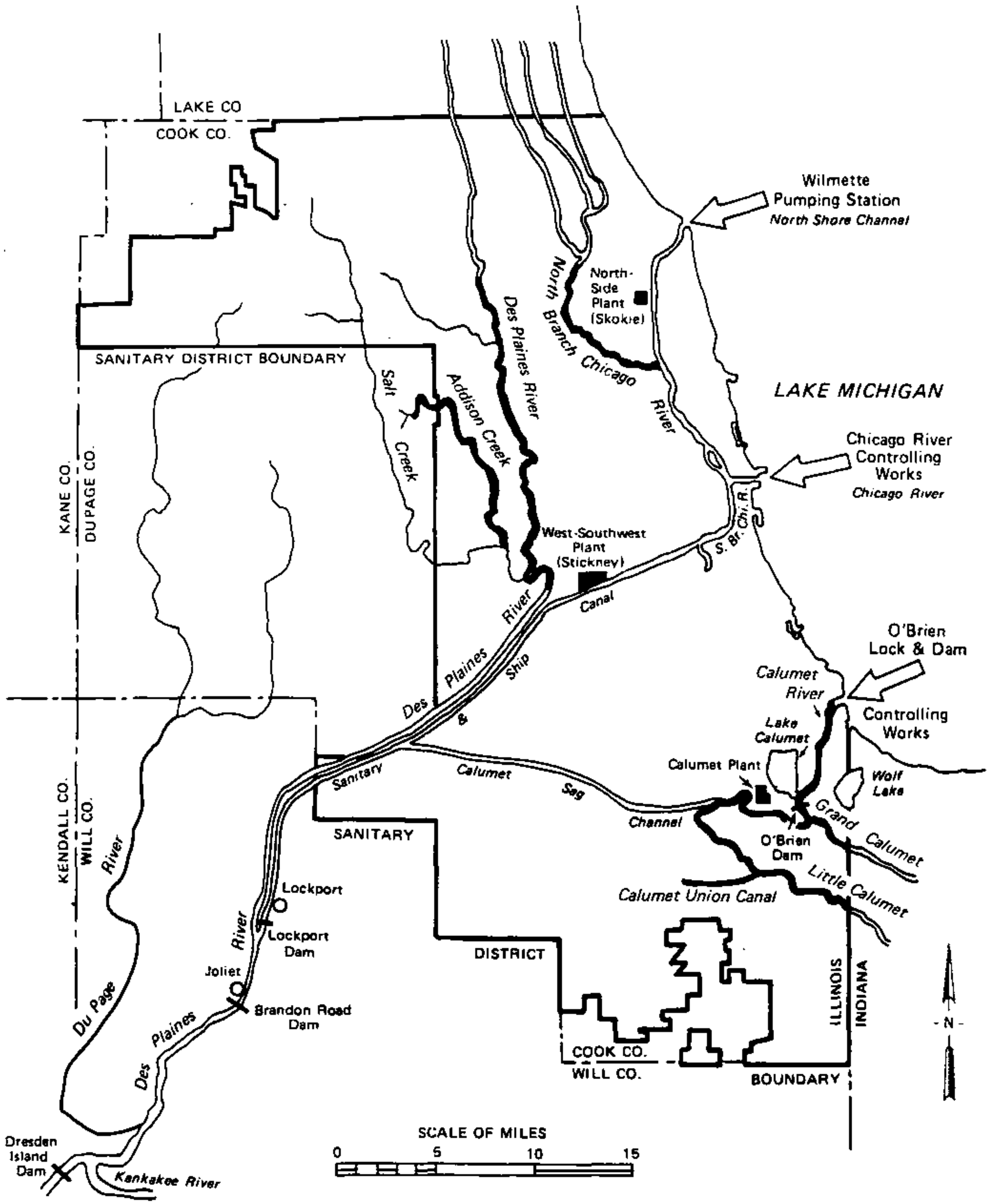

Figure 1. Stream reaches in the Chicago drainage system that were studied (Solid reaches indicate study areas)

4. Calumet Union Drainage Canal - 3.50 miles between Western Ave. and its junction with the Little Calumet River

5. Addison Creek - 11.00 miles between York Road and its junction with Salt Creek including 2.5 miles in Du-Page County

6. Des Plaines River - 23.50 miles between Dempster Ave. and 55th Street

7. North Branch of the Chicago River - 11.25 miles between Church Street and its junction with the North Shore Channel

The 19 miles of the Little Calumet River that were studied can be divided into two distinct reaches. One reach, from mile 0 to mile 6.0, is deep and open to commercial navigation, while the other reach, from mile 6.0 to mile 19.0, is shallow and can be navigated only by small power and/or row boats.

Acknowledgments

This investigation was funded by the Research and Development Department of the Metropolitan Sanitary District of Greater Chicago. The work was performed under the general supervision of the Chief of the Illinois State Water Survey.

Special thanks are extended to Irwin Polls for the guidance he provided during the study. Thanks are also extended to Alan Kirwan, John Mathis, and Dana Shackleford, w.ho assisted in the field work; Lynn Weiss, who prepared the illustrations; Linda Johnson, who typed the original manuscript; and Gail Taylor, who edited the report.

METHODS AND EQUIPMENT

To accomplish the study objectives all 77.75 stream miles had to be traversed by some means. The large, deep rivers were surveyed by using a 21-foot, semi-vee boat (figure 2), and intermediate size streams were navigated by using a 14-foot, flat-bottom boat (figure 3). Small streams were surveyed by either wading or using a 12-foot, inflatable rubber boat (figure 4).

Prior to the start of the field work, maps were prepared in the office to aid in the surveying and sampling process and to provide a means for recording certain field observations.

Figure 2. 21-foot semi-vee sampling boat equipped with power winch and Ponar dredge

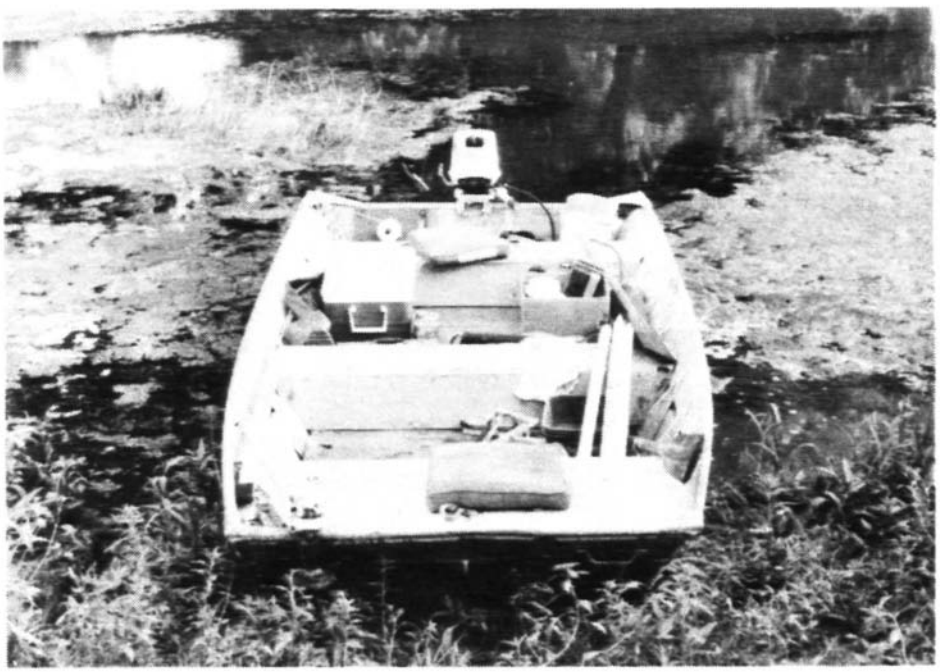

Figure 3. 14-foot flat-bottom sampling boat

Figure 4. 12-foot inflatable rubber sampling boat

Map Preparation and Use

Maps of the reaches of the streams surveyed were prepared using 15-minute (1:24,000) United States Geological Survey (USGS) quadrangle maps and 15-minute USGS floodplain maps. The 1/2-mile mile-point stream designations shown on the USGS floodplain maps were transferred to the streams on the quadrangle maps, which show detailed topographic features but not stream mile points. The 1/4-mile and 3/4-mile points were spotted on these maps by interpolating between the 1/2-mile and 1-mile points. The zero mile points in all cases were referenced to the mouth of the stream. Relative to this, a special situation occurs within the Little Calumet-Calumet River drainage system. This drainage complex, under natural conditions, drains into Lake Michigan. However, the system is now controlled, and during dry weather. Lake Michigan water is diverted into the Calumet Sag Channel. For this study, station mile-point numbering follows the natural flow pattern; i.e., the mouth of the Calumet River is assigned mile 0.00, and successive 1/4-mile points follow uninterrupted to the lllinois-Indiana border.

Photocopies were made of the quadrangle maps for referencing and making notations in the field. The approximate locations of sewer outfalls, sediment sampling stations, and unusual hydrologic and hydraulic stream features were recorded on the maps.

Stream Surveys

The stream surveys had three main parts: identifying and cataloging sewer outfalls, sediment sampling, and recording land use and stream environments in the immediate area of the 1/4-mile point sediment sampling stations. Also, benthos were collected at selected sites. Distances were measured either with a 100-foot fiberglass tape or with a high-quality, lens-displacing range finder having a measurable range from 29 feet (1% accuracy) to 1000 feet (5% accuracy). Figure 5 shows the range finder being used from the 21-foot boat. On small streams requiring wading or the use of the inflatable rubber boat, two-man crews were used; on the large streams navigable by the flat-bottom boat or by the semi-vee boat, three-man crews were used. On the small streams requiring wading or the rubber boat, one to three miles of stream were traversed before the motor vehicle was retrieved by walking overland.

Sewer Outfall Identification and Cataloging

To fully accomplish this task, virtually every foot of the stream channel banks had to be carefully examined. At the

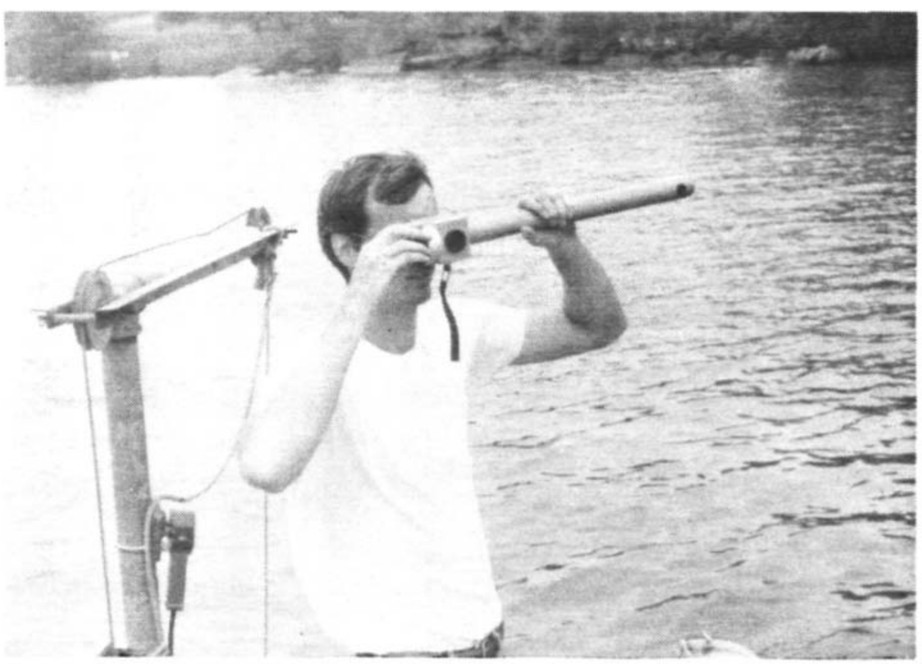

Figure 5. Range finder in use aboard the 21-foot sampling boat

sighting of an outfall, a crew member would identify its type, measure its size, determine the condition of the effluent, if active, and mark the conduit with orange fluorescent paint. A second crew member would record this information and spot the outfalls on a field map, indicating whether the entry was on the right or left bank. The approximate locations were recorded in terms of a plus or minus distance from the 1/4-mile points marked on the maps. For example, an outfall located 350 feet downstream of mile 2.75 would be recorded as 2.75-350; an outfall located 500 feet upstream of 2.75 would be recorded as 2.75+500.

Abbreviations were applied to the shape and type of outfalls. A key to those used is presented in Appendix B. For oval and rectangular outfalls, the vertical dimension was listed first and the horizontal second. A 36-inch-high by 72-inch-wide reinforced concrete, oval culvert would be recorded as 0-36 x 72-RCP.

Sediment Sampling

Sediment samples were taken at the 1/4-mile points determined from the USGS floodplain maps. In some instances, the exact location deviated slightly from the 1/4-mile points to avoid sampling under bridges, around obstructions, in riffles, or in areas devoid of landmarks. Also, sites were shifted somewhat to areas of obvious sludge or sediment deposition which would have been missed otherwise, and to areas which had been sampled historically by the Survey for benthos.

Sampling stations were marked by painting mile points on appropriate landmarks with orange fluorescent paint. Large-stream station numbers were painted on headwalls and retaining walls; small-stream station numbers were usually painted on tree trunks and the tree branches flagged with fluorescent red tape. The object marked, its bank location, and its distance and direction from a prominent landmark were recorded.

The extent of sampling at a given site depended primarily on the size and complexity of the stream. In the large rivers, three samples were taken: one near the right bank, one in the center of the main flow channel, and one near the left bank. In this report, all locations are referenced to looking downstream. Medium-size streams were sampled in the center of the main flow channel, and the right and left banks were physically and visually inspected. Small and/or relatively uniform streams or stream reaches were sampled in the center, and only visual notations were made for side channel conditions.

A 9-inch-square Ponar dredge sediment sampler, operated by using a motorized winch from the 21-foot boat (figure 6), was used to collect samples from the Calumet River and the deeper, lower reaches of the Little Calumet River. Sampling at all other locations was done manually by using a 6-inch-square Petite Ponar dredge (figure 7). A weighted 100-foot fiberglass tape was used to measure water depths from the boats. Waded stream depths were measured with a retractable 16-foot steel carpenter's tape. All undisturbed Ponar sediment samples were photographed with an Olympus OM-25 SLR camera using ISO 400 black and white film. The sediment composition (the percent sand, silt, gravel, etc.) was estimated by thoroughly examining the sediment in the field.

Sampling Station Assessment

A standardized stream information form (figure 8), provided by the District, was used in the field to record topographic and land use features and stream physical, ecological, and environmental conditions. Three field sheets, one for the center and one each for right and left bank positions, were used at each 1/4-mile sampling station. General information at a given site was recorded only on the center form. This included information such as: the direction

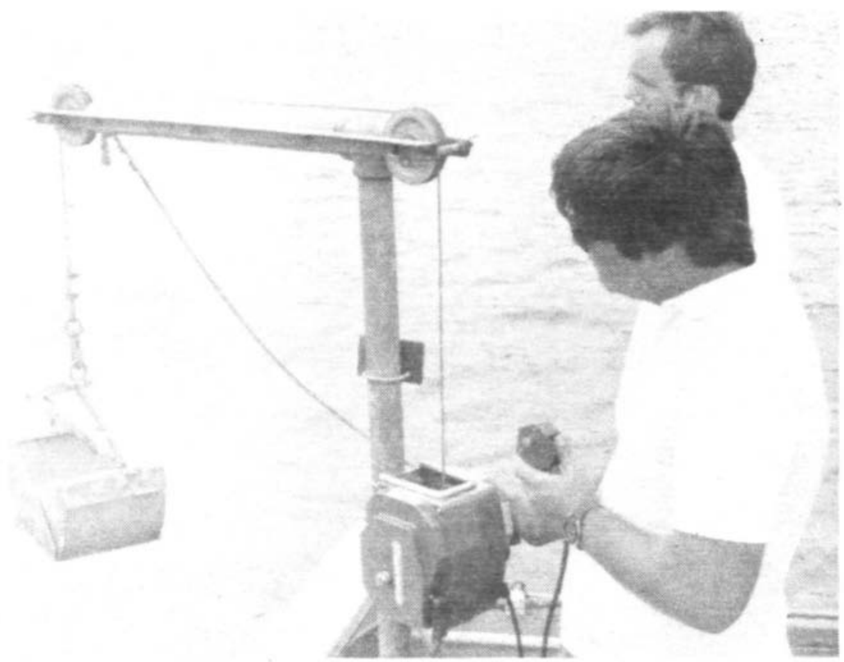

Figure 6. Ponar dredge sediment sampler attached to motorized winch aboard the 21-foot sampling boat

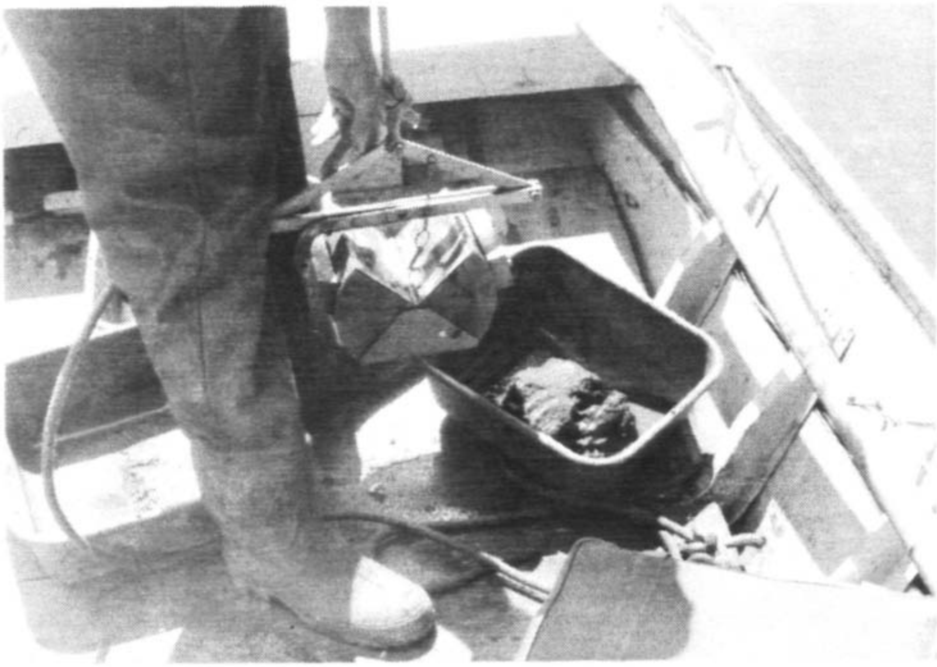

Figure 7. Manual use of the Petite Fonar dredge sediment sampler aboard the 14-foot sampling boat

and distance of a station from a landmark, stream habitat Criffle or pool), stream width, water level conditions, the presence of hydraulic structures, channel alterations, logjams or debris buildup, and the abundance of aquatic macrophytes. Specific information recorded only on bank-side sheets included observations relative to bank erosion, land use, and riparian vegetation. Data pertaining to sediment samples, such as data on sediment composition, color, odor, oil content, and water depth, were recorded at all three channel positions when appropriate. On all sheets the date, time, observer, stream name, mile point, and sampling location were recorded Sediment descriptions, benthos sampling locations, station location markings, and miscellaneous notes were recorded in the remarks section. A brief description of how a station was marked was written on the form corresponding to that stream bank. The completed field forms were accumulated on a weekly basis, and photocopies were sent to the District every Friday afternoon.

Benthic Macroinvertebrate Sampling

During the summer of 1976, Butts and Evans (1978) collected benthos samples at 16 selected locations within reaches of four of the streams surveyed during this study. These sites were resampled for benthos by using the Ponar dredges. Depending upon the degree of sampling difficulty, Metropolitan Sanitary District Of Greater Chicago

Stream Information

Date___/___/______Time_____:_ __ Observer__________________________

Stream___________________________________Stream Mile___________________

Sampling Location Facing Downstream LEFT CENTER RIGHT(circle one)

Direction and Distance From Landmark_________________________________

Stream Habitat POOL RIFFLE (circle one)

Depth____________ft or M Width_____________ft or M

Water Level DRY LOU NORMAL HIGH FLOODED (circle one)

Hydraulic Structures DAM LEVEE BRIDGE ISLAND (circle one)

Channel Alteration/Channelized NO YES ____________________________

Bank Erosion SLIGHT MODERATE SEVERE (circle one)

Losjam or Debris Build-up NO YES ________________________________

Land Use RESIDENTIAL COMMERCIAL/INDUSTRIAL AGRICULTURE FOREST
(circle one)

Riparian Vegetation TREES SHRUBS GRASS DENUDED (circle one)

Aouatic Macrophytes ABSENT SPARSE(0-25%) M0DERATE(25-50%)
(circle one) DENSE(50-75%) FULL(75-100%)

Sediment. Composition: Rock____% Sand____% Plant Detritus____%

(% by Observation) Pebble____% Silt____% Sludge____%

Gravel____% Clay____% Other____%

Sediment Color_______________________Sediment Odor_____________________

Oil in Sediment NONE LIGHT MODERATE HEAVY (circle one)

Remarks____

____

____

Figure 8. Standardized stream information form provided by the District for use in the field

one to three dredge samples were taken and washed through a Wildco Model 190-E20 plastic bucket equipped with a No. 30 sieve for organism retainment. The samples were preserved in 95 percent ethyl alcohol for organism identification and enumeration in the laboratory. Also, benthic organisms casually observed in the routine sediment samples collected at the 1/4-mile stations were included in the sediment descriptions.

Data Compilation and Reduction

The primary purpose of this study was to document, in gross or generalized terms, certain physical, ecological, and environmental characteristics of selected Chicago area streams receiving combined sewer overflows. Consequently. this information, with the possible exception of the benthos data, is basically subjective and is not amenable to extensive mathematical manipulation, interpretation, and reduction. Therefore the data summaries and results are presented mainly in the form of tables and detailed maps. Condensed information and general summaries are presented as short tables in the text, whereas lengthy tabulations and the photographs of the Ponar dredge sediment samples are presented as appendices to the report.

Twenty maps were prepared showing the location of outfalls, tributary streams, off-channel lakes and storage reservoirs, channel dams, islands, bridges, municipalities, major thoroughfares, railroads, bridges, major political boundaries, and sampling stations.

RESULTS

The field work portion of the study was completed between June 3 and September 19, 1985. All results are based upon single visits to each stream or stream reach. The surveying and sampling activities were conducted during relatively stable, low to medium flow conditions except at several short reaches of the Des Plaines River. Water depths as great as 5 feet above "normal" were experienced during the sampling of 6.5 miles of this stream. When water depths appeared significantly greater than "normal" low to medium summer levels, subtractions were made to adjust the depths to "normal" conditions. Consequently, all water depth references and tabulations presented in this report refer to low to medium flow conditions. The relative sizes of the streams studied can be ascertained by examining the average stream widths and depths presented in table 1.

Table 1. Average Depths and Widths of Streams or Stream Reaches Surveyed

Water Course	Symbol	Average Center Depth (ft.)	Average Width (ft.)
Calumet River	CR	32.0	336
Little Calumet' River (miles 0-6)	LC	14.0	472
Des Plaines River	DP	4.1	108
Little Calumet River (miles 6-19)	LC	3.3	59
Grand Calumet River	GC	2.6	62
North Branch of the Chicago River	NB	2.0	40
Addison Creek	AC	1.4	25
Calumet Union Drainage Canal	CU	1.2	16

Twenty maps, exemplified by figure 9, were prepared to show all pertinent information. The remaining 19 maps are presented in Appendix A. The numbered dots represent 1/4-mile point locations where sediment samples were taken and where stream conditions and land use patterns were recorded. The sewer outfall reference numbers, shown in boldfaced type, indicate the relative outfall locations, including the side of the stream in which they are found.

Stream pools were always selected as the location for the 1/4-mile stream sampling location. Riffles are not extensive in many of the streams, and when they were encountered slight adjustments were made in the "exact" 1/4-mile point locations to avoid sampling in riffle areas.

Sewer Outfalls

A total of 863 sewer outfalls were identified, examined, and cataloged over the 77.75 stream miles traversed. The results are summarized in table 2. Figure 9 and the maps in Appendix A show the areal locations. Details relative to each outfall are presented in Appendix B. The alpha-numeric coding used in Appendix B to identify the outfalls refers to the stream and the sequential upstream outfall numbers. For example GC9 in Appendix B refers to sewer number 9, the farthest upstream outfall on the Grand Calumet River (GC), shown on figure 9.

Great care was taken not to miss any significant outfalls. If any were possibly missed, it is certain that they are small, obscured, and inactive. A few of the outfalls listed may possibly be only road ditch tiles or tiles that no longer serve functional purposes. In cases where such identification could be made, the sewers were not cataloged; however, when some doubt existed they were included. The possibility exists that one or more sewer outfalls could discharge to the underground portion of Addison Creek between

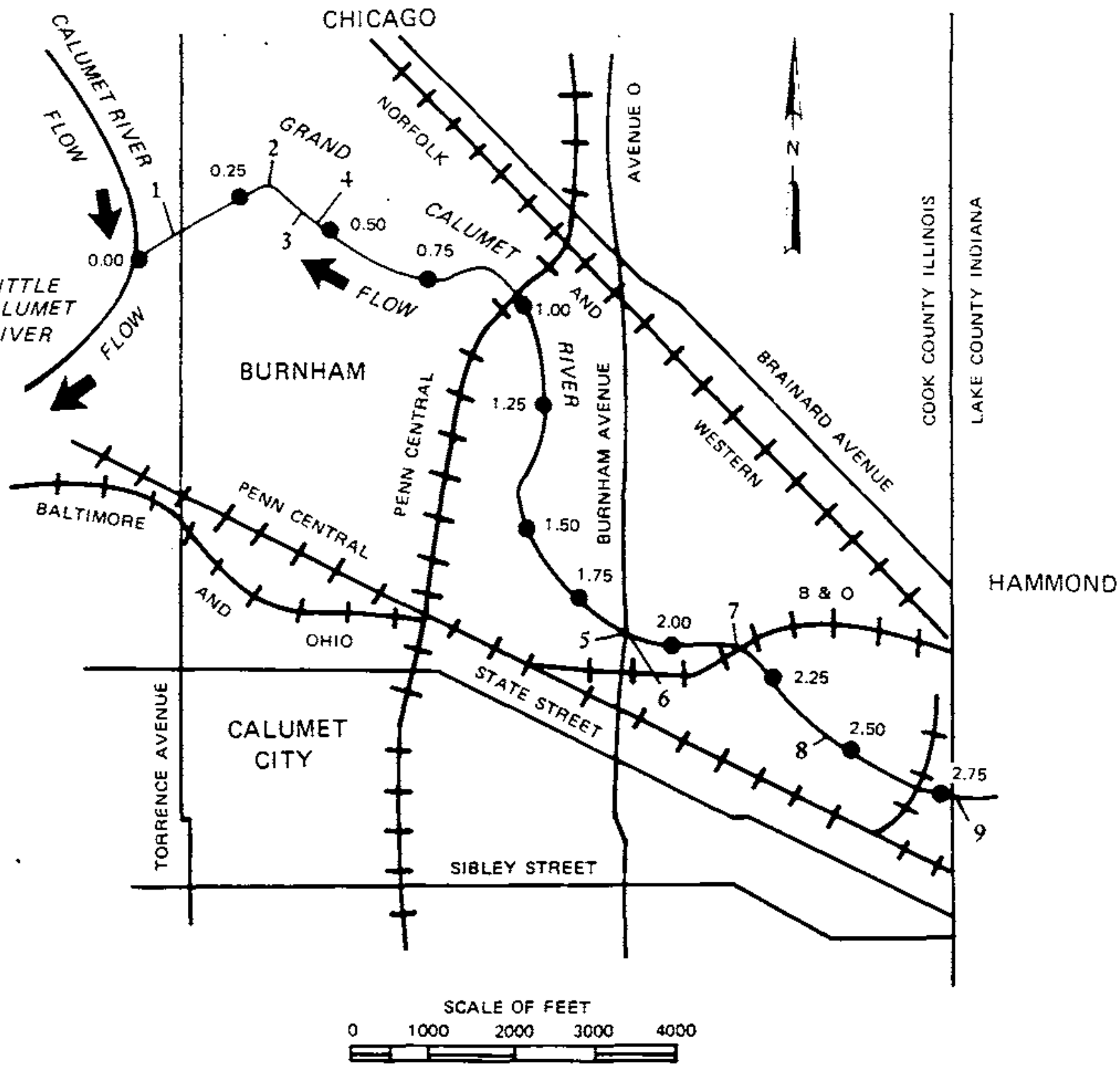

Figure 9. Grand Calumet River (GO sampling stations and outfall locations between mile points 0.00 and 2.75

Table 2. Summary of Sewer Outfall Information

Water Course •.	Number of outfalls	Density (no./mi.)	Percent active	Total Inches of Sewer*	Sewer Inches per mile	Averaae sewer size (inches)
Calumet Union Drainage Canal	77	22.0	22	1843	527	23.9
Addison Cr.	242	22.0	13	5099	464	21.1
North Branch of the Chicago R.	145	12.9	8	3831	348	26.4
Little Calumet R. (miles 0-6)	63	10.5	48	2428	405	33.5
Little Calumet R. (miles 6-19)	128	9.8	36	3838	295	30.0
Des Plames R.	157	6.7	20	6021	256	38.4
Calumet R.	• 42	6.2	19	686	106	16.3
Grand Calumet R.	9	3.3	33	280	102	31.1

* Includes the diameters of round outfalls and the horizontal dimensions of irregular sections

mile points 10.40 and 10.70 (shown on the A-10 map in Appendix A). Also the possibility exists that some undetectable submerged outfalls exist in the deep water reaches of the Calumet and Little Calumet Rivers.

Sewer outfalls which exhibited even slight discharges were labeled active irrespective of prevailing weather conditions at the time of the inspection. Rainfall, which occurred before a few inspections, obviously triggered some discharges and magnified other normally small but sustained discharges.

Sediment Characteristics

A total of 734 bottom sediments were examined and classified during the study; the number for each water course or stream reach is given in table 3. Sediment characteristics and photographs of selected samples are presented in Appendices C and D, respectively. Ponar dredge sampling was attempted at all 1/4-mile sampling stations (including right and left side locations when appropriate) except at Addison Creek mile 10.50 where the creek is underground (Appendix A-10 map) and at Calumet River locations 3.25R and 3.50R, where anchoring and dredging are not permitted due to submerged pipelines.

The Little Calumet River between miles 6.75 and 11.00 is shallow and clear and the bottom consists principally of bed rock. Consequently, in this reach, the sediments were classified as 100 percent rock, although it was possible to collect small samples for photographic purposes from isolated pockets of loose sediments perched on top of the bed rock. Mile 6.75 was the only location within this reach for which no loose sediments were recovered for photographing.

Table 3. Summary of Stream Bottom Sediment Composition

Water Course	Total Samples Classified	Sediment Percentage* Composition Composed of								
		Rock	pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells
Calumet R.	79	1	2	6	19	44	26	1	<1	<1
tittle Calumet R. (miles 0-6)	75	<1	2	5	11	53	18	3	7	1
Des Plaines R.	285	21	3	6	21	35	3	9	0	2
Little Calumet R. (miles 6-19)	156	17	3	4	9	46	2	18	1	<1
Grand Calumet R.	33	0	0	2	29	26	0	29	14	0
North Branch of the Chicago R.	46	0	11	20	43	17	2	1	2	4
Addison Cr.	45	1	5	15	35	24	12	7	1	<1
Calumet Union Drainage Canal	15	0	7	17	43	23	3	7	<1	0

* The percentages are averages for the total number of samples collected per water course

Significant portions of the Des Plaines River sediments have been classified as rock. Because this river is relatively deep and the bottom could not be observed visually, the bottom was classified as 100 percent rock when 5 Ponar sampling attempts produced only large rocks or produced only clinking sounds of the dredge hitting rocks without retaining anything. Similarly, if the dredge produced a thudding sound and contained only small traces of clay on the sampler jaws after 5 sampling attempts, the bottom was classified as 100 percent clay. Oes Plaines River reaches between miles 11.25 and 13.00 and between miles 18.75 and 20.00 were sampled when the river was approximately 5 feet above normal depth. The increased depth and fast current made sampling difficult. At times, no sample could be retained and neither clinking nor thudding sounds could be distinguished. In these cases, the bottoms were arbitrarily classified as 100 percent rock. In a few instances this may have been based on a false presumption. However, the important fact is that in these areas the bottoms are hard and/or compacted and do not consist of loose material which can be retained in a petite Ponar sampler under relatively high flow conditions.

Sediment odor and color characteristics are summarized in tables 4 and 5, respectively. For some of the streams, the number of samples classified for odor and color is less than the respective sediment classification numbers given in table 3, since rock and hard-pan clay bottoms could not realistically be examined for odor and/or color in some instances. The color and odor summary percentages total more than 100 for each stream in the tables since more than one odor or color was distinguished in many of the samples. For example, the percentages in table 4 total 188 for the Grand Calumet River since 100 percent of the samples smelted oily while 88 percent of these also smelled septic. Conversely only 12 percent smelled just oily. Detailed individual sample color and odor descriptions are given in Appendix C.

Table 4. Summary of Stream Bottom Sediment Odor Characteristics

Water Course	Number of samples	Percent of samples with the odor Of: Septic	Oil	Earthv	Fishy	Vegetative	Ncne
Calumet R.	79	5	35	32	4	0	34
Little Calumet R. (miles 0-6)	75	93	93	3	0	0	4
Little Calumet R. (miles 6-19)	153	76	9	3	0	4	16
Grand Calumet R.	33	88	100	0	0	0	0
Calumet Union Drainage Canal	15	33	20	20	0	0	47
Addison Cr.	44	32	27	25	5	7	23
Des Plaines R.	224	54	26	14	<1	<1	23
North Branch of the Chicago R.	46	46	7	2	7	0	46

Table 5. Summary of Stream Bottom Sediment Color Characteristics

Water Course	Number of Samples	Percent of samples with color of: Black	Gray	Brown	Tan
Calumet R.	79	8	80	72	11
Little Calumet R. (miles 0-6)	75	99	52	7	0
Little Calumet R. (miles 6-19)	156	57	50	27	21
Grand Calumet R.	33	88	18	12	0
Calumet Union Drainage Canal	15	27	67	87	7
Addison Cr.	44	36	43	68	18
Des Plaines R.	224	16	75	79	3
North Branch of the Chicago R.	46	22	48	80	11

Sampling Station Conditions

A total of 948 field information forms (figure 8) were filled out and sent to the District over the course of the study. Figure 10 shows a typical completed form as sent. These sheets are too voluminous to include in this report. However, the originals are on file at the State Water Survey and copies are on file at the District for inspection and reference. Stream, bank, and land use characteristics at each station are presented in Appendix E. Specific information pertaining to stream width and depth, bank erosion, logjams, aquatic macrophytes, and presence of oil in the sediments is presented in Appendix E-1. Table 1 gives the average depths and widths of each stream, and tables 6 through 8 summarize the information on oil occurrence, macrophytes, and logjams, respectively.

Categorizing land use and riparian vegetation proved to be more difficult and subjective than anticipated. Often high stream banks, vegetation, and landmarks obscured or limited the field of view. At times the heterogeneous nature of some areas prevented clear-cut classifications from being made.

Metropolitan Sanitary District Of Greater Chicaso

Stream Information

Date 8/8/85 Time 4:50 Observer TH

Stream Des Plaines Stream Mile 16.50

Sampling Location Facing Downstream LEFT **CENTER** RIGHT (circle one)

Direction and Distance From Landmark 900 ft. SW of Crystal Creek

Stream Habitat **POOL** RIFFLE (circle one)

Depth 3' 2" **ft** or M Width 80 **ft** or M

Water Level DRY LOW **NORMAL** HIGH FLOODED (circle one)

Hydraulic Structures DAM LEVEE BRIDGE ISLAND (circle one)

Channel Alteration/Channelized **NO** YES ____

Bank Erosion SLIGHT MODERATE SEVERE (circle one)

Logjam or Debris Build-up **NO** YES ____

Land Use RESIDENTIAL COMMERCIAL/INDUSTRIAL AGRICULTURE FOREST (circle one)

Riparian Vegetation TREES SHRUBS GRASS DENUDED (circle one)

Aquatic Macrophytes (circle one) **ABSENT** SPARSE(0-25%) MODERATE(25-50%) DENSE(50-75%) FULL(75-100%)

Sediment Composition:	Rock ____%	Sand 77 %	Plant Detritus ____%
(% by Observation)	Pebble ____%	Silt ____%	Sludge ____%
	Gravel 20 %	Clay ____%	shells Other 3 %

Sediment Color brown gray Sediment Odor none

Oil in Sediment **NONE** LIGHT MODERATE HEAVY (circle one)

Remarks Sed. – Coarse sand and gravel with some shells. Benthos taken – 2 Petite Ponars

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Figure 10. Typical stream information form as completed in the field for a center sampling location

Table 6. Percentage Occurrence of Oil in Sediments at 1/4-Mile Stream Locations

Water Course	Percentage of Locations With Oils In Sediments
Little Calumet R. (miles 0-6)	100
Grand Calumet R.	100
Calumet R.	93
Little Calumet R. (miles 6-19)	46
Des Plaines R.	44
Calumet Union Drainage Canal	40
Addison Cr.	36
North Branch of the Chicago R.	9

Table 7. Percentage Occurrence of Macrophytes at 1/4-Mile Stream Locations

Water Course	Percentage of Locations Exhibiting Macrophyte Growth in Channel Characterized as:		
	Moderate to Full	Sparse	Absent
North Branch of the Chicago R.	13	69	18
Little Calumet R. (miles 6-19)	23	40	37
Little Calumet R. (miles 0-6)	0	60	40
Grand Calumet R.	0	55	45
Addison Cr.	9	20	71
Calumet Union Drainage Canal	0	27	73
Des Plaines R.	0	6	94
Calumet R.	0	4	96

Table 8. Number and Density of Logjams in Streams or Stream Reaches Surveyed

Water Course	Number of Logjams			Density
	Partial	Complete	Total	(no./mi.)
Little Calumet R. (miles 6-19)	8	5	13	1.00
North Branch Chicago R.	4	7	11	0.98
Des Plaines R.	12	1	13	0.55
Calumet Union Drainage Canal	0	1	1	0.29
Addison Cr.	2	1	3	0.27
Calumet R.	0	0	0	0.00
Little Calumet R. (miles 0-6)	0	0	0	0.00
Grand Calumet R.	0	0	0	0.00

Occasionally, some areas were encountered that did not fit any of the given classifications, such as nonagricultural open areas not connected to industrial, commercial, residential, or park developments. Land use and riparian vegetation at each station are given in Appendix E-2 and summarized in table 9.

Benthic Macroinvertebrates

Benthos samples were collected at 16 stations on four different streams. The number and locations of these stations were dictated by the results of a benthos survey conducted by the State Water Survey in Chicago area streams during the summer of 1976. Detailed comparisons of the 1985 and 1976 results are presented in Appendix F; summary comparisons are presented in tables 10 and 11.

The Illinois Environmental Protection Agency (Illinois Environmental Protection Agency, 1980) has developed standardized procedures for sampling and evaluating macroinvertebrate data to assess the impact of wastewater on receiving streams. The method is based upon determining the Macroinvertebrate Biota Index (MBI) of a benthic sample. Each taxon is assigned a pollution tolerance value from 0 to 11, with 11 being the most tolerant. The MBI is the abundance weighted average of tolerance values for each sample. The IEPA procedure involves hand and net sampling of available habitats in a localized area of a stream for a specified length of time.

In this project, the MBI was calculated by using benthos samples obtained with quantitative bottom dredges. This may result in artificially low MBI ratings when compared to ratings based upon hand collection. However, quantitative sampling gives a more accurate estimate of population levels of the principal organisms in the macroinvertebrate community atagivenstation.

Table 9. Summary of Riparian Vegetation and Land Use Conditions at 1/4-Mile Stream Locations

	Riparian Vegetation Percentage Composition				Land Use Percentage Composition			
Water Course	Trees	Shrubs	Grass	Denuded	Forest	Residential	Commercial/ Industrial	Agriculture
Calumet R.	7	6	26	61	9	0	91	0
Little Calumet R. (miles 0-6)	48	14	24	14	26	8	66	0
Little Calumet R. (miles 6-19)	74	7	19	0	35	32	32	1
Grand Calumet R.	27	0	73	0	14	14	72	0
Calumet Union Drainage Canal	41	33	23	3	3	64	33	0
Addison Cr.	45	22	26	7	6	41	53	0
Des Plaines R.	98	0	1	1	78	6	16	0
North Branch of the Chicago R.	83	9	7	1	80	4	16	0

Table 10. Summary of 1976 and 1985 Benthic Macroinvertebrate Data

		1985			1976		
Water Course	Station	IEPA MBI*	Number of Taxa	Number of individuals	IEPA MBI	Number of Taxa	Number of individuals
Little Calumet R.	6.25C	7.3	3	2,909	9.9	3	13,729
	6.25L	7.4	3	4,536	8.0	5	7,119
	10.25C	7.0	5	7,778	9.6	5	3,572
	13.00R	7.5	7	5,642	10.0	2	295,201
	16.25C	6.4	2	10,291	6.0	2	23,509
	17.75C	6.8	2	13,735	8.6	2	19.806
	18.50C	9.3	3	5,360	10.0	1	12,961
Des Plaines R.	4.75C	7.4	4	1,851	8.2	4	1,434
	6.00L	7.4	3	2,369	9.5	5	40,531
	9.00C	5.6	5	17,696	7.3	7	7,853
	13.25C	6.4	3	5,124	6.8	4	4,315
	16.50C	7.3	5	1,745	6.1	6	13,861
	19.50C	8.5	3	1,034	6.8	4	6,027
	21.25C	9.7	3	776	9.6	2	6,071
Calumet Union Drainage Canal	1.00C	9.3	2	474	8.7	4	6,672
North Branch of the Chicaqo R.	9.75C	5.4	5	22,833	7.6	4	385
Arithmetic Averaqes							
Little Calumet R.	-	7.4	3.7	7,179	8.9	2.9	54,414
Des Plaines R.	-	7.5	3.7	4,371	7.8	4.6	11,442
Median Values							
Little Calumet R.	-	7.3	3.0	5,642	9.6	2.0	18,729
Des Plaines R.	-	7.4	3.0	1,851	7.3	4.0	6,071

*Macroinvertebrate Biota Index

Table 11. Summary of 1976 and 1985 Benthic Community Composition

	1985		1976	
	individuals	percent	individuals	percent
Sphaerium (fingernail clam)	41,108	40	18,874	4
Chironomidae (true midge)	29,063	28	42,816	9
Oligochaeta (aquatic worm)	17,987	17	396,605	85
Asellus (aquatic sow bug)	10,733	10	3,658	1
Others	5,262	5	6,093	1
Totals	104,153	100	468,046	100

DISCUSSION

Adaptability proved to be the key to accomplishing the objectives of this study. The streams and stream reaches surveyed varied widely in size, use, physical condition, and topographic setting as indicated in table 1. The methods, procedures, and equipment used to collect information and data on small streams like Addison Creek and the Calumet Union Drainage Canal differed greatly from those used on the larger rivers like the Calumet and the lower reaches of the Little Calumet Rivers. However, some common problems were encountered on both the big and small streams. For example, one had to be on guard constantly to avoid capsizing or being capsized when using a boat, irrespective of the type of watercraft being used. Ocean liners and freighters posed a constant threat on the Calumet River: when encountered in confined areas, wakes from ocean-going vessels created havoc with sampling procedures and boat stability. Once the 21-foot sampling boat (figure 2) was dashed against a retaining wall and severely damaged. Twice the inflatable rubber boat (figure 4) was capsized when it hit submerged angle iron protruding from the bottom of the Little Calumet River and the Calumet Union Drainage Canal. Nevertheless, the study plan, equipment, and methods and procedures proved to be more than adequate overall. All goals and objectives were achieved. The results reported herein and the detailed information contained on the "stream information" sheets on file with the District should provide a comprehensive data base for evaluating the needs for expanding TARP.

Sewer Outfalls

Generally, the number of sewer outfalls per mile of stream appears to be inversely related to the size of the stream. The data in table 2 indicate that Addison Creek and the Calumet Union Drainage Canal, the two smallest streams surveyed, have significantly greater sewer outfall densities on the average than any of the other streams; the Calumet and Des Plaines Rivers, two of the largest streams, have outfall densities about a third as great. However, the outfall sizes tend to be smaller on the smaller streams, as evidenced by the fact that the average sewer size on Addison Creek was only about 21 inches compared to averages of over 38 inches for the deep reach of the Little Calumet River (miles 0-6) and the Des Plaines River.

Only 3 stream segments produced no outfalls. These were mile 0-1 on the Des Plaines River, mile 7-8 on the Little Calumet River, and the half mile between miles 6 and 6.5 on the Calumet River. The maximum number of inches of discharge per mile was 740, and this occurred between miles 5 and 6 on

Addison Creek. Two other mile segments (4-5 and 5-6 on the Little Calumet River) produced over 700 inches of sewer outfall.

The possibility that the types of sediments found in a stream segment are influenced or dictated by the magnitude of sewer discharges was investigated. The streams or stream reaches studied were divided into mile segments, and the total inches of sewer discharging into these segments were mathematically correlated to the percent composition of clay, silt, and sand found in the sediments examined within these segments. Intuitively, one would suspect sewer overflows to produce buildups of fine sediments in streams with greater overflow volumes producing greater buildups. In other words, significant positive correlations would be suspected to occur between sewer volumes and the fine sediment fractions. This did not prove to be true, however, for the data generated from this study. The correlation coefficients between the sewer volumes expressed in inches per mile and the clay, silt, and sand fractions expressed in average percent composition for each mile segment are, respectively, -0.13, -0.01, and 0.12. Of 78 data pairs, none are statistically significant. In fact, the low negative correlations for clay and silt and the positive value for sand tend to indicate that higher sewer volumes produce locally higher flows that flush away the fines to quieter downstream pools. This possibility will be addressed further in the discussion of the sediment results.

Sediment Characteristics

Composition

Silt is the principal sediment constituent in the four deepest water courses CCalumet River, Des Plaines River, and both segments of the Little Calumet River), and sand is the principal sediment constituent in the shallowest four (Grand Calumet River, North Branch of the Chicago River, Addison Creek, and Calumet Union Drainage Canal). The three streams with the least depth had the highest percentage composition of gravel and pebbles. Clay (hard pan or very compact) was most prevalent in the largest two water courses. The deepening of the Calumet River and the commercially navigable portion of the Little Calumet River for barge traffic probably exposed this clay. In these streams, various depths of sediments, usually silt, are found over light gray or tan clay. Clay is very difficult to detect when thoroughly mixed with silt. For example, the Water Survey has found that Illinois River side-channel and backwater lake sediments containing equal fractions of silt and clay have soft and creamy textures similar to sediments composed entirely of silt (unpublished

1982 upper Illinois Waterway data). In this study clay is differentiated from silt by its compactness, color, and strata. In other words, clay usually means compact clay of a different layer and color than the rest of the sample. Soft clay mixed with silt was called silt!

A pattern occurs in the particle sizes mentioned thus far: the larger the particle size, the shallower the stream; the smaller the particle size, the deeper the stream.

Bedrock or large rock substrates occurred infrequently except in the Oes Plaines River and the Little Calumet River between miles 6 and 19. The Little Calumet River has a sizeable stretch of bedrock bottom, and the Oes Plaines River has several areas of swift current and scoured bottom.

The Little Calumet River between miles 6 and 19 and the Grand Calumet River have the highest percentage of detritus. Why this occurs is not readily apparent. Three possible explanations are: (1) the hydraulic characteristics of these two streams are inherently suited to trapping detritus Capproximate depths of both average about 3 feet), (2) the banks contained considerable vegetative growth providing abundant sources of detritus (the two streams had the fewest riparian denuded areas), and (3) the abundance of aquatic macrophytes in both streams was high compared to those in most of the other streams.

Shells are a small but important component of sediments. They persist long after the organisms inhabiting them have died; consequently, significant amounts of shells in sediments are indicative of environments which were historically favorable to the propagation of fresh water mollusks such as fingernail clams. The sediments in the North Branch of the Chicago River and the Des Plaines River had shell compositions of 4 and 2 percent, respectively. Abundant, live fingernail clam populations were casually observed in many of the sediment samples collected in the two streams, and their numerical abundance was documented in benthic macroinvertebrate samples collected at several locations along these streams.

The streams exhibiting the highest sludge content in the channel sediments were the Grand Calumet River and the Little Calumet River between miles 0 and 6. The sediments in two areas (the juncture of the Grand Calumet River and Calumet River and the area just downstream of the effluent outfall from the District's Calumet Sewage Treatment Works on the Little Calumet River) contained particularly high fractions of sludge. The sediments in these areas were such that wakes from slow moving boats were sufficient to disturb the bottom, releasing great quantities of gas bubbles. The rising bubbles carried bottom solids to the surface, where they floated and slowly disintegrated (figure 11).

Figure 11. Floating organic solids resulting from bottom disturbances on the Little Calumet River below the Calumet wastewater treatment plant

The sediments of the Grand Calumet River were generally black, had a septic odor, and looked and smelled oily. This indicates significant pollutional inputs to this river. The sediments in this river were particularly sludgy and oily in the lower 1/4 mile (stations 0.00 and 0.25) and from station 2.00 to the Indiana border. These sediments contained abundant oligochaete worms and smelled septic and oily.

The lower 1/2 mile (stations 6.25 and 6.50) of the non-commercially navigable segment of the Little Calumet River contains some sludge/silt sediments, particularly along the sides. From stations 6.75 to 11.00, bedrock with attached algae prevails. Except for isolated cases, the sediments are fairly clean until station 16.50. Above this station to the Indiana border, the sediments tend to be darker, organically enriched silts. Dissolved nutrients in the water promote prolific algal growth in the bedrock portion of the stream. Decomposition of algal mats (shown in figure 12) and their movement downstream, and possible backflows from the commercially navigable portion of the Little Calumet River tend to pollute the lower reaches of the shallow portion of the river.

The sediments in the first two miles (stations 0.00 through 2.00) of the Calumet River are relatively clean. Most of the samples from the remainder of the stream were

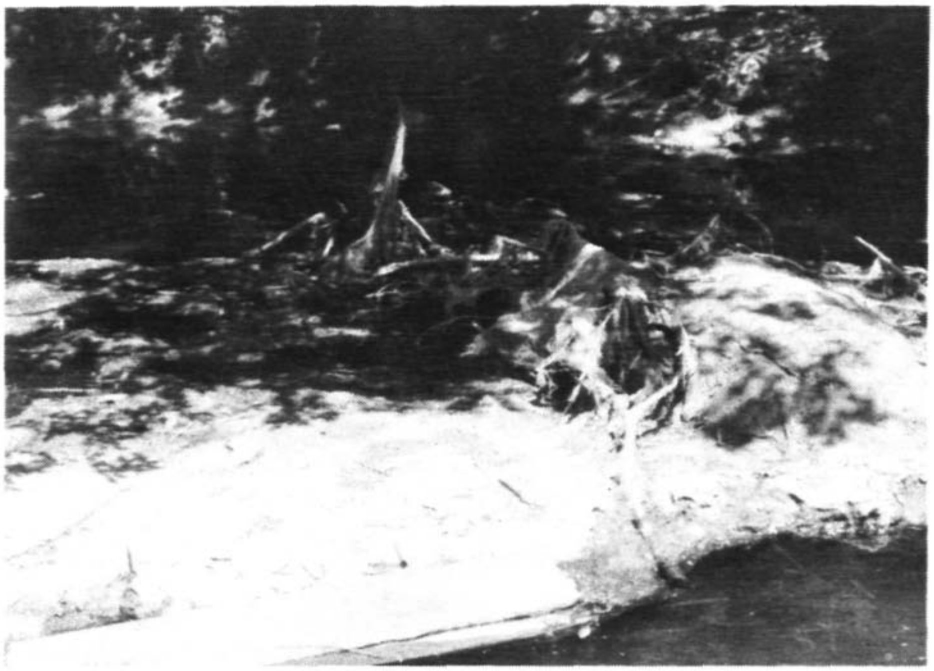

Figure 12. Decomposing algae mats along a shallow reach of the Little Calumet River

organically enriched. These samples were grayish-brown silt containing abundant oligochaetes; however, the sediments are still in much better condition than the sediments in the Grand Calumet or Little Calumet Rivers. High quality Lake Michigan diversion water probably offsets much of the pollutional effect of sewer overflows and/or backflows from the Little Calumet River.

The Calumet Union Drainage Canal consists of a relatively straight and narrow artificially constructed channel. Although this stream has the highest outfall density, little sludge was found. The sediment in this stream was composed chiefly of sand and gravel. Perhaps the stream morphology is responsible for this apparent scouring of the sediments.

Addison Creek is somewhat narrow and pollution-free over most of its length. However, a marked change occurs in the vicinity of station 2.50. From here to the creek's confluence with Salt Creek, the shorelines were lined with sludge and sludge-like sediments extending a few feet above and below the low-flow waterline. Matted sewage fungus was observed in many areas of this stream segment.

The North Branch of the Chicago River is similar to Addison Creek in that the upper reaches of the stream have sediments which are fairly clean and the lower reaches have sediments which are somewhat polluted. In the middle reaches, between mile points 9.00 and 5.00, the shoreline sediments exhibit increased organic enrichment. Below mile 5.00, the shore areas frequently consist of soft black sediments with a thin layer of bluish-gray fungus. The final 3/4 mile of the North Branch is concrete-lined . Nevertheless, sludge-like sediments line the shore above the top edge of this slab.

The Des Plaines River is the longest, widest, and deepest of the non-commercially navigable streams studied. Trees and forest line most of its shores, and six channel dams are in the study area. The sediments are generally somewhat enriched and are brownish gray. No extensive areas of sludge deposits exist, nor do identifiable trends in sediment quality occur in the segment of the Des Plaines River studied.

All the streams had some sewer outfall areas which displayed sludge deposits to some extent. Most of these deposits were restricted to off-channel outlets. Technically, such depositions were not directly contributing to water pollution or water quality degradation at the time of the survey. Only when these overflow areas appeared to impact conditions within the stream itself were they noted.

Odor

Often several odors were detected in a given sediment sample. Consequently, the total percentage for each stream in table 4 adds up to more than 100. Septic odors were most commonly detected. All the streams had significant percentages of septic-smelling sediments except for the Calumet River. Not surprisingly, the two streams having the highest percentage of septic smelling samples, the Little Calumet River between miles 0 and 6 and the Grand Calumet River, had the highest average percentage of sludge in the sediment samples (table 3).

Second in order of frequency were oil odors. Almost all the samples examined in the Grand Calumet River and the Little Calumet River between miles 0 and 6 had an oily smell. Over one-third of the Calumet River samples had an oil odor. The oily smells in the sediments of these three rivers is corollary to the fact that these rivers also had the highest percentages of samples containing oil (table 6). The North Branch of the Chicago River and the Little Calumet River between miles 6 and 19 had the lowest percentage of samples smelling of oil.

Earthy odors were third in frequency. Almost one-third of the Calumet River samples smelled earthy. Earthy odors are generally associated with relatively unpolluted sediments, so it was not surprising that the highly polluted Grand Calumet River produced no earthy-smelling sediment samples.

Fishy and vegetative odors were detected so infrequently that the maximum percentage for any stream was only 7 for each odor, and 3 of the 8 streams produced neither of the odors. The 7 percent maximums occurred in the North Branch of the Chicago River and Addison Creek. The fact that these streams were shallow and the bottoms were often covered with filamentous algae and macrophytic growths and fungus may have accounted for this.

Almost half of the samples from the Calumet Union Drainage Canal and the North Branch of the Chicago River had no discernible odor. This is in line with the fact that about 60 percent of the sediments in the center of the channels of these two streams were composed of sand and gravel (table 3).

Color

Samples were credited with more than one color if they consisted of several different colored layers of sediment or if there was a mixture of several colors in a homogeneous sample. Consequently, as with odors, the color percentage totals for each stream in table 5 add up to more than 100.

Almost all the sediments from the Little Calumet River between miles 0 and 6 and from the Grand Calumet River were predominantly black, while over half of those examined in the Little Calumet between miles 6 and 19 were predominantly black. Gray dominated Calumet river sediments, while brown was dominant in the rest of the streams. Generally, deeper streams tend to have black, gray, blackish-gray, or grayish-black sediments, while shallower streams tend to have brown or tan sediments.

Oil

Oil was visible in over 90 percent of the Little Calumet (miles 0-6), Calumet, and Grand Calumet River sediment samples. Only 9 percent of the samples from the North Branch of the Chicago River contained noticeable oil. Visible oil occurred in one-third to one-half the samples in the other four streams. The Grand Calumet River, the Little Calumet River (miles 0-6), and Calumet River have the highest percentage of samples with the presence and odor of oil. These streams also ranked highest in proportion of commercial/industrial land use. Calumet River sediments between miles 5.25 and 6.00 just downstream from a chemical-petroleum loading dock were particularly oily. Commercial navigation is prevalent in the Calumet River and the Little Calumet River (miles 0-6) and upstream of the area sampled in the Grand Calumet- River.

Physical Conditions

Stream Channel Conditions

The nature of the water courses studied ranged from totally man-made canals and ditches to natural streams subjected to limited alterations. To some extent, all the streams displayed the effects of human endeavors to change or improve the natural hydraulic characteristics of the water courses. Classic forms of alteration such as channelization, straightening, damming, bank stabilization, dredging, and stream containment were encountered.

The name Calumet Union Drainage Canal is used in this report to include, collectively, the Calumet Union Drainage Ditch extending from mile 0 to 1.0 and the Calumet Union Drainage Canal extending above mile 1.0. The "Ditch" is a dredged and cleaned natural water course used to connect the completely straight, artificially aligned drainage "Canal" to the Little Calumet River. At the time of the survey, crawler-tractor tracks were evident in the "Ditch," indicating that channel clearing and dredging had recently taken place.

The North Branch of the Chicago River is relatively free of human attempts to change the natural flow regime of the river. Only the last 3/4 mile shows any indication of channel modification; the bottom of this short reach has been lined with reinforced concrete. The slab extends from shore to shore and the cross section is a flat-V shape. The reach of the Des Plaines River studied is similar to the North Branch of the Chicago River in that generally the river has been left to follow its natural course.

Addison Creek, while not extensively channelized, has been changed significantly in several localized areas. Between miles 10.40 and 10.70, it is routed underground through a residential area (Appendix A-10), and between miles 9.75 and 10.00 a very large in-channel flood retention basin has been excavated (figure 13 and Appendix A-10). Channel straightening has occurred in an industrial-residential area between miles 7.75 and 8.75. Also, in this area, an off-channel flood retention or overflow basin is being constructed (Appendix A-10). Additional channelization has occurred in the last 3.75 miles of the creek before it empties into Salt Creek (Appendices A-8, A-9).

The shallow stretch of the Little Calumet between the Indiana border and mile 6 generally flows over a natural meandering course, although some short segments, such as that between miles 13.50 and 14.50 (Appendix A-5), appear on maps as having been straightened somewhat. Whether such reaches

Figure 13. In-channel flood retention basin and inlet control spillway on Addison Creek between miles 9.75 and 10.00

have been straightened could not be conclusively verified in the field. In the area around Lansing, low levees appeared to have been constructed many years ago. Two off-channel overflow storage reservoirs, similar to those observed on Addison Creek, are found along the upper reaches of the Little Calumet River (Appendix A-6). A reservoir is presently being constructed near mile point 18.00.

The Grand Calumet does not show any effects of extreme channelization. The river flows in a sweeping, meandering 'fashion. It is possible that some sharp bends and meanders were eliminated to produce the existing serpentine shape, but if this was done it was not readily evident in the field.

Basically, the deep-draft navigable streams still appear to occupy their original courses with some minor modifications in channel alignment. Most straightening has been effected in "bits and pieces" by building retaining walls, headwells, and unloading docks, and by riprapping shores. The Calumet River has been deepened to accommodate ocean-going freighters, and its flow direction is controlled at the Thomas J. O'Brien Lock and Dam at mile 6.00.

Channel Dams

Low-head channel dams can significantly alter the natural flow regimes of streams. These structures can create pools and slack-water areas which trap sediments. Both Addison Creek and the Des Plaines River had 6 such structures, and the North Branch of the Chicago River had 3. The locations of these structures on Addison Creek are noted on Appendix A maps A-9 and A-10, as a "dam" or "small dam," because no official name could be determined. The six dams on the Des Plaines River are referred to by name: Fairbank Road Dam and Hoffman Dam (Appendix A-T1), Armitage Avenue Dam (Appendix A-13), Dam No. 4 or Devon Avenue Dam (Appendix A-15), Touhy Avenue Dam and Dempster Street Dam (Appendix.A-16). The North Branch dams are shown on Appendix A maps A-17 and A-19. The physical settings and structural details of the 6 dams on the Des Plaines River and 2 of the 3 dams on the North Branch of the Chicago River have been described by Butts and Evans (1978).

Log jams

Logjams were not observed in the deep-water navigation areas but were common in the smaller streams where they averaged about one every 1.5 miles of stream. Some of these jams were only partial, while others completely blocked the channel from bank to bank. Figure 14 shows the largest logjam encountered in the study; it occurred on the Little Calumet River at mile 16.75. The number, type, and density of logjams are summarized in table 8, and specific locations and types are listed in Appendix E-1.

Figure 14. Logjam on the Little Calumet River at mile 16. 75

Streams tending to have the most logjams appeared to be those having the highest percentage of land use in forest and where the riparian vegetation was predominantly trees. About half the jams were created at hydraulic constrictions such as bridges, dams, and islands. Bridges appeared to be very efficient at collecting trash and logs. Railroad bridges, which generally have closely spaced, in-stream bridge supports, were especially efficient at trapping logs and timbers Cfigure 14).

Bank Erosion

Active bank erosion sites are listed in Appendix E-l. The commercially navigable streams appeared to be more vulnerable to erosion than the smaller, shallower streams. Bank erosion was rated as slight at virtually all stations on the commercially non-navigable streams. Many reaches of the smaller streams still meander freely through forest preserves, park lands, and limited land developments. These streams appear to have slightly more curves now than they appear to have in traces appearing on 20-year-old topographic maps. However, some problem areas do exist along the smaller streams. For example, Addison Creek between George Street and mile 10.50 (Appendix A-10) displayed unstable and eroding stream banks.

Nearly 25 percent of the stations on the commercially navigable water courses exhibited moderate bank erosion. Significant portions of the riverfronts in the heavily industrialized areas are protected by retaining walls, headwalls, and riprap, but those areas left unprotected are being eroded by waves generated by boats and wind. For example, the unprotected north shore of a relatively large, open expanse of water at the junction of the Calumet River and the channel to Lake Calumet (Appendix A-2) is being subjected to severe bank erosion.

Macrophytes

Macrophytes occurred more frequently and were densest within the banks of the North Branch of the Chicago River and the Little Calumet River (miles 6 - 19). Turbidity could be a significant factor regulating macrophyte growths. Streams with abundant populations appeared clearer. The Des Plaines River appeared consistently more turbid than any of the other water courses, and it was almost devoid of such growths (table 7). Although the Calumet River is probably the clearest stream, its depth and confined banks preclude the development of macrophytes. Substrate conditions in the clear shallow Calumet Union Drainage Canal (table 1) appear to limit growths along this water course; the sterile hard-pan bottom in the

"Ditch" and the loose sand and gravel in the "Canal" (table 3) are not conducive to establishing rooted aquatic growths.

Riparian Vegetation and Land Use

Trees represent the largest fraction of riparian vegetation along all the streams except the highly industrialized Calumet River, which generally exhibited denuded banks, and the Grand Calumet River, which generally exhibited grassy shores. Forest and residential land use areas had trees as the principal riparian vegetation (table 9). A significant fraction of residential area bank growth consisted of shrubs or shrub-like scrub-forest vegetation. Riparian vegetation was most variable in commercial and industrial land use areas.

The principal land use along the Calumet, Grand Calumet, and Little Calumet (miles 0 - 6) Rivers is commercial/industrial (table 9). The banks of the Calumet Union Drainage Canal are bordered principally by residential areas. The Des Plaines and the North Branch of the Chicago Rivers flow predominantly through forest preserves and forested park lands. Land use along the Little Calumet River between miles 6 and 19 consists of nearly an equal mix of forest, residential, and commercial/industrial Land along Addison Creek is highly developed for residential and commercial/industrial purposes; only a small percentage consists of forests. Agricultural lands were virtually nonexistent throughout the study area. Only the Little Calumet River between miles 6 and 19 had any notable agricultural lands.

Benthic Macroinvertebrates

The benthos or benthic macroinvertebrate community is composed principally of four taxonomic groups: Sphaeriurn. Chironomidae, Oligochaeta, and Asellus. These taxa made up over 95 percent of the individuals collected in the four streams sampled in 1985 and 1976. State Water Survey sampling experience has shown that these organisms may attain very high population densities and tend to be clumped in distribution, i.e., spaced unevenly over the bottom. These factors make accurate evaluations of these populations difficult without a rigorous, in-depth sampling program. The cursory sampling program employed was aimed at determining if any marked changes in the benthic community had occurred since the 1976 sampling.

The June 16, 1976 sample at station LC 13.00R contained almost 300,000 Oligochaetes/m^2. That sample represents 63 percent of the organisms collected in all the samples in 1976.

This population volatility distorts arithmetic averages and statistical evaluations, and makes comparisons difficult. Consequently both arithmetic averages and median values are presented at the bottom of table 10.

Some variation in the data may have resulted from the fact that some stations were sampled during different time periods in 1985 and 1976. For example during 1985 station LC 6.25C was sampled in the spring (June 19), whereas during 1976, it was sampled in the fall (September 28). During the 1976 study, the sampling stations were not specifically marked or identified in the field; consequently the locations could not be duplicated exactly during the 1985 study. The matchup at LC 13.00R particularly appears suspect and is an extreme example. A small but somewhat polluted tributary enters the Little Calumet River here. The 1976 benthic samples appear to have been taken immediately downstream of the tributary, whereas during 1985 samples were collected immediately upstrearm.

With these limitations in mind, some generalizations can be made. The 1985 benthic macroinvertebrate data indicate that the Des Plaines and Little Calumet (miles 6 - 19) Rivers are similar in MBI rating and taxa per sample, although in comparison with 1976 the Little Calumet (miles 6 - 19) has improved and the Des Plaines has deteriorated slightly (table 10). Drawing conclusions from only two samples each from the Calumet Union Drainage Canal and the North Branch of the Chicago River is difficult, yet the 1986 sample from the latter river had the best MBI rating and a relatively high population and number of taxa per sample.

Table 11 shows that the 1985 collection as a whole produced fewer organisms. These fewer organisms, however, were somewhat more desirable and indicative of cleaner water conditions, as a cursory examination of the IEPA MBI ratings in table 10 shows.

The overall large difference in numbers shown in table 11 is due mainly to the fact that far fewer oligochaetes were found in 1985 than in 1976. These organisms are generally pollution tolerant and have a high MBI rating. Although some improvement appears to have occurred in the last 9 or 10 years, the benthos still have a high tolerance rating and population unbalances persist.

The streams are very productive and should provide ample food for fish and wildlife if sediment and water conditions improve. Fingernail clams, found in abundance at several locations, are particularly important because they can serve as an important source of food for waterfowl.

SUMMARY AND CONCLUSIONS

1. The streams or stream reaches studied represent a wide variety of hydraulic, hydroloaic. topographiC, and sediment quality conditions. Sediment conditions varied greatly between streams and within given stream reaches. However, all the streams or stream reaches exhibited localized areas of sludge deposits in the sediments; these areas usually occurred in the immediate vicinity of sewer outfalls or in quiet slack-waters or pools.

2. The Grand Calumet River and the commercially navigable reach of the Little Calumet River (stations 0.00 through 6 00) exhibit the most extensive areas of sludoe deposits in the sediments within the streams or stream reaches studied. These sediments are indicative of significant pollutional inputs.

3. Two factors. in addition to sewer overflows, appear to add to or helP cause the degraded nature of some of the sediments observed in the lower reaches of the non-commercially navigable Portion of the Little Calumet River. In the upper reaches, prolific algal growths occur in shallow bedrock riffles. These algal mats die, decompose, "sluff off" and appear to be carried downstream where they settle and become integrated with bottom sediments in pool and slack-water areas. Also, the extreme lower reach of the commercially non-navigable portion of the Little Calumet River (stations 6.25 and 6.50) appears to be subjected to backflows from the degraded reach of the commercially navigable portion of the river.

4. Generally. Calumet River sediments are enr iched but not nearly to the degree observed in the Little Calumet and Grand Calumet Rivers. High quality Lake Michigan water probably tempers the effects of periodic inputs from the limited number of outfalls observed along this river and from backflows from the Little Calumet River. The sediments In the upper end near Lake Michigan particularly appear to be in better condition than those examined near the O'Brien lock and dam.

5. Addison Creek and the North Branch of the Chicago River are significantly different in flow carrying capacity and drainage topography. but both streams exhibit similar sediment pollution patterns. In the upper reaches, both the channel and bank sediments are relatively clean. In the middle reaches, the channel sediments remain relatively clean; however, degraded sediments begin to appear intermittently along the shores and banks and around almost all the larger sewer outfalls. The lower reaches begin to show continuous narrow bands of severely degraded sediments along the low-flow

water edge, some buildup of degraded sediments in the channel, and sludge deposits around the immediate area of most combined sewer overflows. Sediment degradation in areas near the tail end of the river appears to result from the delivery of sediments from upstream combined sewer overflows during high flow conditions.

6. The Des Plaines River sediments are relatively pollution free. Most exhibit some enrichment, but discernible trends and patterns of sediment quality were lacking.

7. Little correlation appears to exist between sewer outfall densities and the polluted condition of the bottom sediments in the stream channels. The Calumet Union Drainage Canal has the highest outfall density, yet the sediments throughout the length of this stream were relatively pollution-free. Scouring appears to keep the main channel areas free of sludge or fine sediments except in localized pools and slack-water areas, even in streams having high outfall densities. High sewer flows produce high streamflows which move pollutional-type sediments downstream.

8. Most streams exhibited sludoe deposits in the immediate areas of many combined sewer outfalls. but few in the channel areas. Three possible reasons for this are: (1) large storm events cause large overflows and high streamflows, thereby carrying lightweight sewer solids downstream to slack-water and pool areas, while lower overflow rates near the end of large storms could possibly wash out solids at sufficiently low velocities as to cause deposition only in the outlet area near shore; (2) small storm events are sufficient to flush solid depositions in the sewer onto the bank areas but not into the stream channel; and (3) small continuous dry weather sewage discharges observed at a few locations could cause slow buildups of sludge and sewage solids.

9. A high correlation appeared to exist between land and stream use and the presence and odor of oil in the sediments. The Grand Calumet River, the Little Calumet River (miles 0-6), and the Calumet River, which are all affected by commercial navigation and bounded principally by commercial and industrial properties, had the highest percentage of oily samples. Calumet River sediments downstream of a petro-chemical loading dock were particularly oily.

10. The North Branch of the Chicago River has the potential of becoming a "showcase" urban stream. This stream flows mostly through forest preserves and park lands. Its dry weather flow is clear, it has a sand-gravel bottom, and it is relatively free flowing, in that few channel dams obstruct its flow. Presently, the sludge deposits lining the banks and the areas around combined sewer outfalls detract from the beauty

of the stream. Also, combined sewage overflows provide nutrients which promote unsightly fungus and filamentous algal growths along the banks and in some channel areas. Elimination of the overflows could produce a pristine-like urban water course.

11. Most of the streams are biologically very productive in terms of macrophytes and benthos. The benthic community is dominated by a few pollution-tolerant organisms which reach high population densities. These organisms could provide ample food for fish and waterfowl if sediment and water quality conditions improve. The limited benthic data tend to indicate a reduction in oligochaete domination of the benthos in the last ten years.

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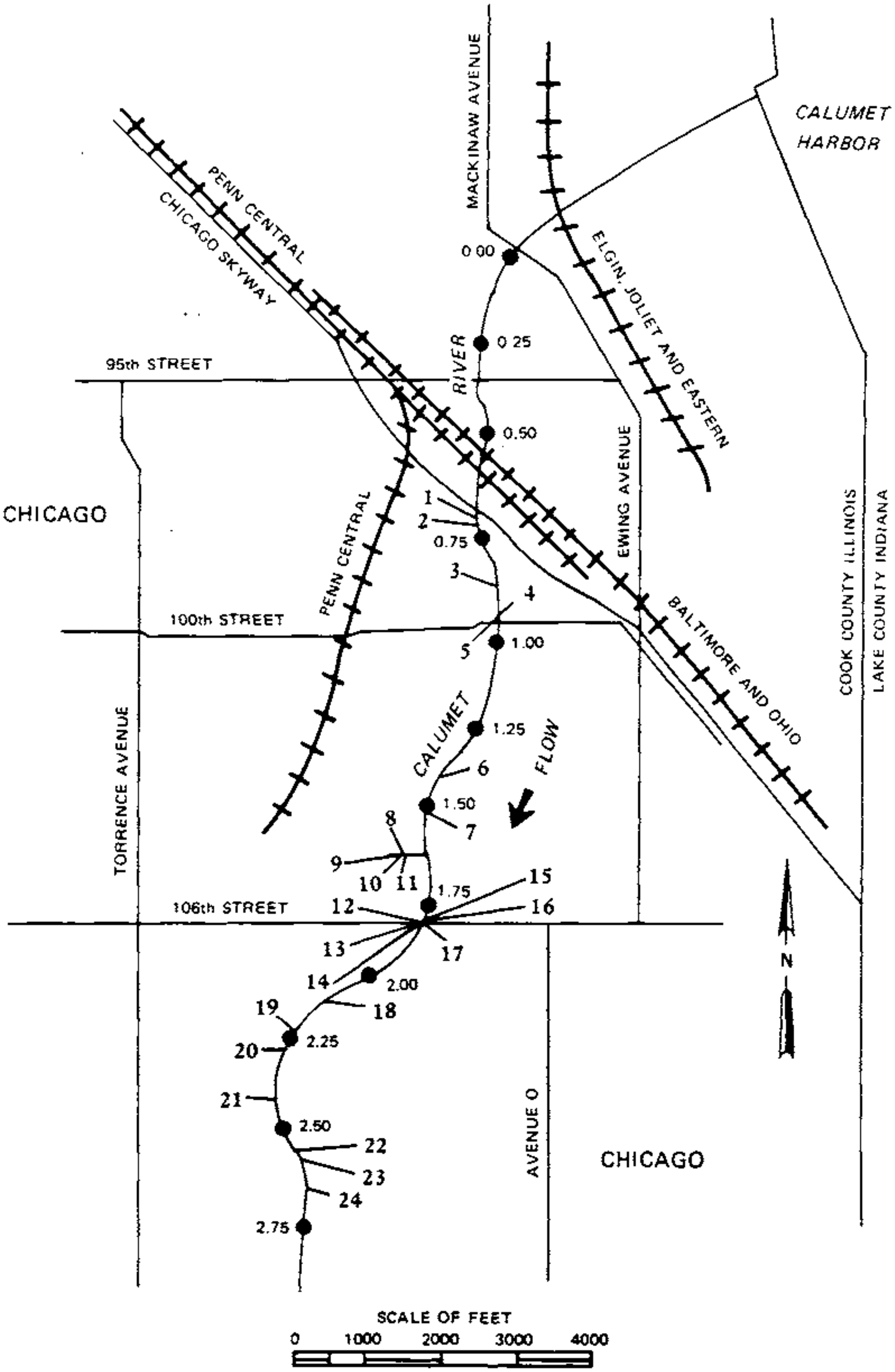
Currie, R.G., and K. Kendrick. 1981. Facilities planning study update supplement and summary action plan. The Metropolitan Sanitary District of Greater Chicago.

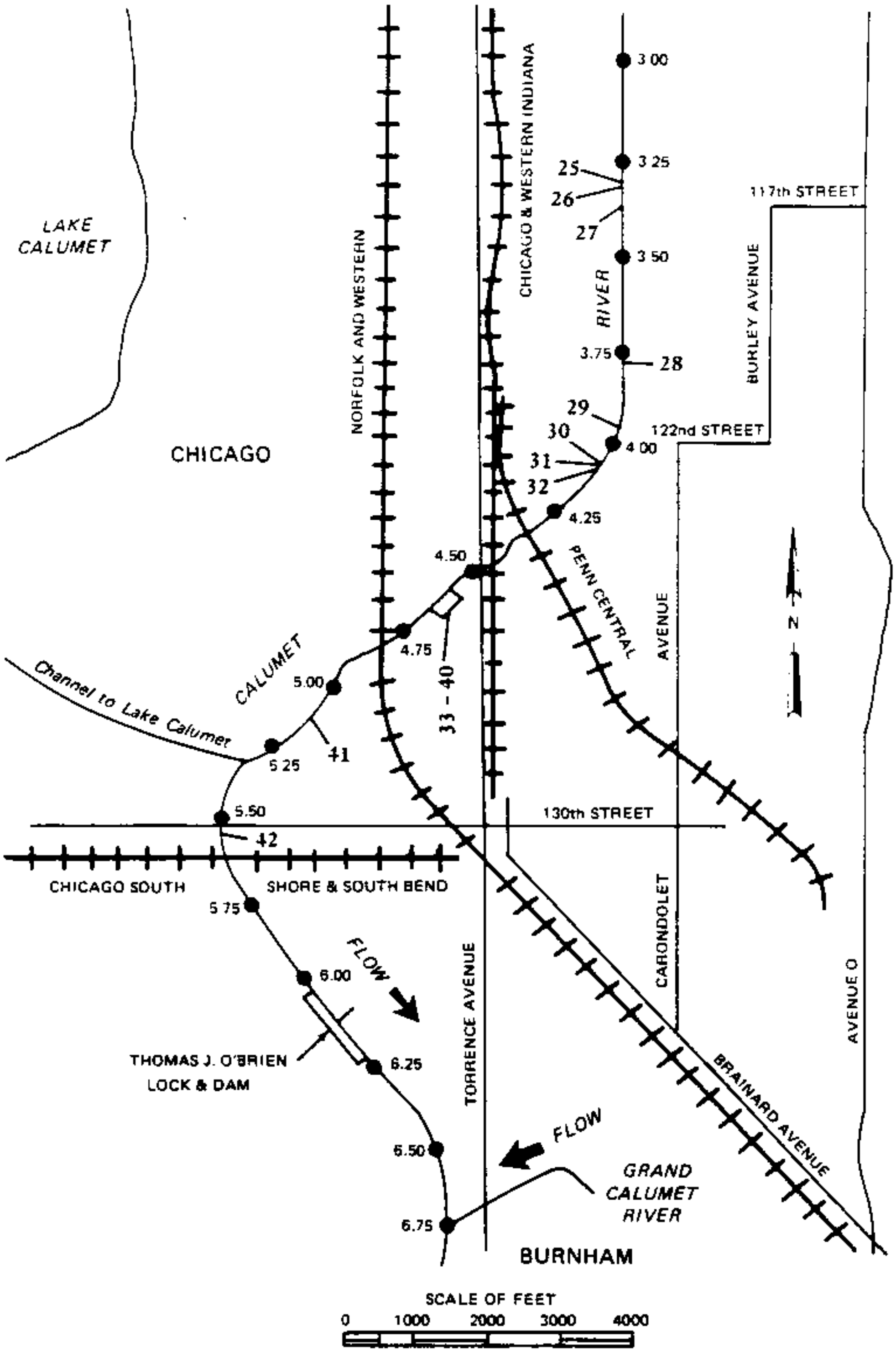
Illinois Environmental Protection Agency. 1980. Field methods manual - biological monitoring. IEPA, Division of Water Pollution Control, Springfield, IL, Section IX.

Appendix A

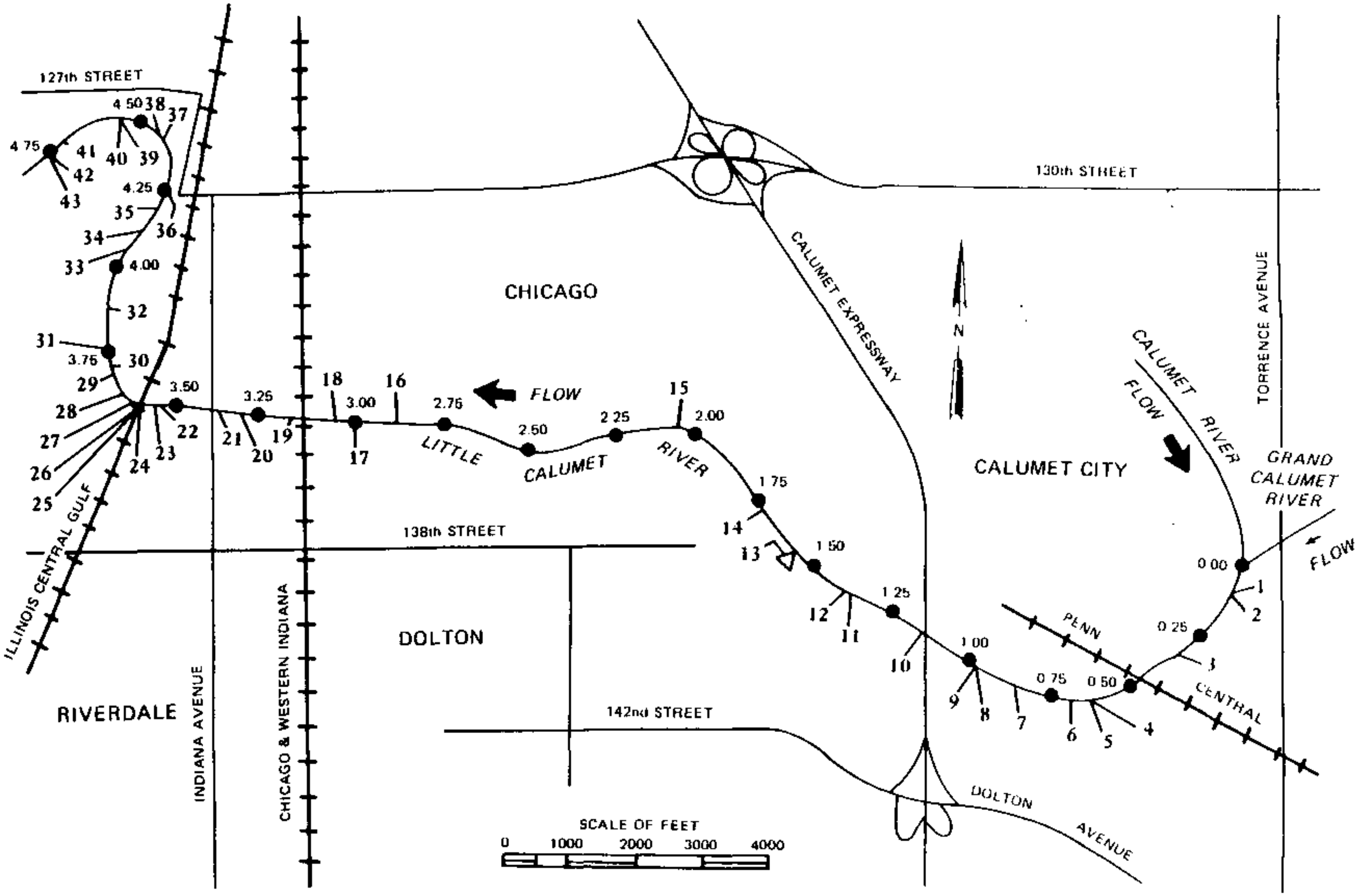
Maps Showing Stream Sampling Stations and Outfall Locations



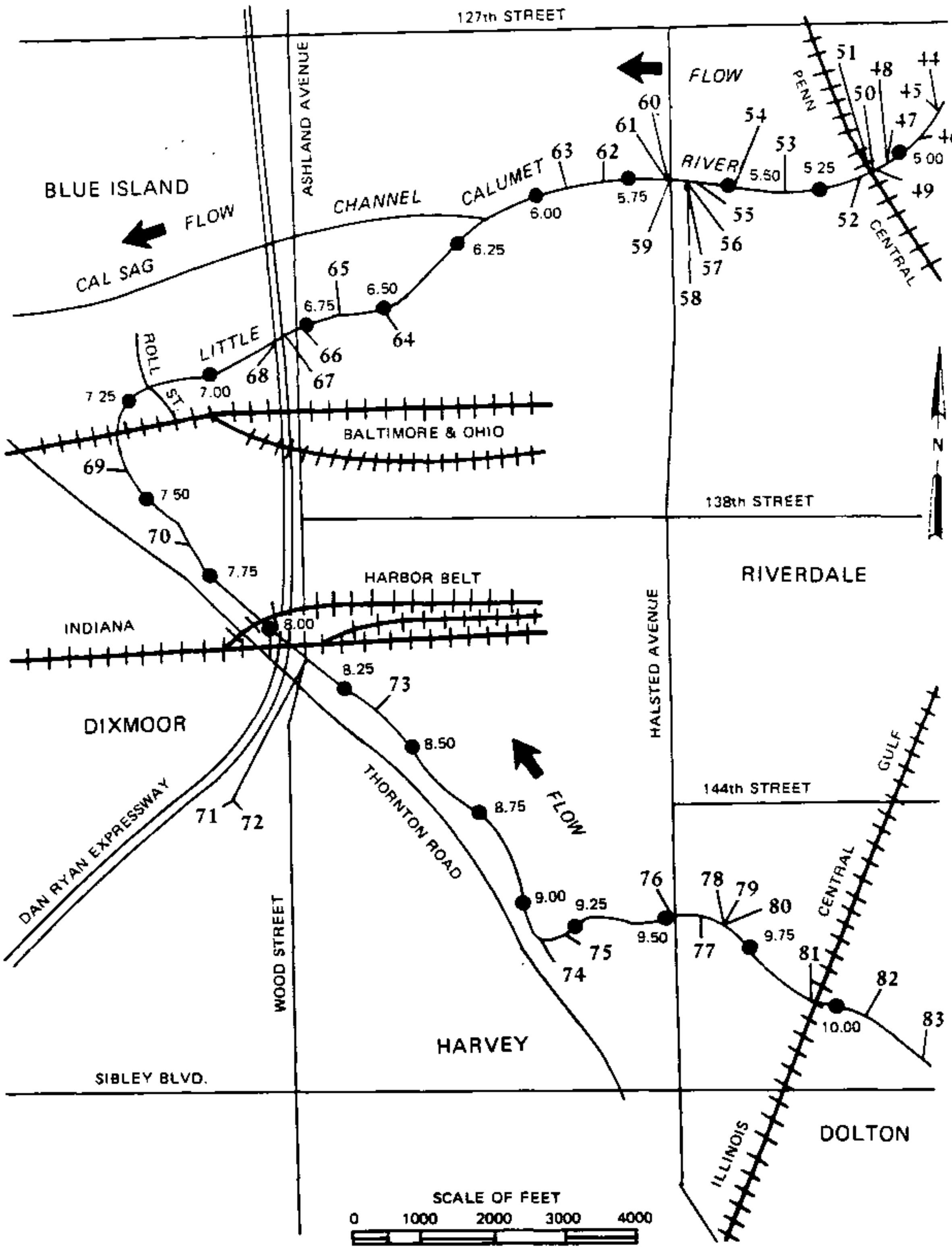
Appendix A-1. Calumet River (CR) sampling stations and outfall locations between mile points 0.00 and 2.75



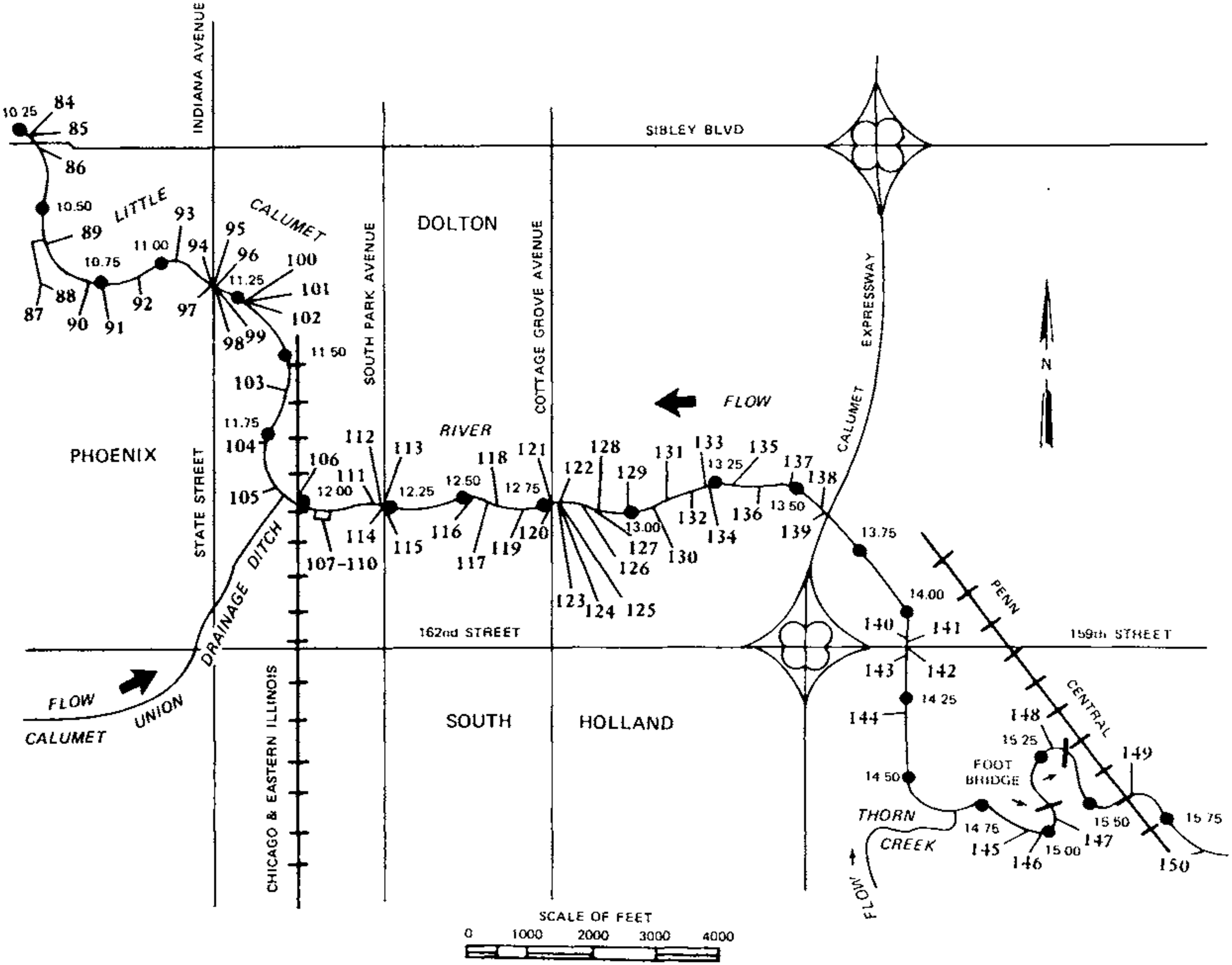
Appendix A-2. Calumet River (CR) sampling stations and outfall locations between mile points 3.00 and 6.75



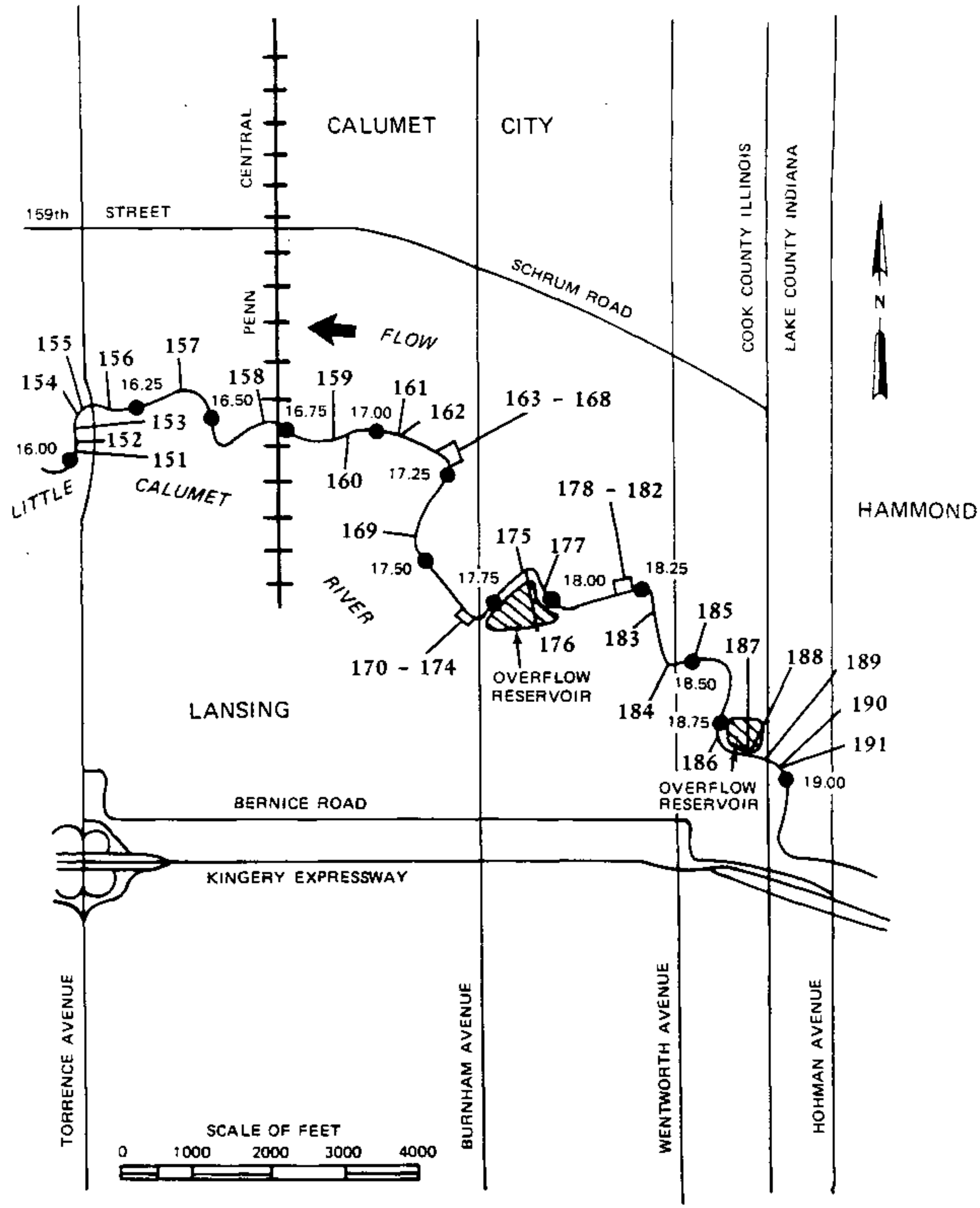
Appendix A-3. Little Calumel Kiver (LC) sampling stations and outfall locations between mile points 0.00 and 4.75



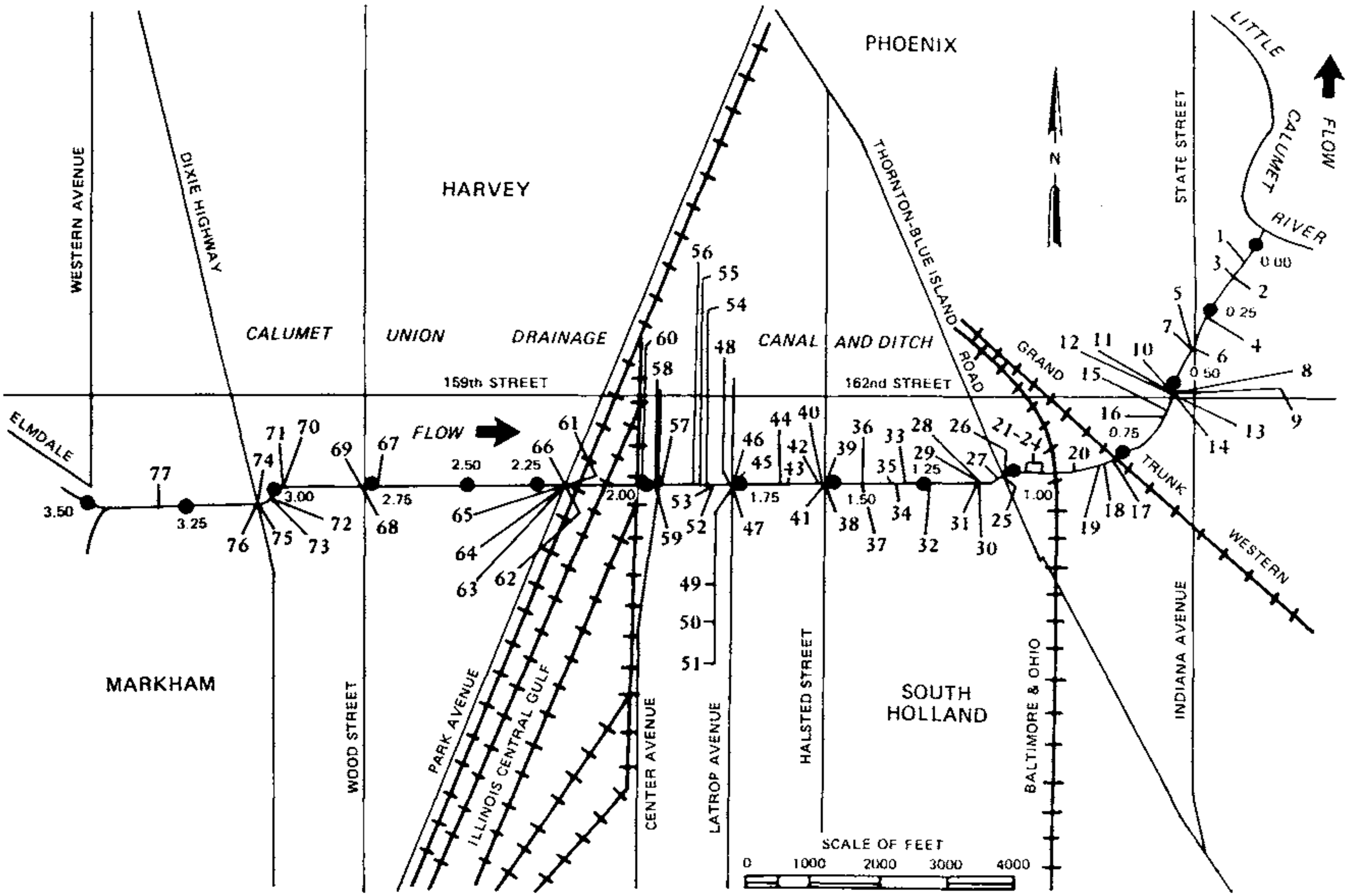
Appendix A-4. Little Calumet River (LC) sampling stations and outfall locations between mile points 5.00 and 10.00



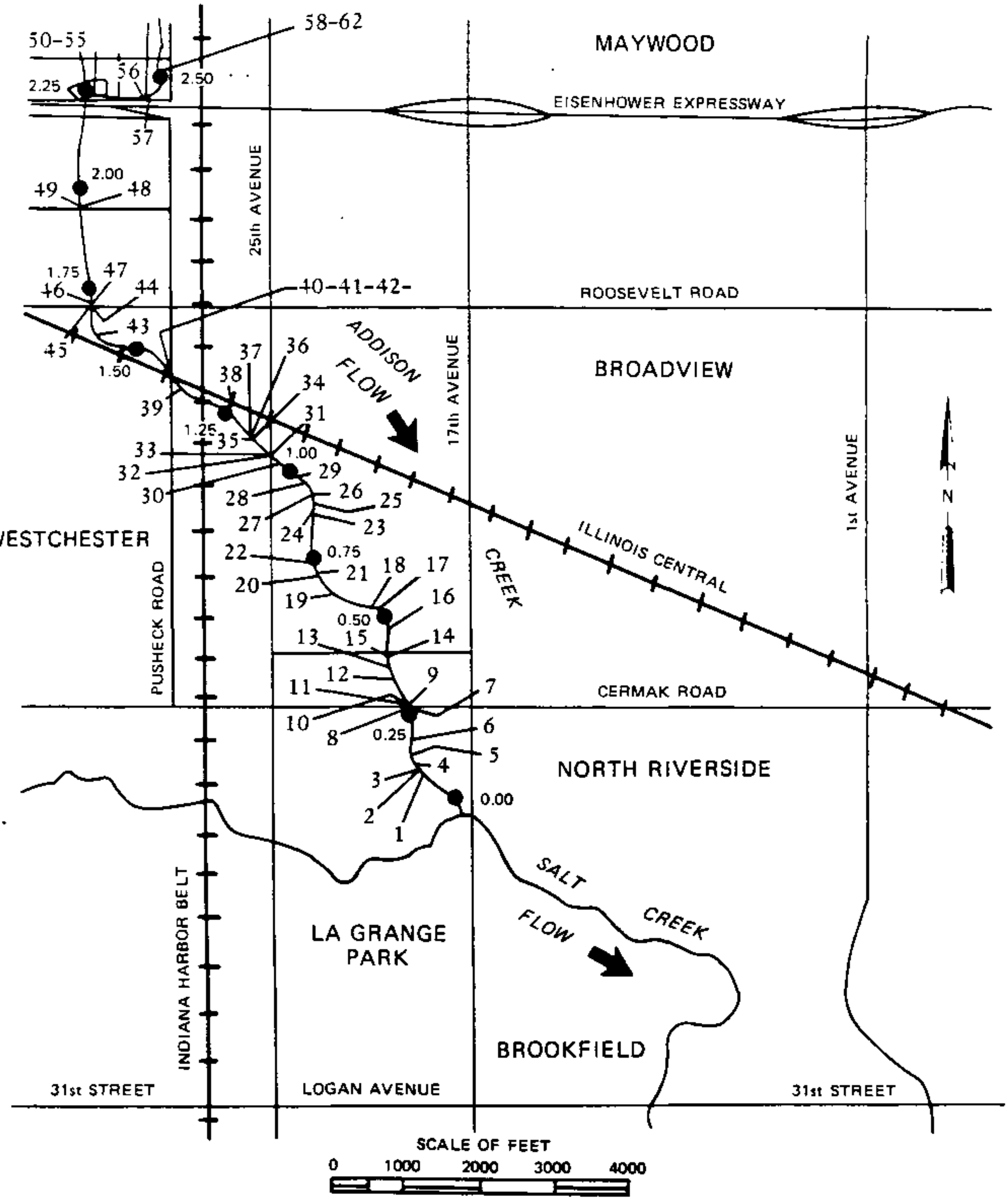
Appendix A-5. Little Calumet River' (LC) sampling stations and outfall locations between mile points 10.25 and 15.75



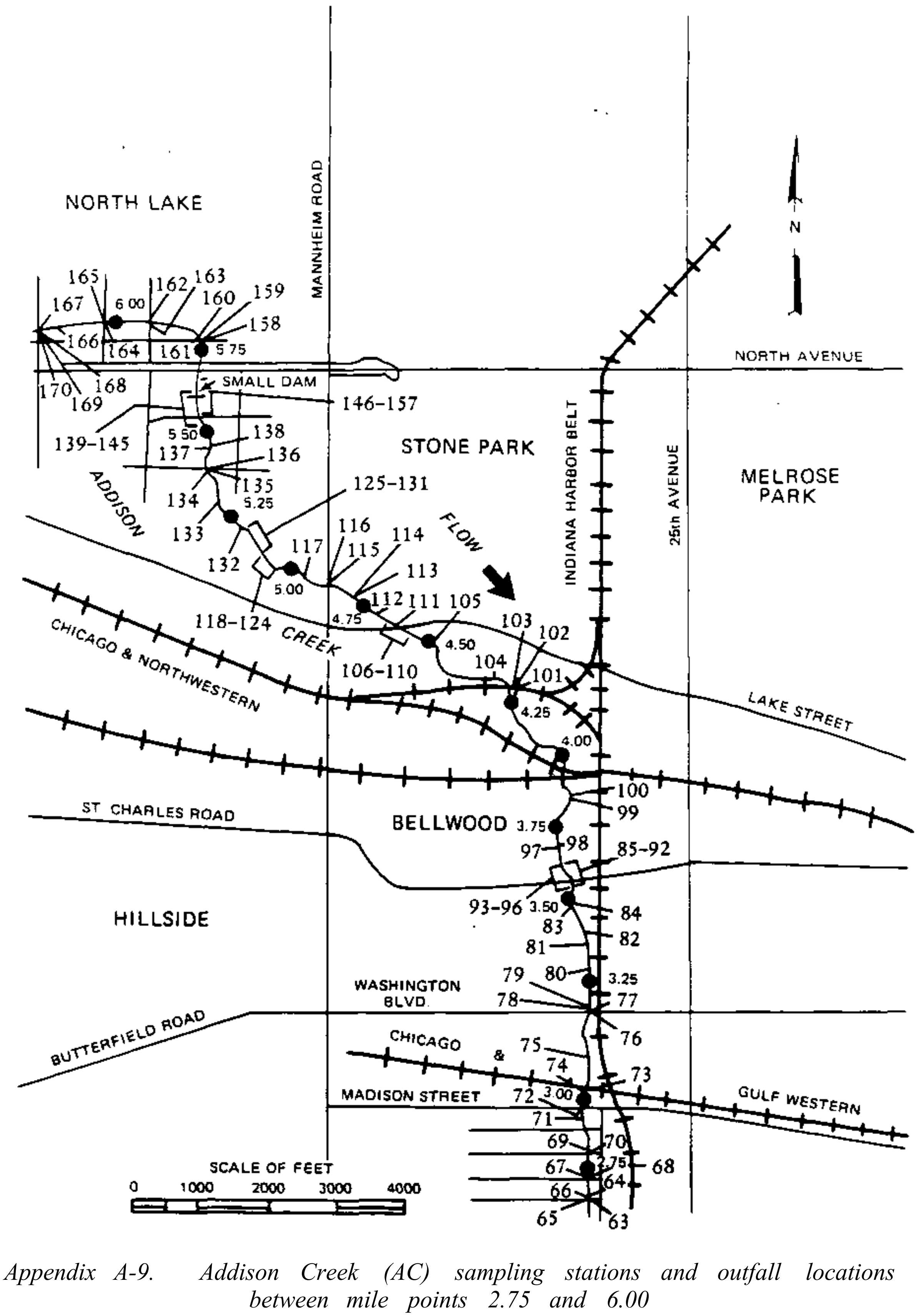
Appendix A-6. Little Calumet River (LC) sampling stations and outfall locations between mile points 16.00 and 19.00



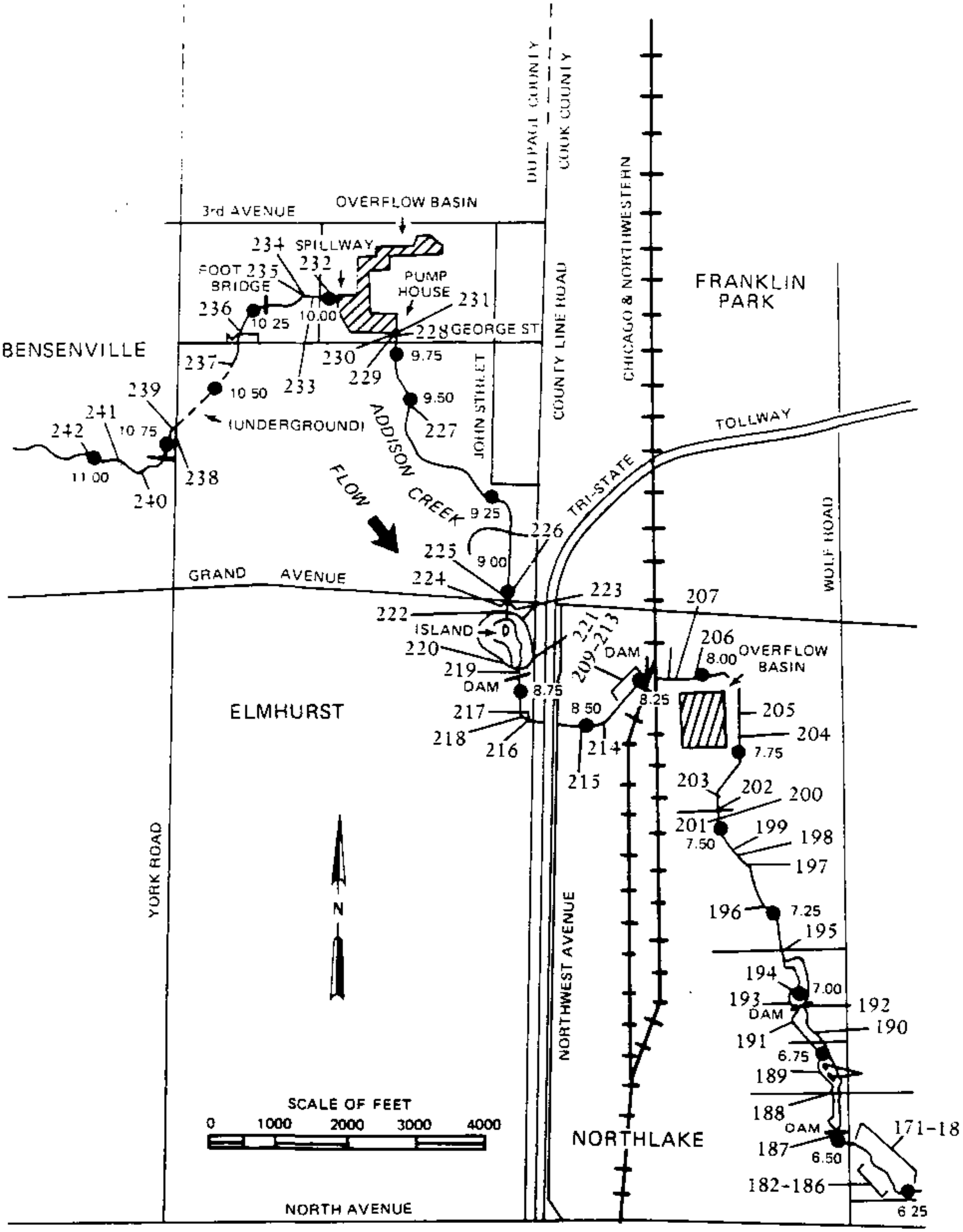
Appendix A-7. Calumet Union Drainage Canal and Ditch (CU) sampling stations and outfall locations between mile points 0.00 and 3.50



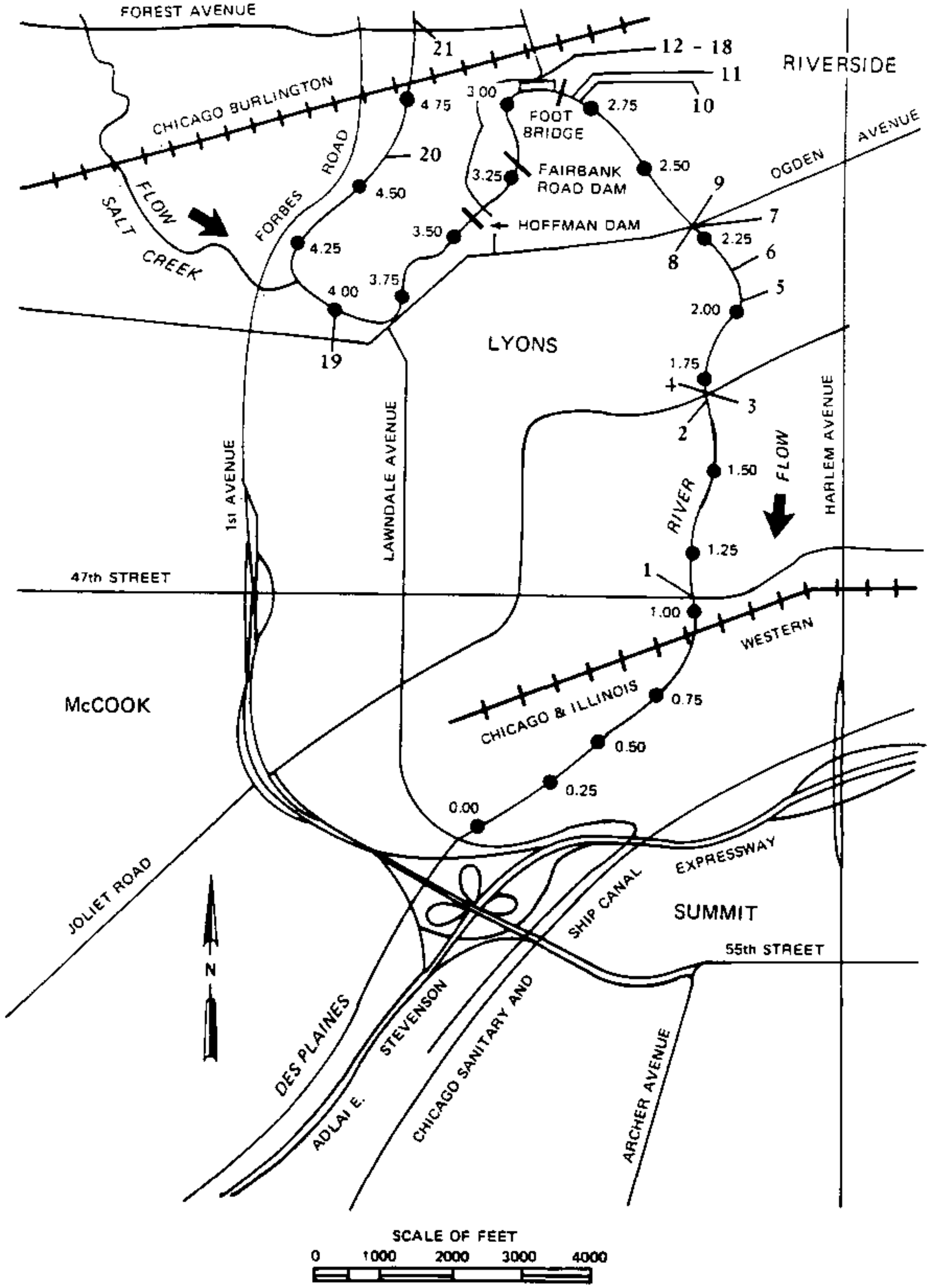
Appendix A-8. Addison Creek (AC) sampling stations and outfall locations between mile points 0.00 and 2.50



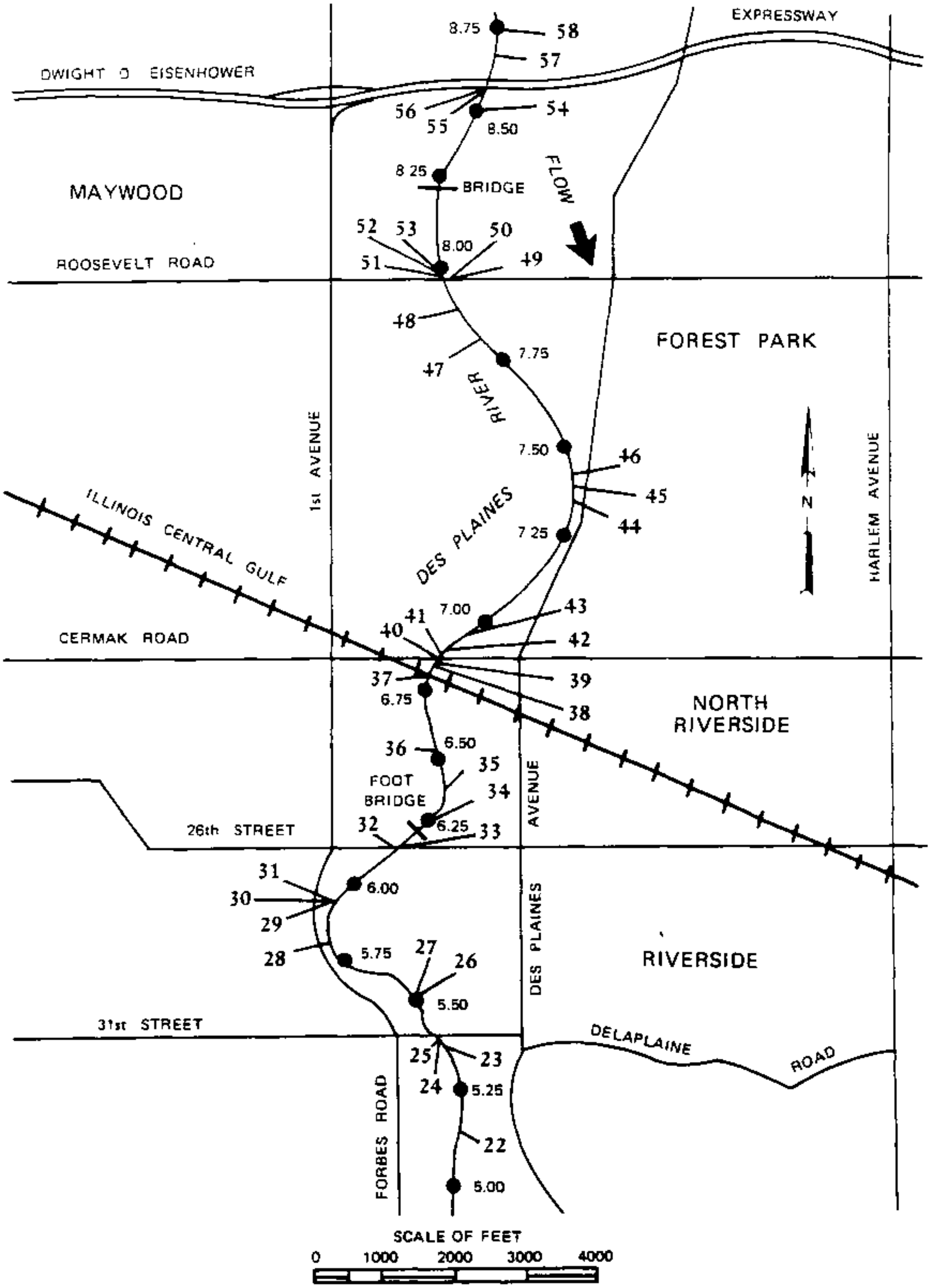
Appendix A-9. Addison Creek (AC) sampling stations and outfall locations between mile points 2.75 and 6.00



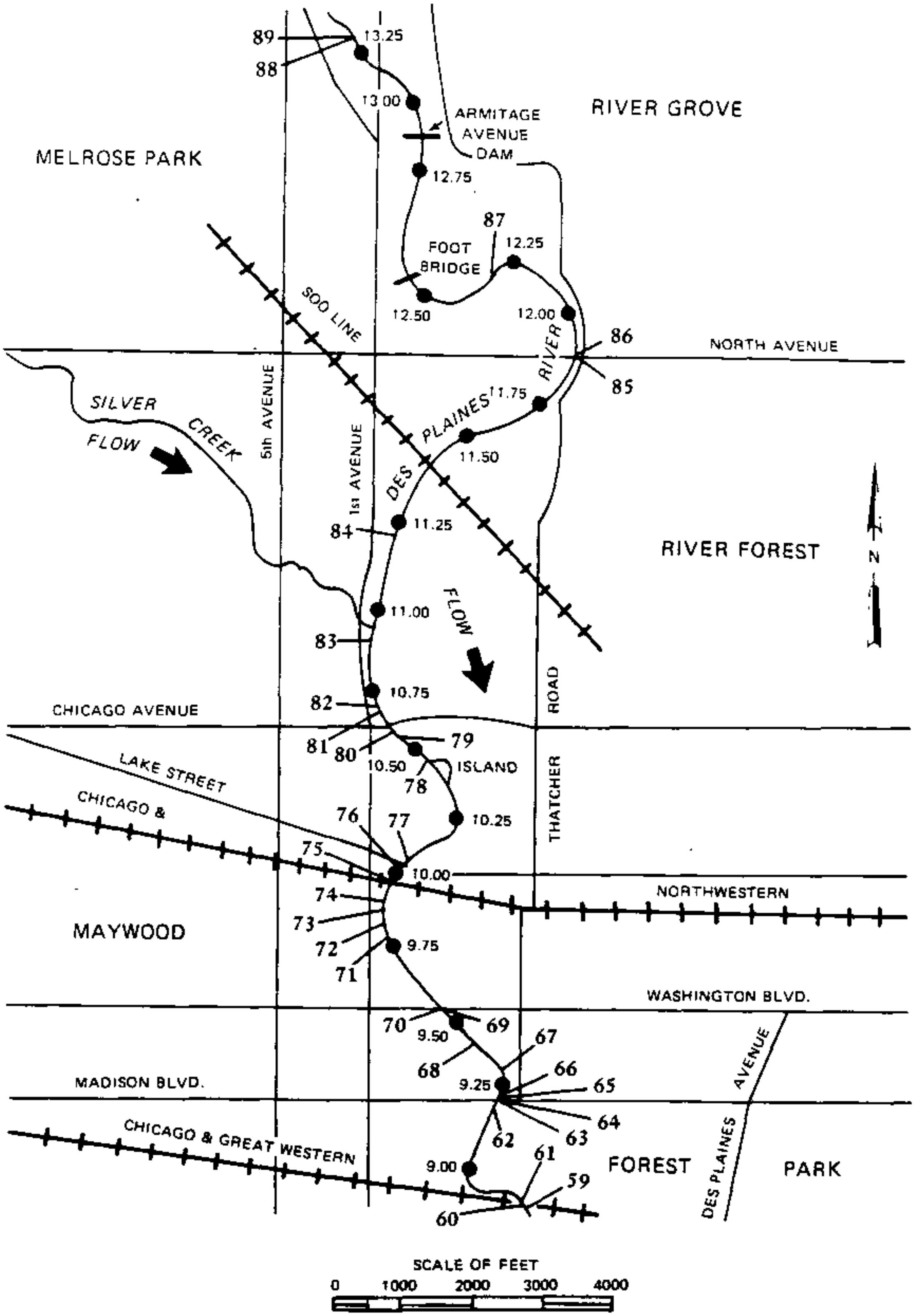
Appendix A-10. Addison Creek (AC) sampling stations and outfall locations between mile points 6.25 and 11.00



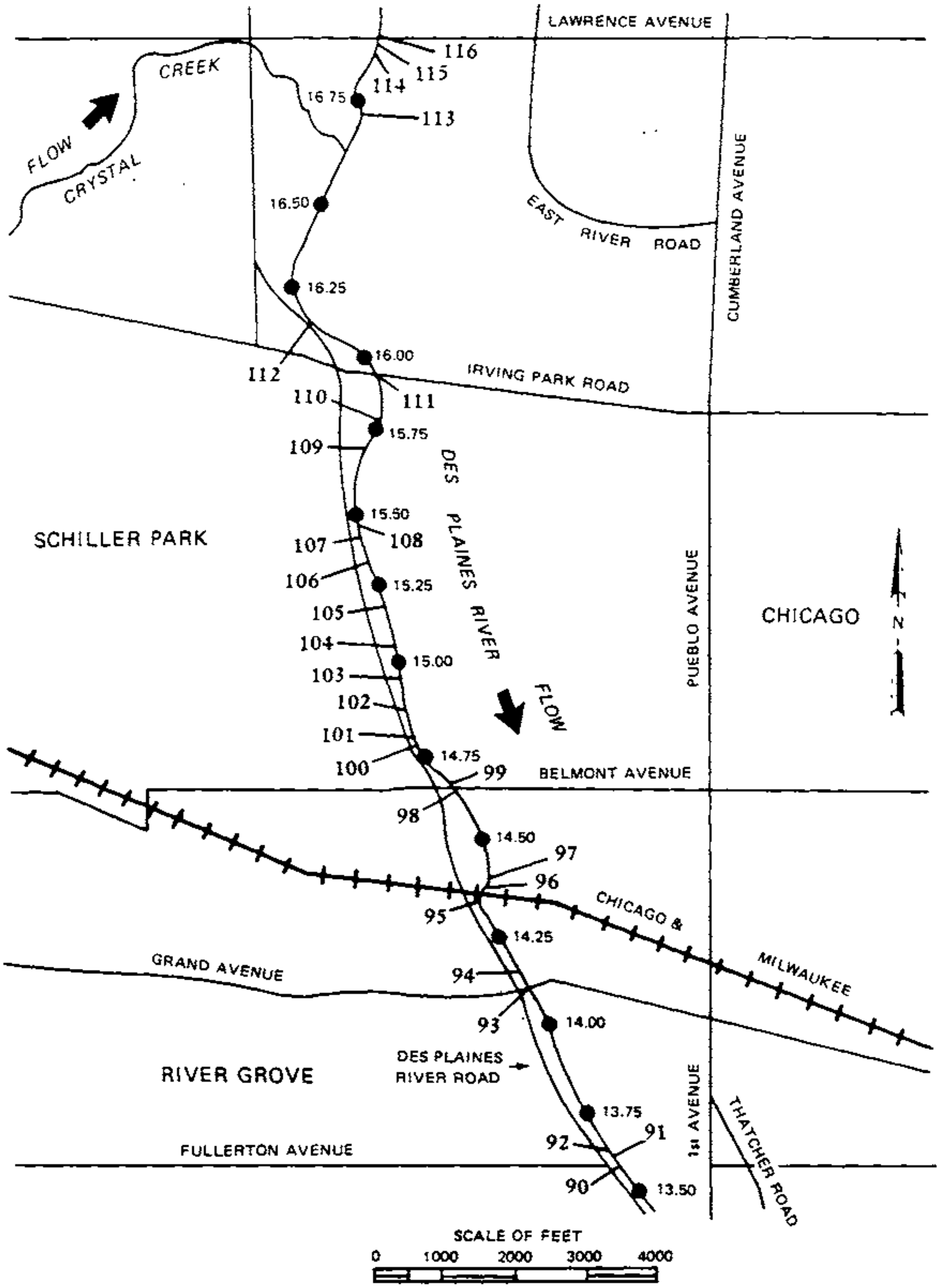
Appendix A-11. Des Plaines River (DP) sampling locations and outfall locations between mile points 0.00 and 4.75



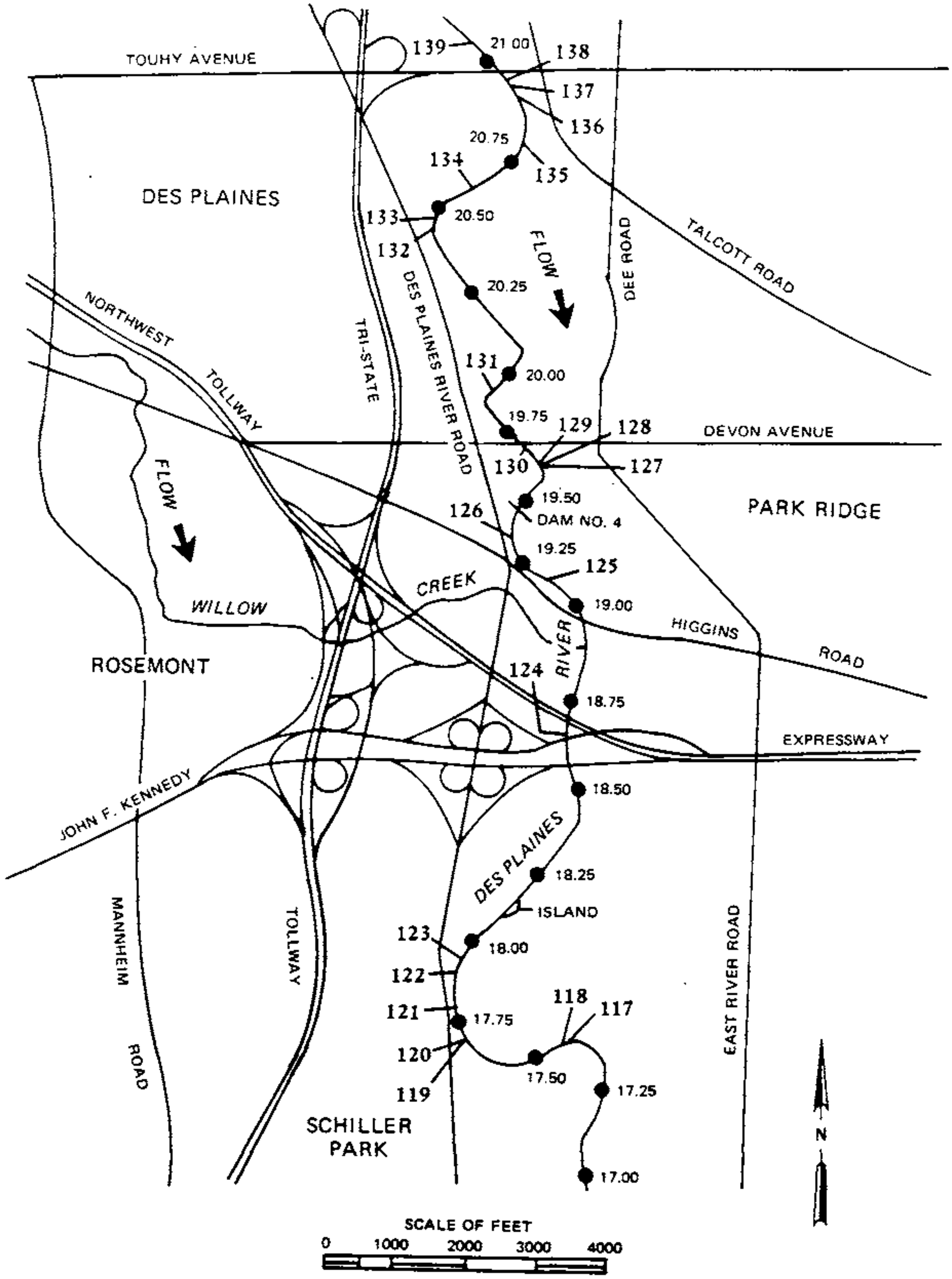
Appendix A-12. Des Plaines River (DP) sampling stations and outfall locations between mile points 5.00 and 8.75



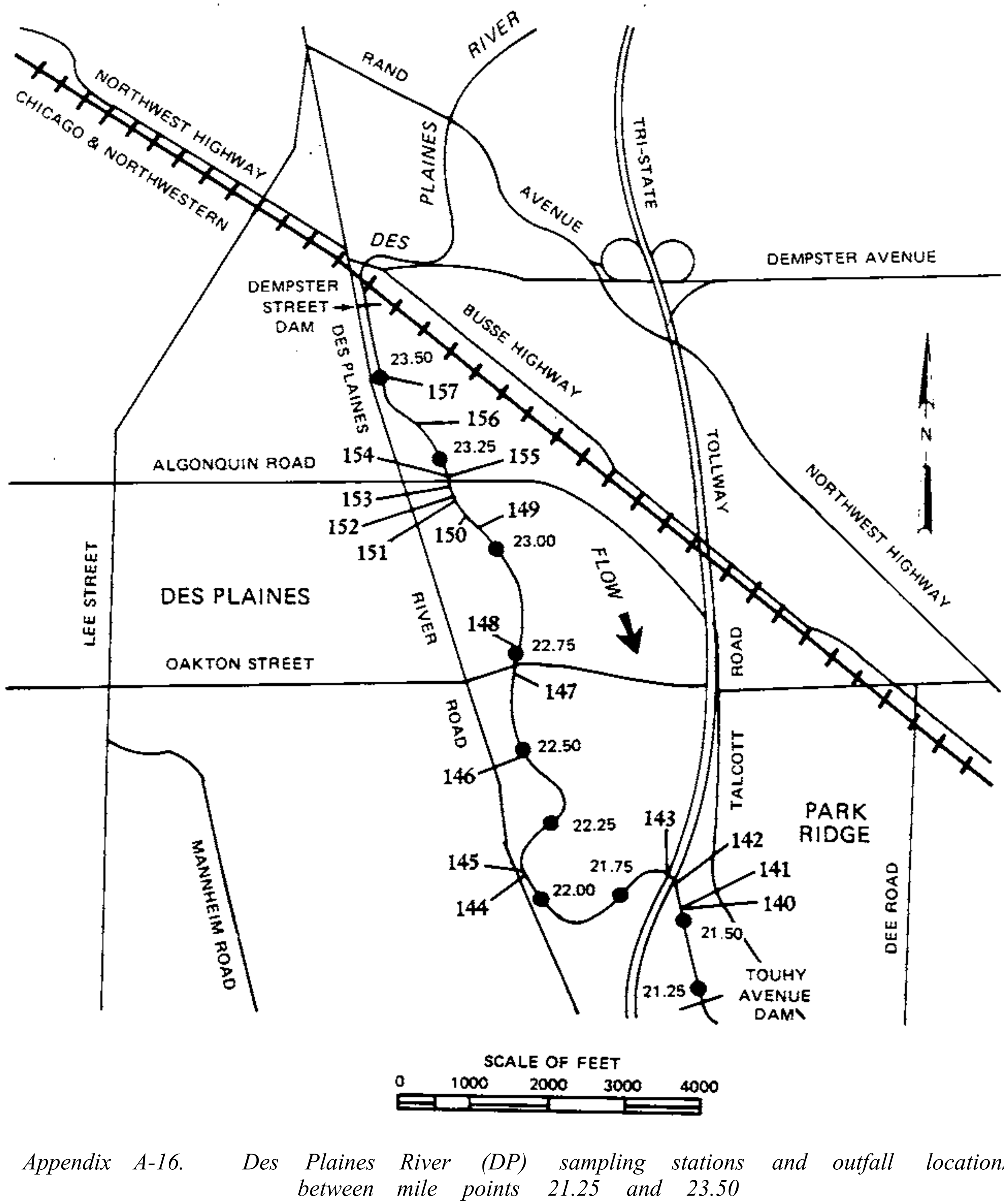
Appendix A-13. Des Plaines River (DP) sampling stations and outfall locations between mile points 9.00 and 13.25



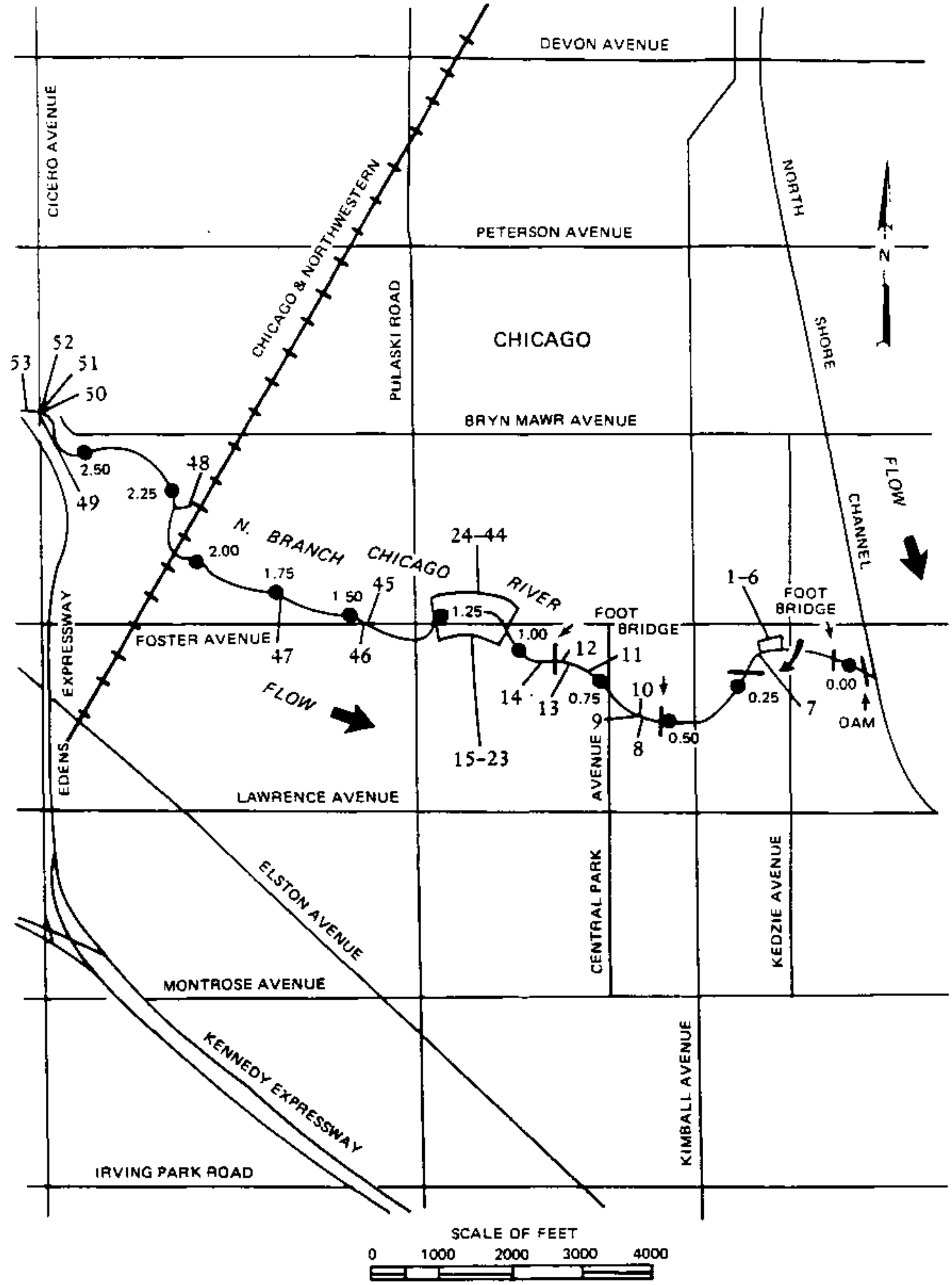
Avpendix A-14. Des Plaines River (DP) sampling stations and outfall looavions between mile points 13.50 and 16.75



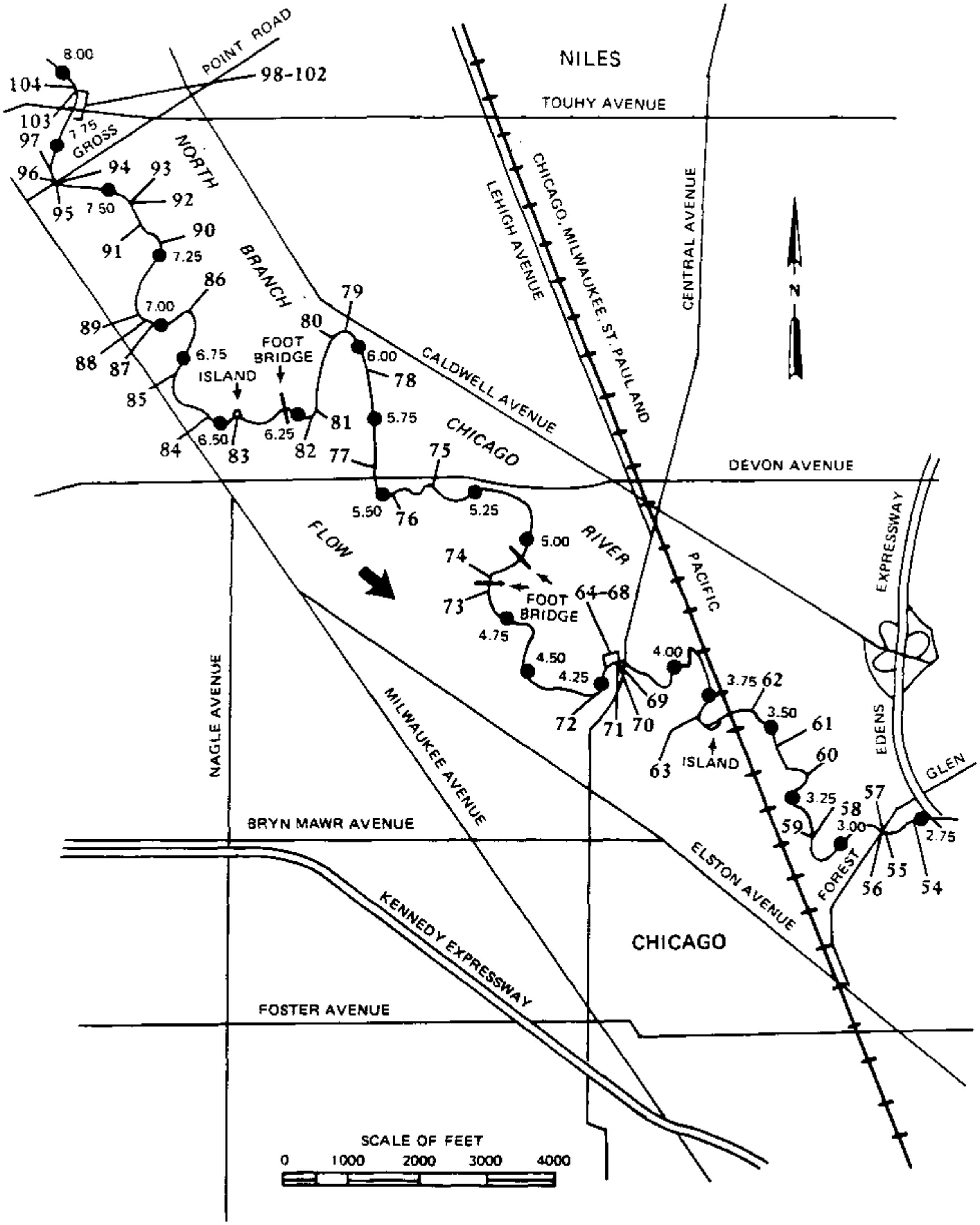
Appendix A-15. Des Plaines River (DP) sampling stations and outfall locations between mile points 17.00 and 21.00



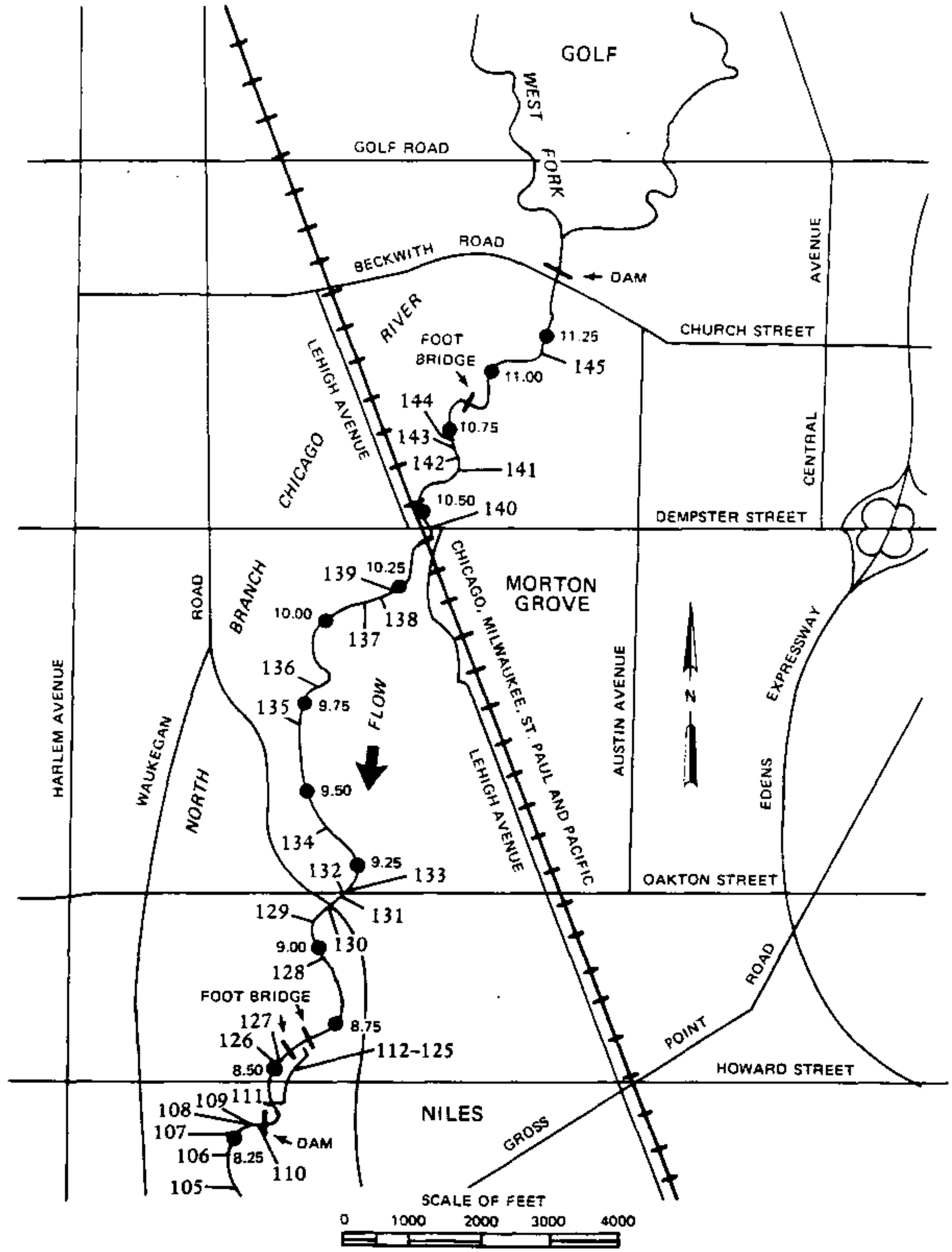
Appendix A-16. Des Plaines River (DP) sampling stations and outfall locations between mile points 21.25 and 23.50



Appendix A-17. North Branch of the Chicago River (NB) sampling stations and outfall locations between mile points 0.00 and 2.50



Appendix A-18. North Branch of the Chicago River (NB) sampling stations and outfall locations between mile points 2.75 and 8.00



Appendix A-19. North Branch of the Chicago River (NB) sampling stations and outfall locations between mile points 8.25 and 11.25

Appendix B

Outfall Locations and Characteristics

Key to Outfall Data

Abbreviation	River
AC	Addison Creek
CR	Calumet River
CU	Calumet Union Drainage Canal
DP	Des Plaines River
GC	Grand' Calumet River
LC	Little Calumet River
NB	North Branch of the Chicago River
	Shape of Pipe
A	Arch
0	Oval
R	Round
Rc	Rectangle
S	Square
	Type
ACP	Asbestos cement pipe
BC	Brick culvert
CIP	Cast iron pipe
CFT	Clay field tile
CMP	Corrugated metal pipe
CPP	Corrugated plastic pipe
PP	Plastic pipe
RCP	Reinforced concrete pipe
RSP	Riveted steel pipe
TSP	Threaded steel pipe
VCP	Vitrified clay pipe
WF	Wooden flume
WSP	Welded steel pipe

Outfall number	Tile Doint station	Distance from station (ft.)	Stream bank	Shane	Size (in)	Type	Color of effluent if active
CRl	0.75	-100	L	RC	60	RCP	submerged
CR2	0.75	-40	L	RC	60	RCP	submerged
CR3	1.00	-700		R	13	CMP	
CR4	1.00	-3 50	R	R	6	CIP	
CR5	1.00	-300	L	R	6	CIP	
CR6	1.50	-310	R	R	6	CMP	
CR7	1.50	+ 30	R	R	3	CIP	
CR8	1.50	1-700	r	R	4	CIP	submerged clear
CR9	1.50	+ 750	R	R	4	CI?	
CR10	1.50	+ 750	R	R	4	CIP	submerged clear
CRll	1.50	+ 750	R	R	2	CIP	
CR12	1.75	+ 230	L	R	4	CIP	
CR13	1.75	+ 280	L	R	4	CIP	
CR14	1.75	+285	L	R	4	CIP	
CRl5	1.75	+225	R	R	4	CIP	
CR16	1.75	+ 230	R	R	4	CIP	
CR17	1.75	+ 285	R	R	4	CIP	
CR18	2.00	+650	R	R	3	CIP	
CR19	2.25	-20	L	R	60	WSP	
CR20	2.25	-80	L	R	31	CIP	
CR21	2.50	-320	L	R	32	RCP	
CR22	2.50	+280	R	A	18	RCP	
CR23	2.50	+ 310	R	R	9	CMP	
CR24	2.75	-600	R	R	60	RCP	heat effl.
CR2 5	3.25	+ 310	L	R	3	CIP	clear
CR26	3.25	+ 340	L	R	3	CIP	clear
CR27	3.25	+660	L	R	1	TSP	clear
CR28	3.75	+ 15	R	R	42	RCP	
CR29	4.00	-100	L	R	60		clear
CR30	4.00	+ 250	r	R	4	CIP	
CR31	4.00	+ 260	L	R	4	PP	
CR32	4.00	+270	L	R	33	RCP	brown
CR33	4.50	+ 300	R	R	9	WSP	
CR34	4.50	+ 360	R	R	9	WSP	
CR3 5	4.50	+420	R	R	9	WSP	
CR36	4.50	+480	R	R	9	WSP	
CR37	4.50	+ 540	R	R	9	WSP	
CR38	4.50	+600	R	R	9	WSP	
CR39	4.50	+660	R	R	9	WSP	
CR40	4.50	+720	R	R	9	WSP	
CR41	5.00	+600	R	R	9	CIP	
CR42	5.50	+150	R	R	45	RCP	
LC1	0.00	+ 290	R	R	1	CIP	
LC2	0.00	+294	R	R	6	VCP	
LC3	0.25	+550	R	R	6	CFT	
LC4	0.50	+775	R	R	27	CIP	clear
LC5	0.50	+795	R	R	26	RCP	
LC6	0.75	-280	R	R	4	CIP	
LC7	0.75	+500	R	R	60	CMP	
LC8	1.00	-23	R	R	36	CMP	
LC9	1.00	-20	R	R	36	CMP	
LC10	1.25	-600	R	R	84	RCP	
LC11	1.50	-640	R	R	19	WSP	
LC12	1.50	-610	R	R	66	RCP	
LC13	1.50	+200	R	R	24	RCP	(in harbor)

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Tvpe	Color of effluent if active
LC14	1.75	-60	R	No pipe visible			clear
LC15	2.00	+ 350	L	R	17	RCP	brown
LC16	3.00	-540	L	R	25	CMP	
LC17	3.00	0	R	R	54	RCP	
LC18	3.00	+ 210	L	Rc	72 x 128	RCP	
LC19	3.25	-650	R	R	4	TSP	
LC20	3.25	+250	R	R	9	CFT	brown
LC21	3.50	-450	R	R	36	RCP	
LC22	3.50	+300	R	R	30	RCP	brown
LC23	3.50	+ 310	R	R	30	RCP	gray
LC24	3.50	+500	R	R	24	RCP	
LC25	3.50	+650	R	R	30	RCP	clear
LC26	3.50	+660	R	R	8	CMP	
LC27	3.50	+670	R	R	45	RCP	clear
LC28	3.75	-650	R	R	25	CIP	
LC29	3.75	-315	R	R	57	CMP	gray
LC30	3.75	-150	L	R	15	CMP	
LC31	3.75	+84	R	R	27	CIP	
LC32	3.75	+475	R	R	24	CMP	clear
LC3 3	4.00	+280	R	R	33	WSP	clear
LC34	4.00	+475	P	R	23	WSP	clear
LC35	4.25	-175	5	R	6	TSP	brown
LC36	4.25	+10	L	O	66	BC	gray
LC37	4.50	-470	E	Rc	165 x 204	RCP	dark
LC38	4.50	-450	E	Rc	162 x 204	RCP	
LC39	4.50	+320	R	R	22	RCP	green
LC40	4.50	+321	R	RC	10 x 12	WF	clear
LC41	4.75	-150	R	R	36	RCP	clear
LC42	4.75	+20	R	R	28	WSP	
LC43	4.75	+ 22	B	R	28	WSP	
LC44	4.75	+475	E	R	24	RCP	brown
LC45	4.75	+477	L	R	6	WSP	clear
LC46	5.00	-120	a	R	30	VCP	clear
LC47	5.00	+240	L	R	28	WSP	
LC48	5.00	+ 243	L	R	31	WSP	
LC49	5.00	+740	R	Rc	33 x 51	RCP	gray
LC50	5.00	+750	L	Rc	149 x 144	RCP	clear
LC51	5.00	+760	L	RC	154 x 138	RCP	clear
LC52	5.25	-160	R	R	41	RCP	clear
LC53	5.50	-850	L	R	48	RCP	green
LC54	5.50	-5	L	R	4	CIP	
LC55	5.75	-500	R	R	12	CFT	
LC56	5.75	-405	R	R	41	RCP	
LC57	5.75	-400	R	R	19	CFT	brown
LC58	5.75	-390	R	R	24	CIP	
LC59	5.75	-300	R	R	12	VCP	gray
LC60	5.75	-270	L	R	45	CMP	clear
LC61	5.75	-255	L	R	12	CMP	
LC62	5.75	+310	L	R	48	RCP	green
LC63	5.75	+580	L	R	4	CFT	
LC64	6.50	+5	R	R	33	RCP	clear
LC65	6.75	-550	L	R	12	VCP	
LC66	6.75	+50	R	R	24	RCP	clear
LC67	6.75	+180	R	R	24	RCP	clear
LC68	6.75	+400	R	R	24	RCP	clear
LC69	7.50	-550	L	Tributary			

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
LC70	7.75	-450	L	Small. tributary			
LC71	8.00	+ 540	L	R	120	RCP	
LC72	8.00	+ 550	L	R	37	RCP	
LC73	8.25	+375	R	R	29	RCP	clear
LC74	9.00	+ 500	L	R	88	RCP	
LC75	9.25	-100	L	R	84	RCP	
LC76	9.50	+ 180	R	R	46	RCP	clear
LC77	9.50	+450	L	R	72	RCP	gray
LC78	9.75	-500	R	R	53	CIP	
LC79	9.75	-490	R	R	53	CIP	
LC80	9.75	-480	R	S	90	wooded cover over outfall	
LC81	10.00	-425	R	R	30	VCP	
LC82	10.00	+400	R	R	24	CMP	clear
LC33	10.25	-150	R	R	19	CMP	clear
LC34	10.25	+250	R	R	40	CMP	clear
LC85	10.25	+260	R	R	21	CMP	
LC36	10.25	+300	R	R	24	RCP	clear
LC87	10.50	+400	L	O	37 x 57	CMP	clear
LC88	10.50	+410	L	R	24	RCP	
LC89	10.50	+420	R	R	30	VCP	
LC90	10.75	-100	L	R	8	CFT	clear
LC91	10.75	0	L	R	48	BC	
LC92	11.00	-350	L	R	36	CMP	clear
LC93	11.00	+ 150	R	R	12	RCP	
LC94	11.25	-300	R	R	12	RCP	
LC95	11.25	-290	R	R	12	VCP	
LC96	11.25	-280	R	R	26	RCP	clear
LC97	11.25	-300	L	R	2	TSP	clear
LC98	11.25	-295	L	R	12	VCP	
LC99	11.25	-290	L	R	24	RCP	clear
LC100	11.25	+85	R	R	25	CMP	clear
LC101	11.25	+87	R	R	18	RCP	
LC102	11.25	+90	R	R	24	CMP	
LC103	11.50	+600	L	R	21	RCP	clear
LC104	11.75	+10	L	R	18	CMP	clear
LC105	12.00	-400	L	Small tributary			
LC106	12.00	-250	R	R	25	CMP	
LC107	12.00	+300	L	R	7	CPP	
LC108	12.00	+325	L	R	7	CPP	
LC109	12.00	+350	L	R	9	CPP	
LC110	12.00	+375	L	R	7	CPP	
LC111	12.25	-190	R	R	20	RCP	
LC112	12.25	-180	R	R	15	VCP	
LC113	12.25	-170	R	R	29	RCP	clear
LC114	12.25	-180	L	R	48	RCP	clear
LC115	12.25	-150	L	R	18	RCP	
LC116	12.50	+50	L	R	2	PP	
LC117	12.50	+250	L	R	25	CMP	clear
LC118	12.50	+375	R	Small tributary			
LC119	12.75	-350	L	R	15	CMP	
LC120	12.75	+95	L	R	24	RCP	
LC121	12.75	+95	R	R	30	RCP	
LC122	12.75	+180	R	R	56	WSP with flap	
LC123	12.75	+180	L	R	24	CMP	
LC124	12.75	+185	L	R	16	WSP	
LC125	12.75	+186	L	R	16	WSP	

Outfall number	Mile Doint station	Distance from station (ft.)	Stream bank	Shace	Size (in)	Type	Color of effluent if active
LC126	12.75	+ 525	L	R	18	CMP	clear
LC127	12.75	+620	L	R	24	CMP	
LC128	12.75	+640	R	R	20	CMP	
LC129	13.00	-10	R	Small. tributary			
LC130	13.00	+150	L	R	30	CMP	clear
LC131	13.00	+425	R	R	27	CMP	clear
LC132	13.00	+900	L	R	24	RCP	
LC133	13.25	-150	R	R	24	CMP	clear
LC134	13.25	-50	L	R	24	RCP	
LC135	13.25	+ 200	R	R	35	RCP	clear
LC136	13.25	+700	L	R	29	RCP	
LC137	13.50	-50	R	R	35	RCP	clear
LC138	13.50	+600	R	R	18	RCP	clear
LC139	13.50	+650	L	R	68	RCP	clear
LC140	14.00	+550	L	R	36	RCP	clear
LC141	14.00	+ 580	R	R	30	RCP	clear
LC142	14.00	+640	R	R	15	RCP	
LC143	14.00	+660	L	R	18	RCP	clear
LC144	14.25	+200	L	Small tributary			
LC145	15.00	-200	L	R	35	CMP	clear
LC146	15.00	-30	L	R	12	RCP	
LC147	15.00	+150	L	R	36	CMP	clear
LC148	15.25	+200	R	R	30	RCP	
LC149	15.50	+650	R	R	42	RCP	clear
LC150	16.00	-350	L	Small tributary			
LC151	16.00	+15	L	R	28	RCP	
LC152	16.00	+100	L	R	56	RCP	clear
LC153	16.00	+230	L	R	15	RCP	
LC154	16.00	+ 550	R	R	12	RCP	
LC155	16.00	+ 590	R	R	46	RCP	clear
LC156	16.25	-350	R	R	18	RCP	
LC157	16.25	+650	R	R	74	RCP w/ flap	clear
LC158	16.75	-400	R	R	24	RCP	
LC159	17.00	-650	R	R	42	RCP	
LC160	17.00	-550	L	Small tributary			
LC161	17.00	+350	R	R	18	RCP w/ flap	
LC162	17.25	+355	R	R	42	RCP w/ flap	clear
LC163	17.25	-210	R	R	48	CIP w/ flap	clear
LC164	17.25	-205	R	R	6	CIP	clear
LC165	17.25	-190	R	R	36	CIP. w/ flap	
LC166	17.25	-185	R	R	36	CIP w/ flap	
LC167	17.25	-180	R	R	36	CIP w/ flap	
LC168	17.25	-175	R	R	4	CIP	
LC169	17.50	-400	L	R	22	RCP	clear
LC170	17.75	-340	L	R	24	CIP	
LC171	17.75	-330	L	R	44	CIP	
LC172	17.75	-310	L	R	48	CIP	
LC173	17.75	-300	L	R	48	CIP	
LC174	17.75	-280	L	S	144	wooden flap covering outfall	
LC175	18.00	-405	R	R	10	VCP	
LC176	18.00	-400	L	R	36	CIP w/ flap	clear
LC177	18.00	-90	R	R	36	CIP w/ flap	
LC178	18.25	-125	R	R	42	CIP w/ flap	
LC179	18.25	-115	R	R	42	CIP w/ flap	
LC180	18.25	-105	R	R	42	CIP w/ flap	
LC181	18.25	-90	R	R	48	CIP w/ flap	

Outfall number	Mile coint station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
LC182	13.25	-80	R	R	40	RCP	
LC183	18.25	+300	L	R	21	CIP w/ flap	
LC184	18.50	-400	L	R	27	CIP w/ flan	clear
LC185	13.50	+10	R	R	16	CIP w/ flap	
LC186	18.75	+115	L	R	42	RCP	
LC187	19.00	-600	R	R	46	CIP w/ flap	
LC188	19.00	-580	R	R	6	CIP	
LC189	19.00	-300	R	R	18	CIP w/ flap	
LC190	19.00	-100	R	R	30	RCP	
LC191	19.00	-95	R	R	30	RCP	
GC1	0.00	+270	R	R	36	CMP	clear
GC2	0.25	+425	R	R	36	RCP	clear
GC3	0.50	-400	L	R	44	RCP	
GC4	0.50	-150	R	R	21	RCP	clear
GC5	1.75	+600	L	A	84	RCP	
GC6	1.75	+675	L	R	32	RCP	
GC7	2.00	+600	R	Small tributary			
GC8	2.50	-200	L	suspected submerged outfall			
GC9	2.75	+20	L	R	27	CMP	
CU1	0.00	+400	L	R	21	CMP	
CU2	0.25	-600	R	R	15	CMP	
CU3	0.25	-590	L	R	36	RCP	
CU4	0.25	+135	R	R	22	CMP	clear
CU5	0.50	-390	L	R	30	RCP	clear
CU6	0.50	-370	R	R	24	RCP	clear
CU7	0.50	-350	L	R	36	RCP	
CU8	0.50	+230	R	R	30	CMP	clear
CU9	0.50	+235	R	R	18	CMP	clear
CU10	0.50	+240	L	R	30	CMP	clear
CU11	0.50	+265	L	R	18	CMP	
CU12	0.50	+270	L	R	24	RCP	
CU13	0.50	+260	R	R	18	CMP	clear
CU14	0.50	+270	R	R	41	RCP	clear
CU15	0.50	+400	L	R	12	VCP	
CU16	0.50	+500	L	R	15	CMP	
CU17	0.75	+90	R	R	36	RCP	clear
CU18	0.75	+250	R	R	18	CMP	
CU19	0.75	+300	R	R	18	RCP	
CU20	0.75	+550	L	Small tributary			
CU21	1.00	-450	L	R	17	CMP	
CU22	1.00	-400	L	R	16	CIP	
CU23	1.00	-350	L	R	6	CFT	
CU24	1.00	-300	L	R	21	RCP	
CU25	1.00	+190	R	R	84	RCP	
CU26	1.00	+195	L	R	26	RCP	clear
CU27	1.00	+270	L	R	30	RCP	clear
CU28	1.00	+400	L	R	6	VCP	
CU29	1.00	+425	L	R	12	VCP	
CU30	1.00	+450	R	R	8	RCP	
CU31	1.00	+500	R	R	5	PP	
CU32	1.25	-25	R	Small tributary			
CU33	1.25	+300	L	R	18	RCP	
CU34	1.25	+350	R	R	12	RCP	

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
CU35	1.25	+400	L	R	8	RCP	
CU36	1.50	-260	L	R	12	CIP	
CU37	1.50	-250	R	R	24	RCP	clear
CU38	1.50	+175	R	RC	48 x 53	RCP	
CU39	1.50	+175	L	R	24	RCP	clear
CU40	1.50	+ 195	L	R	24	RCP	
CU41	1.50	+ 195	R	R	24	RCP	clear
CU42	1.50	+300	L	R	12	RCP	
CU43	1.75	-500	L	R	12	CMP	
CU44	1.75	-450	L	R	12	CMP	
CU45	1.75	+ 140	L	R	15	RCP	
CU46	1.75	+150	L	R	18	RCP	
CU47	1.75	+ 150	R	R	18	RCP	
CU48	1.75	+ 180	L	R	15	VCP	
CU49	1.75	+180	R	R	18	RCP	
CU50	1.75	+195	R	R	36	RCP	clear
CU51	1.75	+ 200	R	R	30	RCP	clear
CU52	1.75	+500	R	R	5	PP	
CU53	1.75	+ 500	R	R	4	PP	
CU54	2.00	-800	L	R	18	RCP w/flap	
CU55	2.00	-650	L	R	12	CIP	
CU56	2.00	-600	L	R	18	CIP	
CU57	2.00	-150	L	R	15	RCP	
CU58	2.00	-120	L	R	28	CIP	
CU59	2.00	-75	R	Tributary	•		
CU60	2.00	+35	L	R	8	RCP	
CU61	2.25	-400	L	R	18	RCP	
CU62	2.25	-390	R	RC	36 x 24	RCP	
CU63	2.25	-370	R	RC	60 x 48	RCP	
CU64	2.25	-360	R	R	20	CIP	
CU65	2.25	-350	R	R	15	VCP	
CU66	2.25	-340	L	R	40	RCP	
CU67	2.75	-25	L	R	53	RCP	
CU68	2.75	+100	R	A	30	RCP	
CU69	2.75	+175	L	R	15	RCP	clear
CU70	3.00	-100	L	R	60	RCP	
CU71	3.00	-90	L	R	60	RCP	
CU72	3.00	+50	R	R	18	CIP	
CU73	3.00	+55	R	R	18	CIP	
CU74	3.00	+450	L	R	18	CMP	
CU75	3.00	+450	R	R	18	CMP	
CU76	3.00	+520	R	RC	63 x 148	RCP	
CU77	3.25	+200	L	R	30"	RCP	
AC1	0.25	-650	R	R	18	RCP	gray
AC2	0.25	-600	R	R	16	RCP	
AC3	0.25	-590	R	R	8	VCP	
AC4	0.25	-550	L	R	8	CIP	
ACS	0.25	-450	L	R	6	VCP	
AC6	0.25	-200	L	R	8	CIP	
AC7	0.25	+150	L	R	30	RCP	
AC8	0.25	+160	R	R	36	RCP	
AC9	0.25	+190	L	R	36	RCP	clear
AC10	0.25	+200	R	R	30	RCP	gray
AC11	0.25	+210	R	R	24	RCP	
AC12	0.50	-600	R	R	12	CMP	

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
AC13	0.50	-500	R	R	15	VCP	
AC14	0.50	-425	L	R	48	RCP	clear
AC15	0.50	-400	R	R	29	RCP	
AC16	0.50	-100	L	R	6	CFT	
AC17	0.50	+150	L	R	48	RCP	
AC19	0.50	+250	L	R	21	RCP	clear
AC19	0.75	-450	R	R	15	RCP	
AC20	0.75	-120"	R	R	14	RCP	
AC21	0.75	-100	L	R	12	RCP	
AC22	0.75	-10	R	R	12	RCP	
AC23	1.00	-660	R	R	18	RCP	
AC24	1.00	-650	L	R	12	VCP	
AC25	1.00	-450	L	R	12	VCP	
AC26	1.00	-360	L	R	29	RCP	
AC27	1.00	-350	R	R	46	RCP	
AC28	1.00	-150	R	R	8	VCP	
AC29	1.00	-100	L	R	6	VCP	
AC30	1.00	+ 200	R	R	30	RCP	
AC31	1.00	+400	L	R	24	RCP	
AC32	1.00	+445	R	R	21	RCP	
AC33	1.00	+ 520	R	R	21	RCP	
AC34	1.00	+620	L	R	10	CFT	
AC35	1.25	-630	R	R	18	RCP	clear
AC36	1.25	-620	L	R	6	CMP	clear
AC37	1.25	-600	L	R	15	RCP	
AC38	1.25	-10	L	O	36	CMP culvert	
AC39	1.50	-625	R	R	36	RCP	
AC40	1.50	-520	L	R	45	RCP	
AC41	1.50	-510	L	R	29	RCP	
AC42	1.50	-500	L	R	72	RCP	
AC43	1.75	-550	L	R	12	RCP	
AC44	1.75	-300	L	R	12	RCP	clear
AC45	1.75	-300	R	R	82	RCP	
AC46	1.75	-100	R	R	18	VCP	
AC47	1.75	-100	L	R	15	CMP	
AC48	2.00	-200	L	R	24	CMP	
AC49	2.00	-200	R	R	24	CMP	
AC50	2.25	-200	R	R	27	RCP	
AC51	2.25	-100	R	R	36	RCP	
AC52	2.25	-75	R	R	12	RCP	
AC53	2.25	+200	R	R	12	RCP	
AC54	2.25	+300	R	R	10	RCP	
AC55	2.25	+300	R	R	15	RCP	
AC56	2.50	-250	R	R	12	RCP	
AC57	2.50	-150	L	R	48	RCP	
AC58	2.50	+5	L	R	30	RCP	clear
AC59	2.50	+ 10	L	R	24	RCP	clear
AC60	2.50	+ 15	L	R	36	RCP w/flap	
AC61	2.50	+20	L	R	36	RCP w/flap	
AC62	2.50	+25	L	R	36	RCP w/flap	
AC63	2.75	-350	L	R	12	RCP	
AC64	2.75	-325	L	R	12	RCP	
AC65	2.75	-350	R	R	27	RCP	
AC66	2.75	-325	R	R	12	RCP	
AC67	2.75	-110	R	R	24	RCP	clear
AC68	2.75	-100	L	R	12	RCP	

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
AC69	2.75	+100	R	R	27	RCP	clear
AC70	2.75	+105	L	R	12	RCP	clear
AC71	3.00	-300	R	R	21	RCP	clear
AC72	3.00	-75	R	R	27	RCP	clear
AC73	3.00	+10	L	R	8	CMP	
AC74	3.00	+30	R	R	88	RCP	
AC75	3.00	+400	R	R	12	RCP	
AC76	3.25	-250	L	R	18	RCP	
AC77	3.25	-170	L	R	48	RCP	
AC78	3.25	-170	R	R	21	VCP	
AC79	3.25	-165	R	R	15	VCP	
AC80	3.25	+200	R	R	12	RCP	
AC81	3.25	+700	R	R	15	RCP	
AC82	3.50	-400	L	R	30	RCP	
AC83	3.50	-75	R	R	15	RCP	
AC84	3.50	-25	L	R	12	VCP	
AC85	3.50	+150	L	R	15	VCP	
AC86	3.50	+160	L	R	8	CIP	
AC87	3.50	+200	L	R	8	CIP	
AC88	3.50	+250	L	R	15	VCP	
AC89	3.50	+600	L	R	48	RCP	
AC90	3.50	+605	L	R	48	RCP	
AC91	3.50	+610	L	R	48	RCP	
AC92	3.50	+650	L	R	18	RCP	
AC93	3.50	+150	R	R	15	VCP	
AC94	3.50	+160	R	R	8	CIP	
AC95	3.50	+200	R	R	8	CIP	
AC96	3.50	+590	R	R	12	RCP	
AC97	3.75	-360	R	R	34	RCP	
AC98	3.75	-350	L	R	30	RCP	
AC99	3.75	+400	L	R	8	CMP	
AC100	3.75	+403	L	R	8	CMP	
AC101	4.25	+85	L	R	48	RCP w/flap	
AC102	4.25	+90	L	R	48	RCP w/flap	
AC103	4.25	+100	L	R	4	CIP w/flap	
AC104	4.25	+300	L	R	15	CMP	
AC105	4.50	-10	L	R	8	CMP	
AC106	4.50	+200	R	R.	8	RCP	
AC107	4.50	+560	R	R	24	RCP	
AC108	4.50	+570	R	R	48	RCP	
AC109	4.50	+580	R	R	30	RCP	
AC110	4.50	+600	R	R	24	RCP	
AC111	4.50	+550	L	R	15	RCP	
AC112	4.75	-180	L	O	27 x 42	CMP	
AC113	4.75	+180	L	R	15	CMP	
AC114	4.75	+200	L	R	24	CMP	
AC115	5.00	-610	L	R	12	RCP	
AC116	5.00	-600	L	RC	60 x 96	RCP w/flap	
AC117	5.00	-100	L	R	21	RCP	
AC118	5.00	+319	R	R	12	CMP	
AC119	5.00	+320	R	R	8	CFT	
AC120	5.00	+470	R	R	8	CFT	
AC121	5.00	+500	R	R	8	CIP	
AC122	5.00	+520	R	R	24	CMP	
Aa23	5.00	+540	R	R	6	CFT	
AC124	5.00	+660	R	R	8	VCP	

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size(jn)	Type	Color of effluent if active
AC125	5.00	+600	L	R	16	CMP	
AC126	5.00	+640	L	R	12	CMP	
AC127	5.00	+655	L	R	6	CIP	
AC128	5.25	-650	L	R	12	CMP	
AC129	5.25	-605	L	R	30	CIP w/flap	
AC130	5.25	-600	L	R	8	CIP w/flap	
AC131	5.25	-270	L	R	12	RCP	
AC132	5.25	-250	R	R	24	RCP	
AC133	5.25	+320	R	R	8	CFT	
AC134	5.50	-600	R	R	21	RCP	
AC135	5.50	-630	L	R	12	RCP	
AC136	5.50	-600	L	R	10	CIP	
AC137	5.50	-210	R	R	24	RCP	
AC138	5.50	-200	L	R	12	RCP	
AC139	5.50	+190	R	R	12	CMP	
AC140	5.50	+325	R	R	36	RCP	
AC141	5.50	+350	R	R	24	RCP	
AC142	5.75	-655	R	R	12	CMP	
AC143	5.75	-650	R	R	12	CMP	
AC144	5.75	-610	R	R	24	RCP	
AC145	5.75	-600	R	R	12	CMP	
AC146	5.50	+325	L	R	36	RCP	
AC147	5.50	+3 50	L	R	28	RCP	
AC148	5.50	+400	L	R	10	CIP	
AC149	5.50	+620	L	R	6	CIP	
AC150	5.50	+640	L	R	6	VCP	
AC151	5.50	+640	L	R	6	VCP	
AC152	5.75	-655	L	R	12	RCP	
AC153	5.75	-650	L	R	12	RCP	
AC154	5.75	-640	L	R	26	RCP	
AC155	5.75	-500	L	R	8	CIP	
AC156	5.75	-410	L	R	10	CIP	
AC157	5.75	-300	L	R	48	RCP	
AC158	5.75	+100	L	R	16	TSP w/flap	
AC159	5.75	+100	L	R	16	TSP w/flap	
AC160	5.75	+170	L	R	12	RSP	
AC161	5.75	+185	R	R	12	RCP	
AC162	6.00	-515	E	R	48	RCP	clear
AC163	6.00	-500	B	R	15	RCP	clear
AC164	6.00	+130	R	R	18	RCP	clear
AC165	6.00	+150	L	R	26	RCP	clear
AC166	6.25	-300	R	R	12	CMP	
AC167	6.25	-120	E	R	12	CMP	
AC168	6.25	-110	R	R	40	RCP	
AC169	6.25	-105	R	R	36	RCP	
AC170	6.25	-100	B	R	12	RCP	
AC171	6.25	-50	L	R	12	RCP	
AC172	6.25	+10	L	R	12	CMP	
AC173	6.25	+25	L	R	12	RCP	
AC174	6.25	+100	L	R	12	RCP	
AC175	6.25	+200	L	R	12	RCP	
AC176	6.25	+210	L	R	12	CMP	
AC177	6.50	-600	L	R	12	RCP	
AC178	6.50	-500	L	R	12	RCP	
AC179	6.50	-300	L	R	20	RCP	
AC180	6.50	-250	L	R	10	CMP	

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
AC181	6.50	-150	L	R	12	RCP	
AC182	6.25	+ 200	R	R	12	CMP	
AC183	6.25	+400	R	R	14	CMP	
AC184	6.50	-700	R	R	12	RCP	
AC185	6.50	-600	R	R	36	CMP	clear
AC186	6.50	-400	R	R	12	RCP	
AC187	6.50	+100	R	O	60 x 36	CMP	brown
AC188	6.50	+550	R	R	5	TSP	
AC189	6.75	-200	R	R	60	RCP	clear
AC190	6.75	+ 300	L	R	12	RCP	clear
AC191	7.00	-300	R	R	10	RCP	clear
AC192	7.00	-210	L	R	12	CIP	
AC193	7.00	-50	R	R	36	RCP	clear
AC194	7.00	+40	R	R	48	RCP	clear
AC195	7.25	-390	L	R	18	CMP	
AC196	7.25	+100	R	O	12 x 18	RCP	
AC197	7.50	-400	L	R	36	RCP	clear
AC198	7.50	-300	L	R	12	VCP	
AC199	7.50	-200	L	R	12	CMP	
AC200	7.50	+20	L	R	12	CMP	
AC201	7.50	+30	R	R	18	RCP	
AC202	7.50	+240	L	R	30	RCP	
AC 203	7.50	+400	R	R	16	RCP	
AC 204	7.75	+250	L	R	30	RCP	clear
AC 205	7.75	+600	L	R	18	CMP	clear
AC 206	8.00	+100	L	R	15	RCP	
AC 207	8.00	+640	L	R	46	RCP	
AC 208	8.00	+650	L	R	18	RCP	
AC 209	8.25	-45	L	R	42	CMP	
AC 210	8.25	-40	L	R	42	CMP	
AC 211	8.25	+250	L	R	18	CMP	
AC 212	8.25	+255	L	R	18	CMP	
AC 213	8.50	-650	L	R	8	CIP	
AC 214	8.50	-150	R	R	12	RCP	
AC 215	8.50	+20	R	R	13	RCP	
AC 216	8.75	-250	R	R	24	RCP	
AC 217	8.75	-250	L	R	24	RCP	
AC 218	8.75	-225	R	Small tributary			
AC 219	8.75	+200	R	R	14	VCP	
AC 220	8.75	+250	R	R	4	CFT	
AC 221	8.75	+250	L	R	6	CFT	
AC 222	9.00	-150	R	R	16	VCP	
AC 223	9.00	-80	L	R	18	RCP	
AC 224	9.00	-80	R	R	18	RCP	
AC 225	9.00	-30	R	R	28	RCP	
AC 226	9.00	-30	L	R	18	RCP	
AC 227	9.50	-10	L	R	21	RCP	
AC 228	9.75	+255	L	R	18	CMP	
AC 229	9.75	+255	R	R	48	CIP w/flap	
AC 230	9.75	+260	R	R	48	CIP w/flap	
AC 231	9.75	+260	L	S	54	CIP w/flap	clear
AC 232	10.00	+70	L	R	12	RCP	
AC 233	10.00	+250	R	R	15	CMP	
AC 234	10.00	+600	L	R	18	CMP	
AC 235	10.00	+610	L	Tributary			
AC 236	10.25	+275	L	R	18	RCP	clear

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
AC237	10.50	-300	L	A	12 x 23	RCP	
AC 238	10.75	-65	R	R	30	RCP	
AC239	10.75	-70	L	R	28	RCP	clear
AC240	11.00	-600	R	R	2	CIP	
AC241	11.00	-350	L	R	4	pp	
AC 242	11.00	+5	L	R	15	CMP	
DP1	1.00	+130	R	RC	36 x 116	RCP	
DP2	1.75	-300	R	R	32	RCP	
DP 3	1.75	-250	L	R	18	VCP	
DP4	1.75	-200	R	R	18	VCP	
DP5	2.00	+85	L	R	12	RCP	
DP6	2.25	-650	L	R	26	RCP	
DP7	2.25	+390	L	R	18	RCP	
DP8	2.25	+395	R	R	60	RCP	
DP9	2.25	+450	L	RC	36 X 60	BC	
DP10	2.75	+500	L	R	24	VCP	
DP11	2.75	+525	L	R	20	CMP	
DP12	2.75	+600	L	R	12	CMP	
DP13	3.00	-610	L	R	12	CMP	
DP14	3.00	-602	L	R	9	CMP	
DP15	3.00	-600	L	R	11	CMP	
DP16	3.00	-500	L	R	24	RCP	
DP17	3.00	-200	L	R	64	RCP	
DP18	3.00	-100	L	R	14	CMP	
DP19	4.00	0	R	R	12	RCP	
DP20	4.50	+450	L	R	12	RCP	
DP21	5.00	-500	L	R	24	RCP	
DP22	5.25	-600	L	R	4	CIP	
DP23	5.25	+600	L	R	36	RCP	
DP24	5.25	+710	R	R	24	CMP	
DP25	5.25	+715	R	R	24	VCP	
DP26	5.50	+50	L	R	12	RCP	
DP27	5.50	+52	L	R	15	RCP	
DP28	5.75	+280	R	R	24	VCP	
DP29	6.00	-620	R	RC	84 x 120	RCP	
DP30	6.00	-610	R	RC	84 x 120	RCP	
DP31	6.00	-600	R	RC	84 x 120	RCP	
DP32	6.00	+750	R	O	53 X 66	RCP	
DP33	6.00	+750	L	O	53 X 66	RCP	
DP34	6.25	0	L	R	10	CMP	
DP35	6.50	-500	L	R	8	CIP	clear
DP36	6.50	+70	R	R	12	CMP	clear
DP37	6.75	+150	R	R	30	VCP	
DP38	6.75	+300	L	R	34	RCP	
DP39	6.75	+350	L	R	80	RCP	
DP40	6.75	+450	R	R	20	VCP	clear
DP41	6.75	+500	R	R	44	RCP w/flap	
DP42	6.75	+500	L	R	17	RCP	
DP43	7.00	-110	L	R	10	VCP	clear
DP44	7.25	+550	L	R	24	VCP	
DP45	7.50	-700	L	R	46	RCP	clear
DP46	7.50	-400	L	R	Est. 72	RCP	
DP47	7.75	+280	R	R	41	RCP	
DP48	7.75	+700	R	R	15	VCP	
DP49	8.00	-240	L	S	56	RCP	

Outfall number	Mile point Station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
DP50	8.00	-240	L	R	20	CMP	
DP51	8.00	-200	R	S	48	RCP	
DP52	8.00	-155	R	R	22	CMP	
DP53	8.00	-150	R	R	18	RCP	clear
DP54	8.50	0	L	R	13	vcp	
DP55	8.50	+125	R	R	54	RCP	
DP56	8.50	+130	R	R	12	CMP	
DP57	8.75	-280	L	R	17	VCP	clear
DP58	8.75	-5	L	R	10	CMP	clear
DP59	8.75	+430	L	R	64	RCP	
DP60	8.75	+440	R	RC	12 x 36	RCP	
DP61	8.75	+460	L	R	26	CMP	
DP62	9.25	-285	L	R	16	RCP	clear
DP63	9.25	-135	L	R	12	CFT	clear
DP64	9.25	-135	L	R	17	RCP	
DP65	9.25	-80	L	R	30	RCP	
DP66	9.25	-30	L	RC	56 X 128	RCP	
DP67	9.25	+300	L	Small tributary			
DP68	9.50	-540	R	R	46	BC	
DP69	9.50	+200	L	R	12	RCP	
DP70	9.50	+240	R	R	60	RCP	white
DP71	9.75	+170	R	R	12	CMP	
DP72	9.75	+400	R	R	22	BC	
DP73	10.00	-775	R	R	53	RCP	gray
DP74	10.00	-650	R	R	29	RCP	
DP75	10.00	-150	R	R	30	RCP	clear
DP76	10.00	+30	R	R	24	RCP	
DP77	10.00	+130	R	R	28	RCP	
DP78	10.50	-230	R	R	35	RCP	clear
DP79	10.50	+320	L	RC	48 X 92	RCP	
DP80	10.50	+400	R	R	8	CFT	clear
DP81	10.75	-245	R	R	10	RCP	
DP82	10.75	-240	R	R	30	CMP	clear
DP83	11.00	-400	R	R	44	BC	
DP84	11.25	-150	R	R	Est. 36	Submerged at time	
DP85	12.00	-590	L	R	15	RCP	
DP86	12.00	-510	L	0	96 X 60	RCP	
DP87	12.25	+350	L	Small tributary			
DP88	13.25	+300	R	R	48	RCP	clear
DP89	13.25	+305	R	R	48	CMP	
DP90	13.50	+275	R	RC	84 x 96	RCP	
DP 91	13.50	+450	L	R	60	RCP	
DP 92	13.50	+510	R	R	19	RCP submerged	
DP 93	14.00	+450	R	R	36	RCP	
DP 94	14.00	+770	R	R	12	RCP	
DP 95	14.25	+730	R	R	46	RCP	
DP 96	14.50	-780	L	R	24	VCP	clear
DP 97	14.50	-675	L	R	20	VCP	clear
DP 98	14.50	+680	R	R	24	VCP	
DP 99	14.75	-500	L	RC	72 X 192	RCP	
DP 100	14.75	+100	R	R	16	VCP	
DP 101	14.75	+120	R	R	27	RCP	clear
DP 102	14.75	+550	R	RC	54 x 48	RCP	
DP 103	15.00	-170	R	Small tributary			
DP 104	15.00	+230	R	R	23	RCP	
DP 105	15.25	-175	R	R	24	RCP submerged	

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
DP106	15.25	+ 300	R	RC	72 x 108	RCP	clear
DP107	15.50	-230	R	R	3	RCP	
DP108	15.50	-140	L	Tributary			
DP109	15.75	-400	R	Small tributary			
DP110	15.75	+•50	R	R	36	VCP	
DP111	15.75	+800	L	S	36	RCP	clear
DP112	16.25	-500	R	R	24	RCP	
DP113	16.75	-375	L	Tributary			
DP114	17.00	-580	L	R	12	VCP	
DP115	17.00	-400	L	R	24	RCP	
DP116	17.00	-270	L	R	120	RCP	
DP117	17.50	-560	L	S	120	RCP	
DP118	17.50	-550	L	S	120	RCP	
DP119	17.75	-133	R	R	8	RCP	back from shore
DP120	17.75	-130	R	S	24	RCP	cXear
DP121	17.75	+175	R	R	24	CMP	clear
DP122	18.00	-525	R	R	24	RCP	gray
DP123	18.00	-275	R	S	72	RCP	clear
DP124	18.75	-500	R	R	36	CMP	clear
DP125	19.25	-400	L	Small tributary			
DP126	19.25	+400	R	R	45	RCP	submerged
DP127	19.50	+610	L	R	36	RCP	clear
DP128	19.50	+620	L	R	42	RCP	submerged
DP129	19.50	+630	L	R	76	RCP	
DP130	19.75	-350	R	R	24	RCP	
DP131	20.00	-300	R	Small tributary			
DP132	20.50	-190	R	R	48	BC	back from shore
DP133	20.50	-50	R	R	23	RCP	clear
DP134	20.50	+450	R	Small tributary			
DP135	20.75	+160	L	R	36	RCP	clear
DP136	21.00	-600	L	S	36	RCP	
DP137	21.00	-400	L	R	72	RCP	
DP138	21.00	-250	L	R	96	RCP	
DP139	21.00	+325	R	R	8	VCP	
DP140	21.50	+ 125	L	R	84	RCP	
DP141	21.50	+150	L	R	65	RCP	
DP142	21.50	+400	L	R	12	CMP	
DP143	21.50	+600	L	Small tributary			
DP144	22.00	+310	R	R	66	RCP	
DP145	22.00	+330	R	R	58	RCP	
DP146	22.50	-90	R	R	35	RCP	
DP147	22.75	-260	L	R	44	RCP	clear
DP148	22.75	+ 20	R	R	58	RCP	submerged
DP149	23.00	+450	L	R	24	RCP	submerged
DP150	23.00	+620	R	R	15	VCP	
DP151	23.25	-700	R	R	54	RCP	
DP152	23.25	-710	R	R	10	CMP	
DP153	23.25	-550	R	R	36	RCP	
DP154	23.25	-280	R	R	42	RCP	
DP155	23.25	-280	L	S	96	RCP	w/wooden flap
DP156	23.25	+600	L	Tributary			
DP157	23.50	+10	L	R	10	CMP	

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type
NB1	0.25	-550	L	R	8	CIP
NB2	0.25	-525	L	R	8	CIP
NB3	0.25	-500	L	R	8	CIP
NB4	0.25	-475	L	R	6	CIP
NB5	0.25	-450	L	R	6	CIP
NB6	0.25	-425	L	R	6	CIP
NB7	0.25	-400	R	R	6	CIP
NB8	0.50	+380	R	R	8	CFT
NB9	0.50	+400	R	R	3	CFT
NB10	0.50	+400	L	R	18	RCP
NB11	0.75	+300	L	R	15	TSP
NB12	1.00	-650	L	R	12	VCP
NB13	1.00	-600	R	R	6	CFT
NB14	1.00	-400	R	RC	8 x 5	BC
NB15	1.00	+150	R	R	6	CFT
NB16	1.00	+540	R	R	9	VCP
NB17	1.00	+560	R	R	9	VCP
NB18	1.25	-400	R	R	6	CFT
NB19	1.25	+50	R	R	6	VCP
NB20	1.25	+ 100	R	R	6	VCP
NB21	1.25	+150	R	R	6	VCP
NB22	1.25	+200	R	R	12	VCP
NB23	1.25	+250	R	R	6	VCP
NB24	1.00	+415	L	R	6	CFT
NB25	1.00	+420	L	R	12	VCP
NB26	1.00	+480	L	R	19	VCP
NB27	1.00	+490	L	R	6	VCP
NB28	1.00	+500	L	R	6	VCP
NB29	1.00	+ 560	L	R	15	VCP
NB30	1.00	+570	L	R	6	VCP
NB31	1.00	+620	L	R	6	VCP
NB32	1.00	+630	L	R	19	VCP
NB33	1.25	-660	L	R	4	CFT
NB34	1.25	-650	L	R	4	CIP
NB35	1.25	-620	L	R	4	CFT
NB36	1.25	-605	L	R	4	CIP
NB37	1.25	-600	L	R	4	CFT
NB38	1.25	-500	L	R	6	CFT
NB39	1.25	-400	L	R	18	VCP
NB40	1.25	-380	L	R	6	CFT
NB41	1.25	-270	L	R	6	CFT
NB42	1.25	-150	L	R	6	CFT
NB43	1.25	-150	L	unknown		submerged
NB44	1.25	+5	L	R	6	CFT
NB45	1.50	-350	L	R	6	VCP
NB46	1.50	-300	R	R	48	RCP
NB47	1.75	-10	R	R	6	CFT
NB48	2.25	-300	L	RC	96 x 144	RCP
NB49	2.75	-500	R	R	16	CIP
NB50	2.75	-525	L	R	48	RCP
NB51	2.75	-500	L	R	6	CIP
NB52	2.75	-475	L	R	10	CIP
NB53	2.75	-400	L	RC	36 x 96	RCP
NB54	2.75	+50	R	R	18	VCP
NB55	3.00	-650	R	R	72	BC
NB56	3.00	-600	R	R	6	CIP

Outfall number	Mile point statioa	Distance from station (ft.)	Stream bank	ShaDe	Size (in)	Type	Color of effluent if active
NB57	3.00	-600	L	R	14	VCP	
NB58	3.25	-500	L	R	9	VCP	
MB59	3.25	-450	R	R	22	RCP	
NB60	3.25	+400	L	R	10	VCP	
NB61	3.50	-250	L	R	26	VCP	
NB62	3.50	+400	L	R	6	VCP	
NB63	3.75	-250	R	R	14	VCP	
NB64	4.25	-460	L	R	12	VCP	
NB65	4.25	-455	L	R	6	VCP	
NB66	4.25	-450	L	R	6	VCP	
NB67	4.25	-425	L	R	6	VCP	
NB68	4.25	-400	L	R	24	RCP	
NB69	4.25	-450	R	R	12	VCP	
NB70	4.25	-425	R	R	6	VCP	
NB71	4.25	-400	R	R	6	VCP	
NB72	4.25	+ 200	R	R	117	RCP	
NB73	5.00	-700	R	R	29	RCP	
NB74	5.00	-600	R	R	8	VCP	
NB75	5.50	-700	L	R	24	RCP	
NB76	5.50	-75	R	R	8	VCP	
NB77	5.50	+300	R	R	12	RCP	
NB78	6.00	-250	L	R	12	CMP	
NB79	6.00	+250	L	R	12	CMP	
NB80	6.00	+300	L	RC	38 x 82	RCP	
NB81	6.25	-225	R	R	8	VCP	
NB82	6.25	-200	R	R	12	RCP w/flap	
NB83	6.50	-300	R	R	18	VCP	
NB84	6.50	+200	R	R	84	RCP	
NB85	6.75	-175	R	R	10	CMP	
NB86	7.00	-400	L	R	12	CFT	
NB87	7.00	+75	R	R	10	VCP	
NB88	7.00	+150	R	R	24	CMP	clear
NB89	7.00	+250	R	R	12	VCP	
NB90	7.25	+150	L	R	24	RCP	
NB91	7.50	-600	R	R	42	RCP	
NB92	7.50	-310	L	O	44 x 66	RCP	
NB93	7.50	-300	L	O	44 x 66	RCP	
NB94	7.75	-350	L	R	24	RCP	
NB95	7.75	-350	R	R	16	RCP	
NB96	7.75	-300	R	R	12	RCP	
NB97	7.75	-250	R	R	58	BC	
NB98	8.00	-460	L	R	12	CMP	
NB99	8.00	-450	L	R	52	RCP	clear
NB100	8.00	-400	L	R	42	RCP	clear
NB101	8.00	-350	L	R	24	RCP	
NB102	8.00	-250	L	R	48	RCP	
NB103	8.00	-260	R	R	12	CMP	
NB104	8.00	-250	R	R	16	VCP	
NB105	8.00	+150	R	R	14	VCP	
NB106	8.25	-200	R	R	12	ACP	
NB107	8.25	+10	R	R	10	ACP	
NB108	8.25	+200	R	RC	95 x 125	RCP	
NB109	8.25	+201	R	R	29	RCP	
NB110	8.25	+450	L	R	27	RCP	clear
NB111	8.50	-610	R	R	4	VCP	
NB112	8.50	-605	L	R	4	CFT	

Outfall number	Mile point station	Distance from station (ft.)	Stream bank	Shape	Size (in)	Type	Color of effluent if active
NB113	8.50	-600	L	R	6	CIP	
NB114	8.50	-500	L	R	8	CIP	
NB115	8.50	-400	L	R	8	CIP	
NB116	8.50	-200	L	R	36	RCP	
NB117	8.50	-150	L	R	48	RCP	
NB118	8.50	+280	L	R	4	CIP	
NB119	8.50	+283	L	R	4	VCP	
NB120	8.50	+285	L	R	6	CIP	
NB121	8.50	+290	L	R	6	CIP	
NB122	8.50	+295	L	R	6	CIP	
NB123	8.50	+300	L	R	6	PP	clear
NB124	8.50	+500	L	R	30	RCP	clear
NB125	8.50	+600	L	Routfall silted in			
NB126	8.50	+10	R	R	4	CIP	
NB127	8.50	+20	R	R	4	CIP	
NB128	9.00	-50	R	R	42	RCP	clear
NB129	9.00	+300	R	R	18	RCP	gray
NB130	9.25	-600	L	R	18	RCP	clear
NB131	9.25	-450	L	R	24	CMP	clear
NB132	9.25	-400	R	R	54	RCP	clear
NB133	9.25	-300	L	R	76	RCP	
NB134	9.50	-600	R	R	54	RCP	
NB135	9.75	-300	R	R	64	RCP	
NB136	9.75	+250	R	R	12	RCP	
NB137	10.25	-500	L	R	24	RCP	
NB138	10.25	-300	L	R	24	RCP	
NB139	10.25	-100	R	Small tributary			
NB140	10.50	-190	L	R	29	CMP	
NB141	10.75	-700	L	R	10	VCP	
NB142	10.75	-550	R	R	30	RCP	clear
NB143	10.75	-250	R	R	12	CMP	
NB144	10.75	-175	R	R	74	RCP	
NB145	11.25	-200	L	R	60	RCP	

Appendix C

Sediment Sample Characteristics

Sampling station	Percent sediment composition: Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Color: Black	Gray	Brown	Tan	Odor: Oil	Septic	Fishy	Earthy	Vegetative	None
CR O.OOC	25	20	25	15		15					X		X			X			
CR O.OOR	15			20	60		5			X	X						X		
CR O.OOL	5			15	75		5			X	X						X		
CR 0.25C						100					X								X
CR 0.25R		15	15	30		40				X	X								X
CR 0.25L			10	10		80					X								X
CR 0.50C	50	10	15	20	5						X	X							X
CR 0.50R			10	10	30	50						X							X
CR 0.50L		5	5	10	20	60						X							X
CR 0.75C	15			10	10	65					X	X							X
CR 0.75R				5	90		5				X	X							X
CR 0.75L				40	60							X							X
CR 1.00C			5	10		85					X								X
CR 1.00R			10	20	70						X	X							X
CR 1.OOL		10	20	15	55						X	X							X
CR 1.25C				10	30	60					X	X							X
CR 1.25R			20	10	30	40					X	X							X
CR 1.25L			15	10	15	60					X	X							X
CR 1.50C		5	5	10	30	50					X	X							X
CR 1.50R				5	95						X	X							X
CR 1.50L				5	95						X	X							X
CR 1-75C			10	15	75						X	X							X
CR 1.75R			5	5	90						X	X		X					
CR 1.75L				5	93		2				X	X		X					
CR 2.00C			2	3	95						X	X							X
CR 2.00R					95		5				X	X							X
CR 2.00L				40	20	40						X							X
CR 2.25C			15	15	20	50				X		X					X		
CR 2.25R			5	5	90						X	X				X			
CR 2.25L		20	15	15	30'	20				X		X					X		
CR 2.50C					100						X	X					X		
CR 2.50R				5	75	20					X	X					X		
CR 2.50L		10	10	5	75						X	X					X		
CR 2.75C					100						X	X					X		
CR 2.75R					100						X	X					X		
CR 2.75L		25	20	20	25	10					X	X					X		
CR 3.00C				2	93	5					X	X		X					
CR 3.00R			15	2	68	15					X	X		X					
CR 3.00L				3	97						X	X		X					
CR 3.25C			10		90						X	X		X					
CR 3.25R		No sample																	
CR 3.25L			10	25	15	50					X	X		X			X		
CR 3.50C				2	71	25			2		X	X		X					
CR 3.50R		No sample																	
CR 3.50L		15	15	10	35	20	5				X	X		X					
CR 3.75C				5	10	85					X	X							X
CR 3.75R					95		5				X	X		X	X				
CR 3.75L			40	48	10				2		X	X		X					
CR 4.00C			15	20	15	50					X	X		X			X		
CR 4.00R						100					X								X
CR 4.00L			20	25	35	17			3		X	X		X					
CR 4.25C		10	10	10	70						X	X		X					
CR 4.25R				25		75					X			X					
CR 4.25L				5	95						X	X		X					

Sampling station	Percent sediment composition: Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Color: Black	Gray	Brown	Tan	Odor: Oil	Septic	Fishy	Earthy	Vegetative	None
CR 4.50C					5	95						X							X
CR 4.50R				2	98							X		X	X				
CR 4.50L			1	97	1				1				X				X		
CR 4.75C			5	2	86	5	1		1		X	X		X					
CR 4.75R			10	5	85						X	X		X					
CR 4.75L			5	85		10							X				X		
CR 5.00C			4	4	92						X	X		X					
CR 5.00R		15	10	10	58	5	2				X	X		X					
CR 5.00L				88	2	10							X				X		
CR 5.25C			15		65	20					X	X		X					
CR 5.25R			3	3		94					X								
CR 5.25L				95		5							X				X		X
CR 5.50C					100						X	X							
CR 5.50R			30	30	10	30					X	X		X					X
CR 5.50L				5		95					X			X					
CR 5.75C				3		96			1		X						X		
CR 5.75R			3	96	1						X	X					X		
CR 5.75L				30	70						X	X		X					
CR 6.00C				5	87	5	3				X	X		X	X				
CR 6.00R				99	1								X				X		
CR 6.00L			15	15	50	20					X	X					X		
CR 6.25C				60		40							X	X			X		
CR 6.25R				100									X			X	X		
CR 6.25L						100					X						X		
CR 6.50C				2		98					X						X		
CR 6.50R				35	20	25	15	5		X	X	X		X	X				
CR 6.50L				60	20		15	5					X				X		
LC O.OOC			5	10	15	15	20	35		X				X	X				
LC 0.00R				2	80	5	5	8		X				X	X				
LC O.OOL				15	10	45	20	10		X				X	X				
LC 0.25C			5	5	10	75		5		X				X	X				
LC 0.25R				5	85		5	5		X				X	X				
LC 0.25L				10	15	45	20	5	5	X				X	X				
LC 0.50C				5	75	10	5	5		X				X	X				
LC 0.50R				5	90		5			X				X	X				
LC 0.50L			5	5	80		5	5		X				X	X				
LC 0.75C				5	80	5	5	5		X				X	X				
LC 0.75R	15		10	15	10	50				X	X			X	X				
LC 0.75L				15	74		5	5	1	X				X	X				
LC l.OOC					92		3	5		X				X	X				
LC l.OOR		5		20		70	5			X	X						X		
LC l.OOL	5		5	70	20					X				X	X				
LC 1.25C		15	15	15	20	20		5	10	X				X	X				
LC 1.25R					90			10		X				X	X				
LC 1.25L				5	85			10		X	X	X		X	X				
LC 1.50C			10	10	20	60				X	X			X	X				
LC 1.50R					90			10		X	X			X	X				
LC 1.50L					90		5	5		X	X	X		X	X				
LC 1.75C		10	10	15	60			5		X	X			X	X				
LC 1.75R					90			10		X	X			X	X				
LC 1.75L				80	10			10		X	X			X	X				

	Percent sediment composition									Color				Odor					
Sampling station	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
LC 2.00C					70	20		10		X	X			X	X				
LC 2.00R			10		55	15	2	10	8	X	X			X	X				
LC 2.00L				30	50			10	10	X	X			X	X				
LC 2.25C		5	5	5	10	67	2	5	1	X	X			X	X				
LC 2.25R				10	78		1	10	1	X	X			X	X				
LC 2.25L			10	10		80					X								X
LC 2.50C			10	10	25	50		5		X	X			X	X				
LC 2.50R					90			10		X	X			X	X				
LC 2.50L				5	60	25		10		X	X			X	X				
LC 2.75C					88		2	10		X	X			X	X				
LC 2.75R				40	55			5		X	X	X		X	X				
LC 2.75L					90			10		X	X			X	X				
LC 3.00C			5	5		85			5	X	X			X	X				
LC 3.00R		10		15	20	50		5		X	X	X		X	X				
LC 3.00L					95			5		X	X			X	X				
LC 3.25C			10	10		79			1	X	X	X		X	X				
LC 3.25R					90		1	8	1	X	X			X	X				
LC 3.25L					90		2	8		X	X			X	X				
LC 3.50C			5	10		85				X	X								X
LC 3.50R		20	20		55			5		X	X			X	X				
LC 3.50L		5	5		75		5	10		X	X			X	X				
LC 3.75C				5	45	50				X	X			X	X				
LC 3.75R		15	15	15	50			5		X	X			X	X				
LC 3.75L				50	40		1	8	1	X	X			X	X				
LC 4.00C			10	10	30	50				X	X			X	X				
LC 4.00R					90			10		X	X			X	X				
LC 4.00L					90			10		X	X			X	X				
LC 4.25C		60		15	5	15		5		X	X			X	X				
LC 4.25R				10	70		10	10		X	X			X	X				
LC 4.25L			5		70		10	15		X				X	X				
LC 4.50C			20	10	20	30	5	15		X				X	X				
LC 4.50R				50	35			15		X				X	X				
LC 4.50L			10	10	25		35	20		X				X	X				
LC 4.75C		10	10	10	20	40		10		X				X	X				
LC 4.75R					88		2	10		X				X	X				
LC 4.75L					90			10		X				X	X				
LC 5.00C			5	5	40	40		10		X				X	X				
LC 5.00R					88		2	10		X				X	X				
LC 5.00L				5	10	82		3		X	X						X		
LC 5.25C			85	10	4			1		X									X
LC 5.25R					89		1	10		X				X	X				
LC 5.25L			10	40	37			10	3	X				X	X				
LC 5.50C			15	15	55		10	5		X				X	X				
LC 5.50R					90			10		X				X	X				
LC 5.50L			5	80	5			10		X				X	X				
LC 5.75C			10		40	40		10		X				X	X				
LC 5.75R		20	20		40	10		10		X				X	X				
LC 5.75L					80	10		10		X				X	X				
LC 6.00C					87		3	10		X				X	X				
LC 6.00R					90			10		X				X	X				
LC 6.00L					89		1	10		X				X	X				

	Percent sediment composition									Color				Odor					
Sampling station	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
LC 6.25C			20	55	20		3		2	X	x			X					
LC 6.25R			5		85		5	5		X	X			X					
LC 6.25L					55		40	5		X	X			X					
LC 6.50C			10	15	50		20	5			X				X				
LC 6.50R			25	20	50			5		X	X			X	X				
LC 6.50L					50		45	5		X	X			X	X				
LC 6.75C	100												X						
LC 6.75R	100												X						
LC 6.75L	100												X						
LC 7.00C	100												X						X
LC 7.00R	25						75						X						X
LC 7.00L	100												X						X
LC 7.25C	100												X						X
LC 7.25R				75	10		10	5		X					X				
LC 7.25L	100												X						X
LC 7.50C	100												X						X
LC 7.50R	100												X						X
LC 7.50L		5	10	10	20		50	5		X	X				X				
LC 7.75C	100												X						X
LC 7.75R	100												X						X
LC 7.75L	15				10		70	5		X					X				
LC 8.00C	100												X						X
LC 8.00R	10				10		75	5		X					X				
LC 8.00L	100												X						X
LC 8.25C	100												X						X
LC 8.25R	100												X						X
LC 8.25L	20	40			10		25	5		X					X				
LC 8.50C	25	20	20		10		20	5		X					X				
LC 8.50R	25	20	20		10		20	5		X					X				
LC 8.50L	25	20	20		10		20	5		X					X				
LC 8.75C	20	30	20		10		15	5		X					X				
LC 8.75R	20	30	20		10		15	5		X					X				
LC 8.75L	20	30	20		10		15	5		X					X				
LC 9.00C	100												X						X
LC 9.00R	100												X						X
LC 9.00L	20	30	15	10	5		20			X								X	
LC 9.25C	10	10					80						X					X	
LC 9.25R						20	80				X							X	
LC 9.25L					5		95			X					X				
LC 9.50C		50	10	10	10		20			X				X	X				
LC 9.50R		40	40			20					X						X		
LC 9.50L			50	30	10		10			X	X				X				
LC 9.75C	95			5									X						X
LC 9.75R	100												X						X
LC 9.75L			20	20	40		20			X	X				X				
LC10.00C	100												X						X
LC10.OOR		20	30		20		30			X								X	
LC1O.OOL			10	10	20		60				X							X	
LC10.25C				30	20		50			X					X				
LC10.25R				30	20		50			X					X				
LC10.25L			15	15	50		20			X	X				X				

Sampling station	Percent sediment composition: Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Color: Black	Gray	Brown	Tan	Odor: Oil	Septic	Fishy	Earthy	Vegetative	None
LC 10.50C			35	50	10		5			X	X				X				
LC 10.50R				40	50		10				X	X			X				
LC 10.50L			35	50	10		5			X	X				X				
LC 10.75C	100												X						X
LC 10.75R			20	40	15		25			X	X						X		
LC 10.75L		5	20	25	30		15	5		X					X				
LC 11.00C	95				5								X						X
LC 11.OOR	95				5								X						X
LC 11.OOL	95				5								X						X
LC 11.25C				60	40						X	X			X				
LC 11.25R					80		20			X	X				X				
LC 11.25L			10	70	10		10				X	X			X				
LC 11.50C					100						X	X			X				
LC 11.50R			25		70		5				X	X			X				
LC 11.50L				65	30		5				X	X			X				
LC 11.75C	70			15	15								X		X				
LC X1.75R					90		10			X	X			X	X				
LC 11.75L		10	25	20	25		20			X	X			X	X				
LC 12.00C			30	30	20		20			X	X			X	X				
LC 12.00R					75		25			X	X				X				
LC 12.00L					70		30			X			X		X				
LC 12.25C			20	30	30		20			X	X				X				
LC 12.25R					60		40			X	X				X				
LC 12.25L					60		40			X	X				X				
LC 12.50C				70	30					X	X				X				
LC 12.50R					100					X	X				X				
LC 12.50L					95		5			X	X				X				
LC 12.75C			20	20	40	20				X	X				X				
LC 12.75R					25	40	30		5	X	X				X				
LC 12.75L					20		80			X	X								
LC 13.00C			30	40	30						X	X		X	X			X	
LC 13.00R					90		10			X	X				X				
LC 13.00L					90		10			X	X				X				
LC 13.25C						100					X		X						X
LC 13.25R		30			50		20				X	X			X				
LC 13.25L					60		40				X	X			X				
LC 13.50C				90	10							X					X		
LC 13.50R					80		20				X	X			X				
LC 13.50L				30	50		20				X	X			X				
LC 13.75C			30	30	40					X	X				X				
LC 13.75R					85		15				X	X			X				
LC 13.75L					95		5				X	X			X				
LC 14.00C				5	95						X		X		X				
LC 14.00R					70		30				X	X			X				
LC 14.00L					70		30				X	X			X				
LC 14.25C				30	70							X			X				
LC 14.25R					80	20					X	X			X				
LC 14.25L					95		5				X	X			X				
LC 14.50C					100						X	X			X				
LC 14.50R				5	95							X			X				
LC 14.50L					80	10	10				X	X			X				

Sampling station	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
	Percent sediment composition									Color				Odor					
LC 14.75C				5	95					X	X								X
LC 14.75R					90		10				X	X			X				
LC 14.75L					10		90			X					X				
LC 15.00C		15			70	15				X	X				X				
LC 15.00R					100					X	X				X				
LC 15.00L					70		30				X		X		X				
LC 15.25C					60		40			X					X				
LC 15.25R					95		5				X	X			X				
LC 15.25L				50	30		20			X					X				
LC 15.50C					70		30			X					X				
LC 15.50R					85		15			X	X				X				
LC 15.50L					70		30			X					X				
LC 15.75C					95		5			X	X				X				
LC 15.75R					95		5				X	X			X				
LC 15.75L					80		20				X	X			X				
LC 16.00C				30	70						X	X			X				
LC 16.00R				30	70						X	X			X				
LC 16.00L		5			85		10			X					X				
LC 16.25C					65		35				X	X			X				
LC 16.25R					70		30				X	X			X				
LC 16.25L				20	60		20				X	X			X				
LC 16.50C					30		70			X					X				
LC 16.50R					70		30			X					X				
LC 16.50L					90		10			X					X				
LC 16.75C					20		80			X					X				
LC 16.75R					85		15			X					X				
LC 16.75L		10			65		25			X					X				
LC 17.00C					95		5				X	X					X		
LC 17.00R					60	40				X	X		X		X				
LC 17.00L					80		20			X					X				
LC 17.25C					75		25			X					X				
LC 17.25R					95		5			X					X				
LC 17.25L					50		50			X					X				
LC 17.50C				80	15		5			X									X
LC 17.50R				30	70					X		X			X				
LC 17.50L				20	70		10			X					X				
LC 17.75C					85		15			X	X	X		X	X				
LC 17.75R					97		3			X					X				
LC 17.75L					100					X					X				
LC 18.00C					100					X		X		X					
LC 18.00R					90		10			X		X		X	X				
LC 18.00L					55		45			X				X	X				
LC 18.25C					70		30			X					X				
LC 18.25R					90		10			X	X	X			X				
LC 18.25L					60		40			X					X				
LC 18.50C					95		5			X		X			X				
LC 18.50R					80		20			X	X	X			X				
LC 18.50L					90		10			X				X	X				
LC 18.75C					95		5				X	X			X				
LC 18.75R					40		60			X					X				
LC 18.75L					95		5			X					X				
LC 19.OOC					85		15				X	X			X				
LC 19.00R					80	20					X	X			X				
LC 19.00L					90		10			X	X				X				

Sampling station	Percent sediment composition: Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Color: Black	Gray	Brown	Tan	Odor: Oil	Septic	Fishy	Earthy	Vegetative	None
GC 0.25C							80	20		X				X	X				
GC 0.25R				30				20		X				X	X				
GC 0.25L					90		5	5			X	X		X	X				
GC 0.50C				85				15		X				X	X				
GC 0.50R					90			10			X	X		X	X				
GC 0.50L					90			10			X	X		X	X				
GC 0.75C				85				15		X				X	X				
GC 0.75R				85				15		X				X	X				
GC 0.75L					90			10		X				X	X				
GC 1.00C					30		55	15		X				X	X				
GC 1.00R				80	10			10		X				X	X				
GC 1.00L				25	25		35	15		X				X	X				
GC 1.25C				95				5		X				X	X				
GC 1.25R			10	35	40			15		X				X	X				
GC 1.25L					10		75	15		X				X	X				
GC 1.50C				80			15	5		X				X	X				
GC 1.50R				10			80	10		X				X	X				
GC 1.50L				10			80	10		X				X	X				
GC 1.75C				80			10	10		X				X	X				
GC 1.7 5R					85		5	10		X				X	X				
GC 1.75L				95				5		X	X			X	X				
GC 2.00C				80			10	10		X	X			X	X				
GC 2.00R					65		15	20		X				X	X				
GC 2.00L					10		70	20		X				X	X				
GC 2.25C			50	15	15			20		X				X					
GC 2.25R					10		75	15		X				X	X				
GC 2.25L			15	15	55			15			X	X		X	X				
GC 2.50C					10		80	10		X				X	X				
GC 2.50R					40		40	20		X				X	X				
GC 2.50L					40		30	30		X				X					
GC 2.75C					10		70	20		X				X					
GC 2.75R					10		65	25		X				X					
GC 2.75L					10		75	15		X				X	X				
CU 0.00C				40	25	30	5				X	X					X		
CU 0.25C			20	78	2						X	X							X
CU 0.50C				97	3					X		X							X
CU 0.75C		40	45	12	3						X	X							X
CU 1.00C			40	50	1	9					X	X							X
CU 1.25C		40	50	7	3							X							X
CU 1.50C			15	85							X	X							X
CU 1.75C		30	60	7	3						X	X							X
CU 2.00C				80	20							X					X		
CU 2.25C				50	40		10				X	X			X				
CU 2.50C				60	35		5			X	X	X		X	X				
CU 2.75C				10	85		5			X	X	X			X				
CU 3.00C				30	55		10	5		X				X	X				
CU 3.25C			20	40	30		10						X				X		
CU 3.50C					40		60				X	X		X	X				

Sampling station	Percent sediment composition									Color				Odor					
	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
AC 0.00C			10	45	20		20	5		X				X	X				
AC 0.25C		30	25,	25	10		5	5		X							X		
AC 0.50C		35	30	25	5			5		X			X				X		
AC 0.75C			10	60			30			X				X	X				
AC 1.00C			50	30		20				X	X				X				
AC 1.25C		40	40	20						X			X				X		
AC 1.50C		20	20	30	25			5		X	X				X				
AC 1.75C				5	85		5	5			X		X	X	X				
AC 2.00C		40		40	10		5	5		X	X			X	X				
AC 2.25C				60	10		20	10		X				X	X				
AC 2.50C				70	20			10		X	X	X		X	X				
AC 2.75C				95	2		3					X		X					
AC 3.00C				98	2							X							X
AC 3.25C			20	75	5							X							X
AC 3.50C	60	20	15	5								X	X	X					
AC 3.75C			10	70	20							X		X	X				
AC 4.00C						100					X		X						X
AC 4.25C			60	38			2			X				X					
AC 4.50C				100								X		X					
AC 4.75C			60	38	2							X							X
AC 5.00C			5	60	15	15	5					X					X		
AC 5.25C			20	30	50						X	X					X		
AC 5.50C				40	60						X	X					X		
AC 5.75C				80			20			X		X			X				
AC 6.00C			30	60	10							X				X			
AC 6.25C			75	22	3								X			X			
AC 6.50C			60	20	20							X					X		
AC 6.75C					20	75	5				X	X					X		
AC 7.00C					75	25					X	X	X		X				
AC 7.25C				40	15	40			5		X	X					X		
AC 7.50C					50	50					X		X						X
AC 7.75C		30	20	30	20					X	X	X		X	X				
AC 8.00C			50	45	5							X							X
AC 8.25C				60	25		10		5			X							X
AC 8.50C		10	50		40					X	X	X							X
AC 8.75C					20	20	58		2			X						X	
AC 9.00C				40	55		5			X	X	X					X		
AC 9.25C				10	70		20				X	X						X	
AC 9.50C					80		20					X							X
AC 9.75C			10	25	45		20					X						X	
AC 10.00C				5		95						X					X		
AC 10.25C		10	5	15		70					X	X							X
AC 10.50C	No sample																		
AC 10.75C				10	70		20				X	X			X				
AC 11.00C				5	75		20			X	X	X			X				
DP 0.00C				80			15		5			X					X		
DP 0.00R				10	20		70			X	X						X		
DP 0.00L				10		90						X					X		
DP 0.25C				10	75		10		5	X	X								X
DP 0.25R					99		1			X	X				X				
DP 0.25L				75	5		15		5		X	X			X				

	Percent sediment composition									Color				Odor					
Sampling station	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
DP 0.50C				93			5		2			X							X
DP 0.50R				83			15		2		X	X							X
DP 0.50L					80		20			X	X				X				
DP 0.75C			30	68					2			X							X
DP 0.75R				95			3		2			X							X
DP 0.75L					70		30			X	X				X				
DP 1.00C				95			3		2		X	X							X
DP 1.00R					100						X	X							X
DP 1.00L			10	10	50		30			X	X								X
DP 1.25C	100																		
DP 1.25R		70	20	5	5						X	X							X
DP 1.25L	100																		
DP 1.50C	100																		
DP 1.50R					5		95				X	X			X				
DP 1.50L					5		95				X	X			X				
DP 1.75C	100																		
DP 1.75R	100																		
DP 1.75L		100								X	X								X
DP 2.00C	100																		
DP 2.00R		68		20	2		10					X							X
DP 2.00L	100																		
DP 2.25C				99					1			X							X
DP 2.25R					50		50			X	X				X				
DP 2.25L					80		20			X					X				
DP 2.50C			10	85	5							X							X
DP 2.50R	40			10	40		10			X	X								X
DP 2.50L					90		10			X	X				X				
DP 2.75C			60	40								X							X
DP 2.75R					10		90			X	X				X				
DP 2.75L					98		2			X	X				X				
DP 3.00C	100																		
DP 3.00R	100																		
DP 3.00L	70				20		10					X			X				
DP 3.25C	100																		
DP 3.25R	100																		
DP 3.25L		30	30	15	25						X					X			
DP 3.50C			5		90		5				X	X		X	X				
DP 3.50R					80		20			X	X			X	X				
DP 3.50L					95		5				X	X		X	X				
DP 3.75C	100																		
DP 3.75R	100																		
DP 3.75L				5	85		10				X	X		X	X				
DP 4.00C	100																		
DP 4.00R							100					X						X	
DP 4.00L					85		15				X	X		X	X				
DP 4.25C				70	10				20		X	X					X		
DP 4.25R					70		30				X	X		X	X				
DP 4.25L					100						X	X		X	X				
DP 4.50C	100																		
DP 4.50R					70		30				X	X		X	X				
DP 4.50L					90		10				X	X		X	X				

Sampling station	Percent sediment composition									Color				Odor					
	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
DP 4.75C		14	25	40	20				1		X	X					X		
DP 4.75R					70		30				X			X	X				
DP 4.75L		10	10		50	20	10				X	X		X	X				
DP 5.00C	100																		
DP 5.00R					95		5				X	X		X	X				
DP 5.00L					95		5				X	X		X	X				
DP 5.25C			38	60	2							X							X
DP 5.25R					98		2				X	X		X	X				
DP 5.25L	100																		
DP 5.50C	100																		
DP 5.50R					60		40				X			X	X				
DP 5.50L		30	30	25	10		5				X	X		X	X				
DP 5.75C	100																		
DP 5.75R	95				5							X							X
DP 5.75L					2		98			X				X	X				
DP 6.00C			40	58	2							X							X
DP 6.00R					95		5				X	X		X	X				
DP 6.00L					100						X	X		X					
DP 6.25C	100																		
DP 6.25R					90		10				X	X			X				
DP 6.25L	100																		
DP 6.50C	100																		
DP 6.50R					90		10				X			X	X				
DP 6.50L					95		5				X	X		X	X				
DP 6.75C	100																		
DP 6.75R					90		10				X				X				
DP 6.75L					55		45				X	X		X	X				
DP 7.00C		40	20	40								X							X
DP 7.00R					97		3				X	X		X	X				
DP 7.00L					95		5				X	X			X				
DP 7.25C			27	70	3							X							X
DP 7.25R					95		5				X	X		X	X				
DP 7.25L					85		15				X			X	X				
DP 7.50C	100																		
DP 7.50R			15		75		10				X	X		X	X				
DP 7.50L						100						X					X		
DP 7.75C	100																		
DP 7.75R					98		2				X	X		X	X				
DP 7.75L				30	68		2				X			X	X				
DP 8.00C				70	30						X	X		X	X				
DP 8.00R					97		3				X	X		X	X				
DP 8.00L					98		2				X	X		X	X				
DP 8.25C	100																		
DP 8.25R				10	85		5				X	X		X	X				
DP 8.25L					100						X	X	X	X	X				
DP 8.50C				15	25				60		X	X							X
DP 8.50R				20	30		50				X	X			X				
DP 8.50L						100					X						X		
DP 8.75C	100																		
DP 8.75R					30		70				X				X				
DP 8.75L					90		10				X	X			X				

Sampling station	Percent sediment composition: Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Color: Black	Gray	Brown	Tan	Odor: Oil	Septic	Fishy	Earthy	Vegetative	None
DP 9.00C			55	30	5				10			X							X
DP 9.00R					97		3				X	X			X				
DP 9.00L			20	20	60						X	X					X		
DP 9.25C	100																		
DP 9.25R				70	20		10			X	X			X	X				
DP 9.25L				20	10	70					X						X		
DP 9.50C		20	20	40	5				15			X							X
DP 9.50R					80		20				X	X		X	X				
DP 9.50L					40		60				X			X	X				
DP 9.75C		40	30	25	5							X							X
DP 9.75R		20	15	15	50						X	X			X				
DP 9.75L					75		25				X	X		X	X				
DP 10.00C			20			80					X						X		
DP 10.00R	100																		
DP 10.00L					50	50					X	X		X	X				
DP 10.25C	100																		
DP 10.25R					85		15				X	X			X				
DP 10.25L	100																		
DP 10.50C			25	25		50					X	X					X		
DP 10.50R		40	20	20		20					X	X					X		
DP 10.50L					65		35			X	X	X			X				
DP 10.75C		50	25	10	15						X	X					X		
DP 10.75R		20			80						X	X		X	X				
DP 10.75L					85		15			X	X			X	X				
DP 11.00C				80	20						X	X					X		
DP 11.00R					98		2				X	X			X				
DP 11.00L					85		15			X	X	X			X				
DP 11.25C			30	30	40						X	X							X
DP 11.25R					80	10	10				X	X			X				
DP 11.25L					85		15				X	X			X				
DP 11.50C			10	10	30				50		X	X							X
DP 11.50R					100						X	X			X				
DP 11.50L		40	30	10	20						X	X					X		
DP 11.75C	100																		
DP 11.75R					60		40				X	X		X	X				
DP 11.75L	100																		
DP 12.00C	100																		
DP 12.00R	100																		
DP 12.00L						100													
DP 12.25C			15	15	70						X	X			X				
DP 12.25R				75			15		10		X						X		
DP 12.25L			50	30	20						X	X							X
DP 12.50C		40	30	25			5					X							X
DP 12.50R	100																		
DP 12.50L	100																		
DP 12.75C				95					5		X						X		
DP 12.75R			15	85							X						X		
DP 12.75L					90		5		5		X	X			X				
DP 12.00C	100																		
DP 13.00R				60					40		X				X				
DP 13.00L	100																		

Sampling station	Percent sediment composition									Color				Odor					
	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
DP 13.25C				60	5		5		30		X	X					X		
DP 13.25R					100						X	X			X				
DP 13.25L					75		20		5		X	X			X				
DP 13.50C				95					5		X	X		X					
DP 13.50R					98		2			X	X	X		X					
DP 13.50L					95		5				X	X					X		
DP 13.75C				80	5				15		X	X					X		
DP 13.75R					98				2	X	X	X		X					
DP 13.75L					97				3		X	X					X		
DP 14.00C				80			5		15	X		X					X		
DP 14.00R					90		5		5		X	X			X				
DP 14.00L				15	80				5	X	X	X			X				
DP 14.25C				70	3		7		20	X		X					X		
DP 14.25R					97		3				X	X							X
DP 14.25L					100						X	X			X				
DP 14.50C				80	10				10		X	X					X		
DP 14.50R				10	90						X	X			X				
DP 14.50L					98				2		X	X		X					
DP 14.75C				40	50				10		X	X					X		
DP 14.75R	100																		
DP 14.75L					95		5				X	X			X				
DP 15.00C				70	5		5		20		X	X					X		
DP 15.00R					95		5				X	X			X				
DP 15.00L					100						X	X			X				
DP 15.25C			10	80	3				7			X					X		
DP 15.25R					100						X	X			X				
DP 15.25L					98				2		X	X		X	X				
DP 15.50C			85	10	5							X					X		
DP 15.50R			5		93				2		X	X			X				
DP 15.50L				5	85		10			X	X	X		X	X				
DP 15.75C			92	5	3							X	X						X
DP 15.75R				65	5		30			X	X						X		
DP 15.75L	100																		
DP 16.00C				100								X							X
DP 16.00R					100						X	X		X	X				
DP 16.00L					100						X	X		X	X				
DP 16.25C			80		20							X							X
DP 16.25R		10				90					X								X
DP 16.25L				95	5							X							X
DP 16.50C			20	77					3		X	X							X
DP 16.50R					90		10			X	X	X			X				
DP 16.50L	100																		
DP 16.75C			40	59	1							X							X
DP 16.75R					85		12		3		X				X				
DP 16.75L				67	20		10		3		X	X			X				
DP 17.00C				90			5		5			X							X
DP 17.00R			30	5	55		10				X	X		X	X				
DP 17.00L				40	60						X	X		X	X				
DP 17.25C		30	50	20								X							X
DP 17.25R				5	90		5				X				X				
DP 17.25L			80	20								X	X						X

Sampling station	Percent sediment composition									Color				Odor					
	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
DP 17.50C			60	37	3						X								X
DP 17.50R			94	5	1						X								X
DP 17.50L			2	83	5		5		3	X	X						X		
DP 17.75C	100																		
DP 17.75R	100																		
DP 17.75L				98	1		1				X								x
DP 18.00C			30	68	2							X							x
DP 18.00R					70		30				X	X			x				
DP 13.00L			20	30	40		10				X						X		
DP 18.25C		10	20	68	2							X							x
DP 18.25R				50	45		5				X								x
DP 18.25L					85		15				X	X			x				
DP 18.50C			10	85	5							X							x
DP 18.50R			20	75	5							X							x
DP 13.50L				50	30		20				X	X							X
DP 18.75C	100																		
DP 18.75R	100																		
DP 18.75L	100																		
DP 19.00C				98	2							X							X
DP 19.00R				55	40		5				X	X			X				
DP 19.00L				65	30		5				X	X			X				
DP 19.25C	100																		
DP 19.25R	100																		
DP 19.25L	100																		
DP 19.50C				85	10		5			X	X	X		X	X				
DP 19.50R				90	10					X		X		X	X				
DP 19.50L	100																		
DP 19.75C	100																		
DP 19.75R	100																		
DP 19.75L				30	50		20				X				X				
DP 20.00C	100																		
DP 20.00R				60			20		20		X								X
DP 20.00L	100																		
*DP 20.25C	100																		
DP 20.25R				10	35		5				X	X		X	X				
DP 20.25L					15		85			X	X			X	X				
DP 20.50C			75		20		5				X								X
DP 20.50R				5	65		30				X				X				
DP 20.50L					80		20				X	X			X				
DP 20.75C	100																		
DP 20.75R				5	10		85			X					X				
DP 20.75L			30	10	60						X	X			X				
DP 21.00C				97	3							X							X
DP 21.00R					95		5				X	X			X				
DP 21.00L					100					X	X	X			X				
DP 21.2SC				60	40							X		X	X				
DP 21.25R					85		15				X	X		X	X				
DP 21.25L					75		25				X	X		X	X				
DP 21.50C			15	83	2							X							X
DP 21.50R					100					X	X	X			X				
DP 21.50L							100												

Sampling station	Percent sediment composition									Color				Odor					
	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
DP 21.75C			5	95								X							X
DP 21.75R					80		20				X	X			X				
DP 21.75L					100						X	X			X				
DP 22.00C			20	75	5							X							X
DP 22.00R		10	85	5								X	X						X
DP 22.00L				70	30						X	X	X		X				
DP 22.25C	100																		
DP 22.25R				98	2							X							X
DP 22.25L		35	60	5								X	X						X
DP 22.50C				93	2				5			X							X
DP 22.50R		20			30		50				X	X			X				
DP 22.50L				70	30						X	X			X				
DP 22.75C				98	2							X							X
DP 22.75R					100					X	X				X				
DP 22.75L					90		10			X	X	X			X				
DP 23.00C				70	30						X	X							X
DP 23.00R				30	60		10				X	X			X				
DP 23.00L	100																		
DP 23.25C				98	2							X							X
DP 23.25R				50	30		20				X	X			X				
DP 23.25L					60		40				X	X			X				
DP 23.50C				90			5		5			X							X
DP 23.50R					60		40				X	X			X				
DP 23.50L				40	60						X	X			X				
NB 0.00C				70	30						X	X							X
NB 0.25C				30	70					X	X								X
NB 0.50C				70	30					X	X								X
NB 0.75C				60	40					X		X							X
NB 1.00C				65	20			5	10		X	X			X				
NB 1.25C		20	20	40	15			5			X	X			X				
NB 1.50C				80					20				X						X
NB 1.75C		30	30	25	10			5		X					X				
NB 2.00C			7	90	3							X							X
NB 2.25C				85	3		10	2				X			X				
NB 2.50C		20	80							X			X						X
NB 2.75C			40	25	15		10	10		X	X			X	X				
NB 2.75L			5	5	75		5	10		X				X	X				
NB 3.00C			50	30	20							X							X
NB 3.25C				97	3								X						X
NB 3.50C				80	10				10			X							X
NB 3.75C			40	40	15			5			X	X			X				
NB 4.00C			10	80	5		5					X			X				
NB 4.25C			50	40	5			5				X			X				
NB 4.50C				40	50			5	5		X	X			X				
NB 4.75C			40	35	10		10	5			X	X			X				X
NB 5.00C			40	55	5							X							X
NB 5.25C			50	45	5							X							X
NB 5.50C			60	35	5							X							
NB 5.75C				90	5			5				X		X	X				
NB 6.00C				75	10			5	10		X	X			X				
NB 6.25C		20	20	40	15			5			X	X							X
NB 6.50C			60	35	5							X							X

	Percent sediment composition									Color				Odor					
Sampling station	Rock	Pebble	Gravel	Sand	Silt	Clay	Detritus	Sludge	Shells	Black	Gray	Brown	Tan	Oil	Septic	Fishy	Earthy	Vegetative	None
NB 6.75C		50	30	10	10							X							X
NB 7.00C		50	35	10	5							X			X				
NB 7.25C		25	15	45	5				10		X	X							X
NB 7.50C		80	10	10								X	X						X
NB 7.75C		20	20	55	5					X		X			X				
NB 8.00C			30	45	5	20						X							X
NB 8.25C		20	30	45	5						X	X							X
NB 8.50C			30	10	15			5	40	X		X				X			
NB 8.75C		40	20	35				5			X	X			X				
NB 9.00C		30		60	5			5		X			X		X				
NB 9.25C		20	20	10	15	35					X	X			X				
NB 9.50C			5	20	25				50		X	X				X			
NB 9.75C			15	30	40				15		X	X			X				
NB 10.00C				30	50				20		X	X			X				
NB 10.25C		10	30	20	40						X	X			X				
NB 10.50C		70	20	5	5						X	X				X			
NB 10.75C		15	15	30	20	20					X	X					X		
NB 11.OOC		10	20	30	40						X	X							X

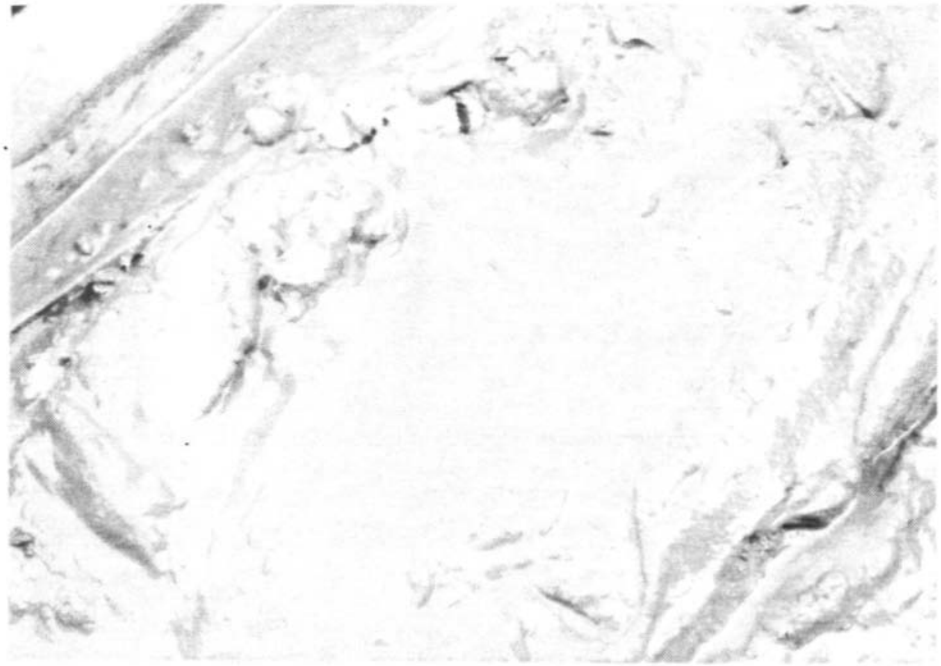
Appendix D

Photographs of Selected Sediment Samples

Calumet River

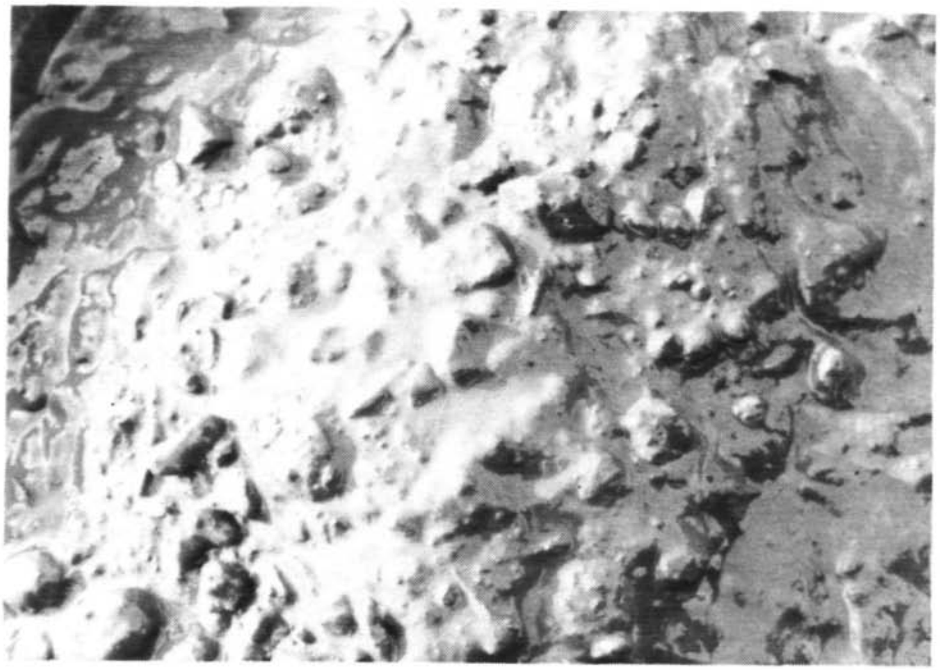
CR O.OOL

CR 0.25L



CR 0.50R

CR 0.75R



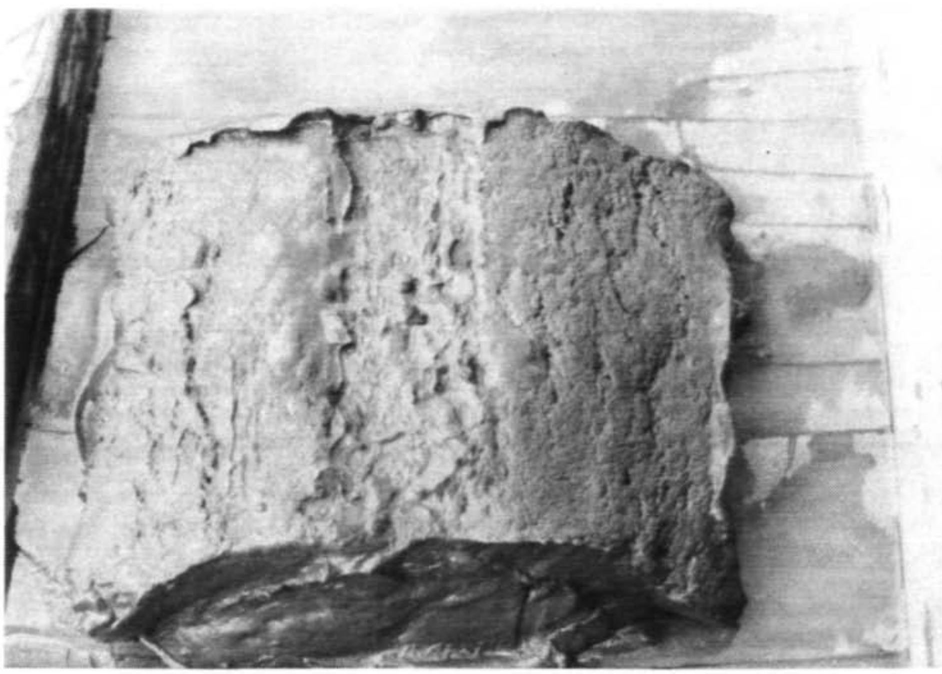
CR 1.00L

CR 1.25L

CR 1.50R

CR 1.75R

CR 2.00R



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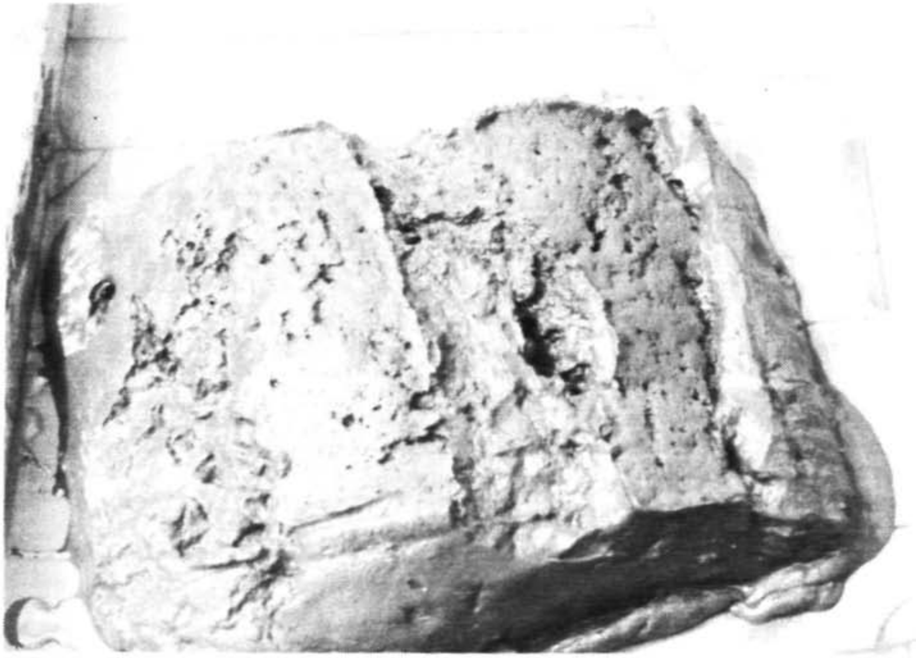
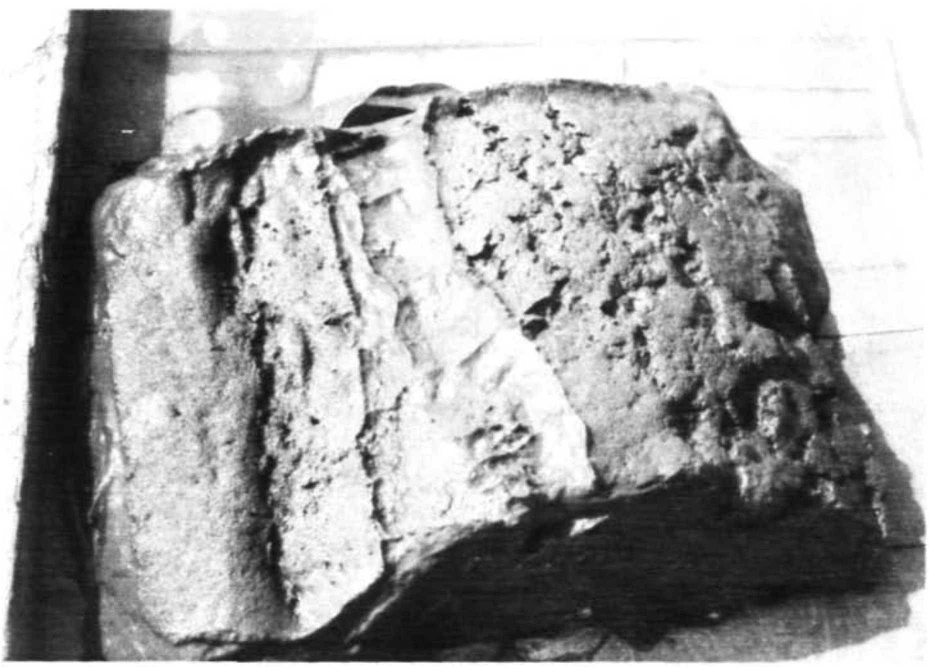


CR 2.50C



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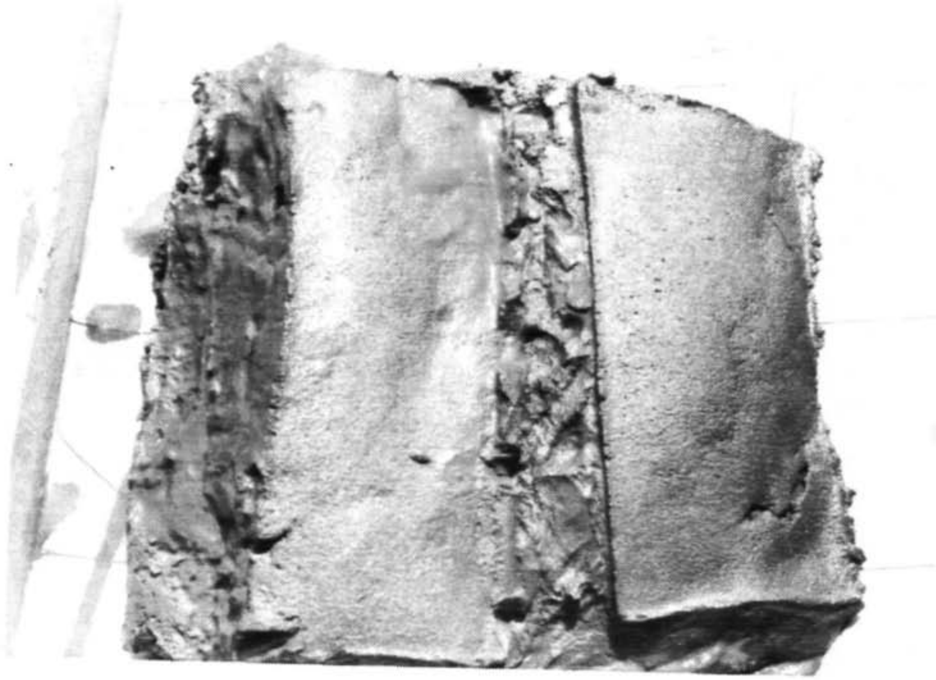

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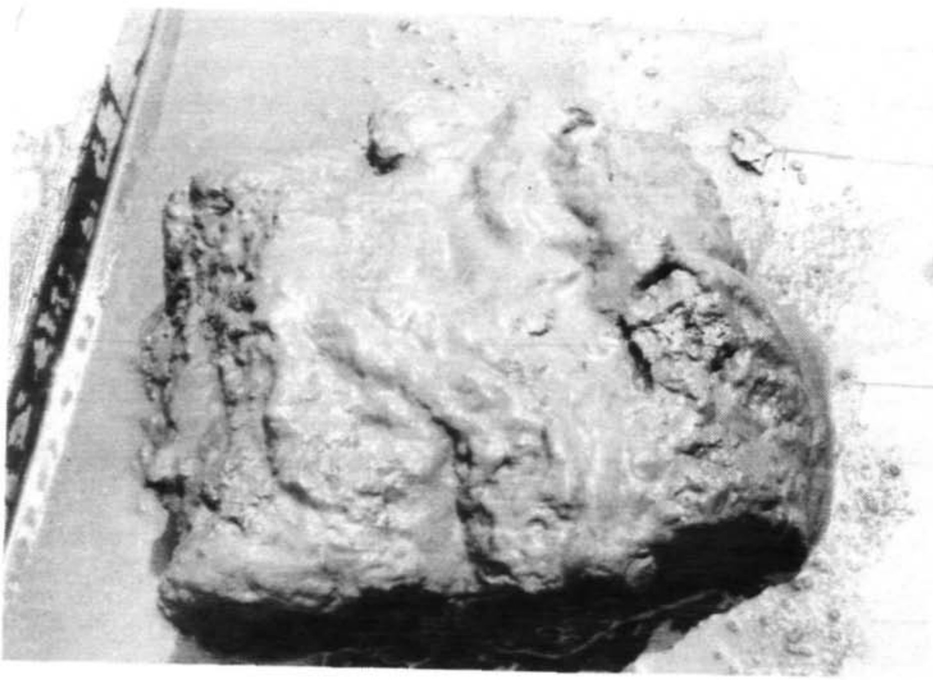
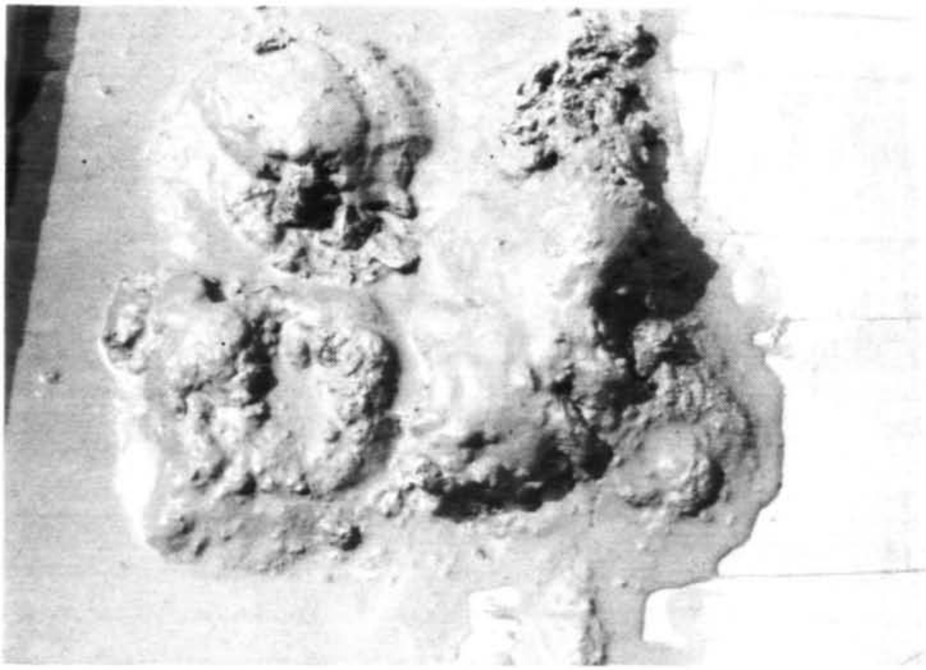


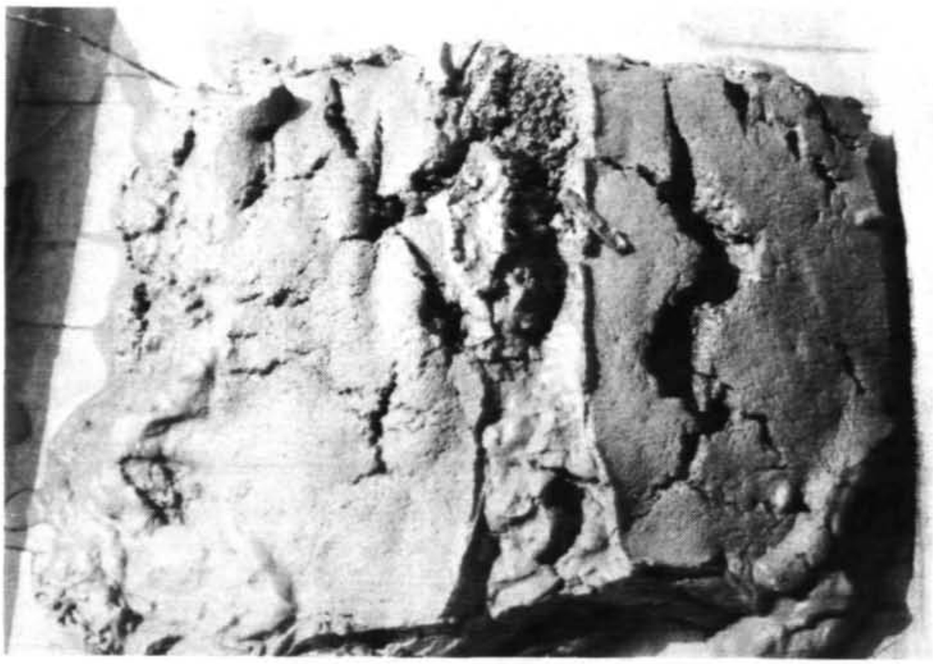
CR 3.25C

CR 3.50C

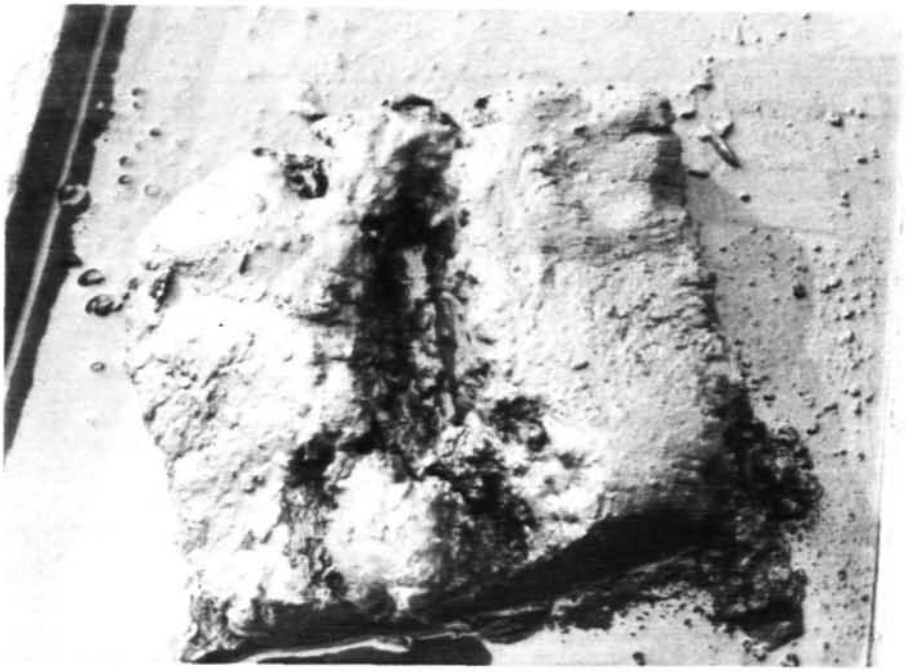
CR 3.75R



CR 4.00L



CR 4.25C



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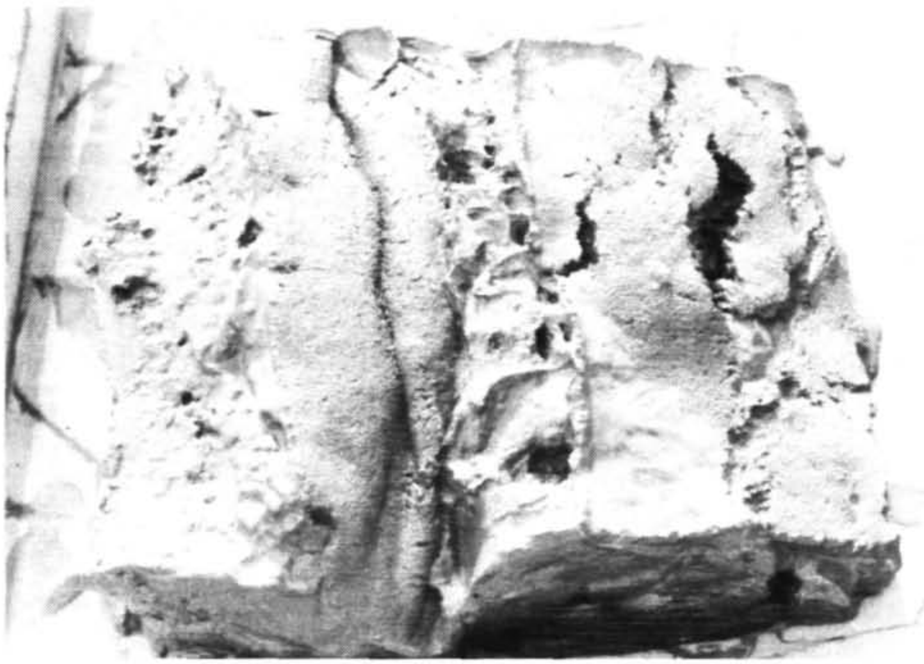

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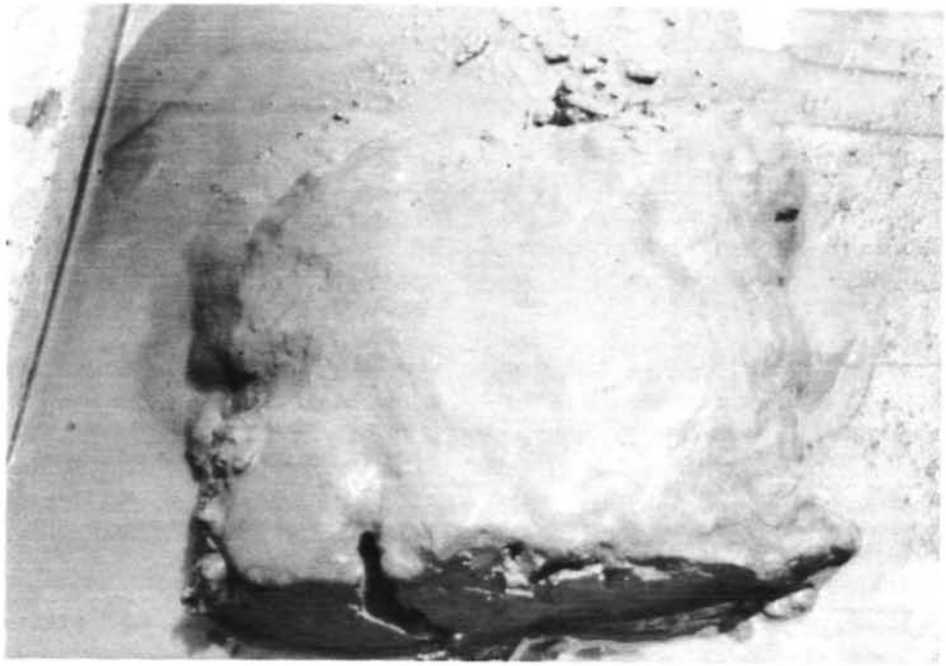

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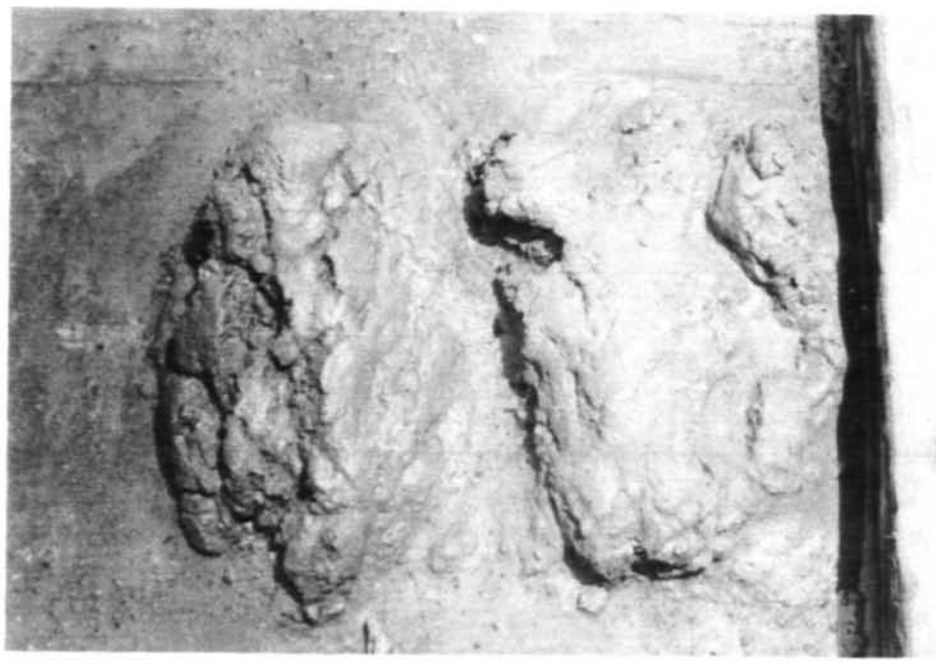

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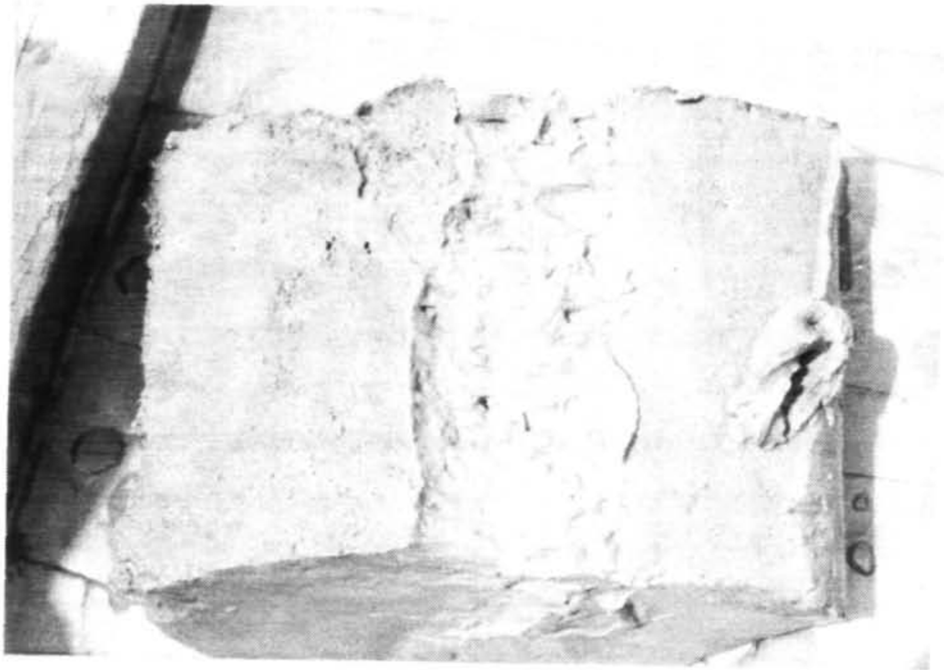

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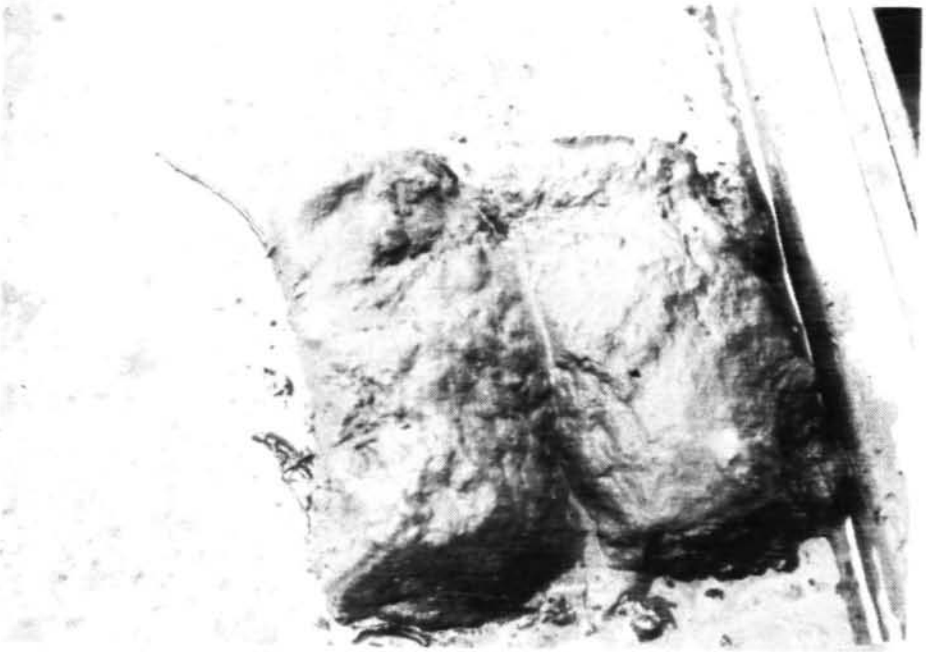
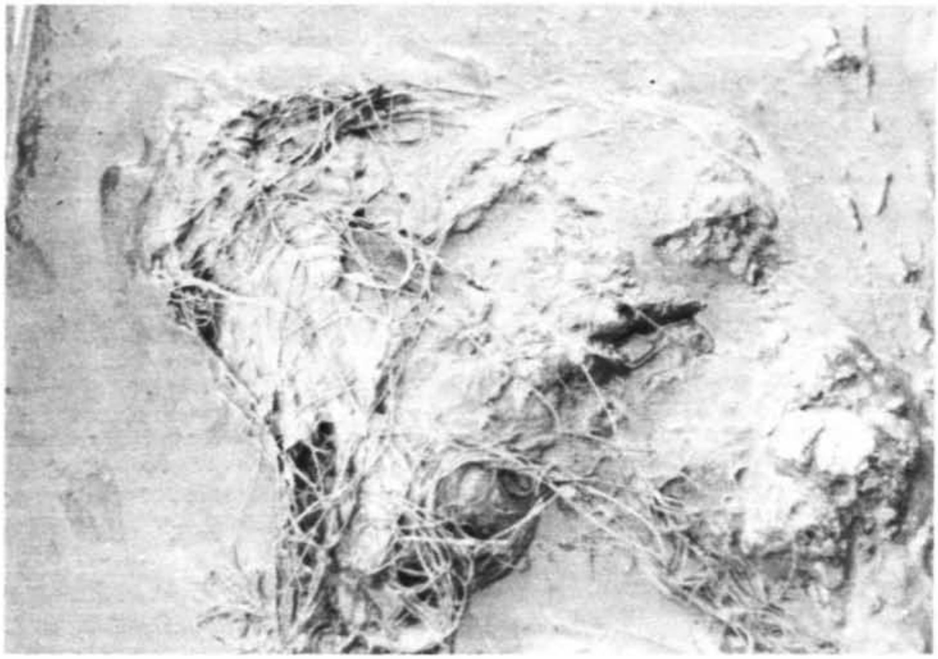


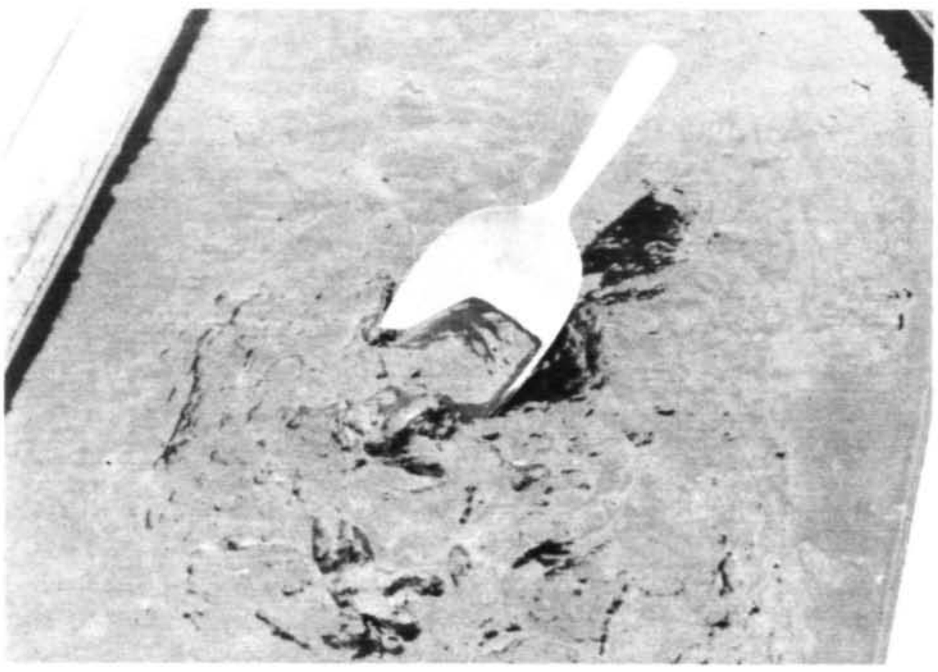
CR 5.75R

CR 6.00C

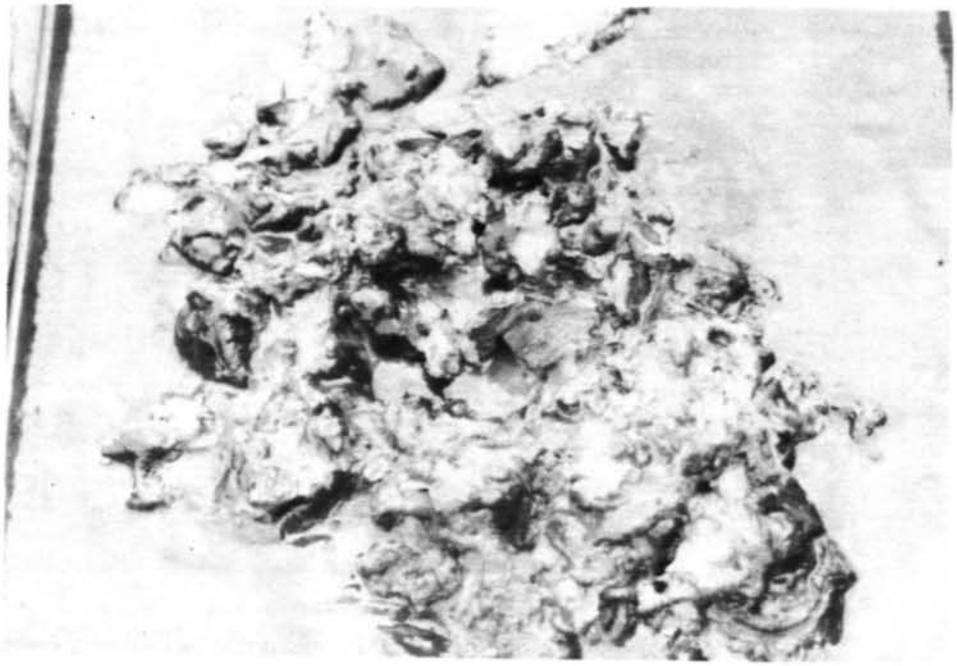
CR 6.25R



CR 6.50L

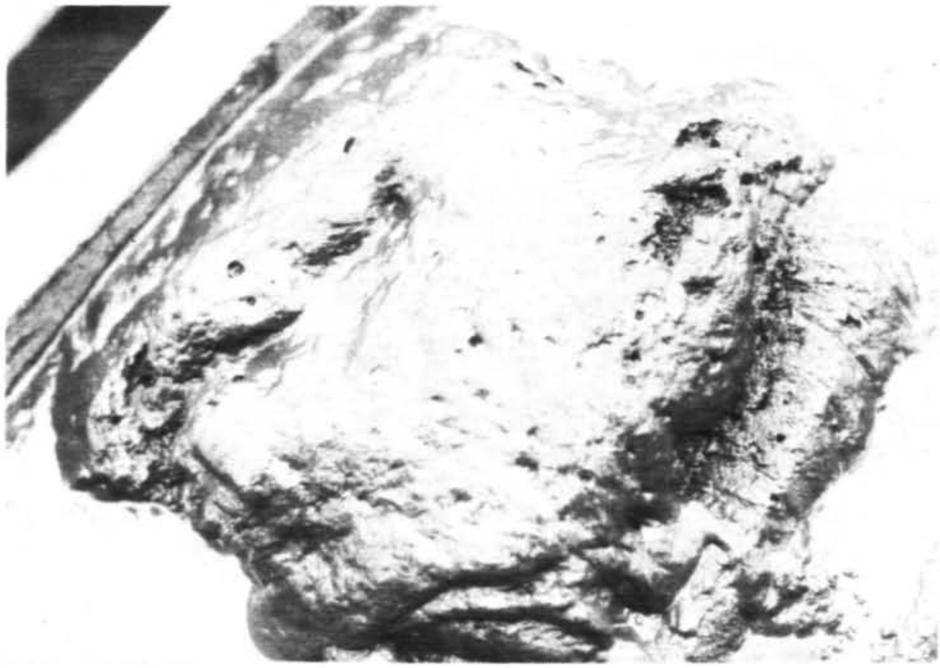


CR 6.75C, GC O.OOC, LC 0.00C



LC 0.25C

LC 0.50L



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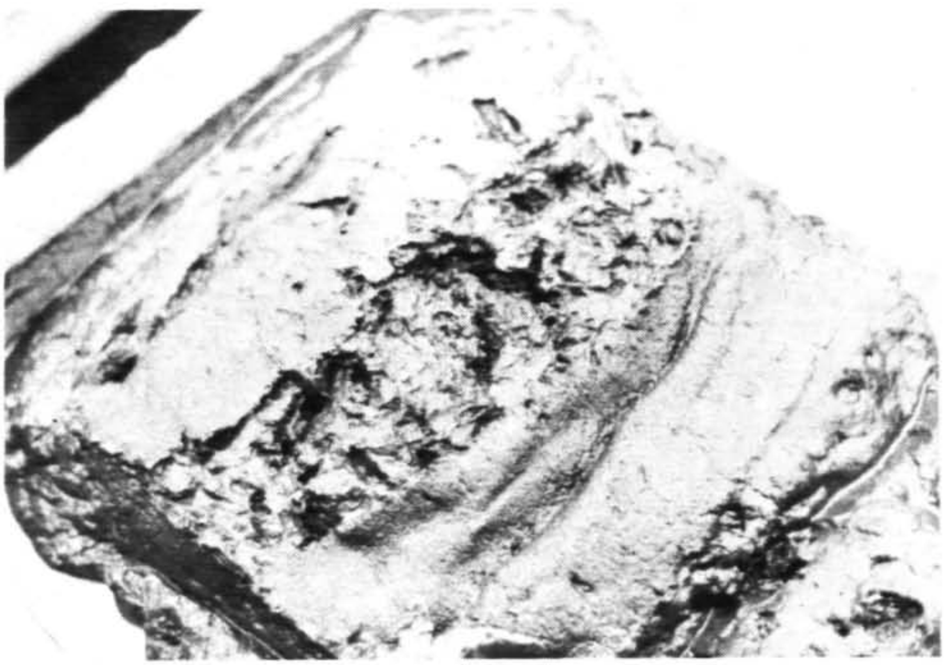
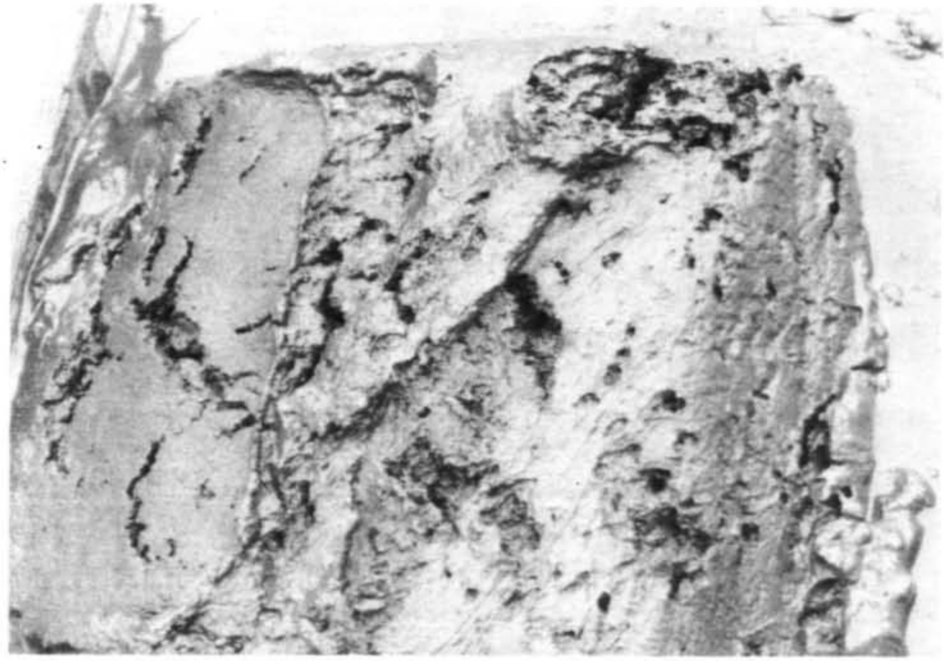
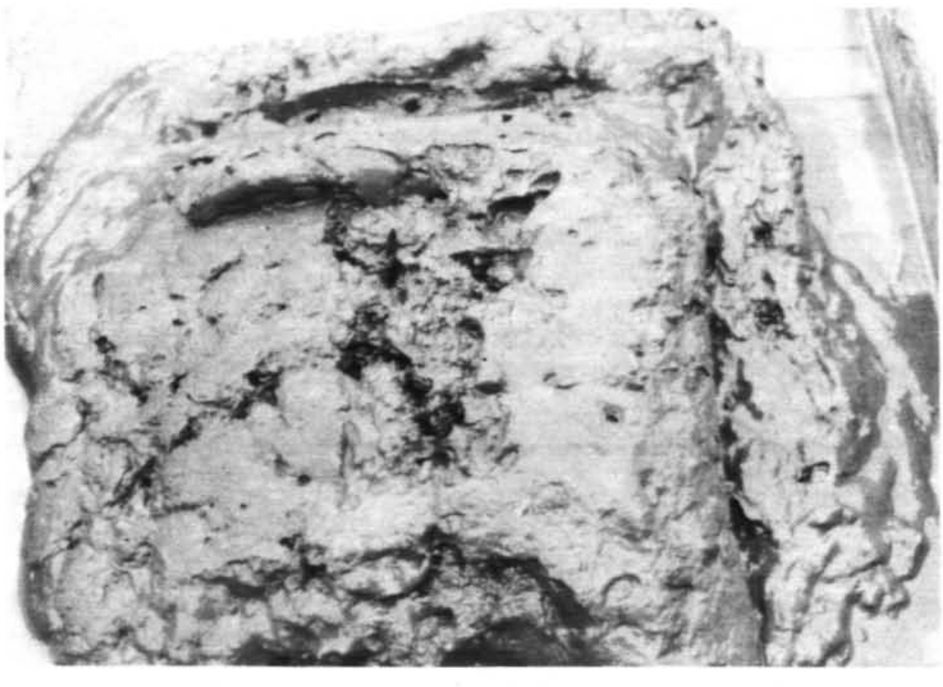


LC 1.OOC



LC 1.25R



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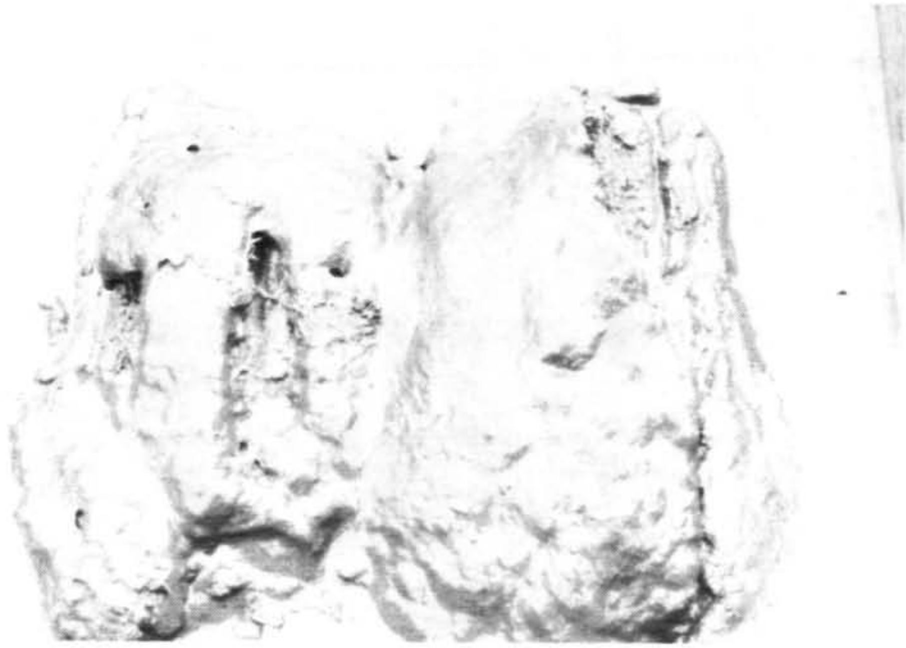
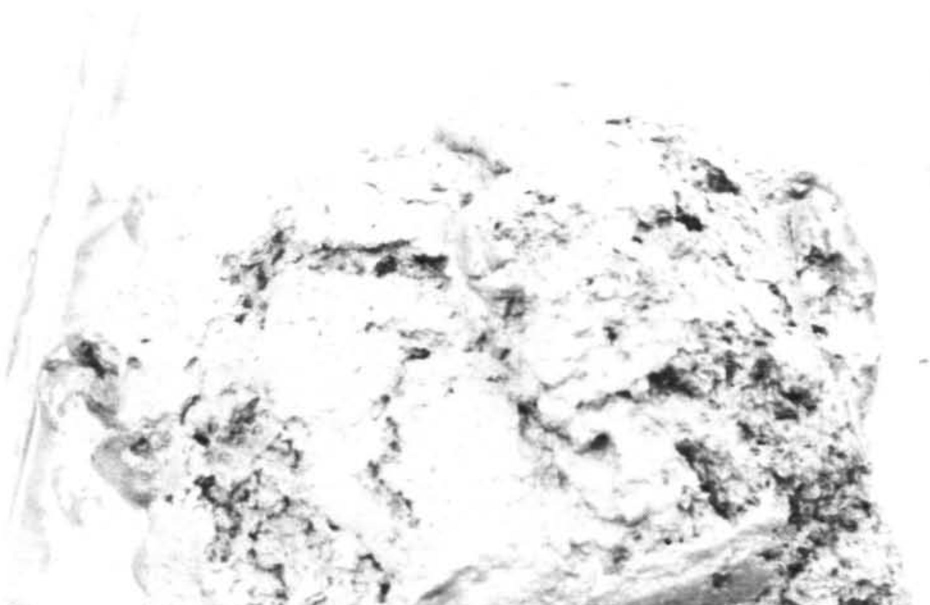
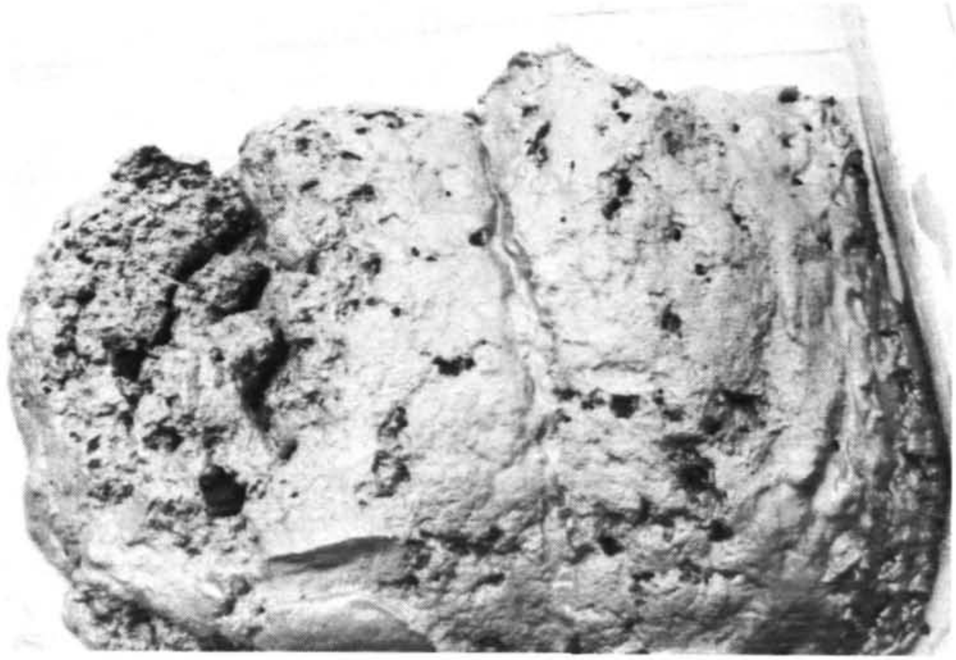


LC 1.75L



LC 2.00C



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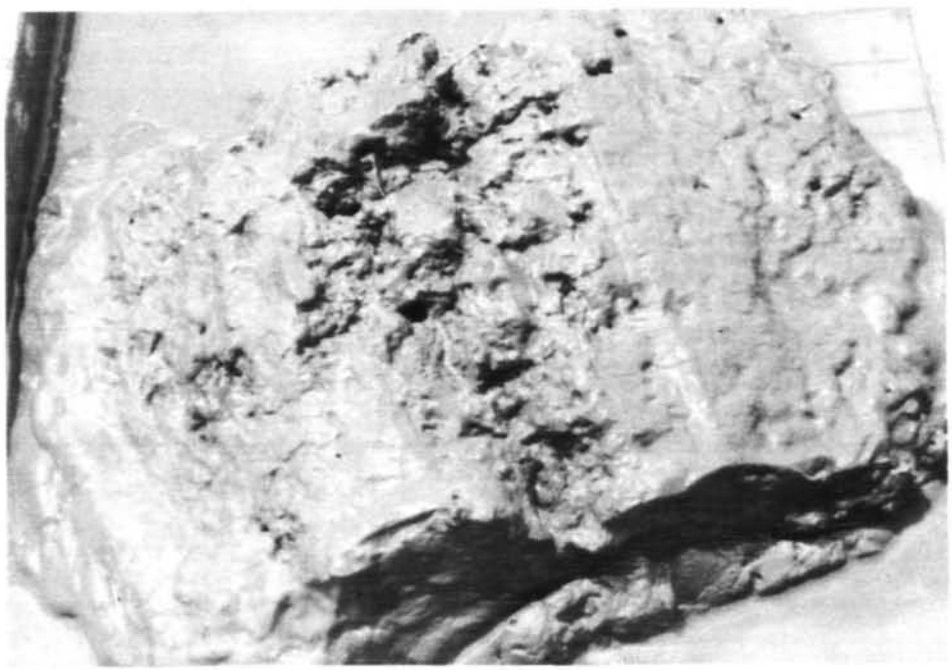

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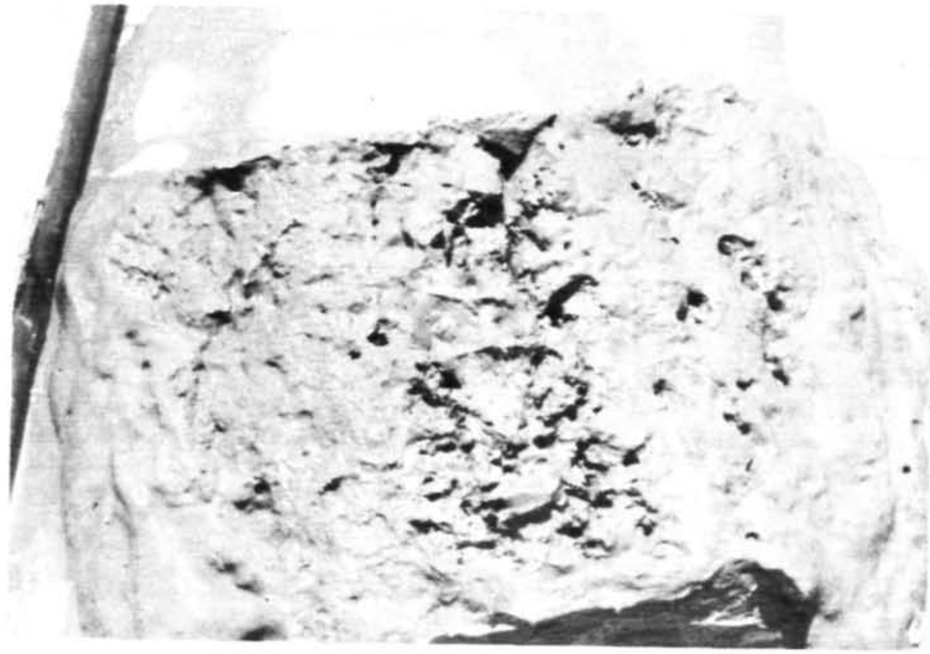
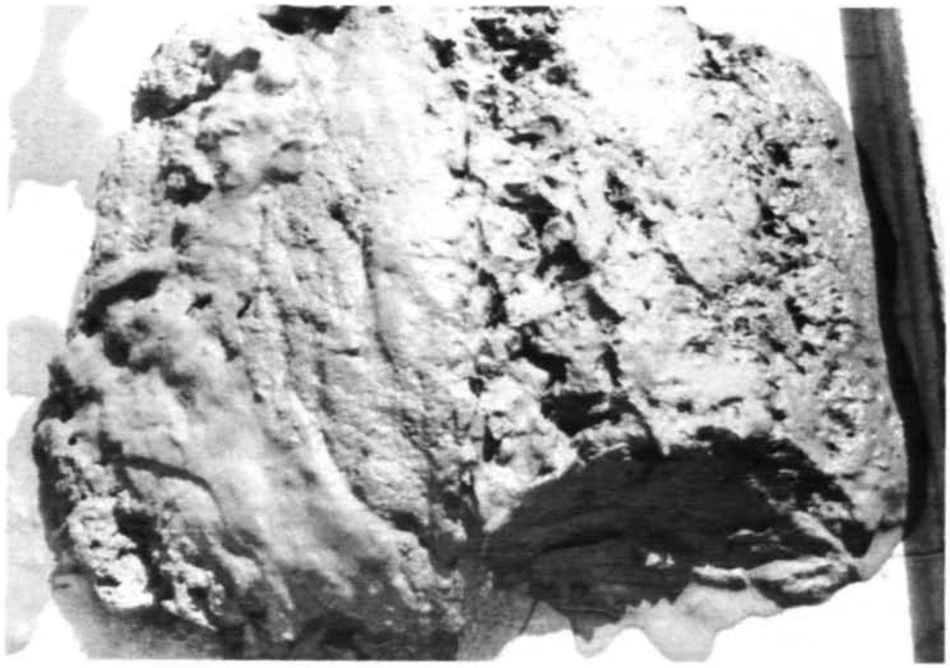


LC 2.75L

LC 3.00L



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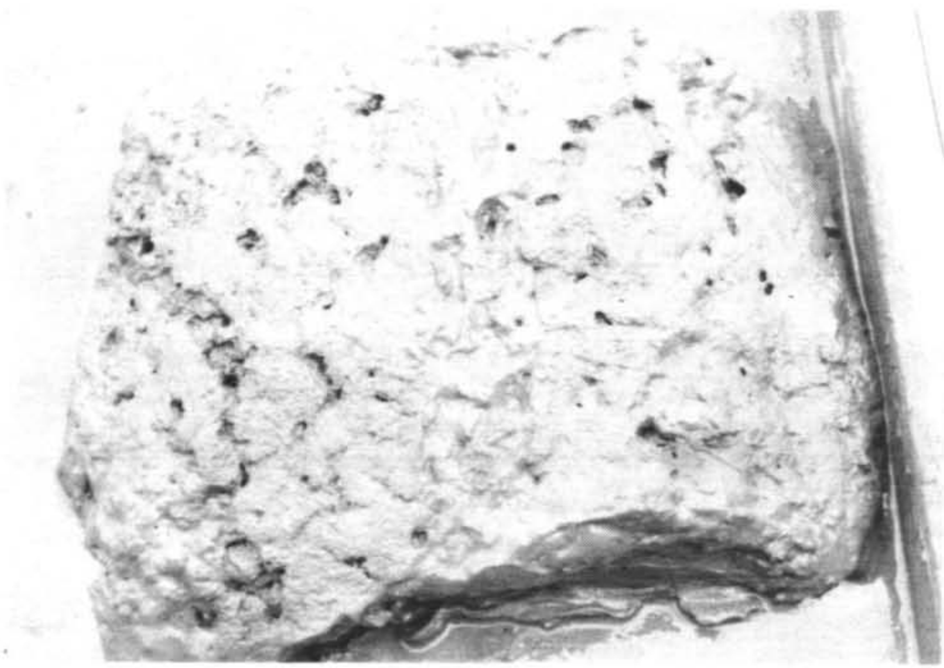
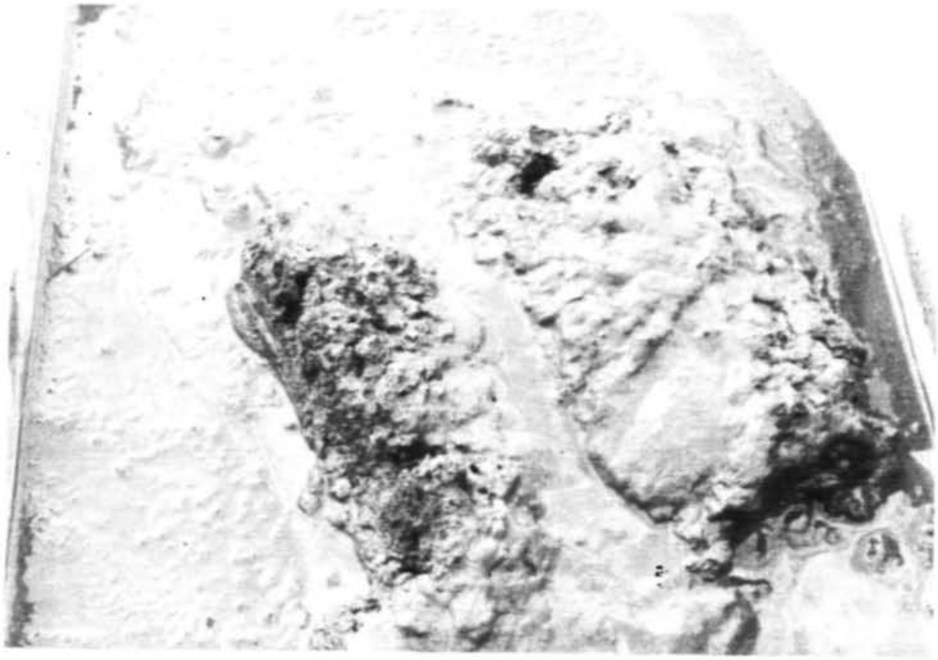
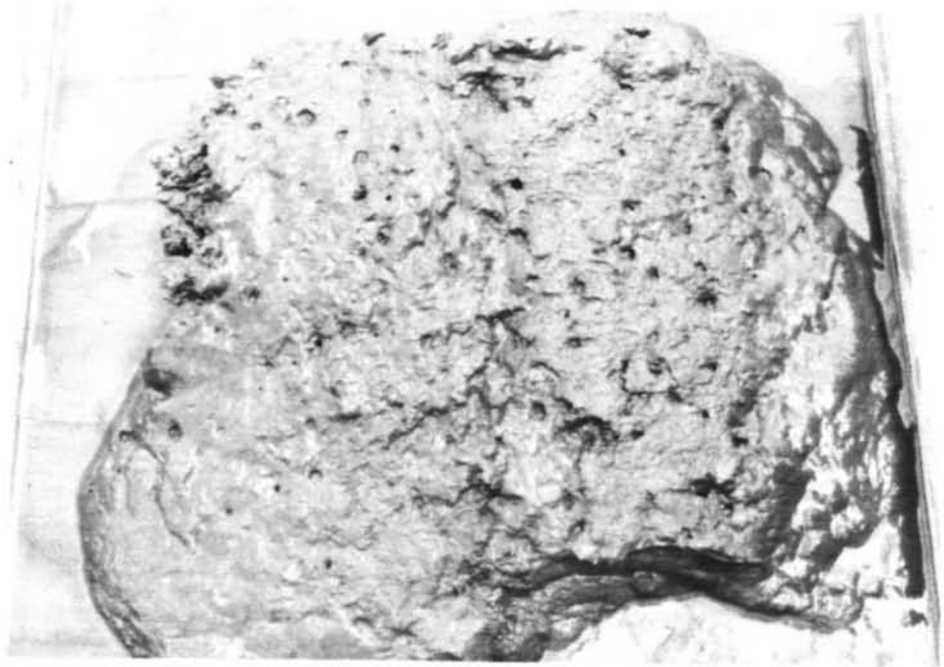


LC 3.50L



LC 3.75L

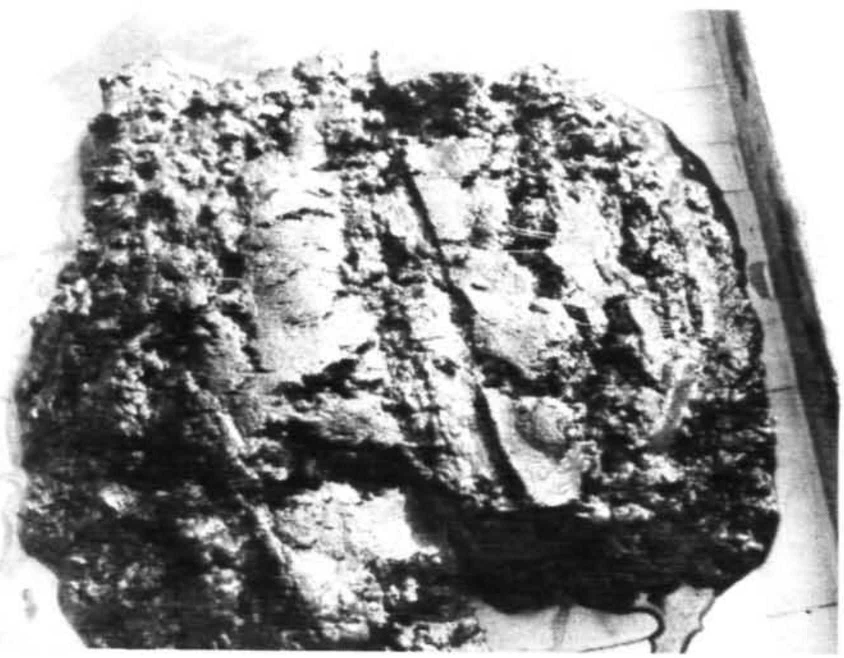
LC 4.00L



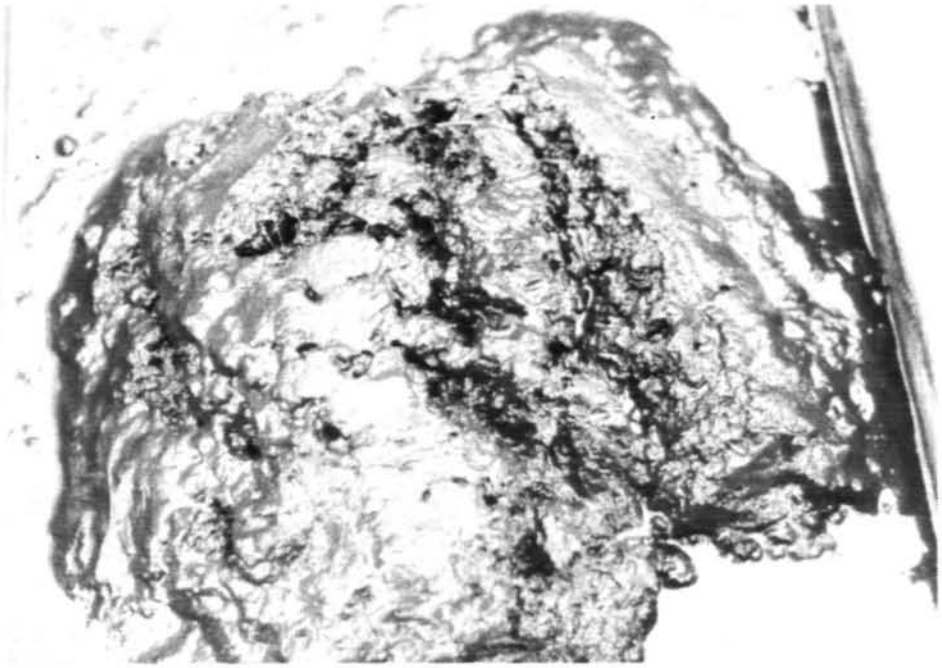
LC 4.25R

LC 4.50L

LC 4.75R



LC 5.00R



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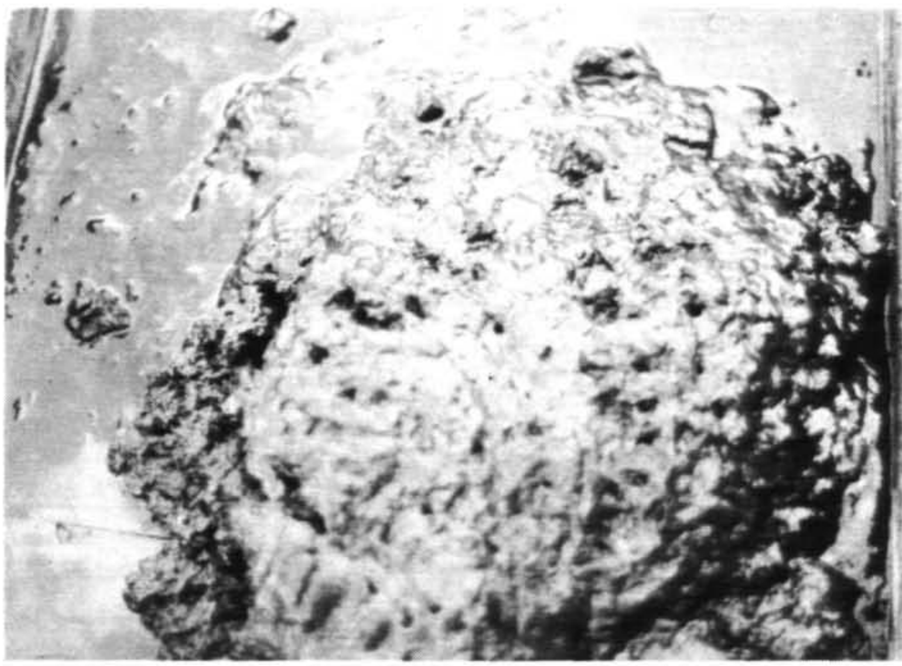

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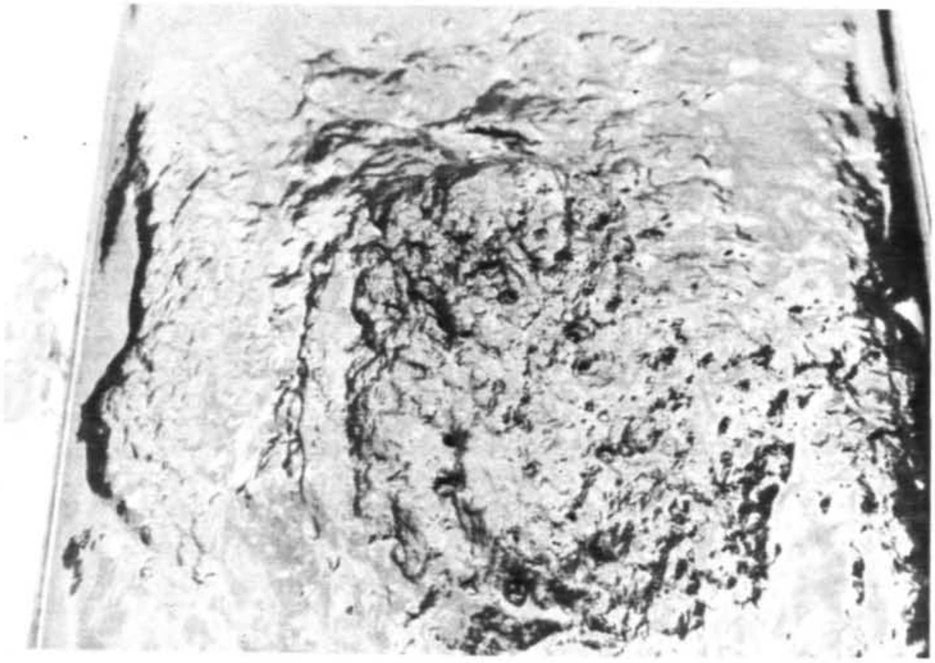

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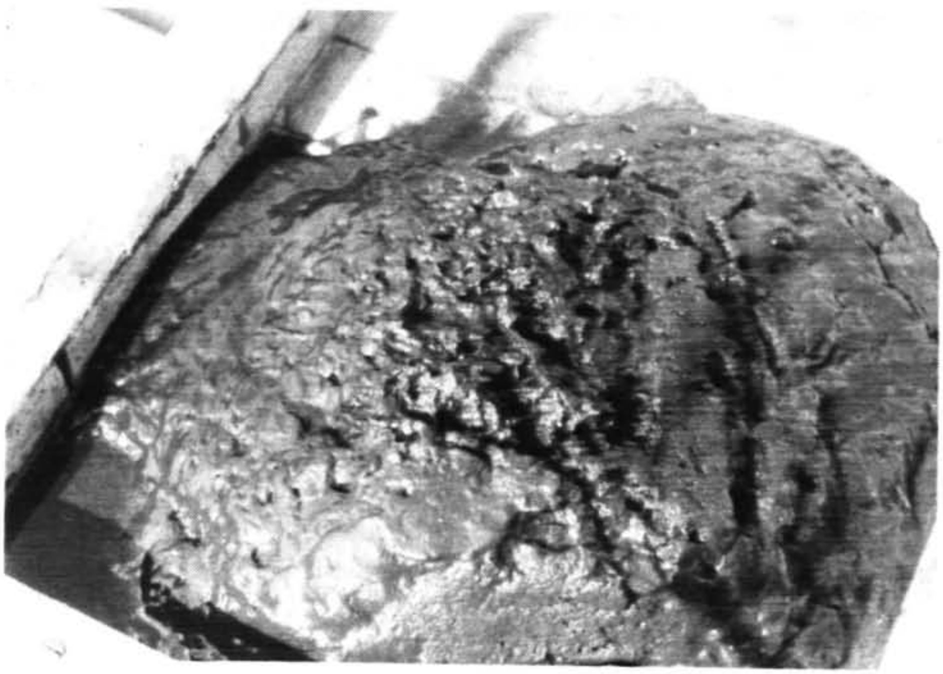
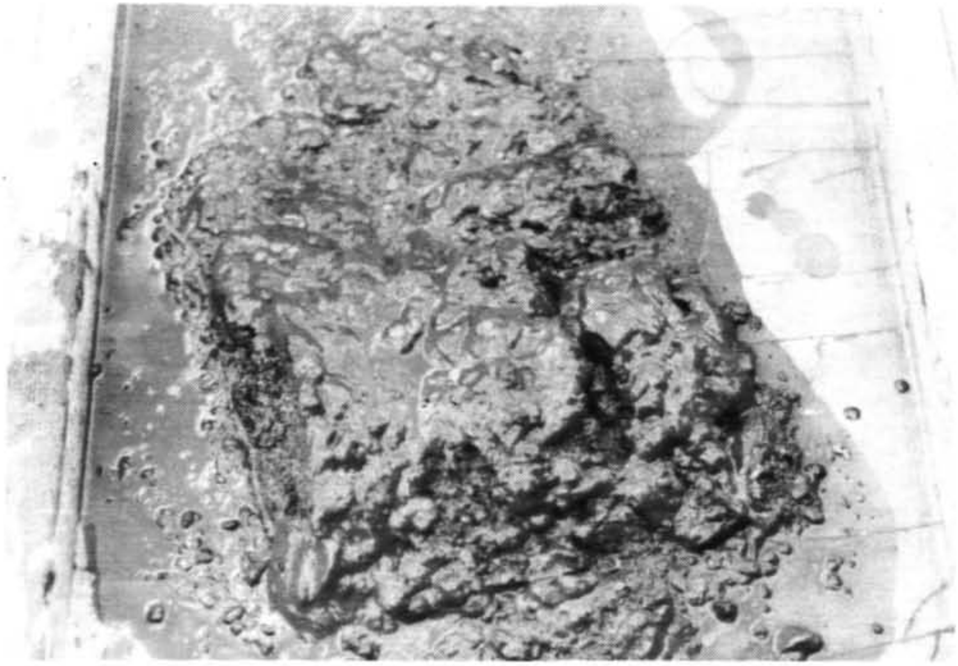
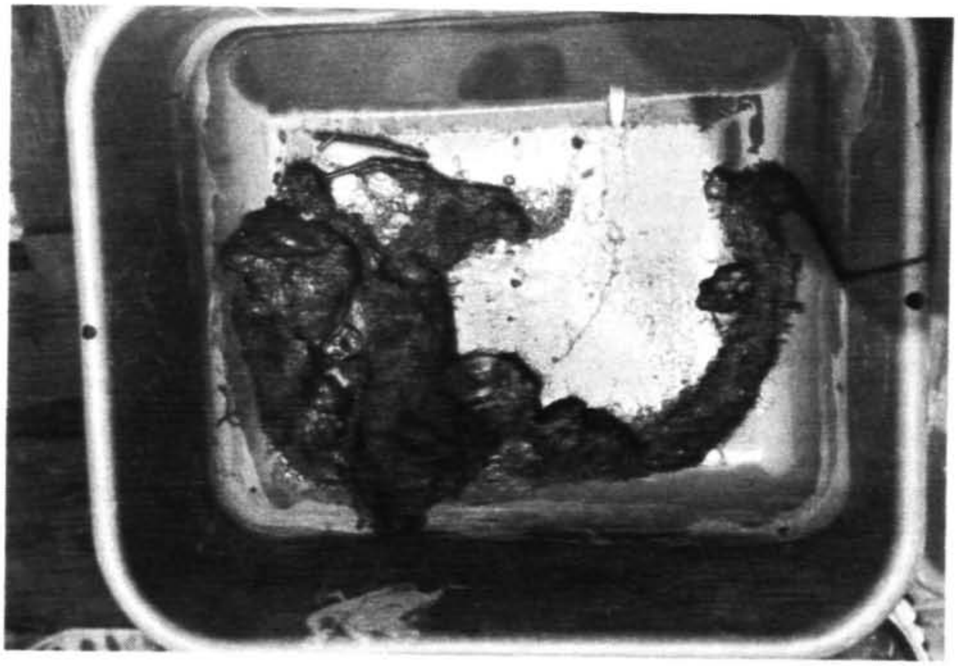


LC 6.00C

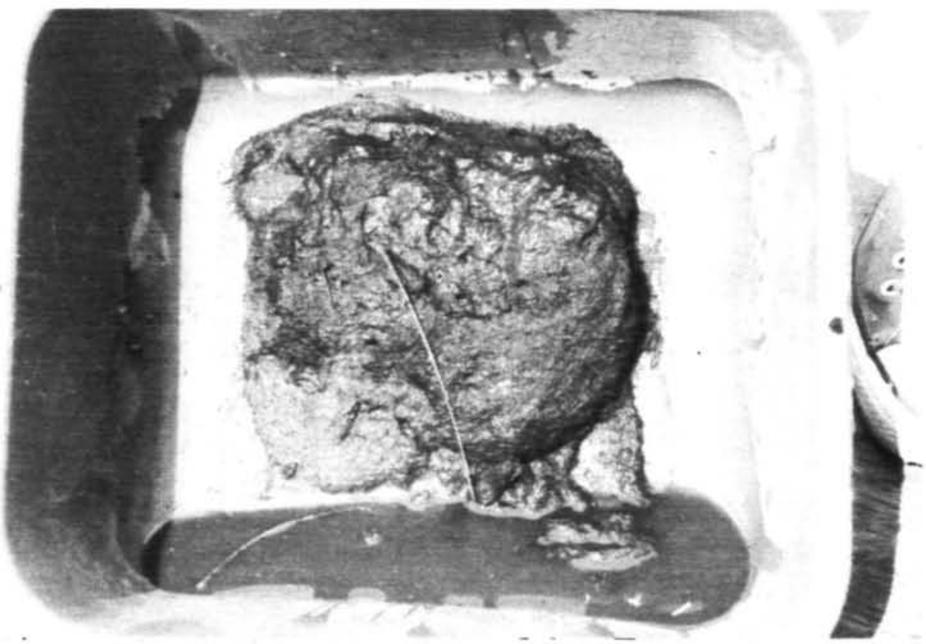


LC 6.25C

LC 6.50L



LC 7.00L



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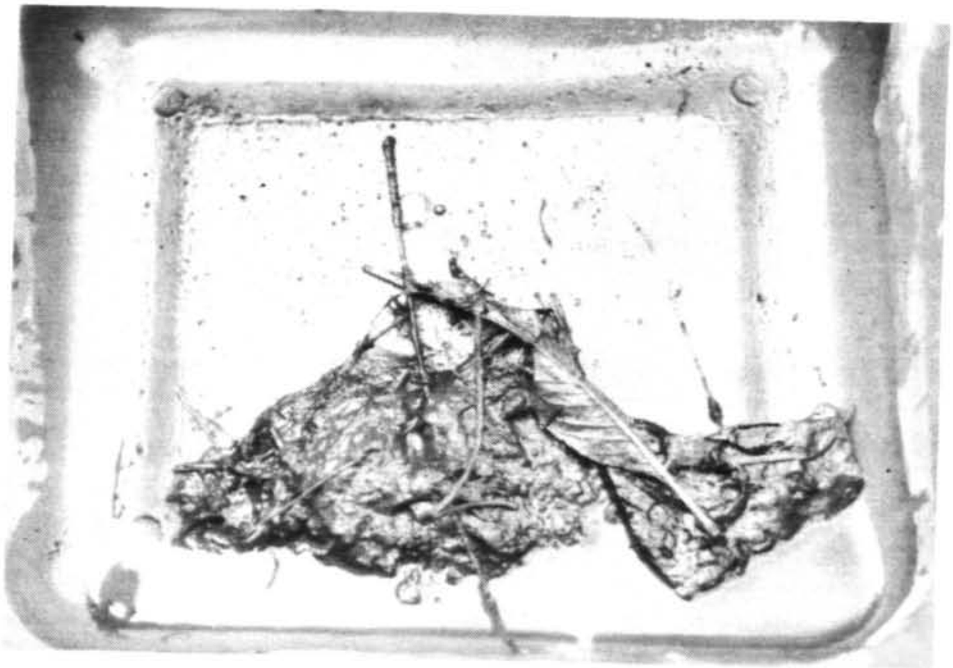
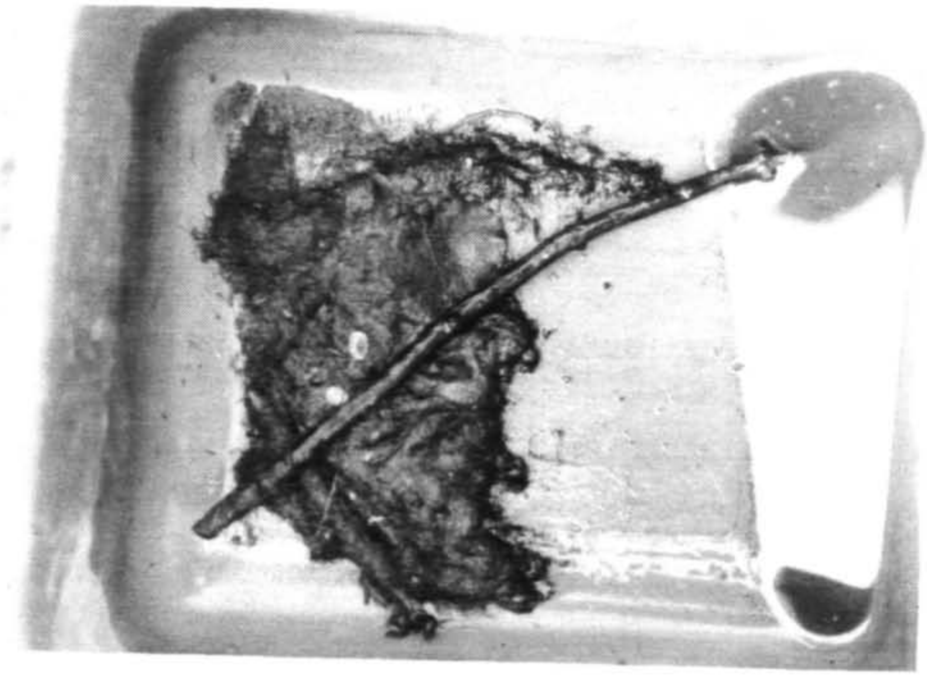


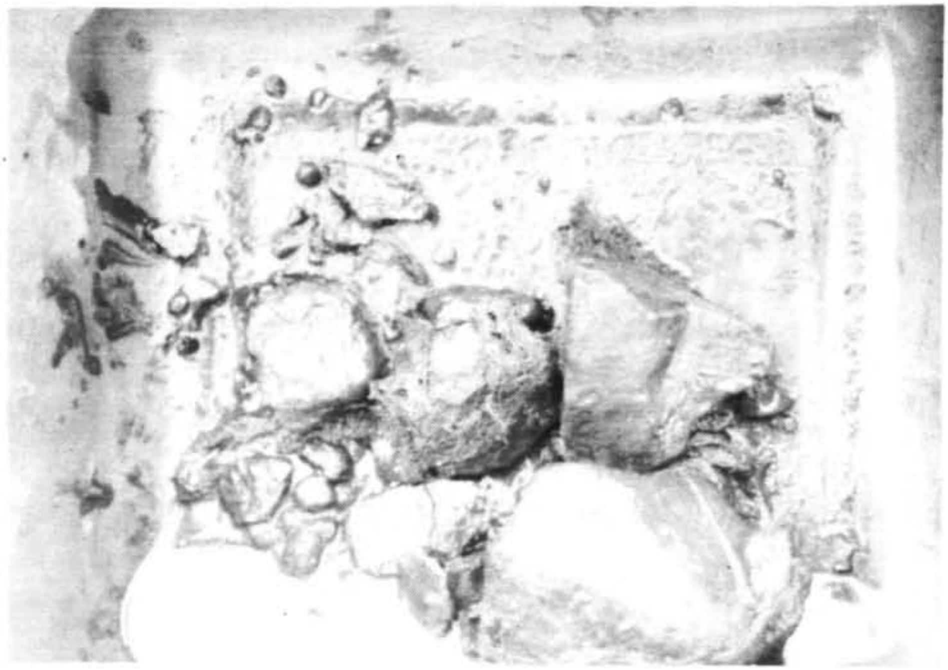
LC 7.50L



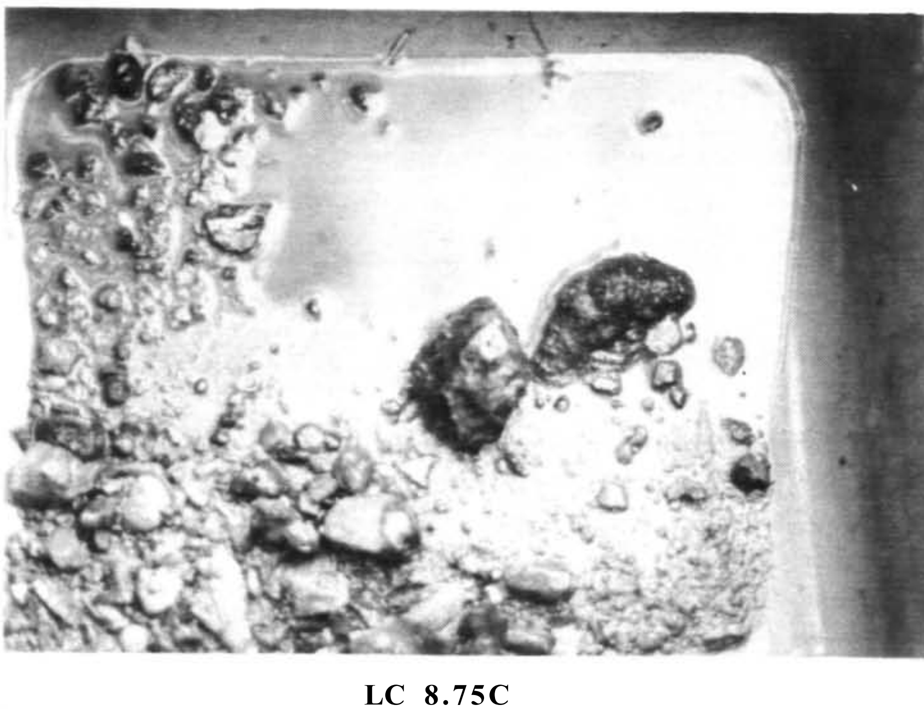
LC 7.75L

LC 8.00R

LC 8.25L

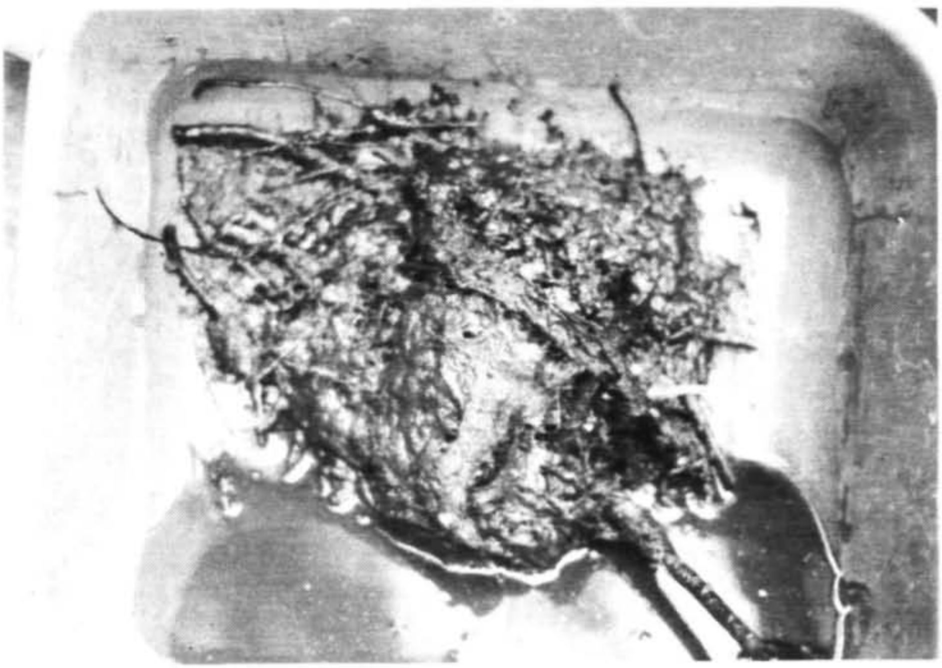


LC 8.50R



LC 8.75C

LC 9.00L



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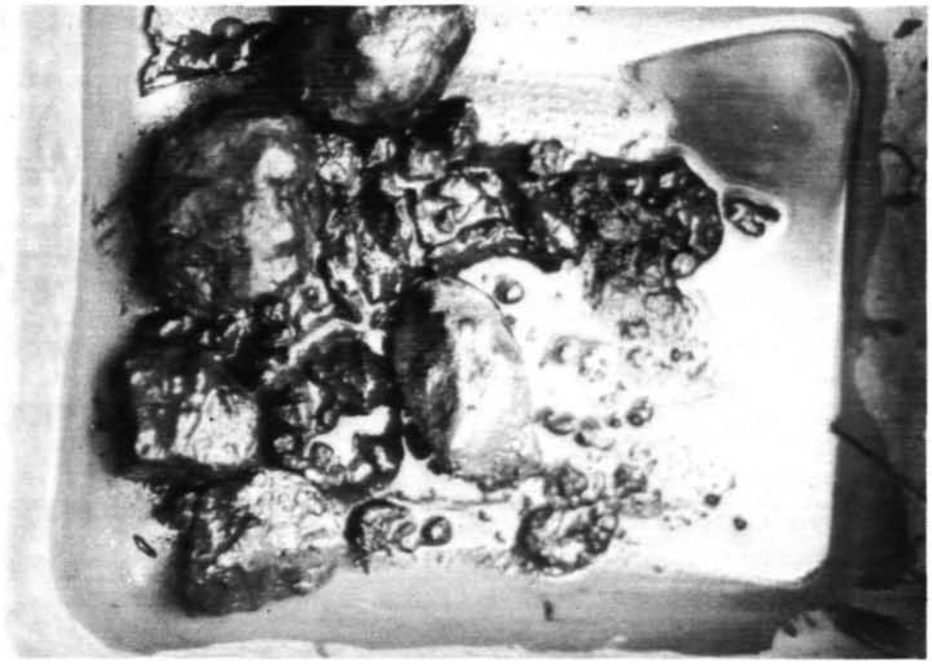
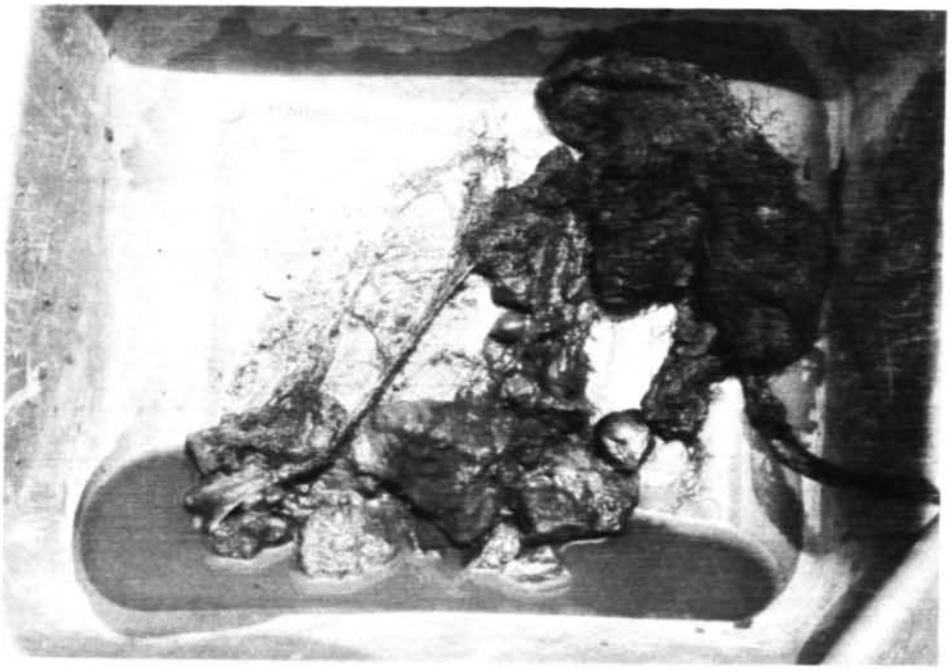
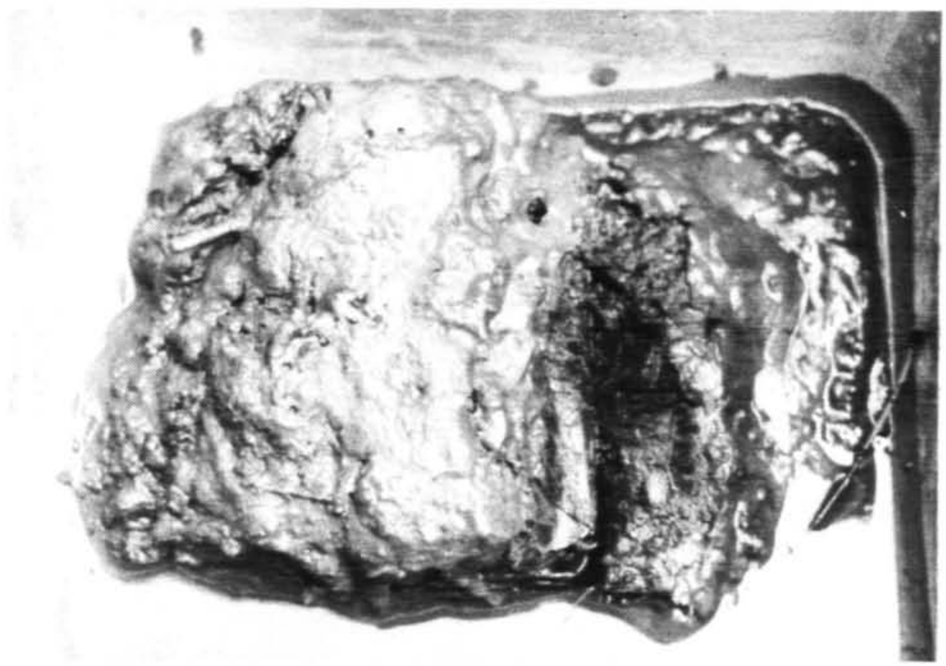


LC 9.50C

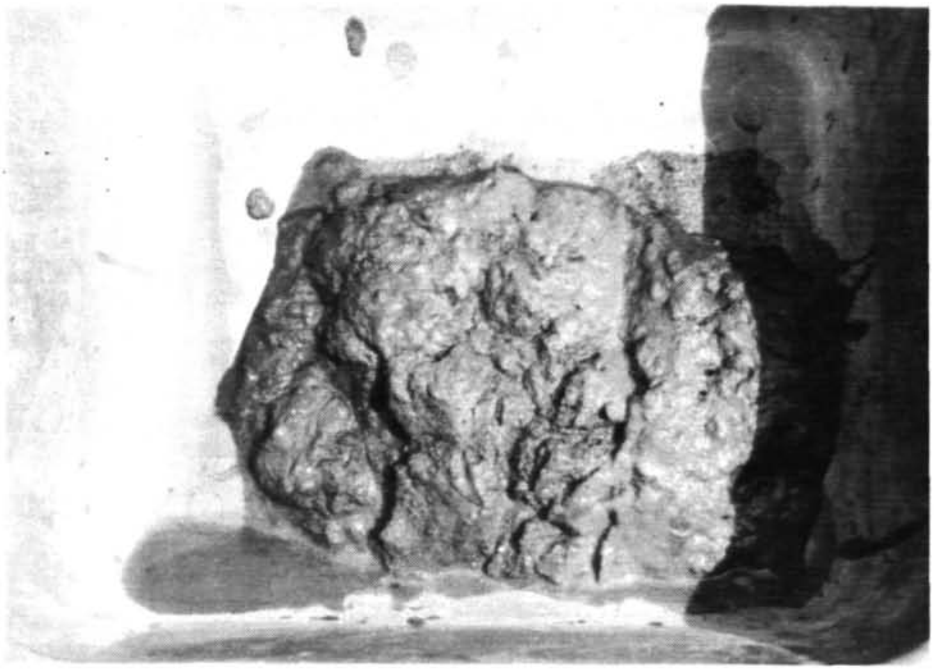
LC 9.75L



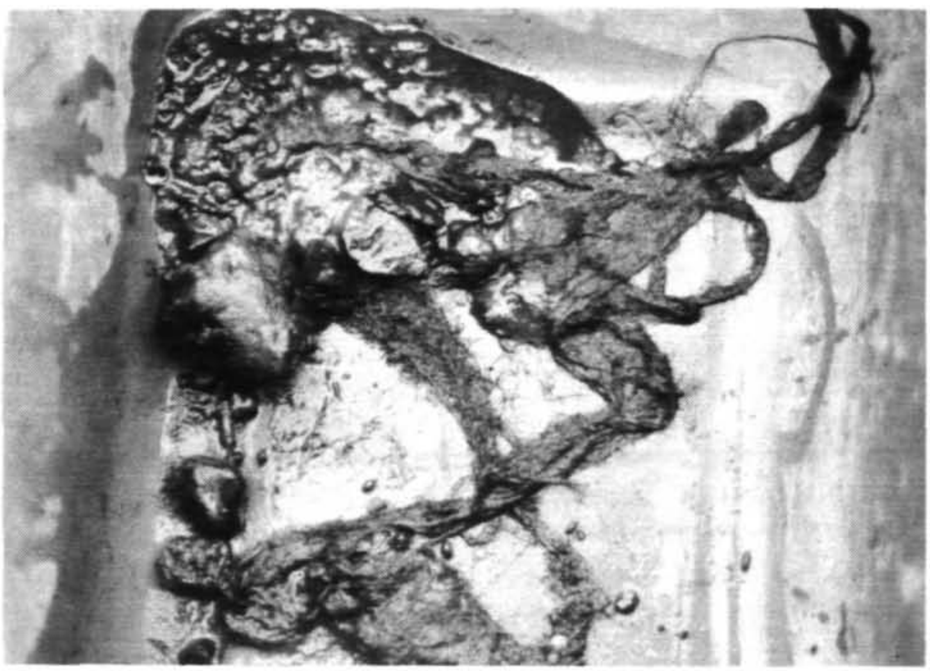
LC 10.00R



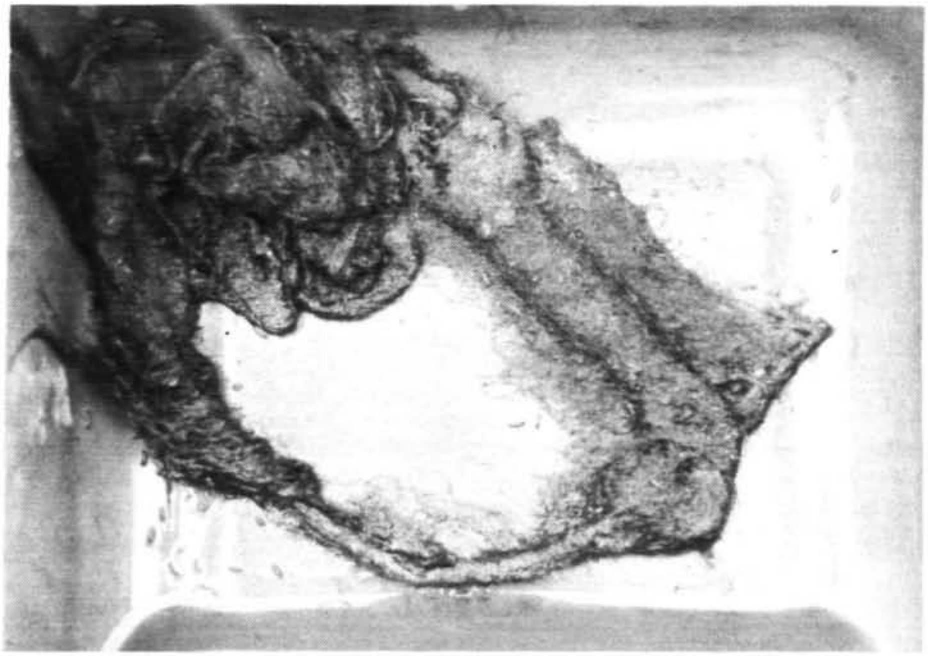
LC 10.25L



LC 10.50R

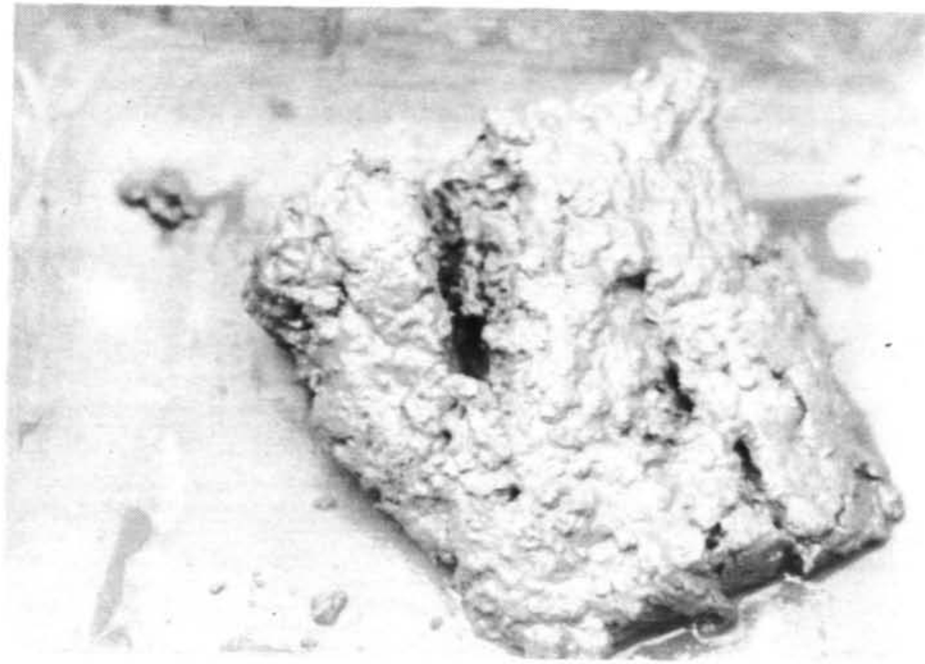


LC 10.75L

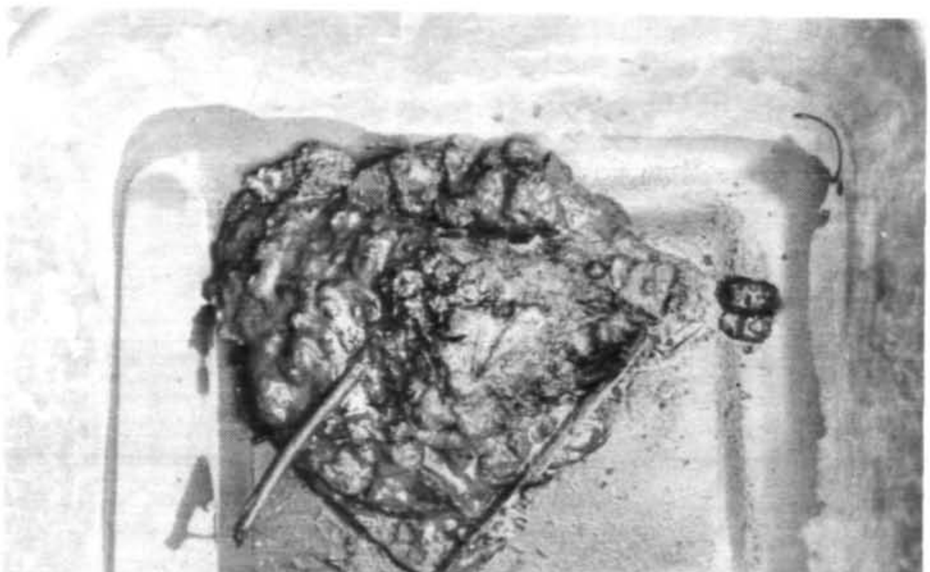


LC 11.00L

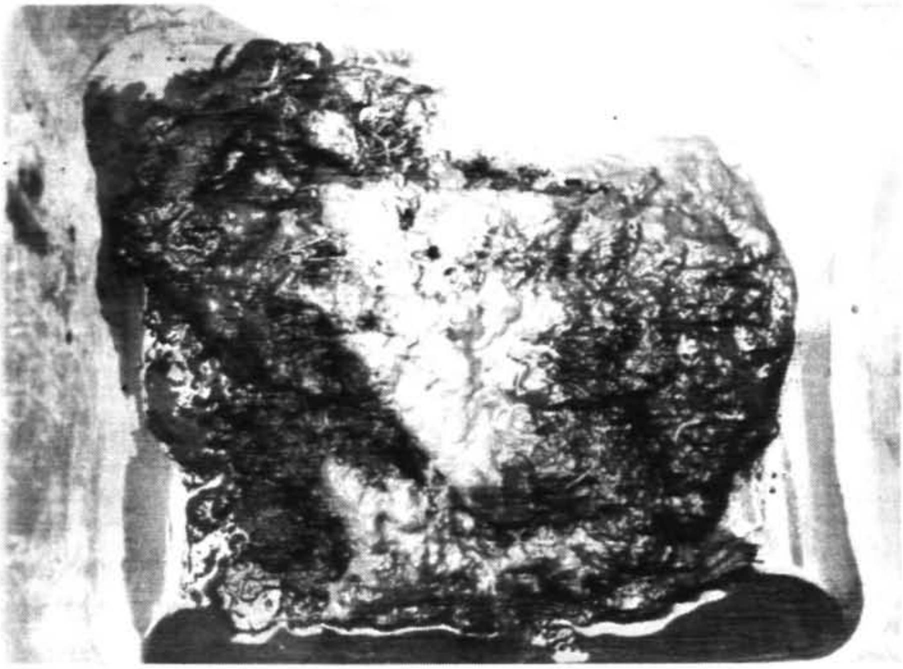
LC 11.25L



LC 11.50C



LC 11.75L



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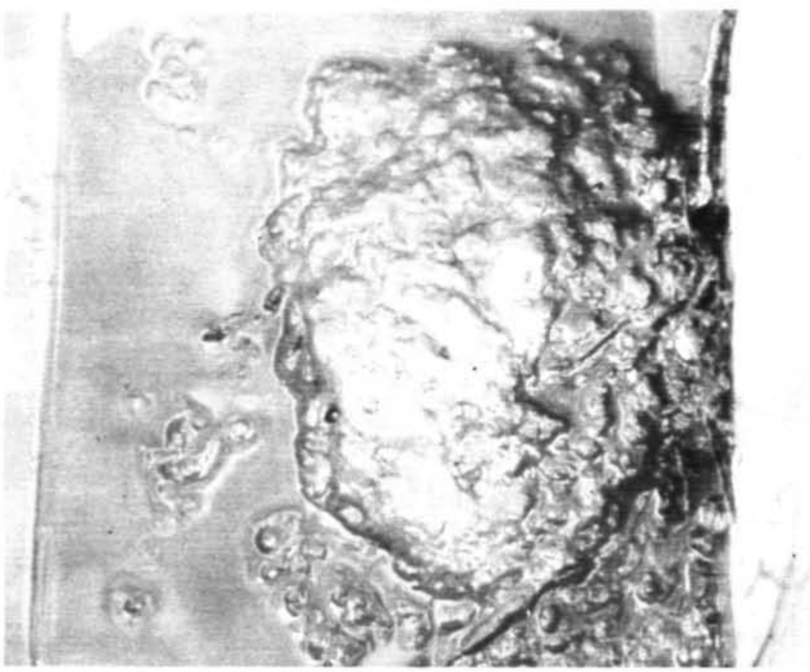

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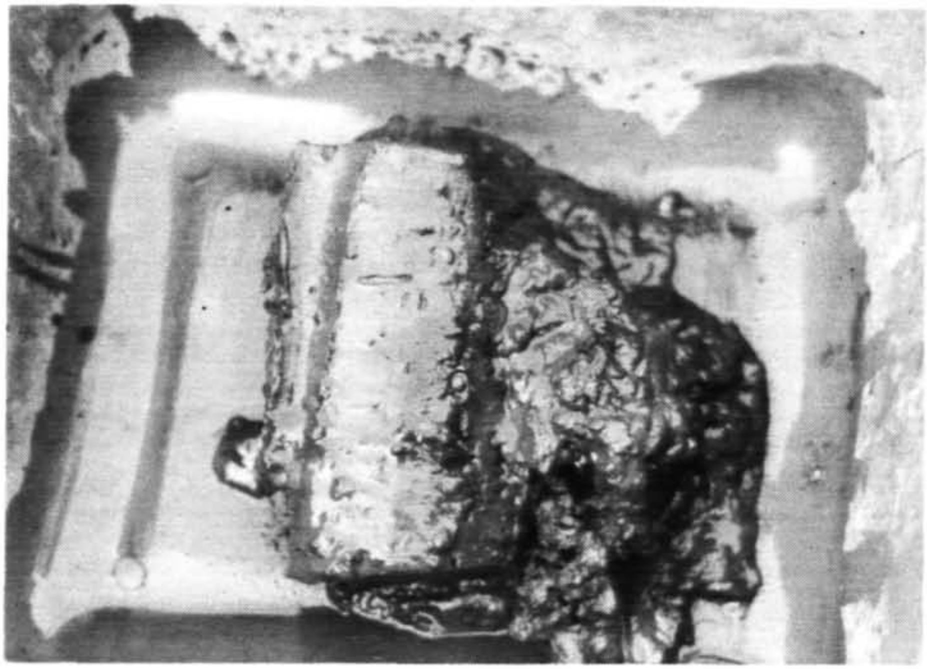

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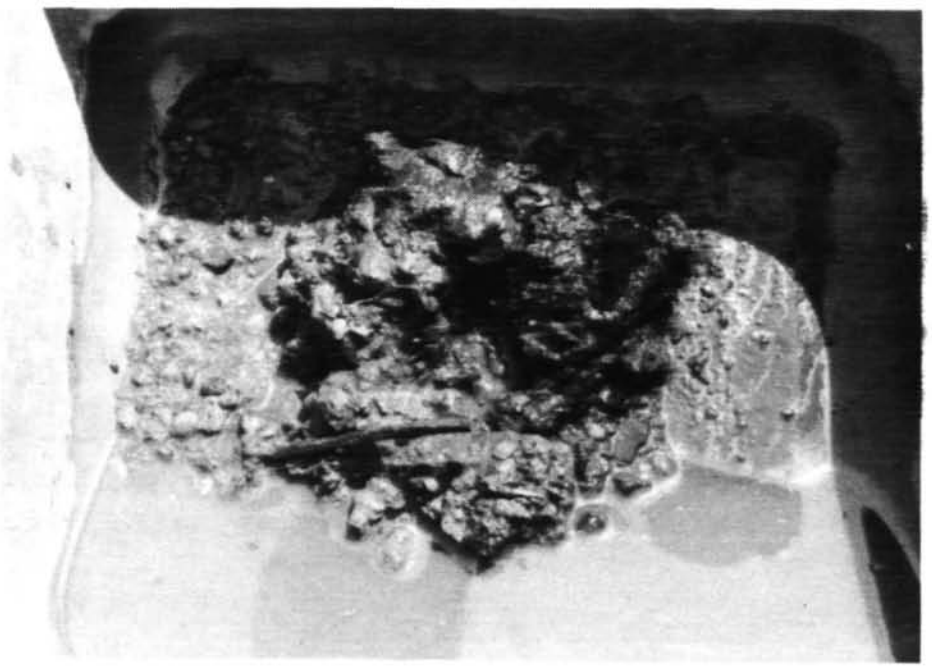
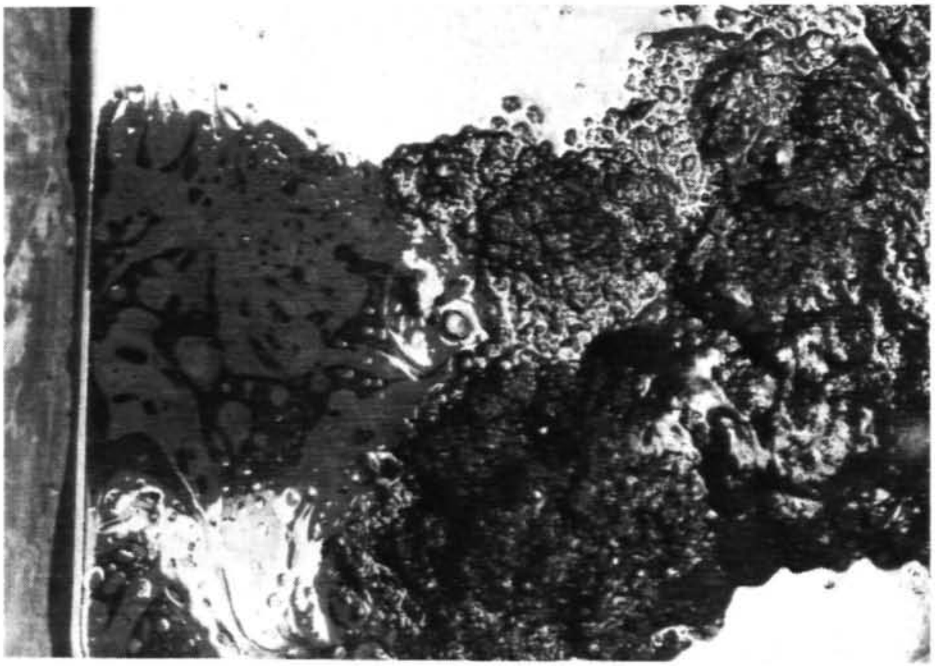
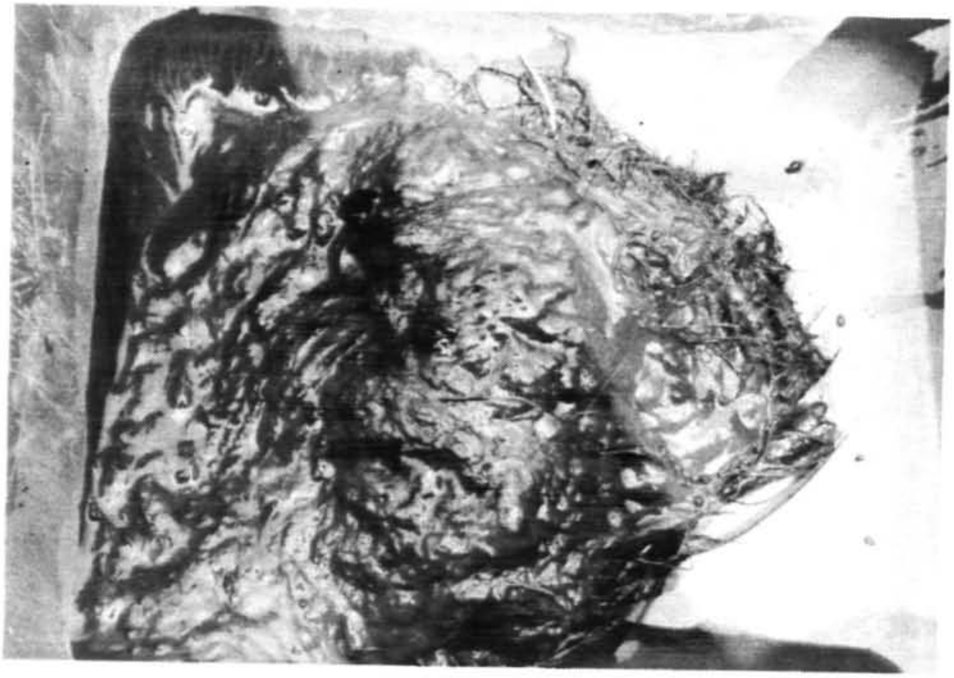


LC 12.75C



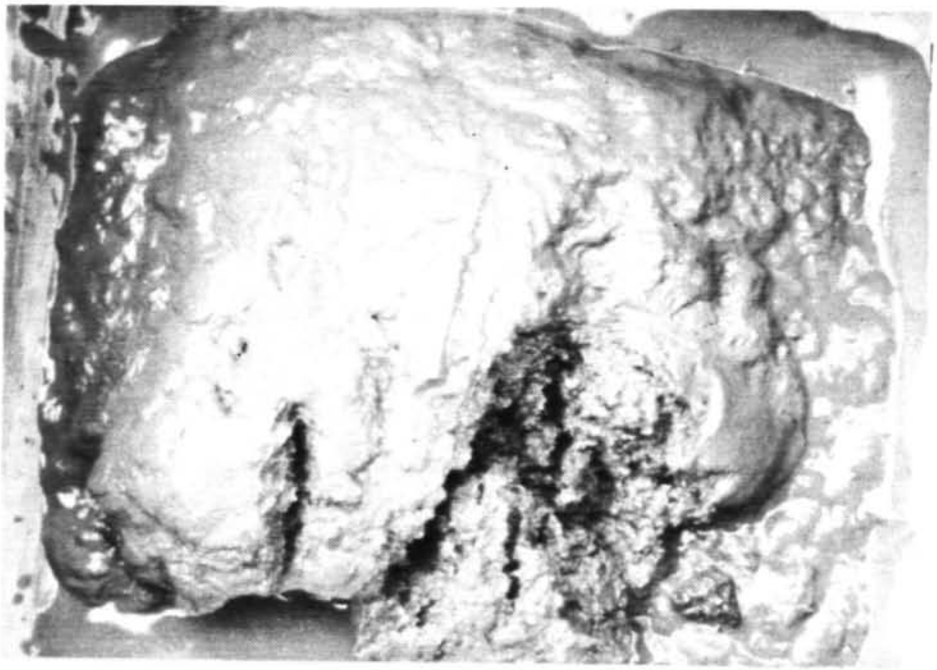
LC 13.00C

LC 13.25R

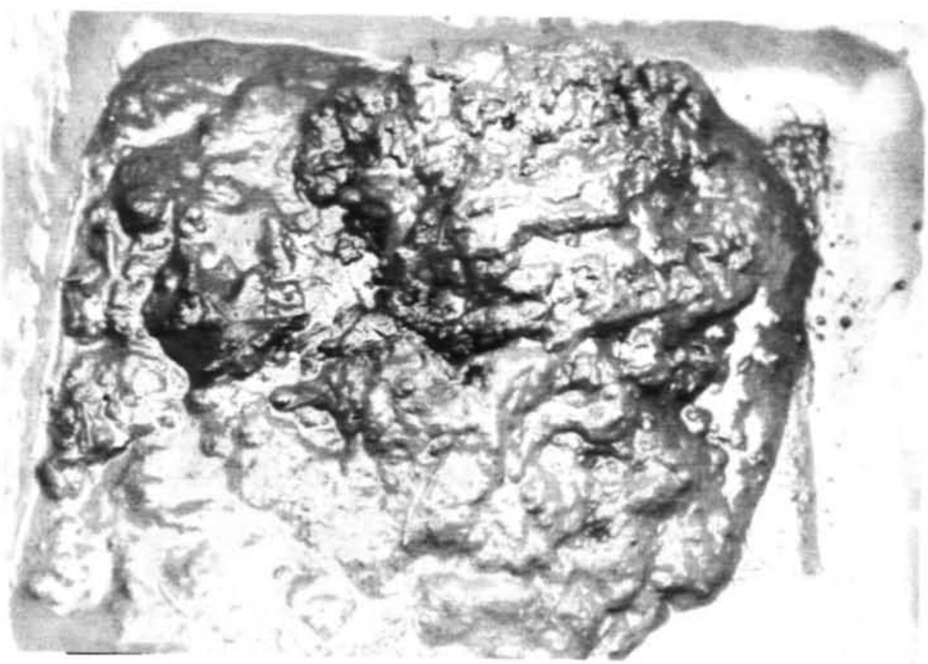


LC 13.50R

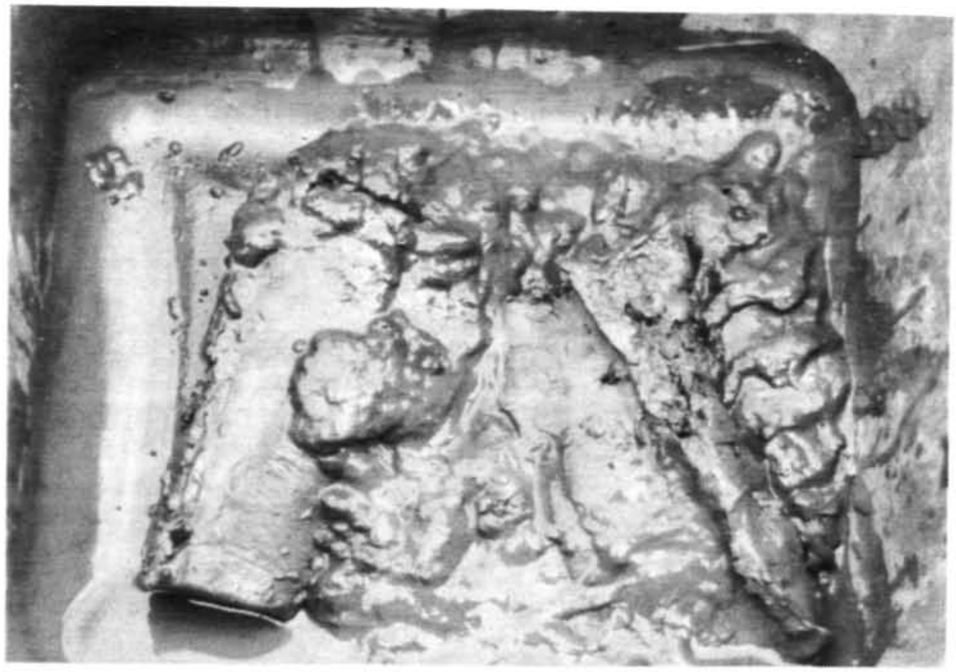
LC 13.75R



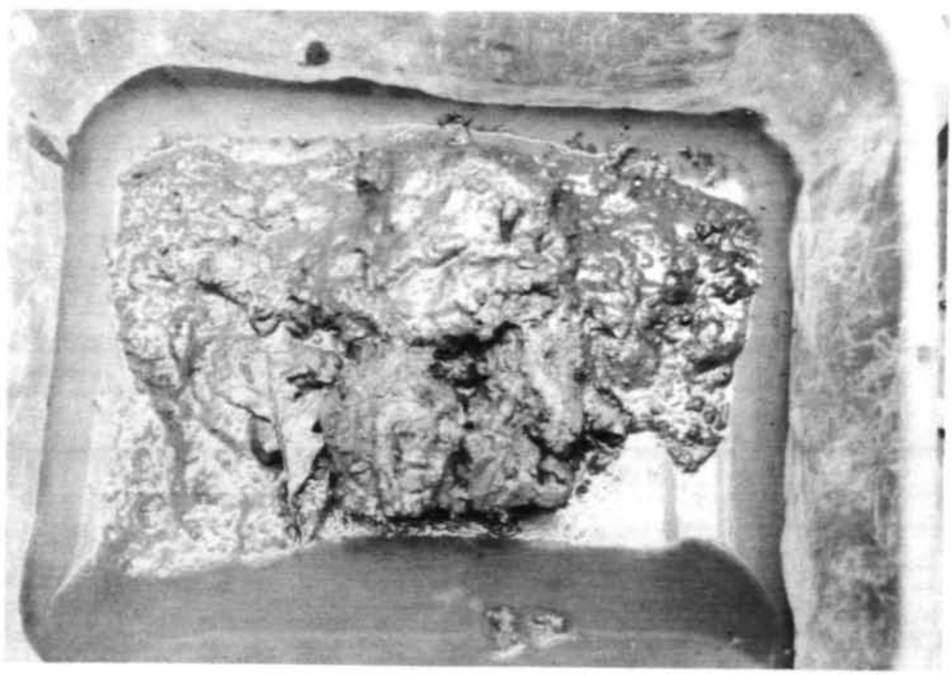
LC 14.00C



LC 14.25L



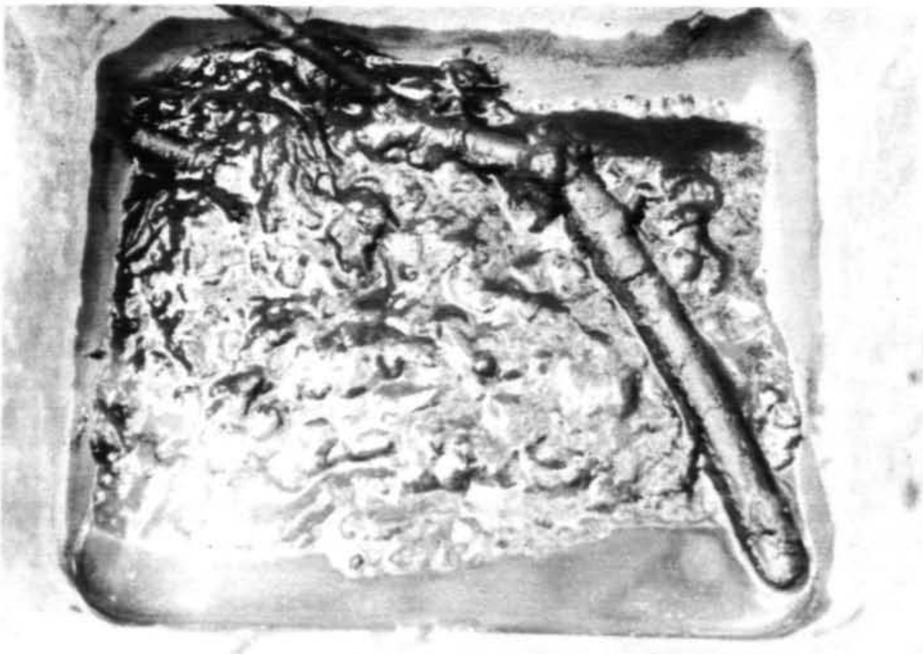
LC 14.50C



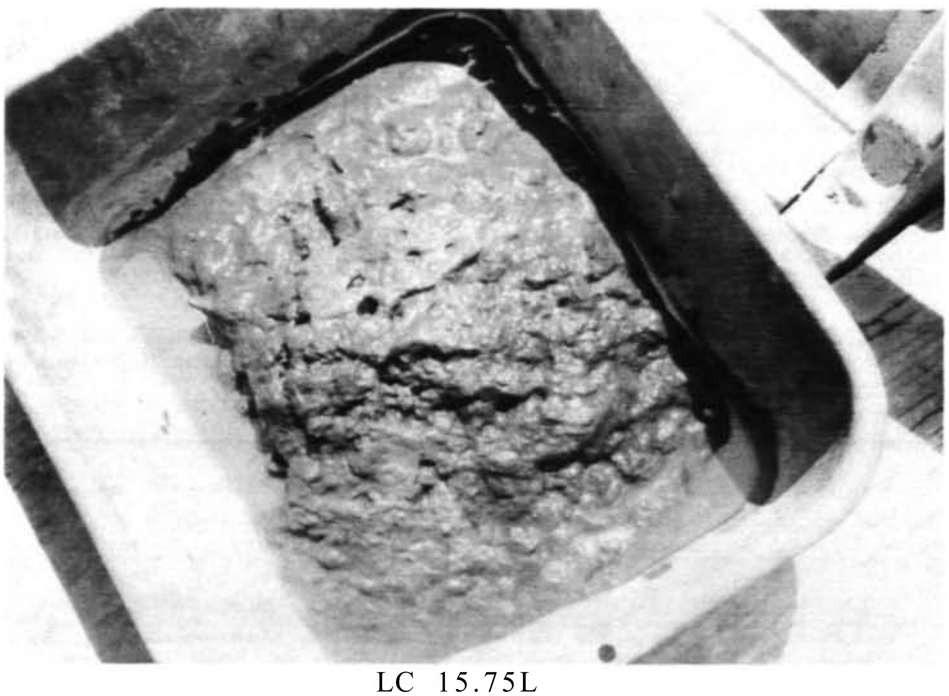
LC 14.75C

LC 15.00L

LC 15.25R

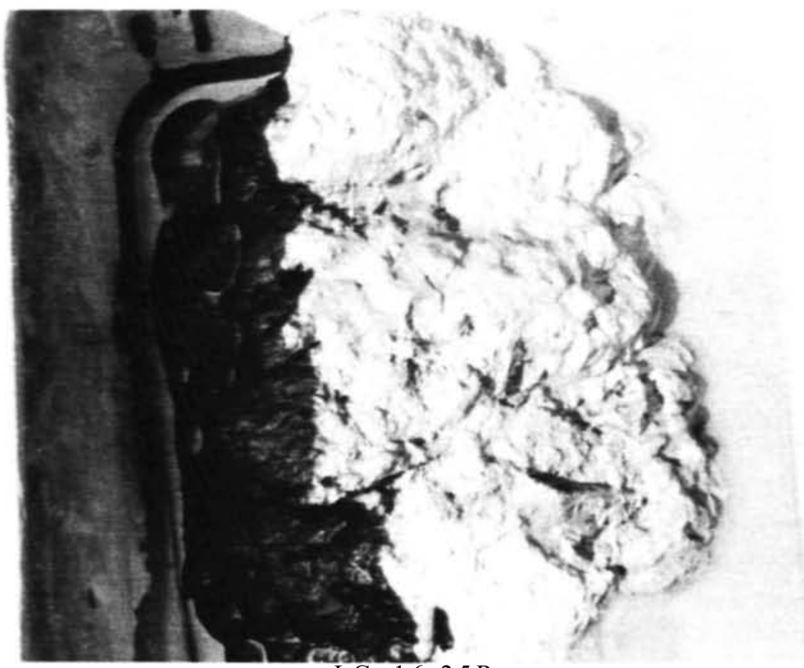


LC 15.50L

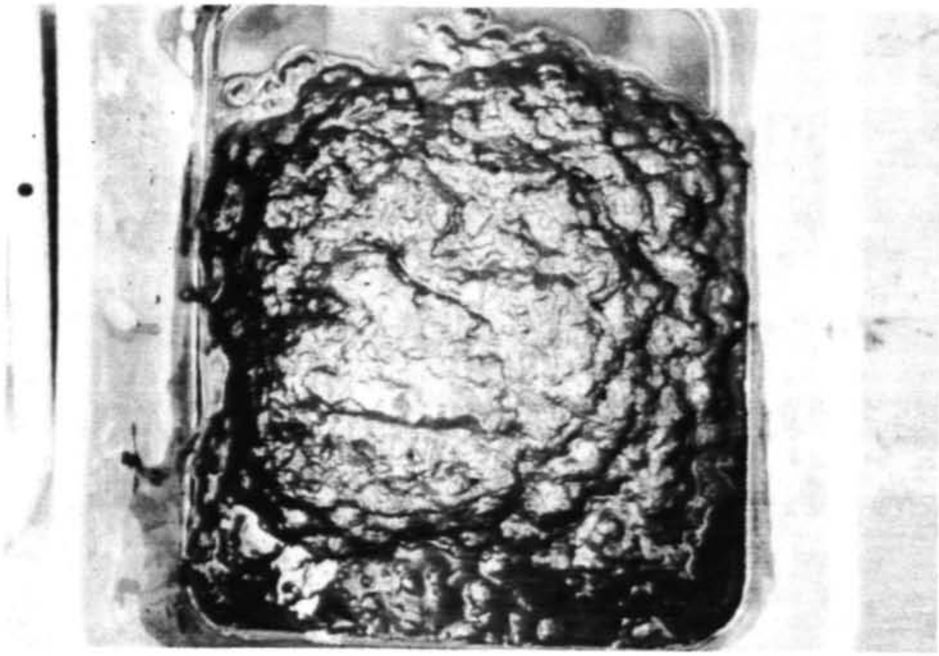


LC 15.75L

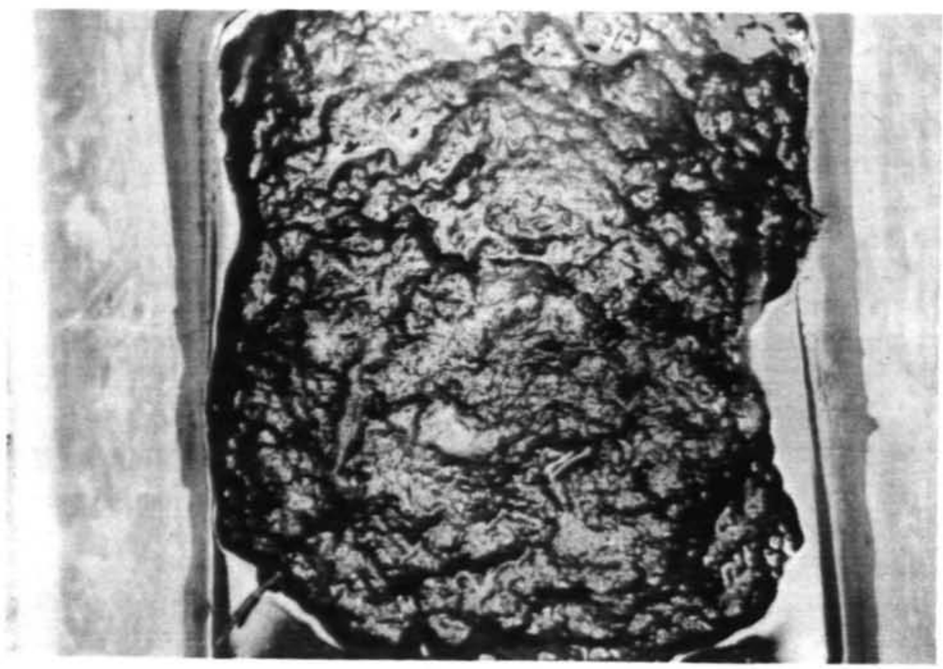
LC 16.00L



LC 16.25R



LC 16.50L



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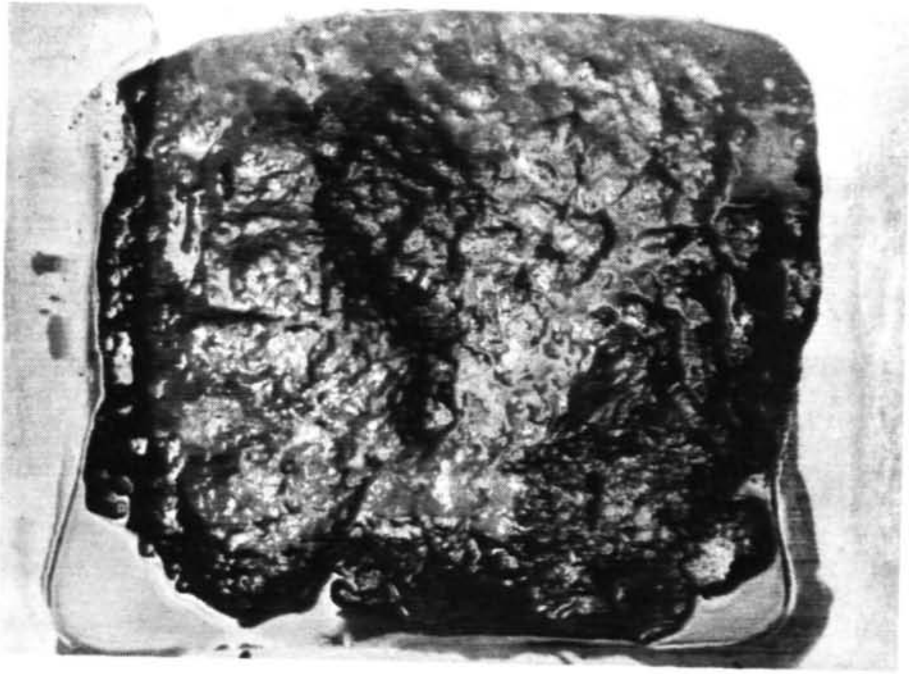

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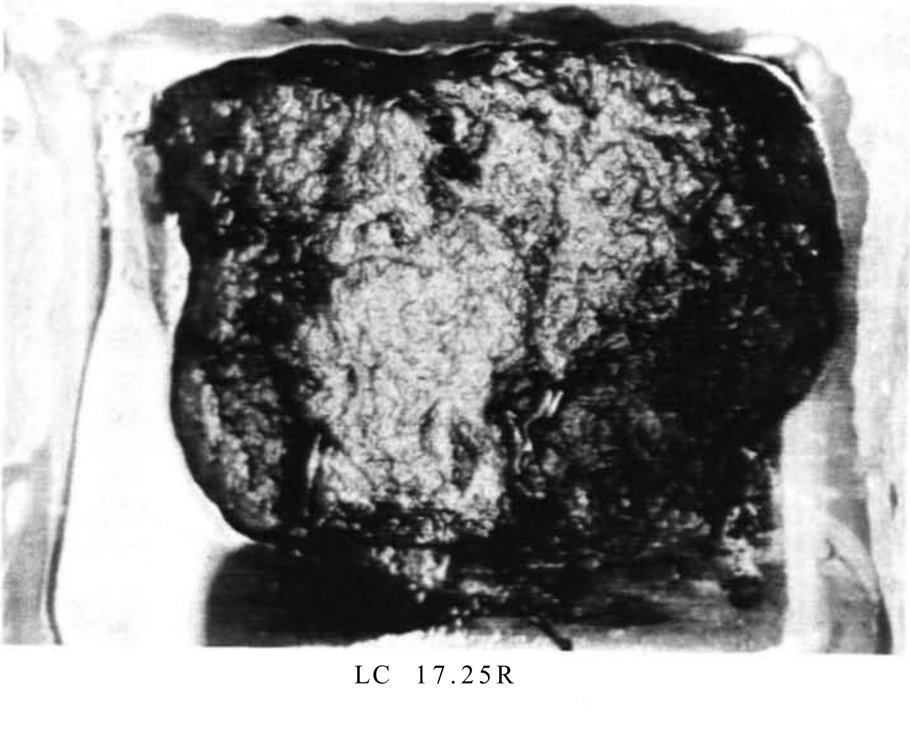

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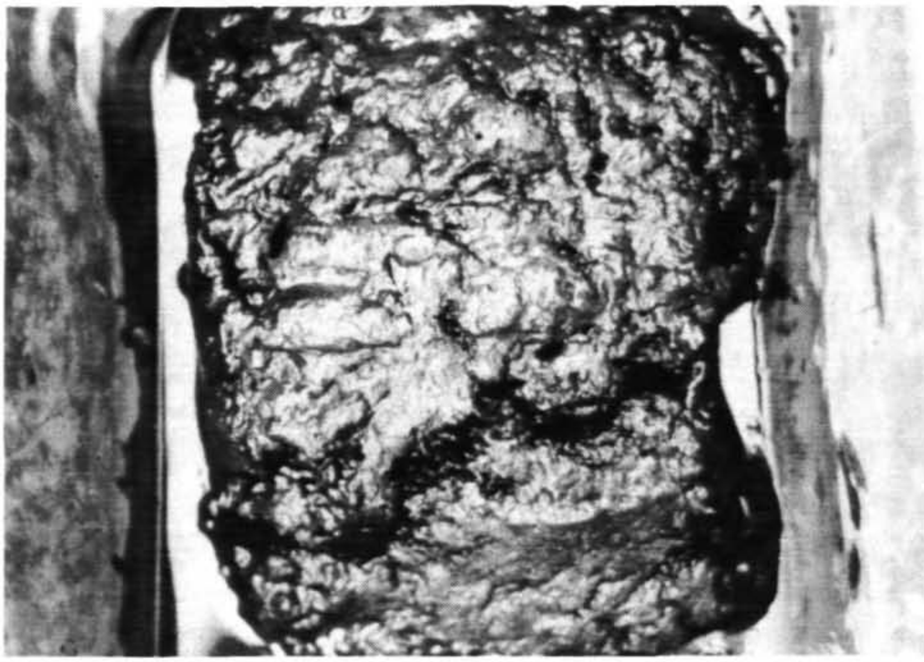
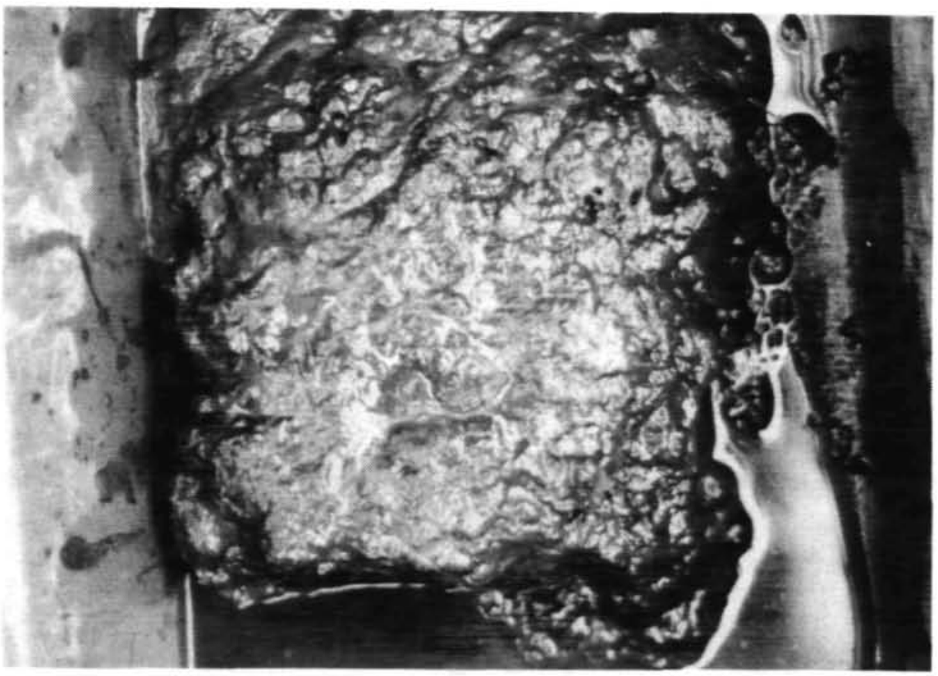
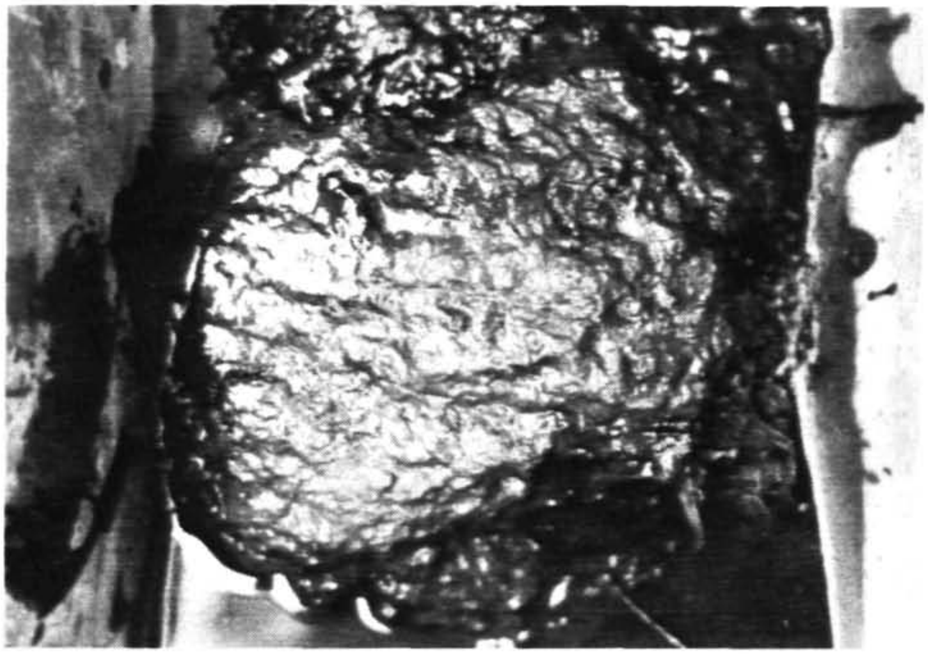


LC 17.50R



LC 17.75C



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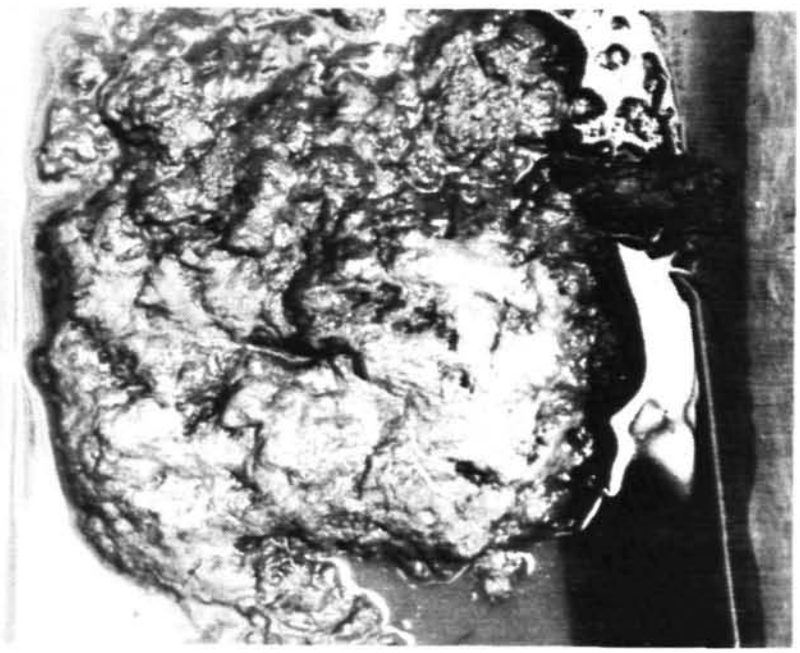
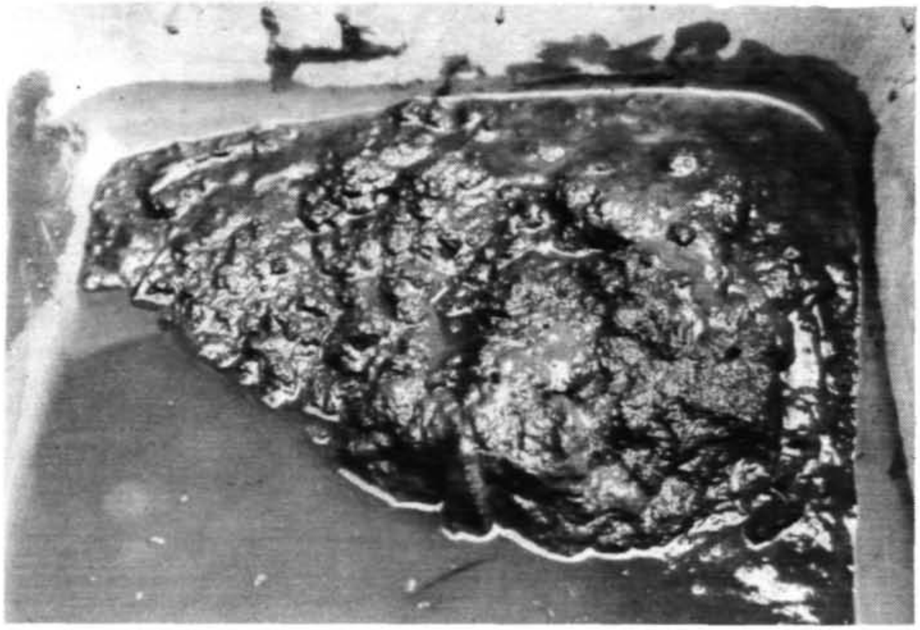
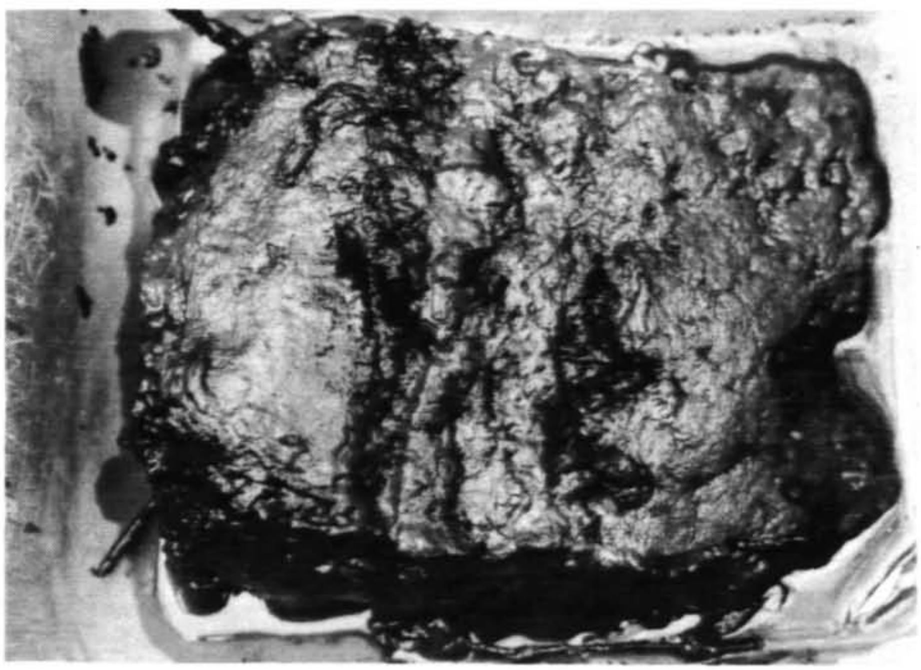


LC 18.25R



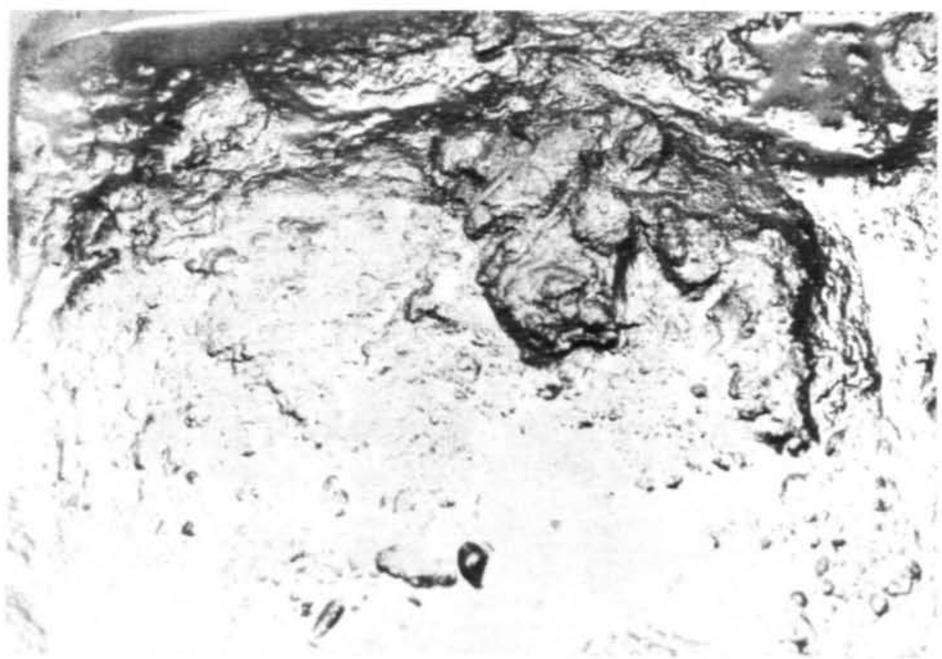
LC 18.50C



LC 18.75L

LC 19.00C

Grand Calumet River



GC 0.2 5R

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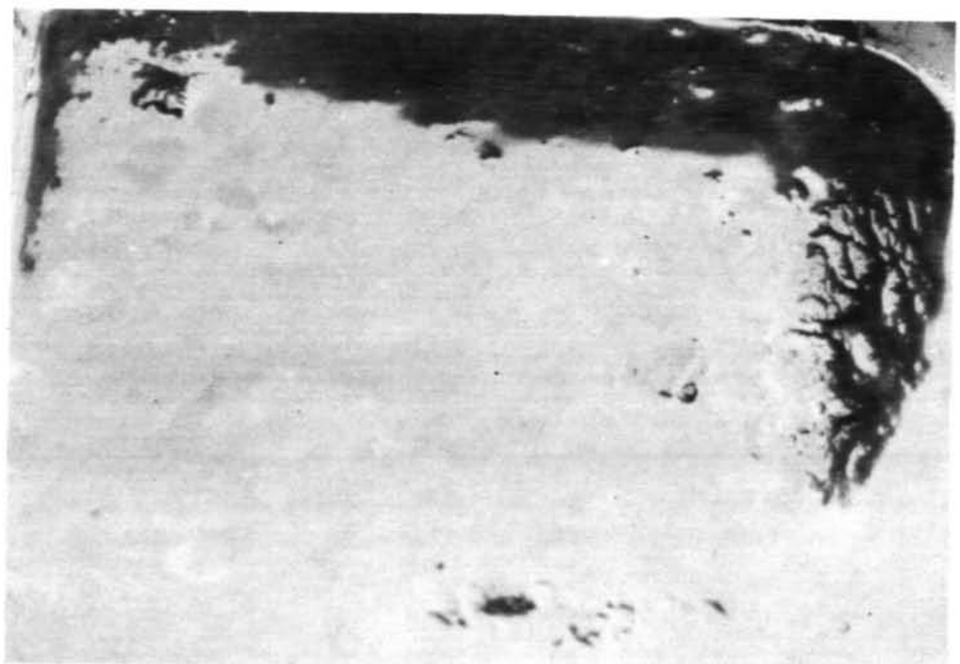

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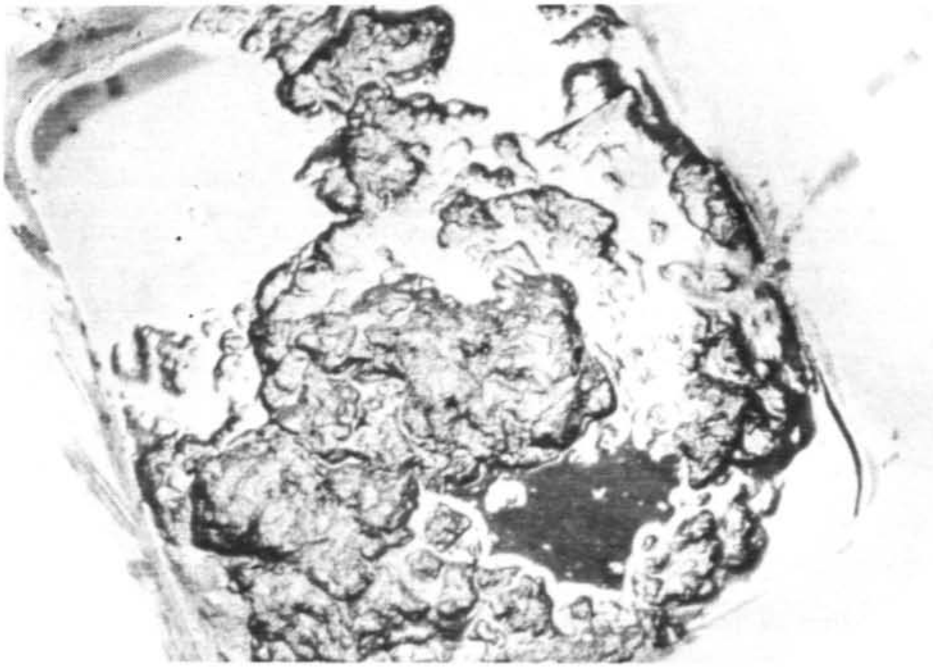

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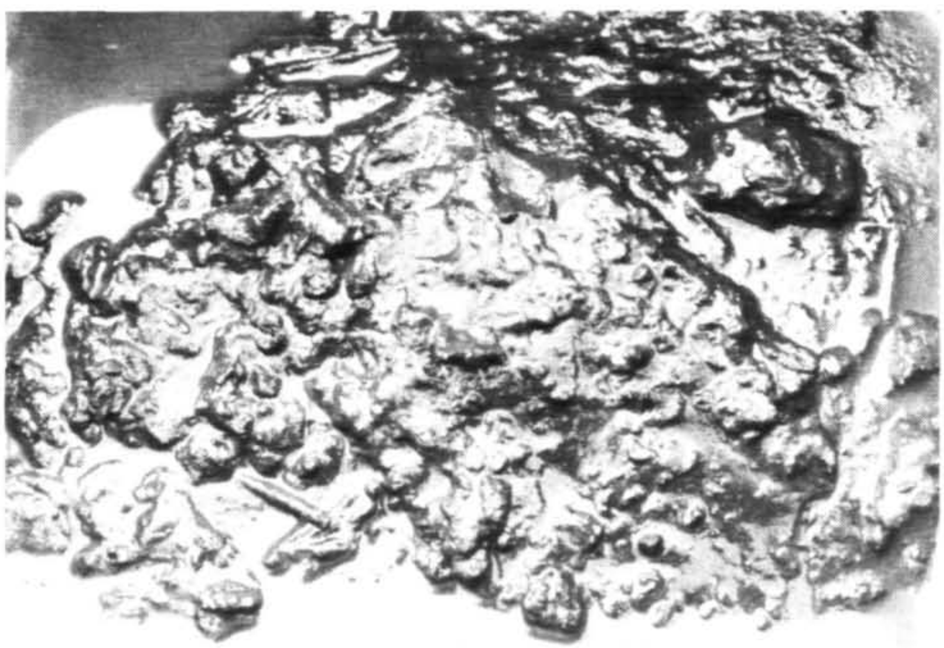

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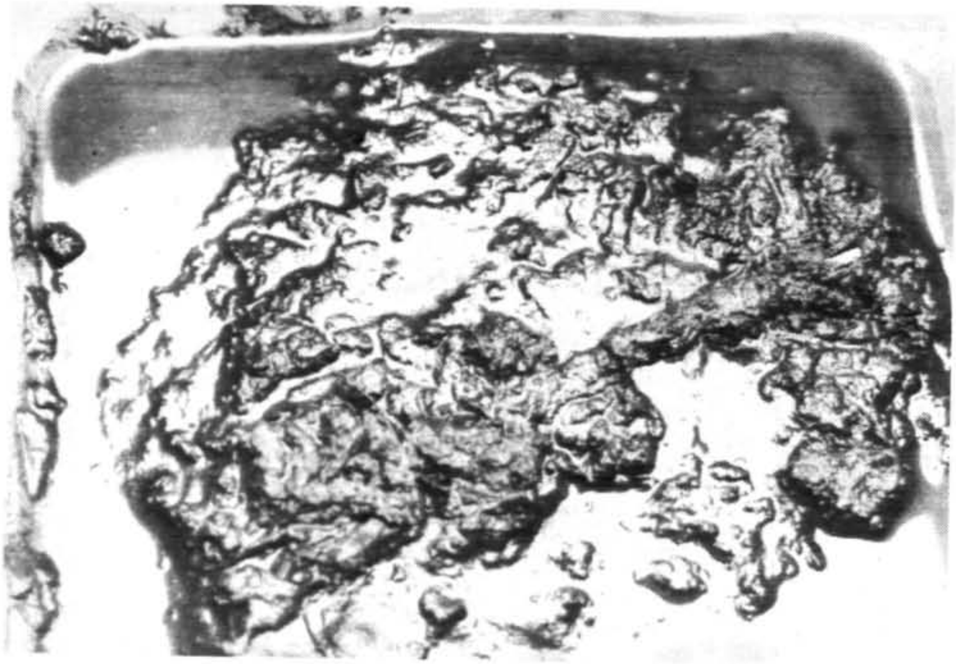

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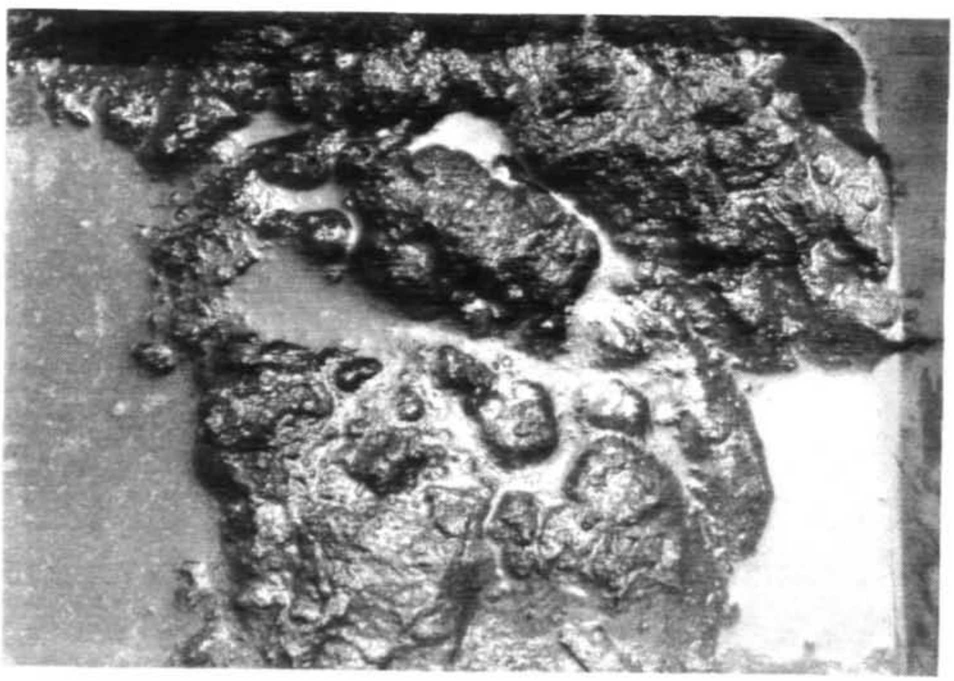

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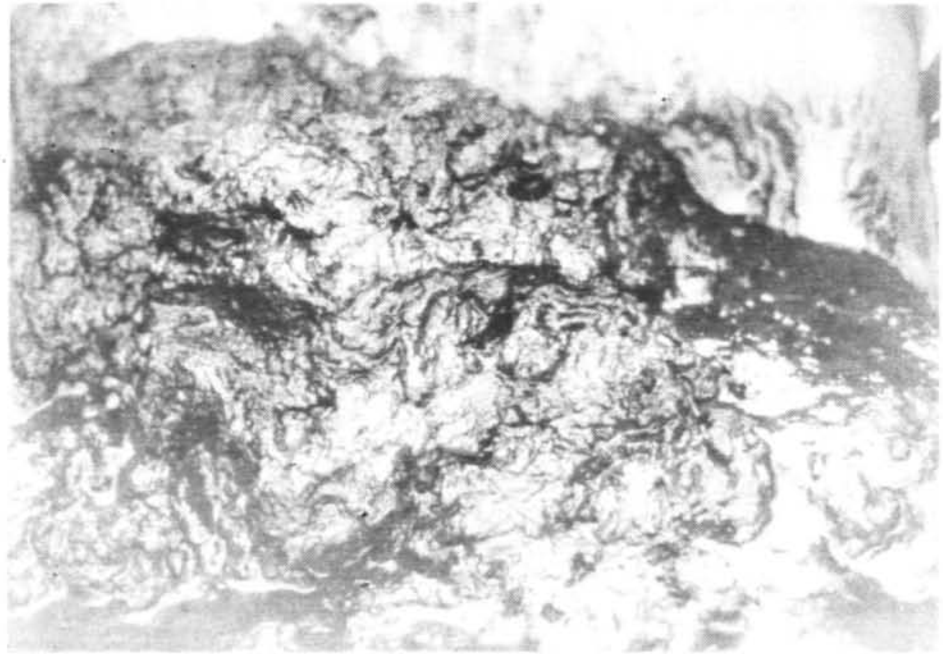

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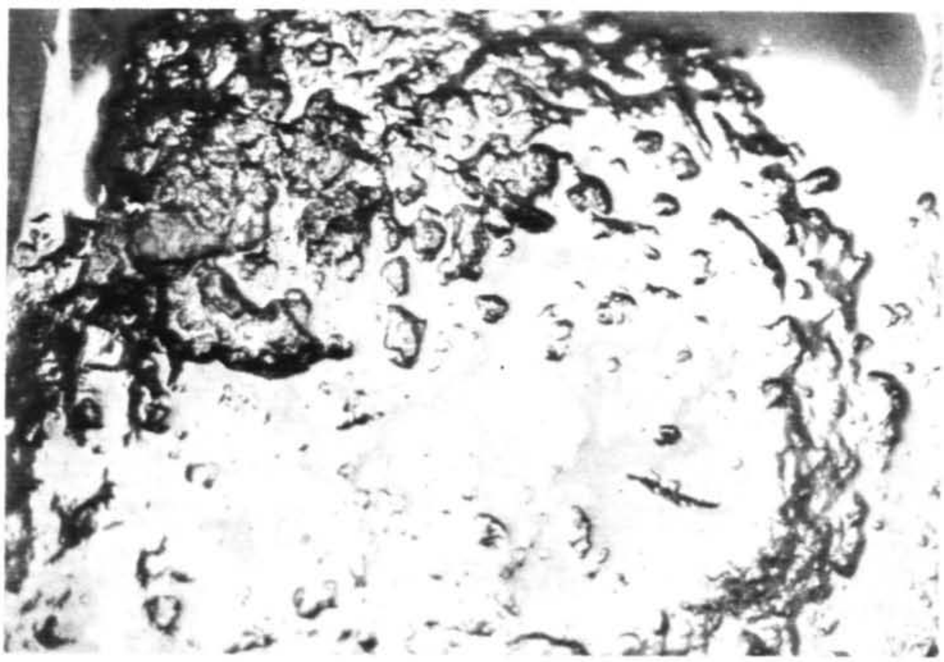

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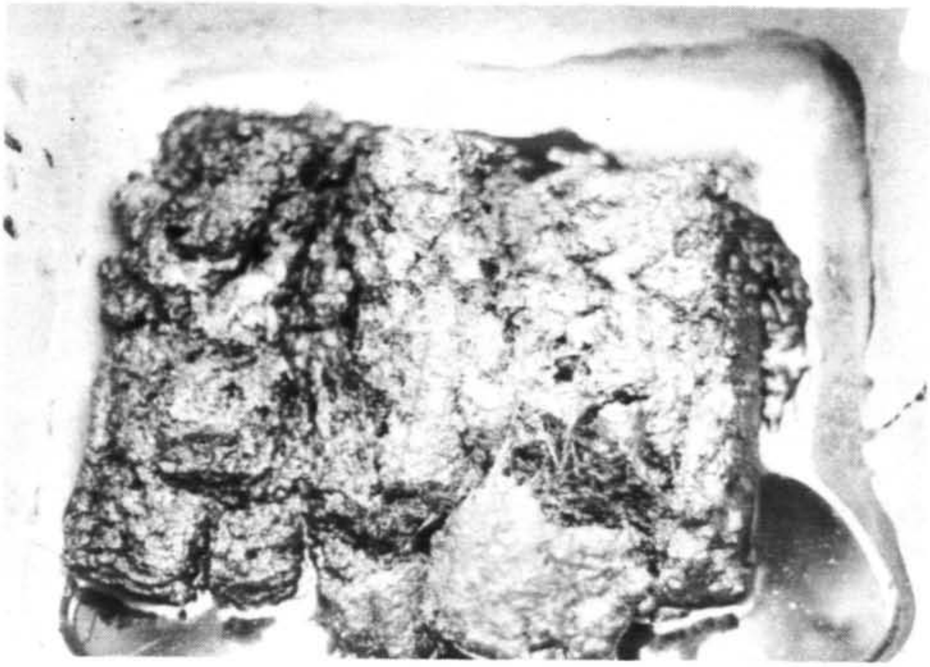

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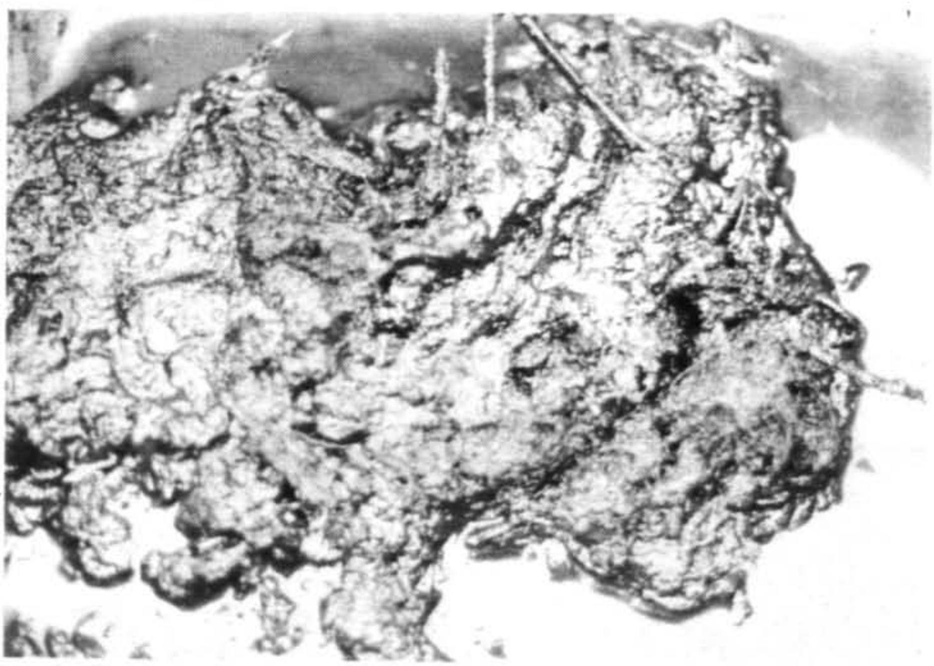

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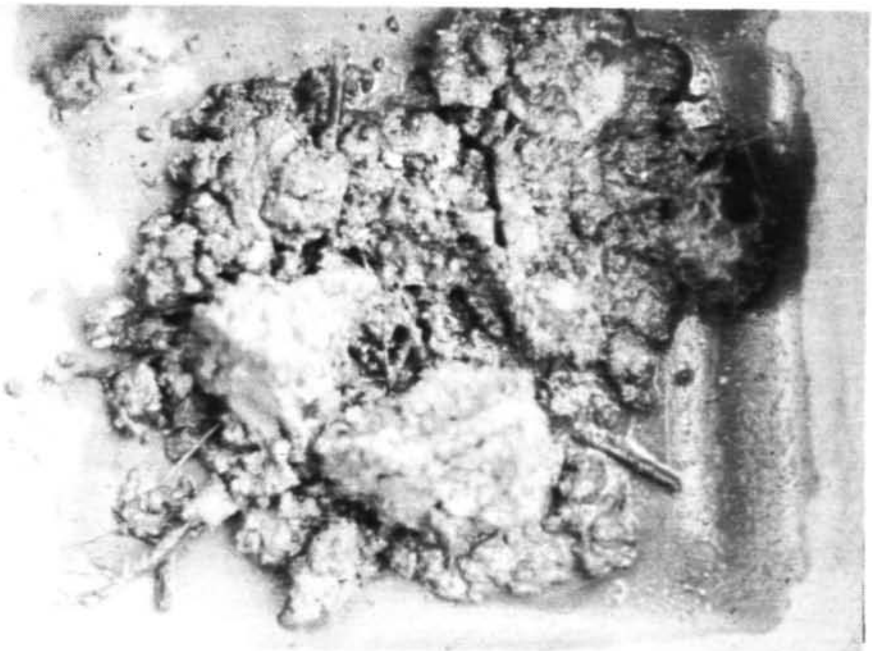

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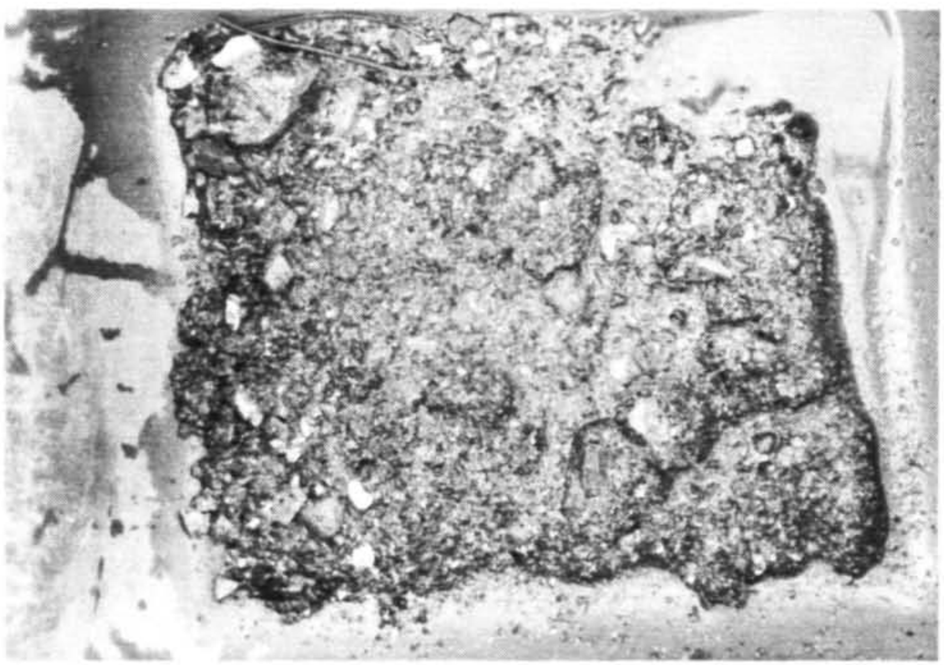

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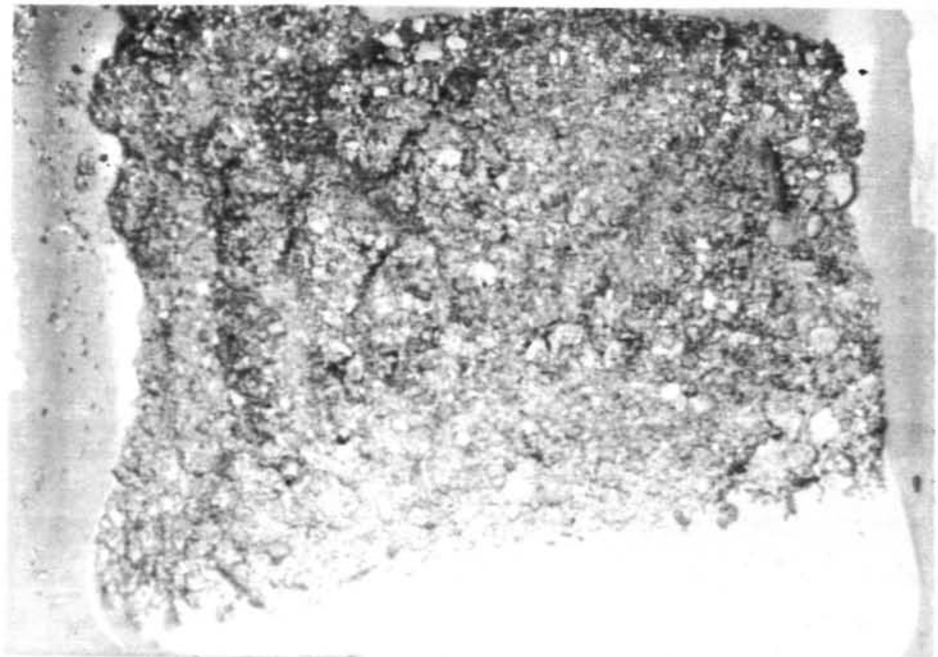

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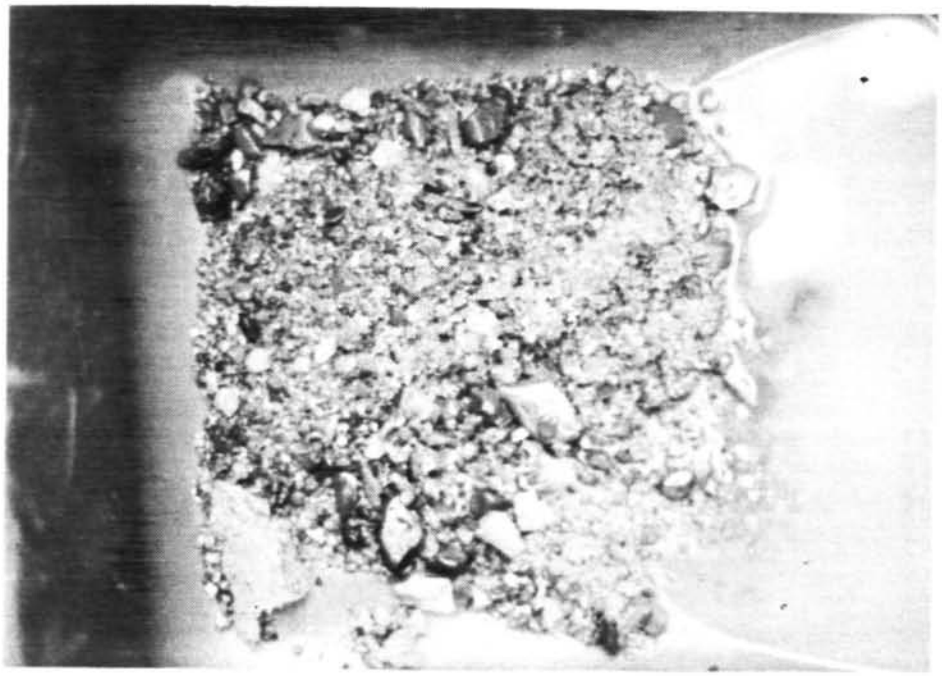

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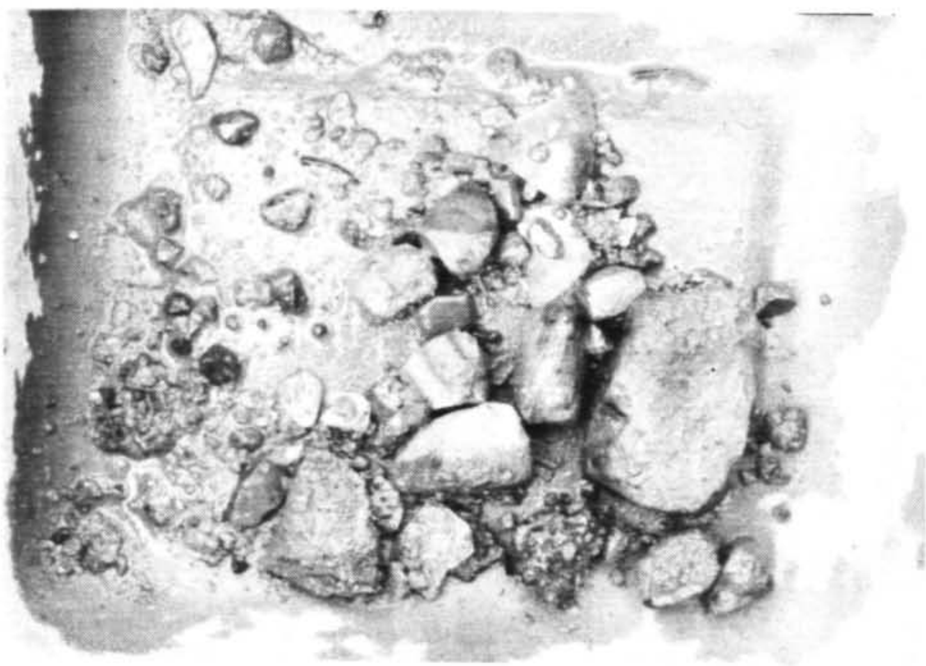

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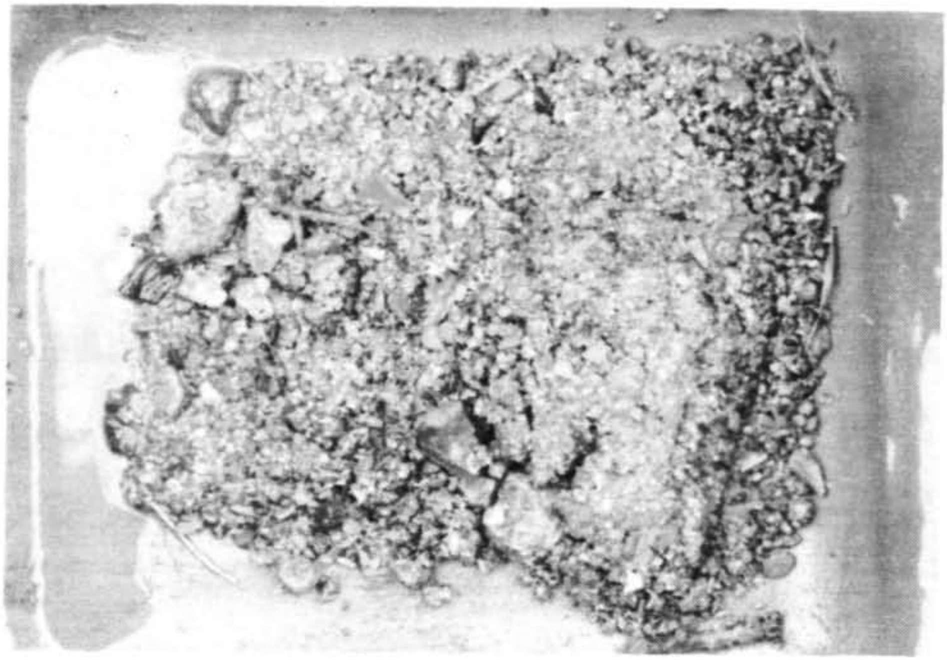

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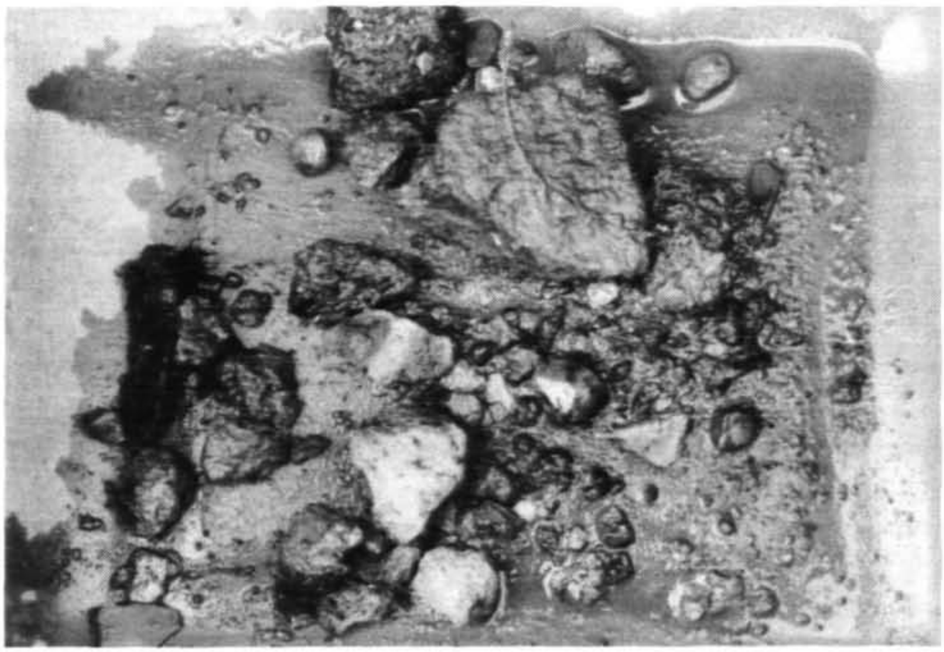

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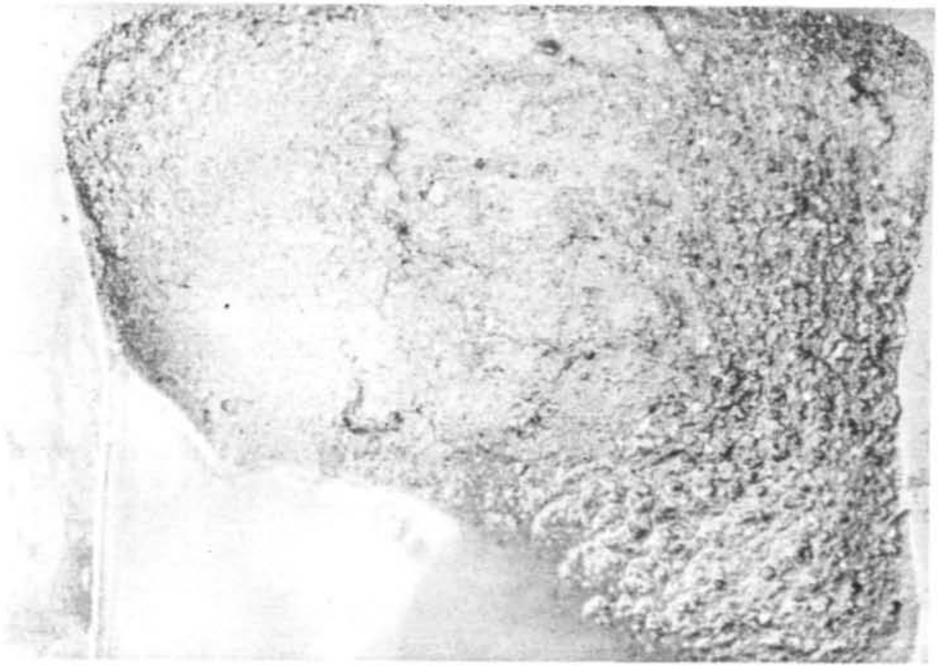

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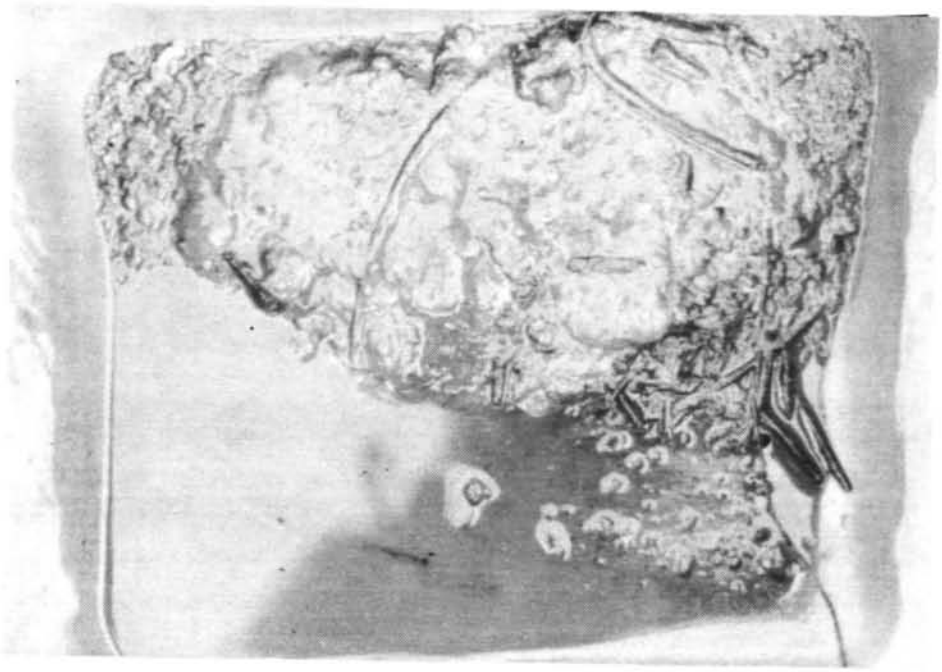
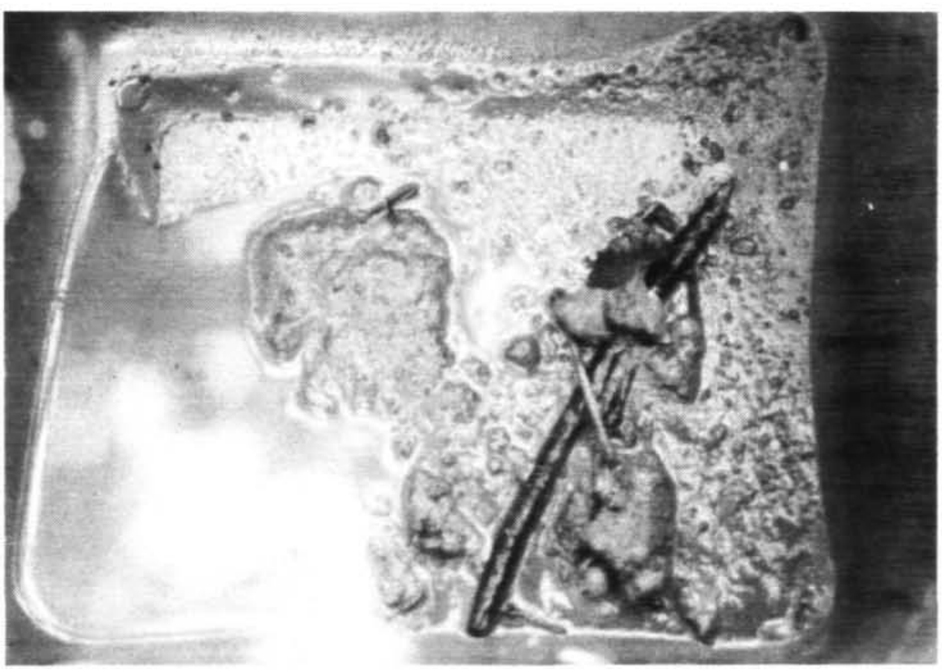


CU 2.50C

CU 2.75C

CU 3.00C



CU 3.25C

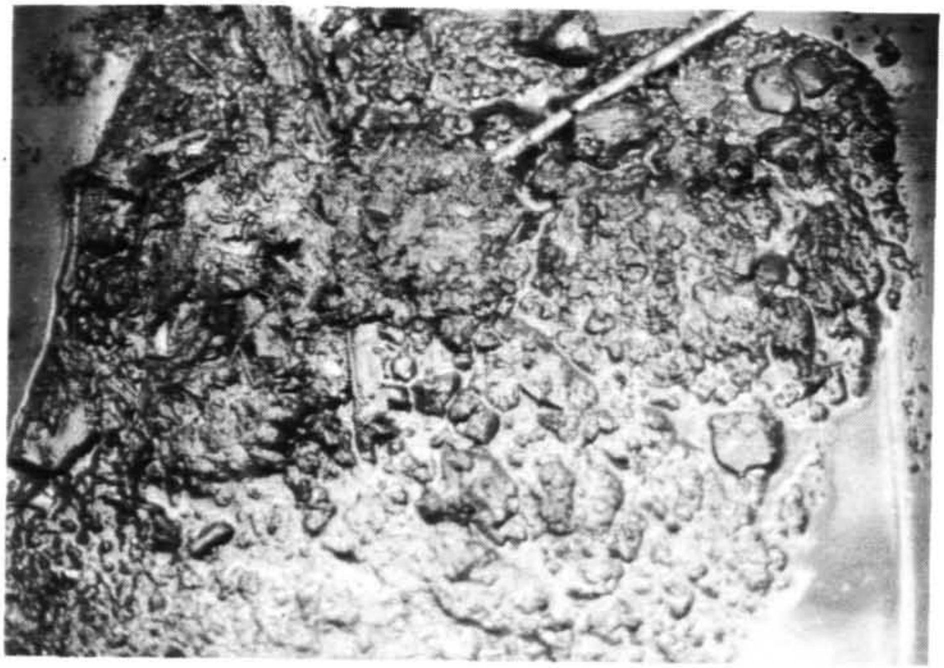
CU 3.50C

Addison Creek

AC 0.00C

AC 0.25C

AC 0.50C



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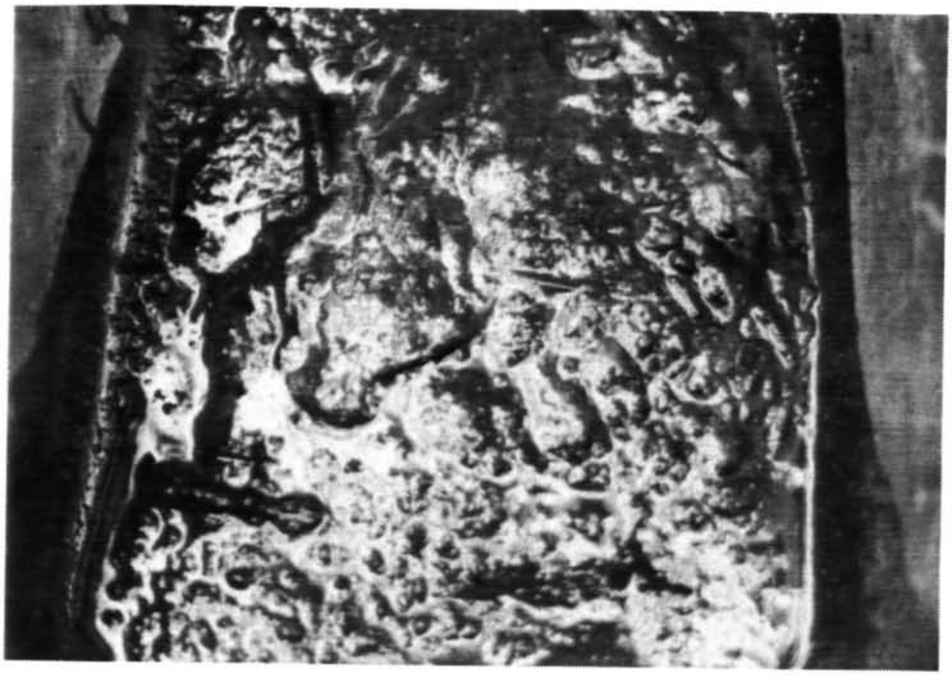

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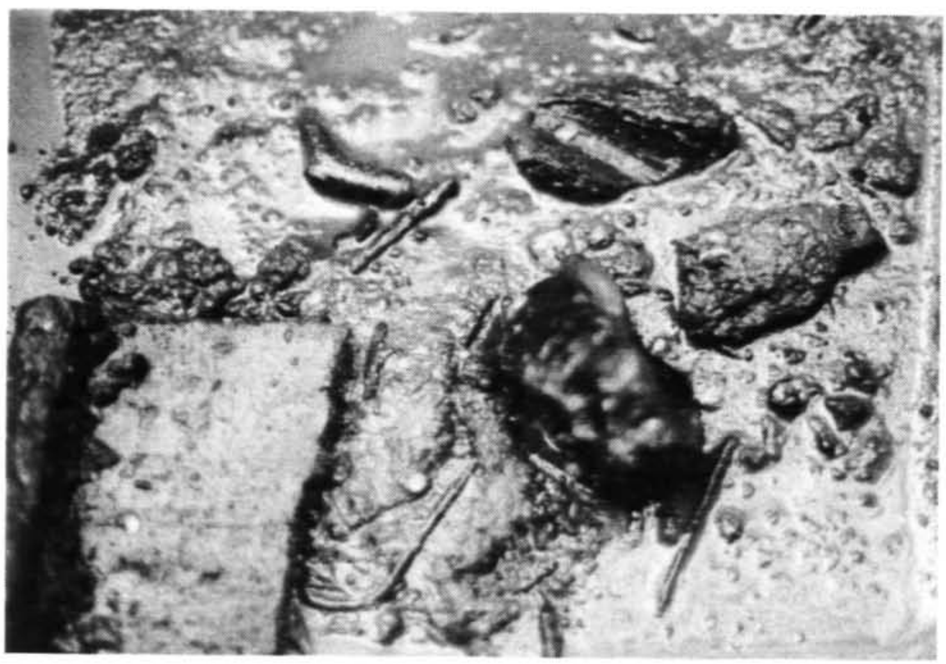

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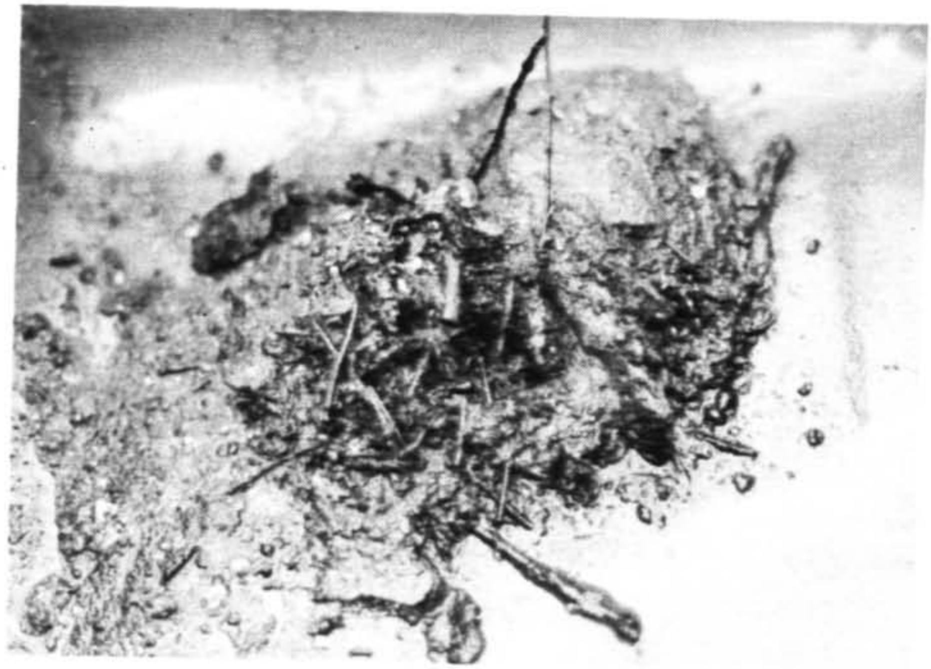

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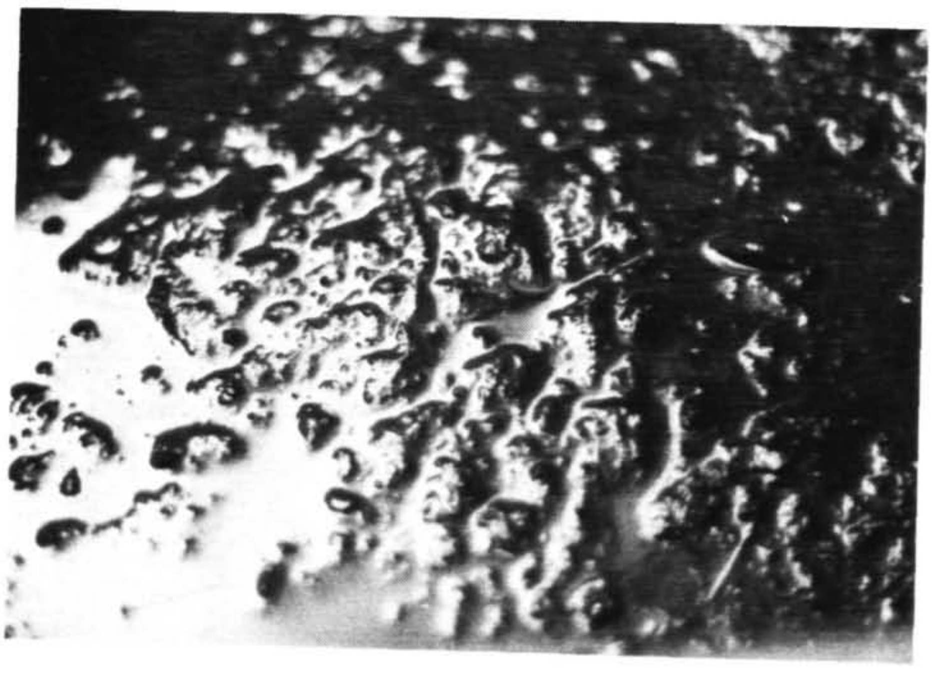

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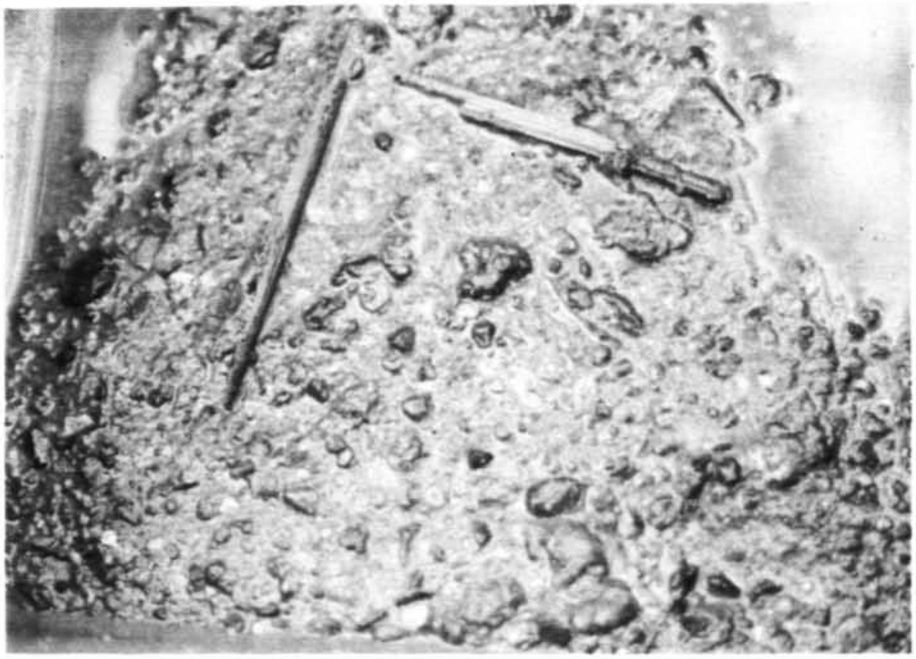

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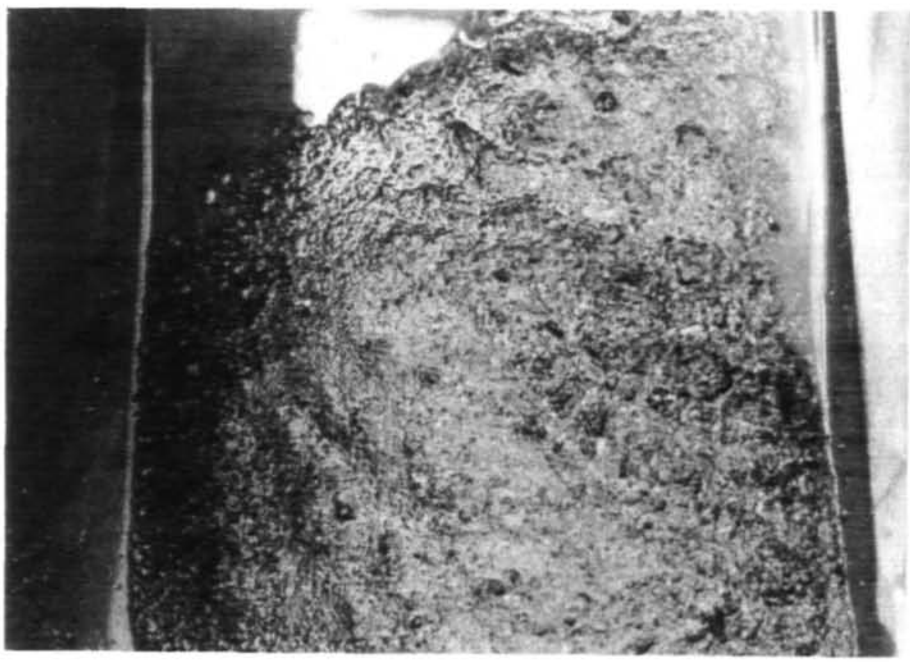

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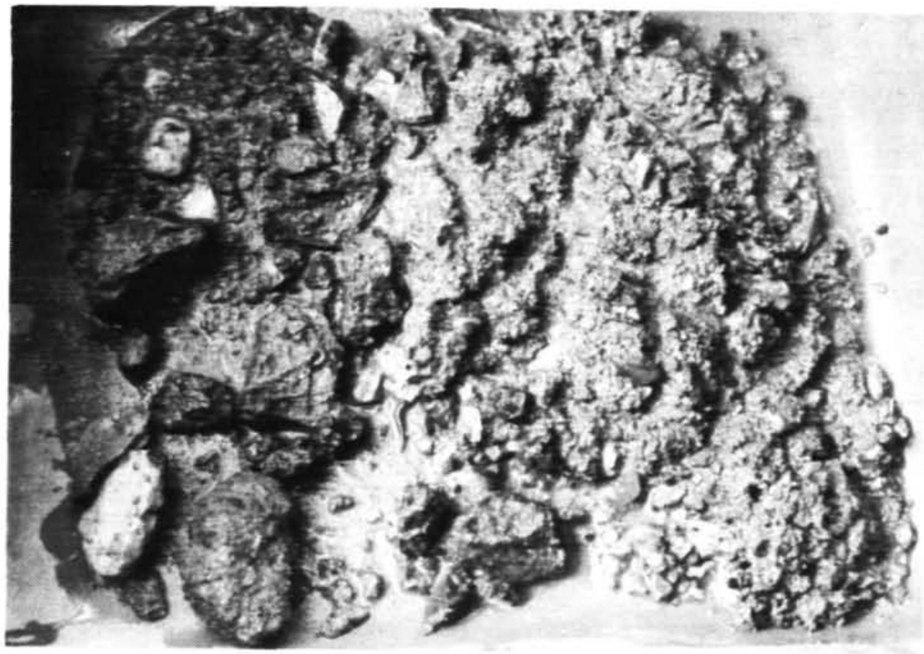

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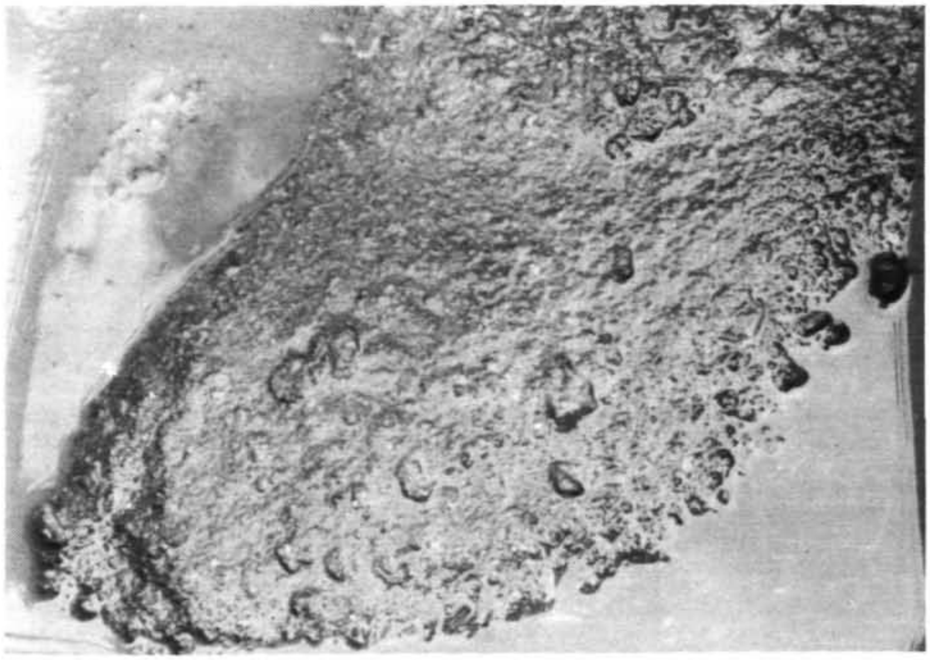

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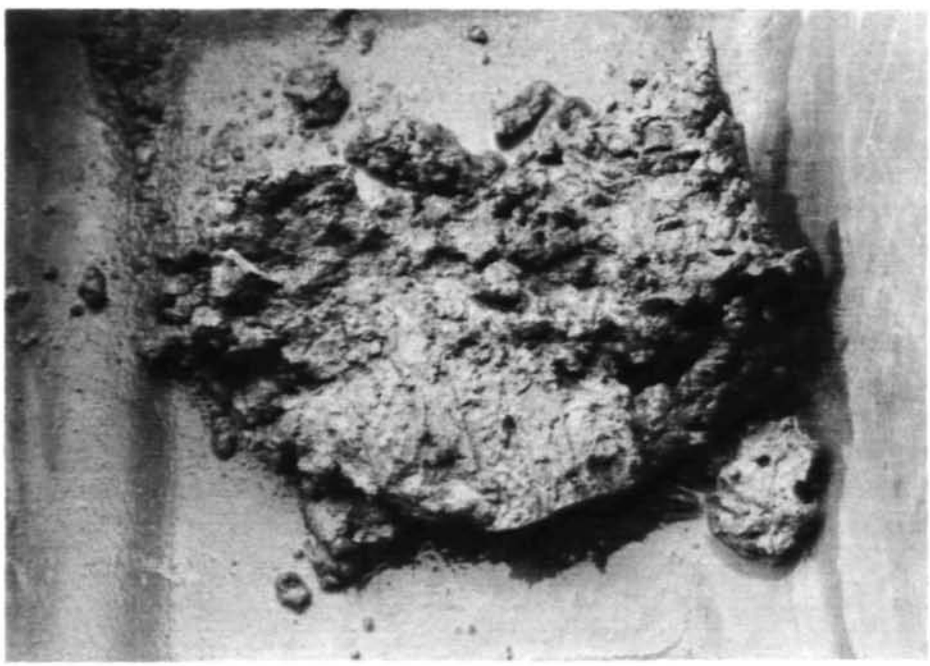

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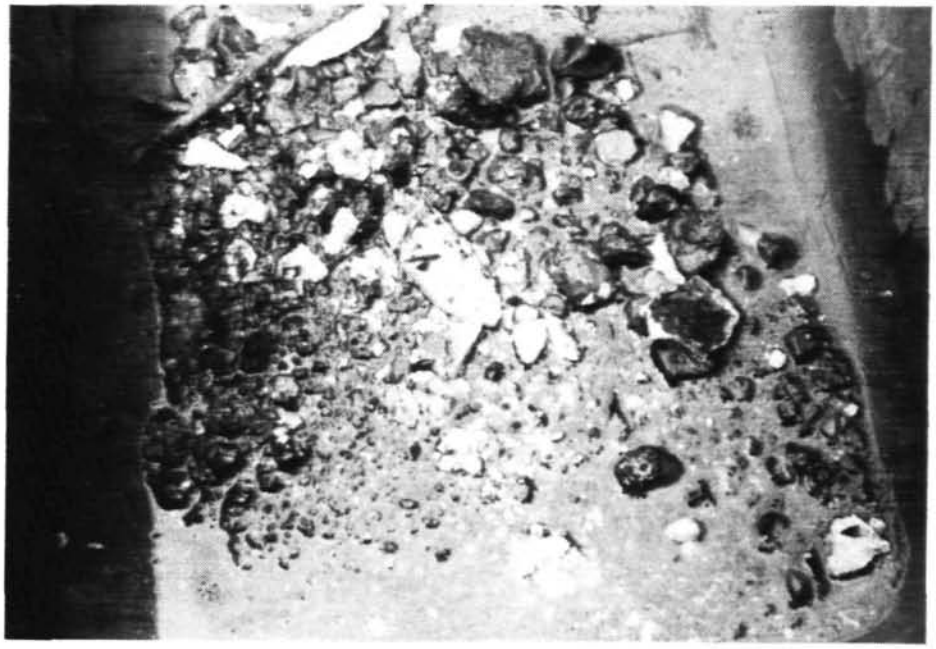

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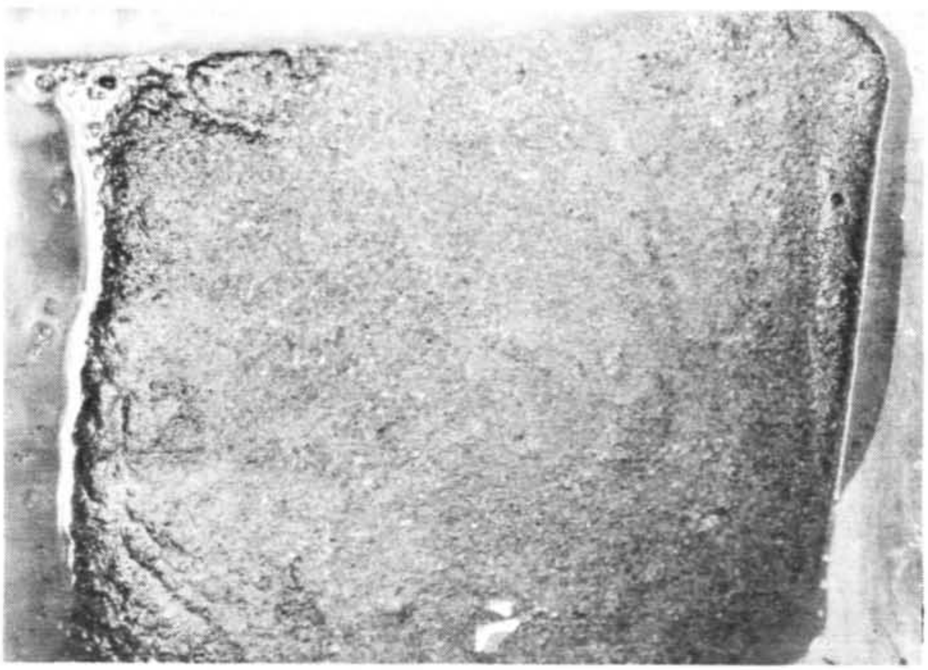

AC 4.50C

AC 4.75C

AC 5.00C

AC 5.25C

AC 5.50C

AC 5.75C

AC 6.00C

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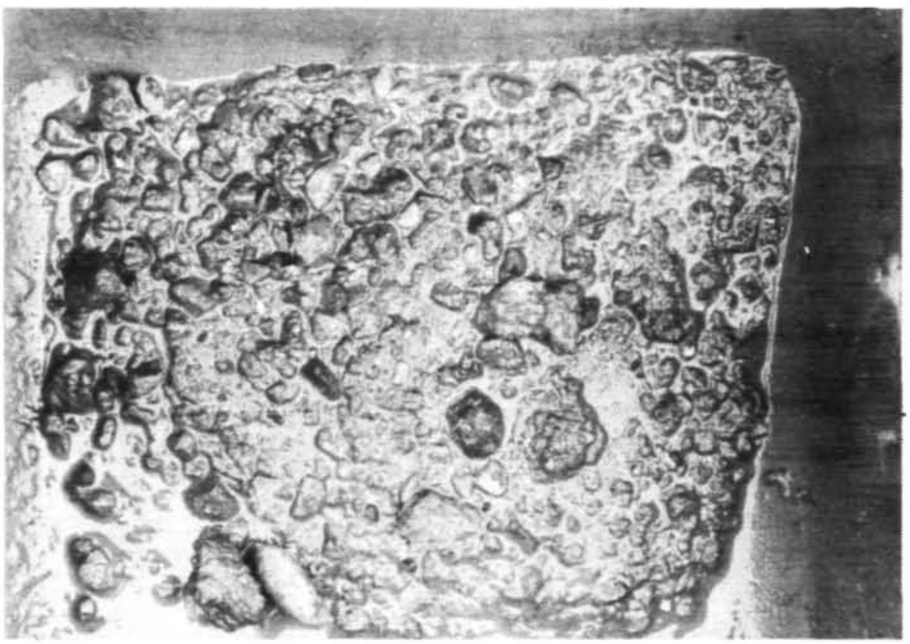

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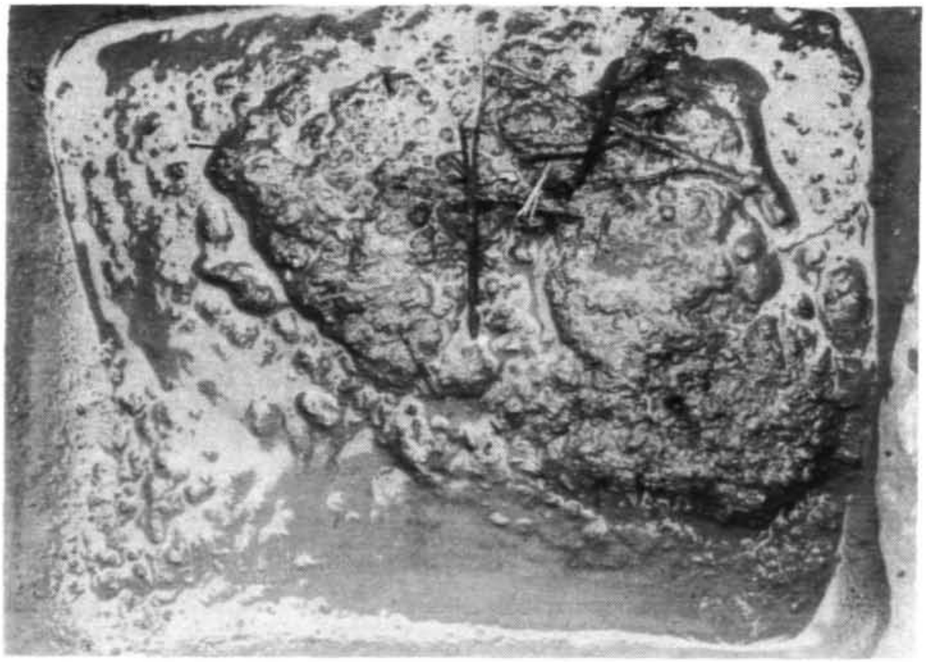

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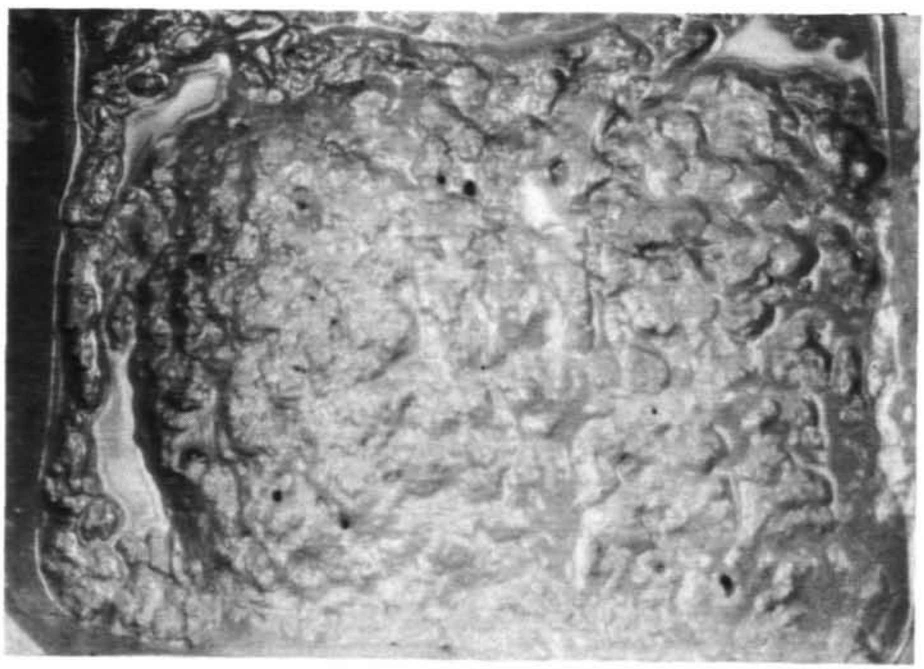

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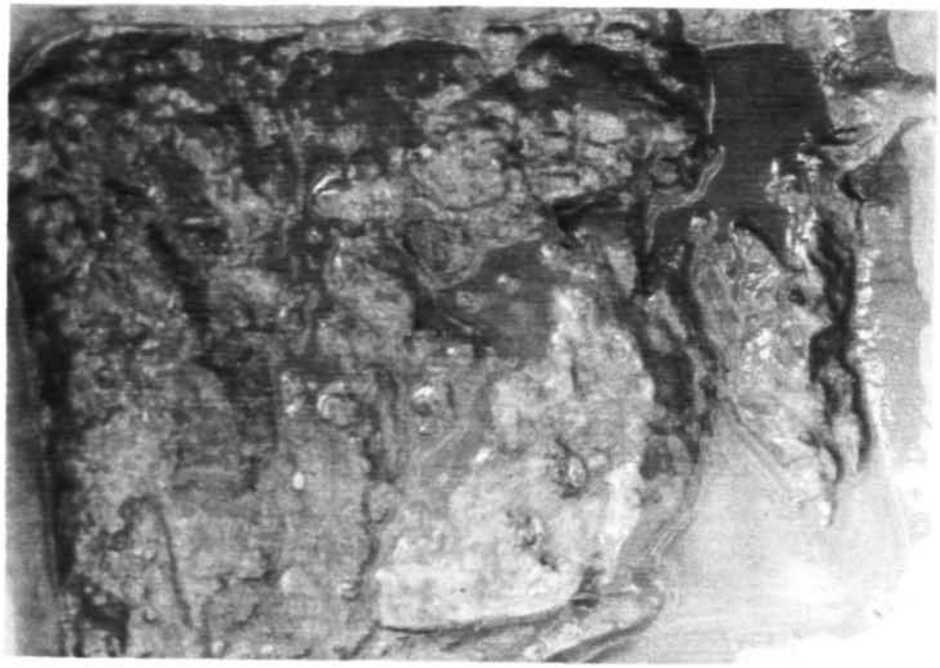

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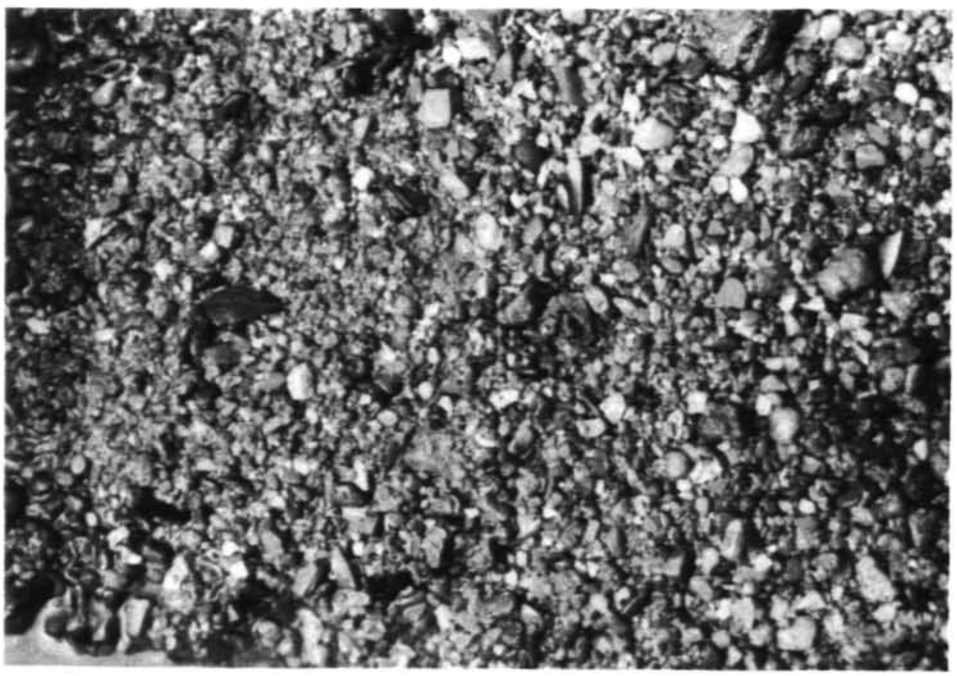

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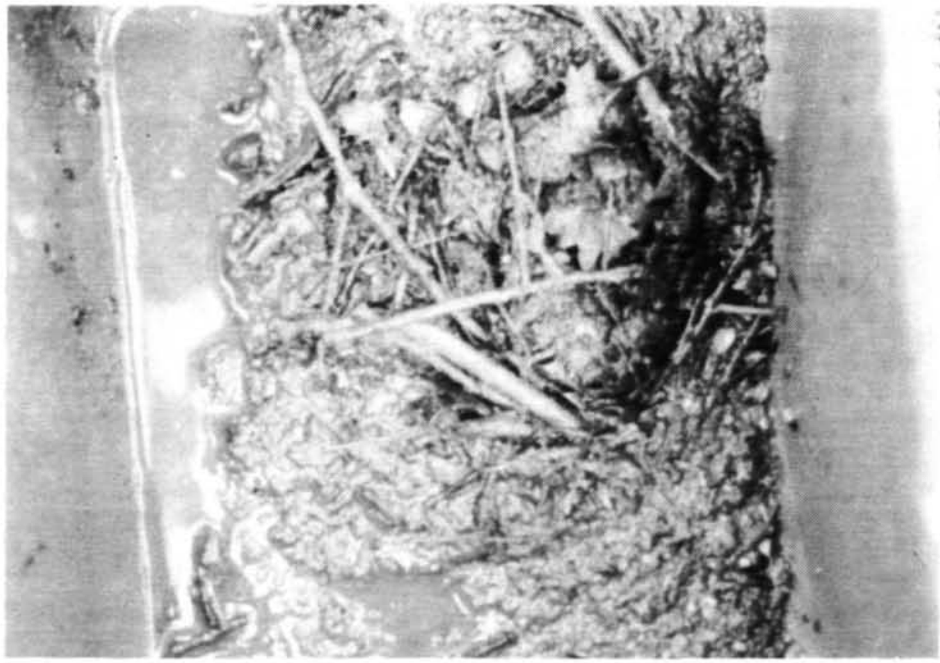

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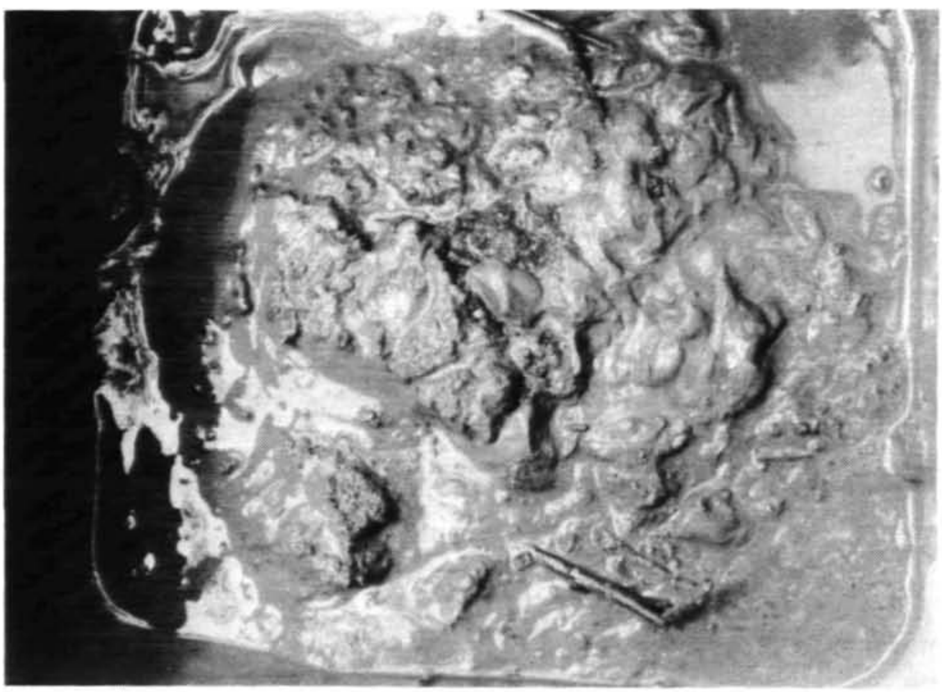

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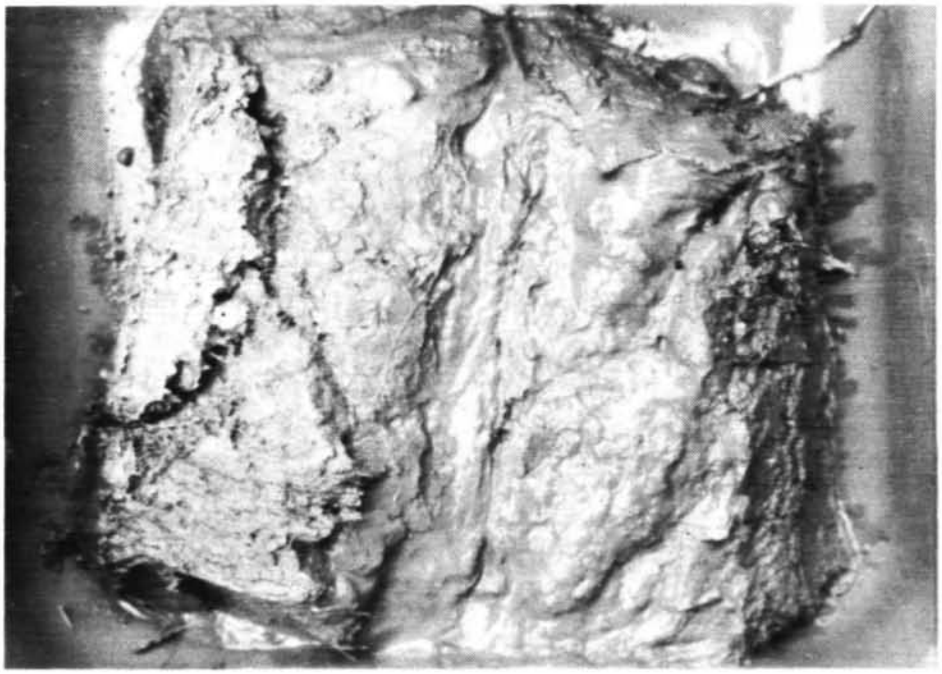

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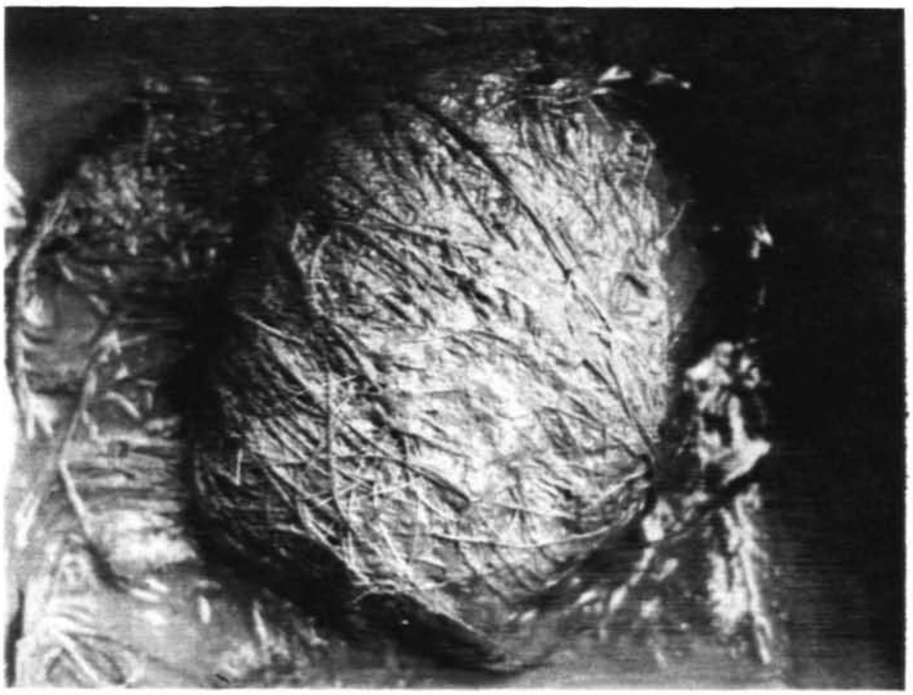

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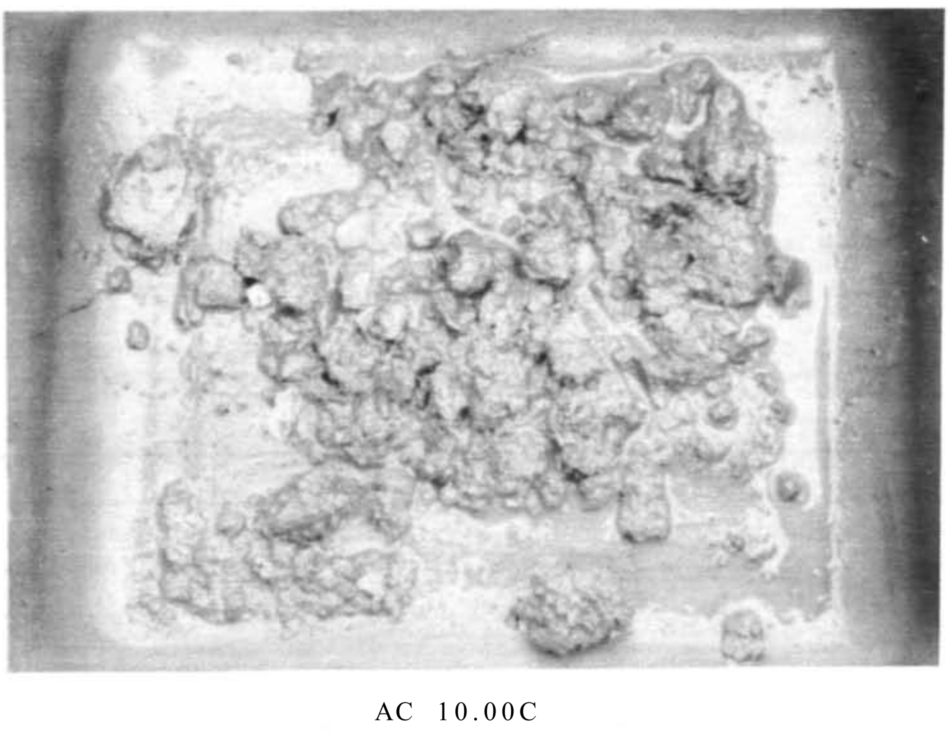

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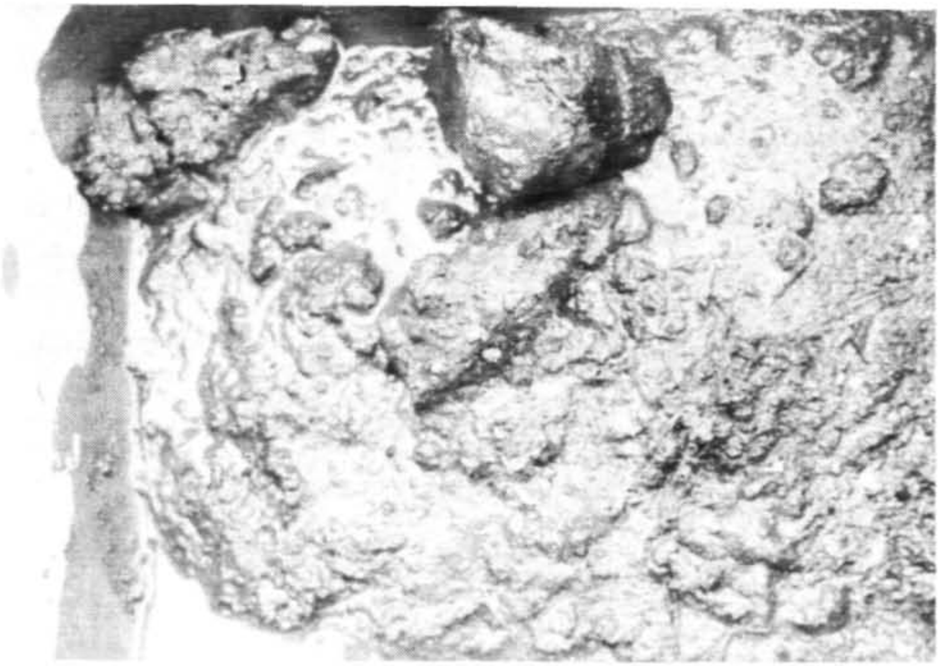

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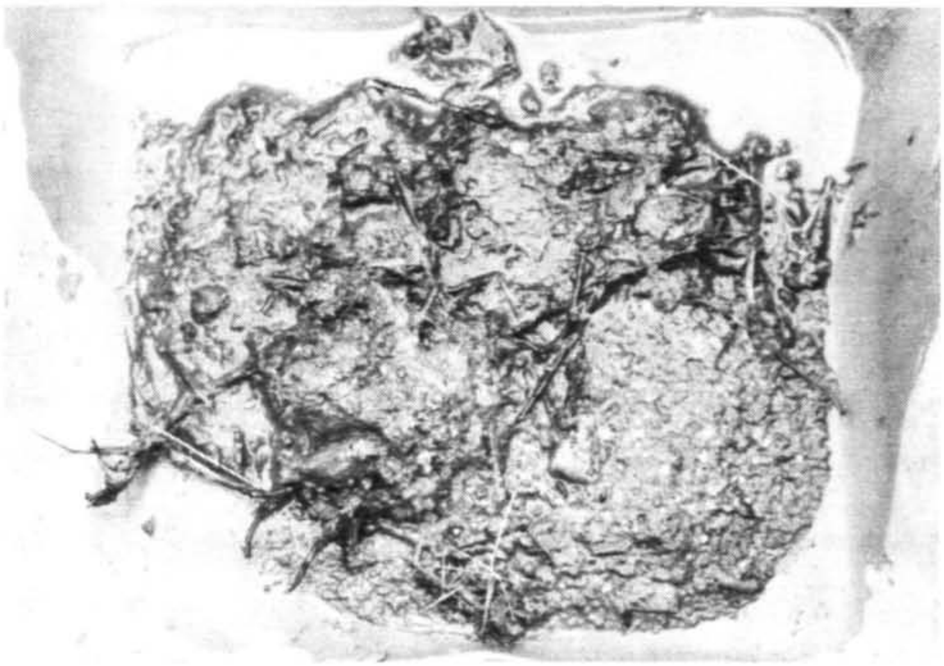
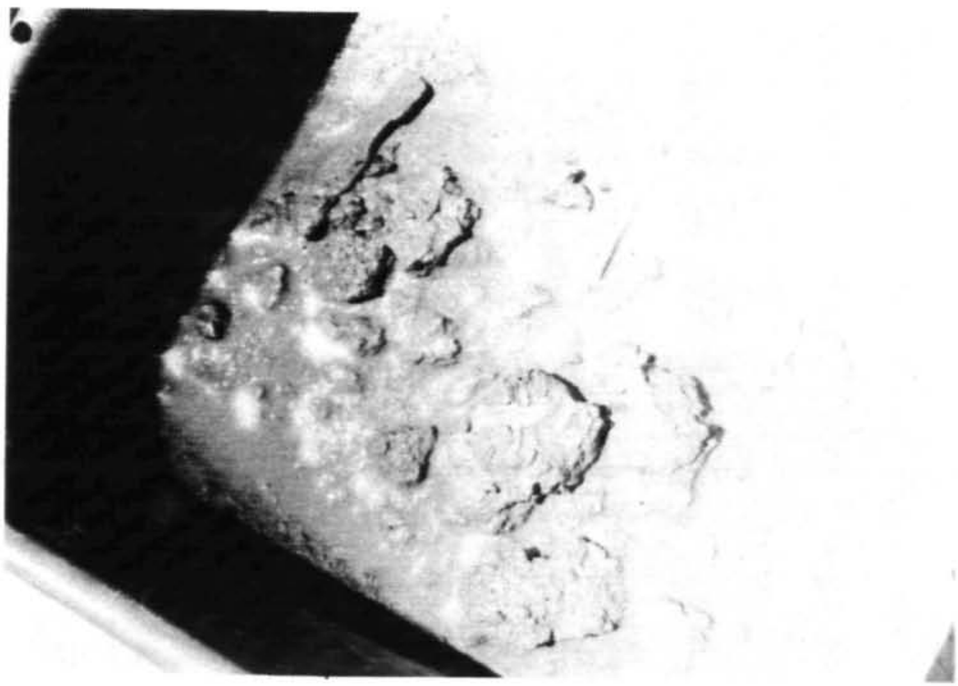


AC 10.75C

AC 11.00C

Des Plaines River



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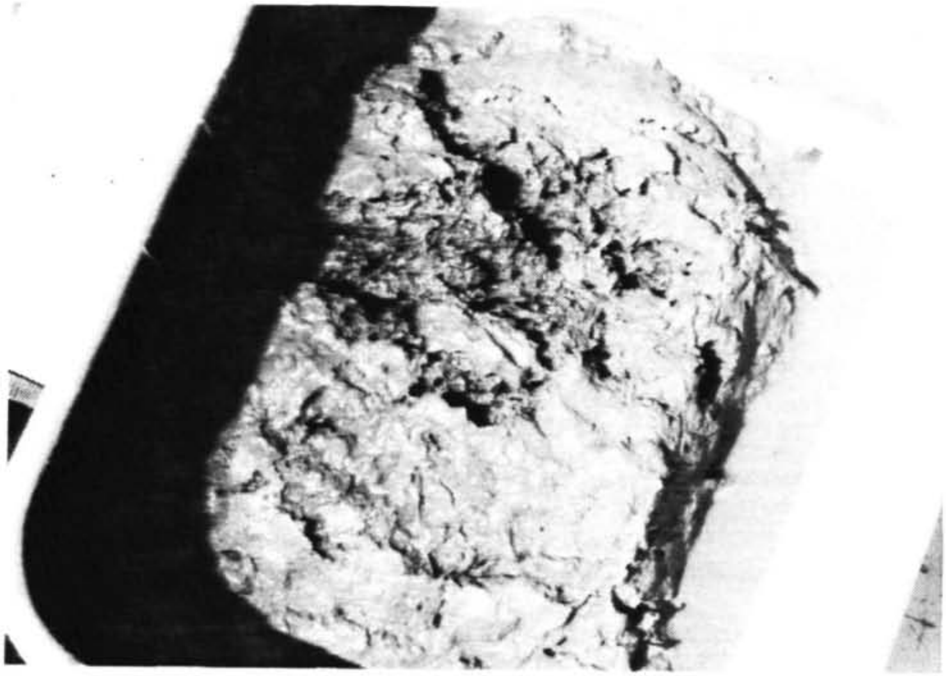

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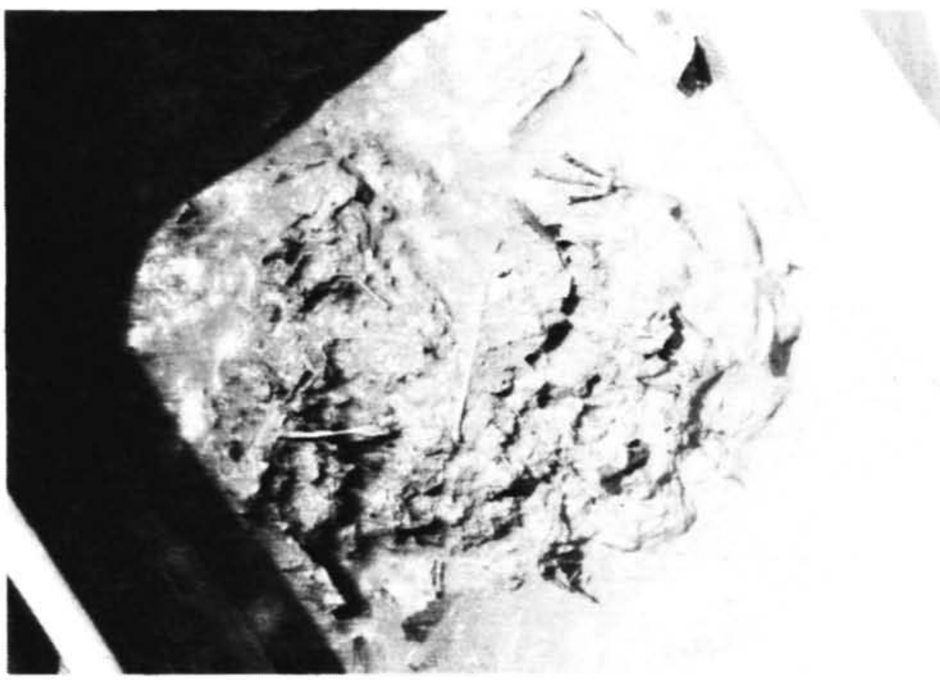

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DP 0.75L

DP 1.00R

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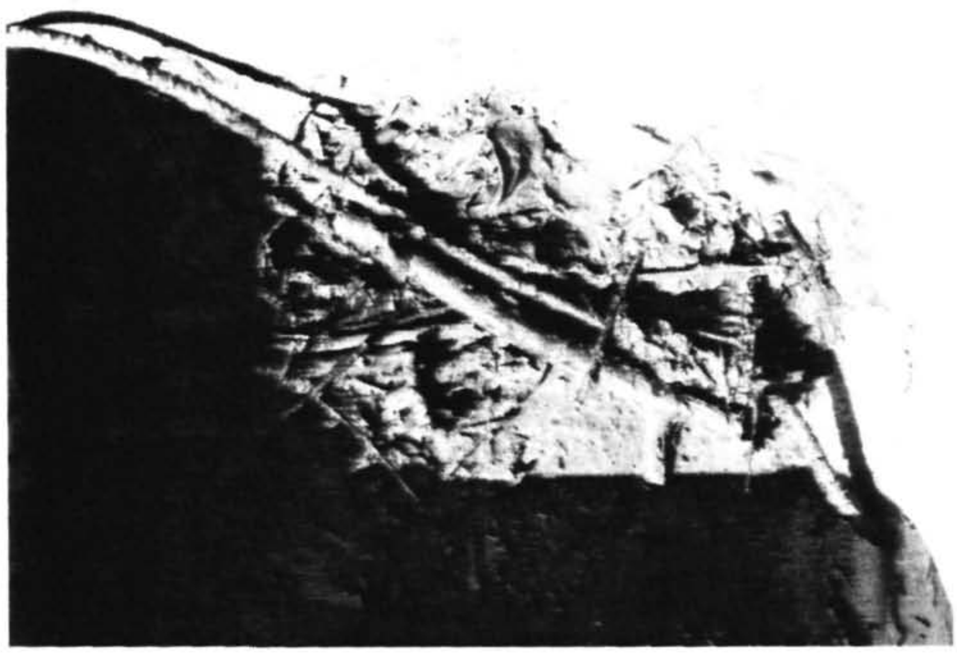
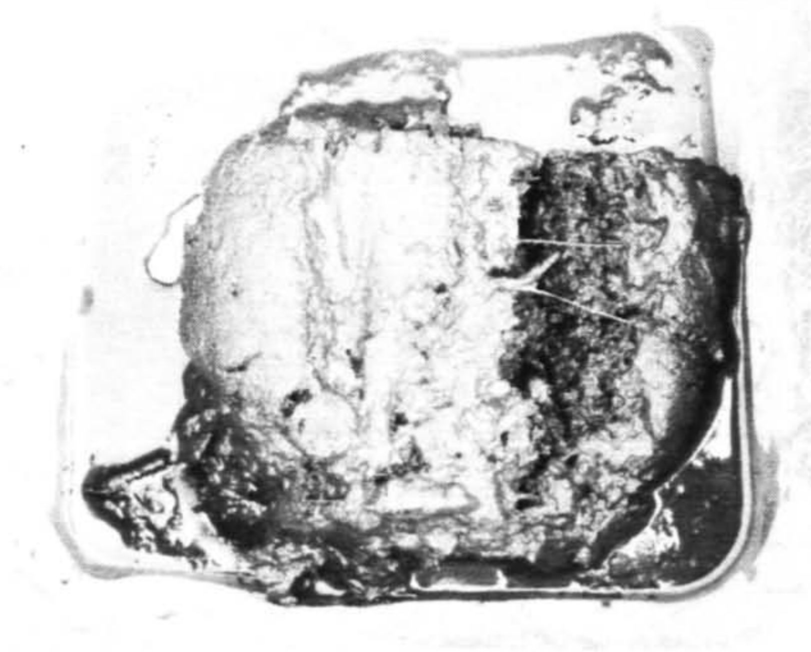


DP 1.50L

DP 1.75L

DP 2.00R



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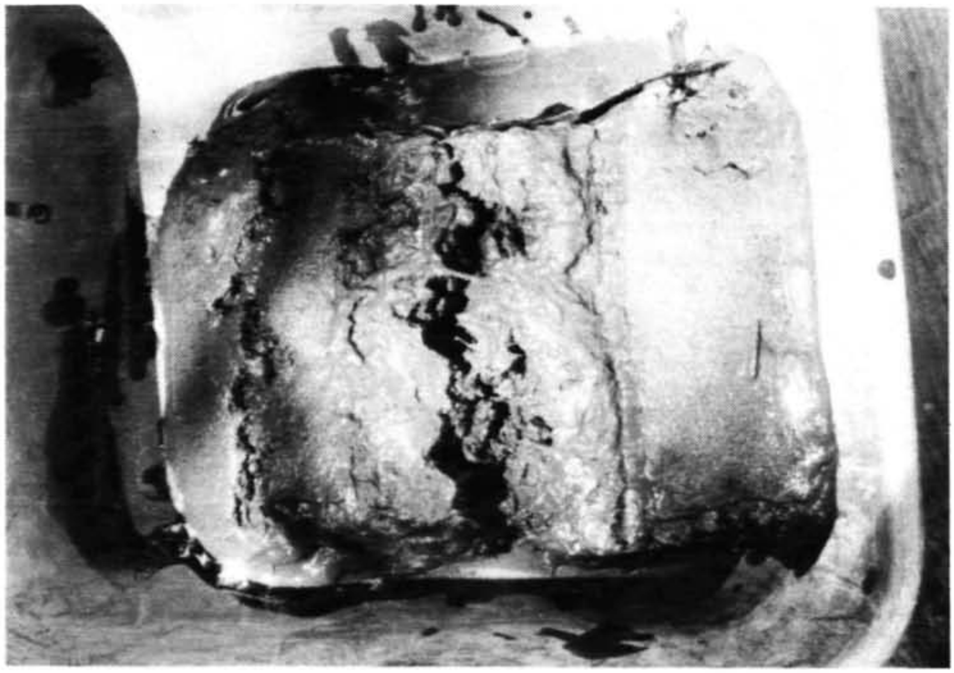

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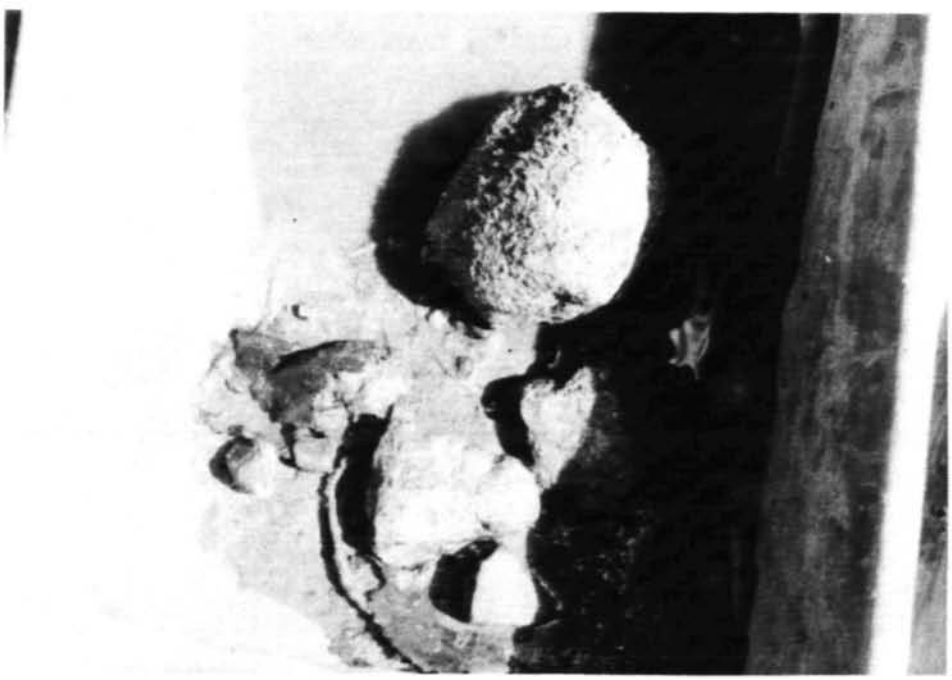

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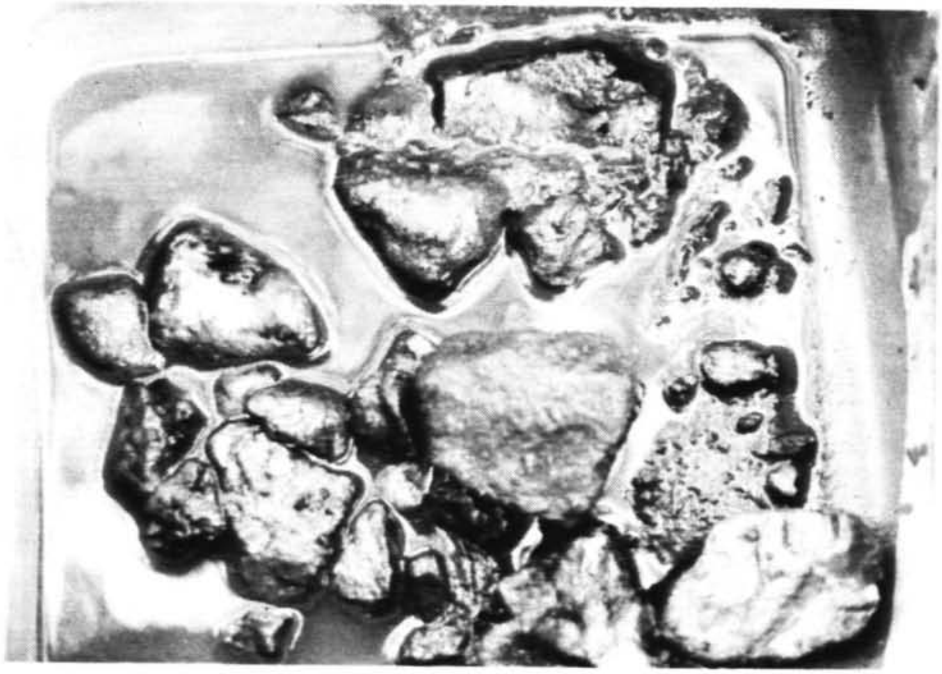

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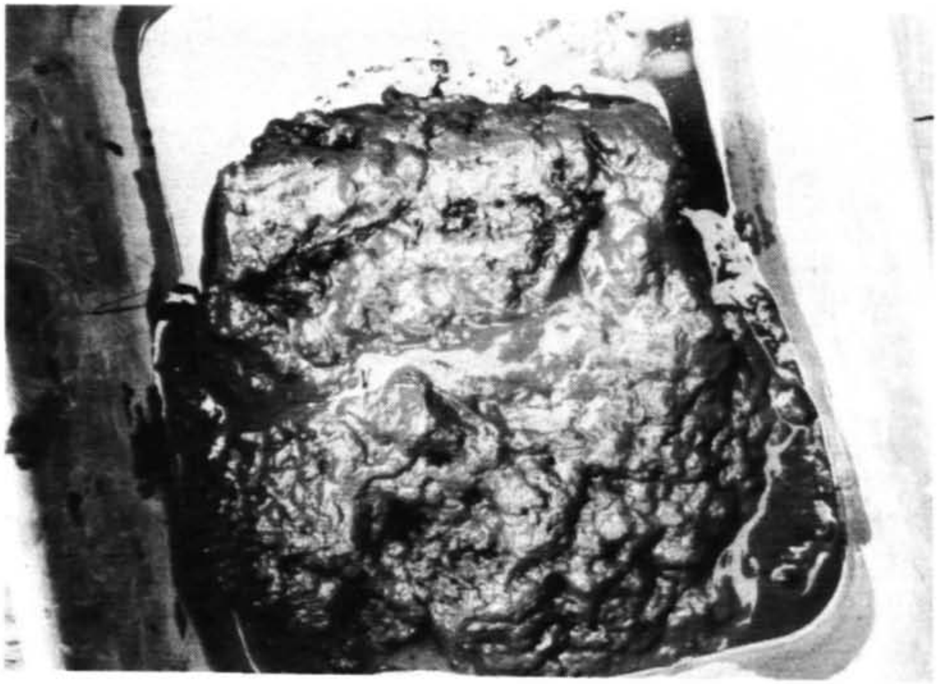

DP 3.75L

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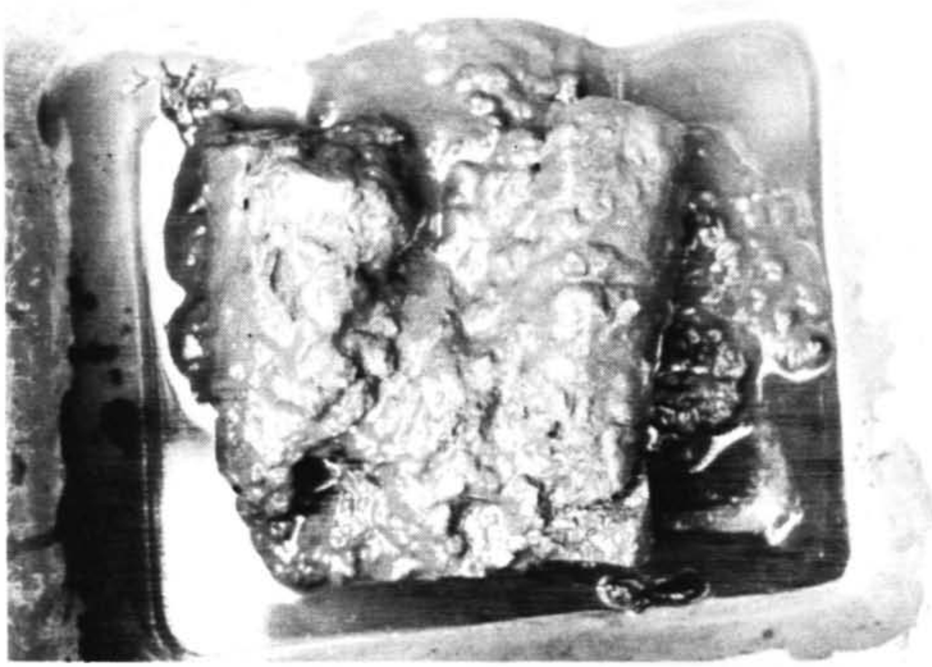

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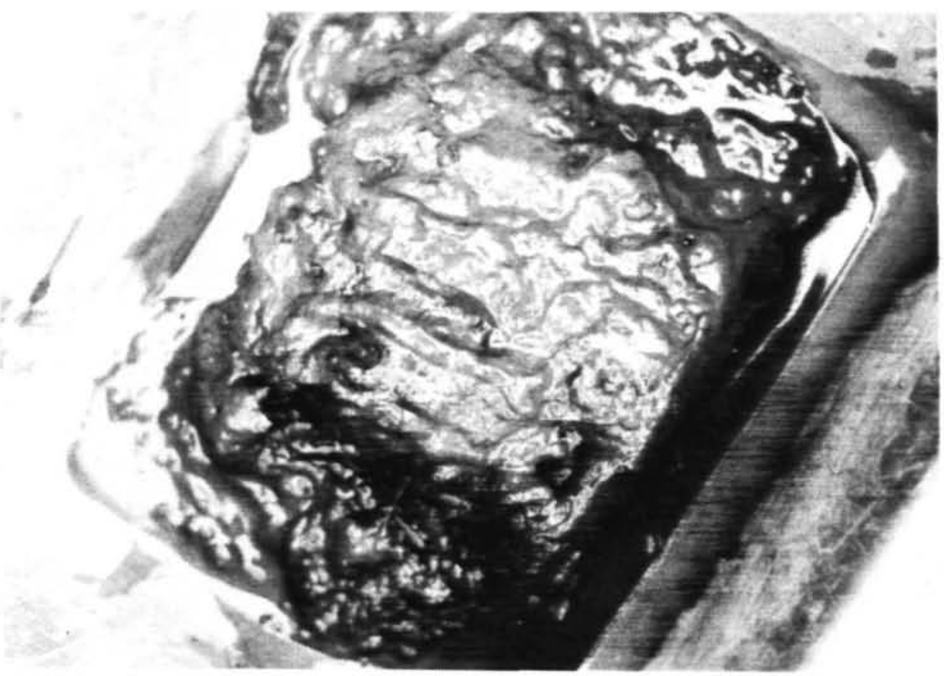

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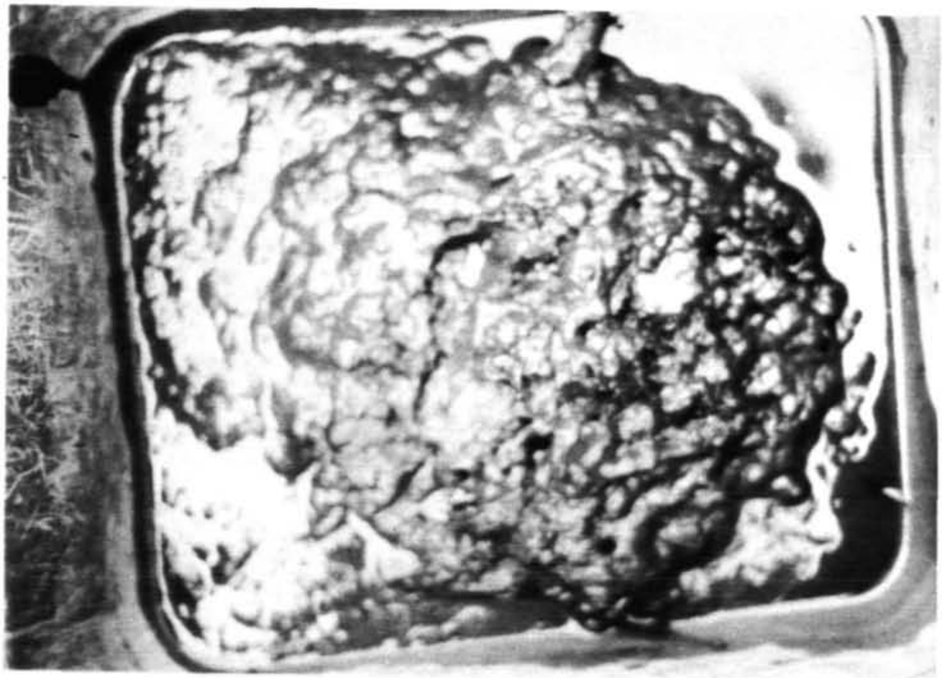

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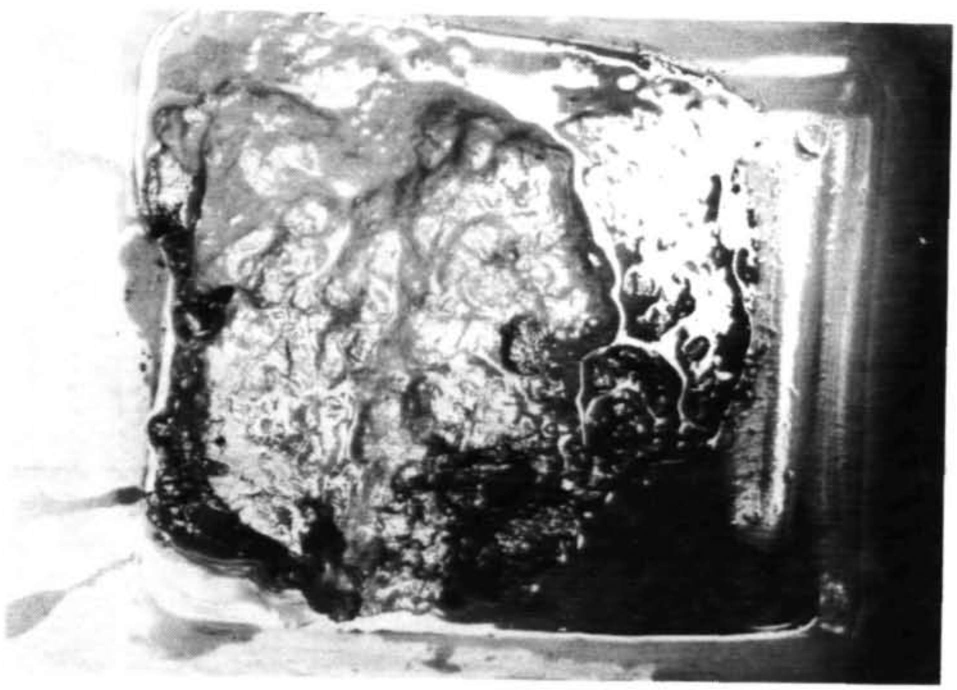

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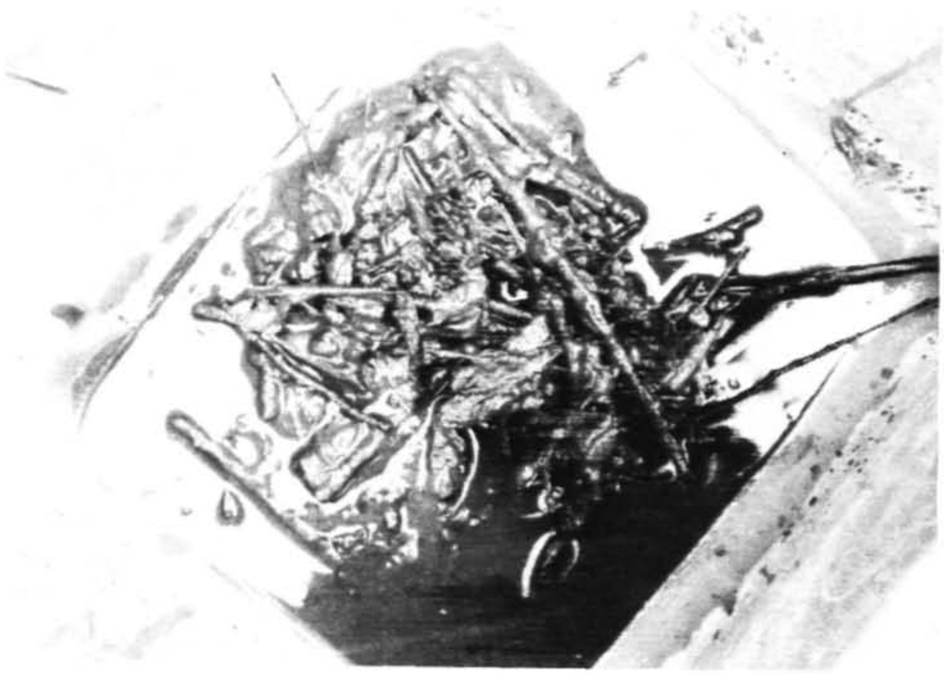
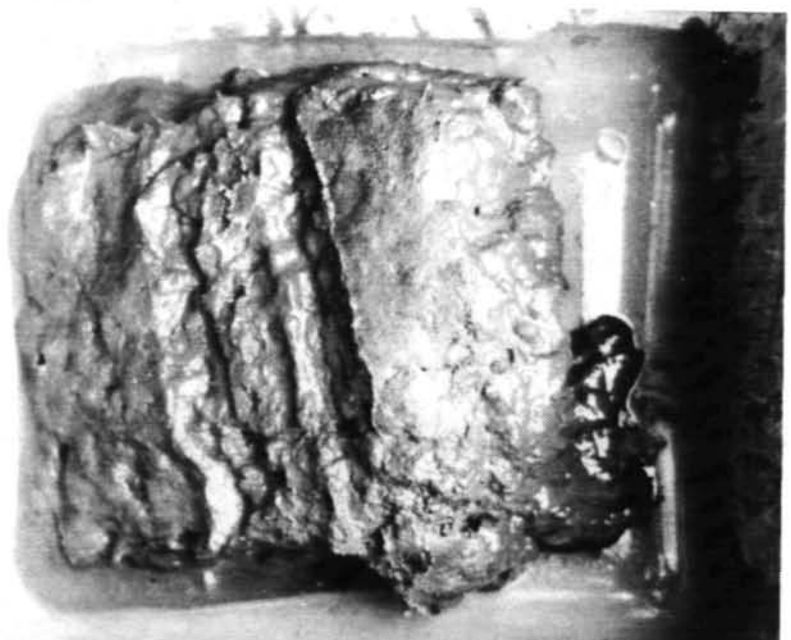


DP 5.50R

DP 5.75L



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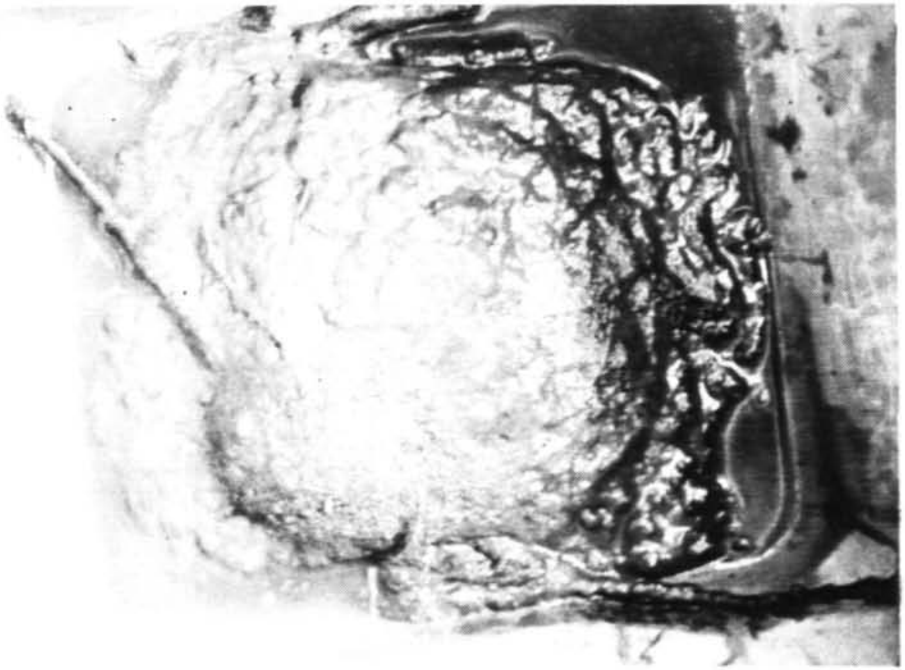

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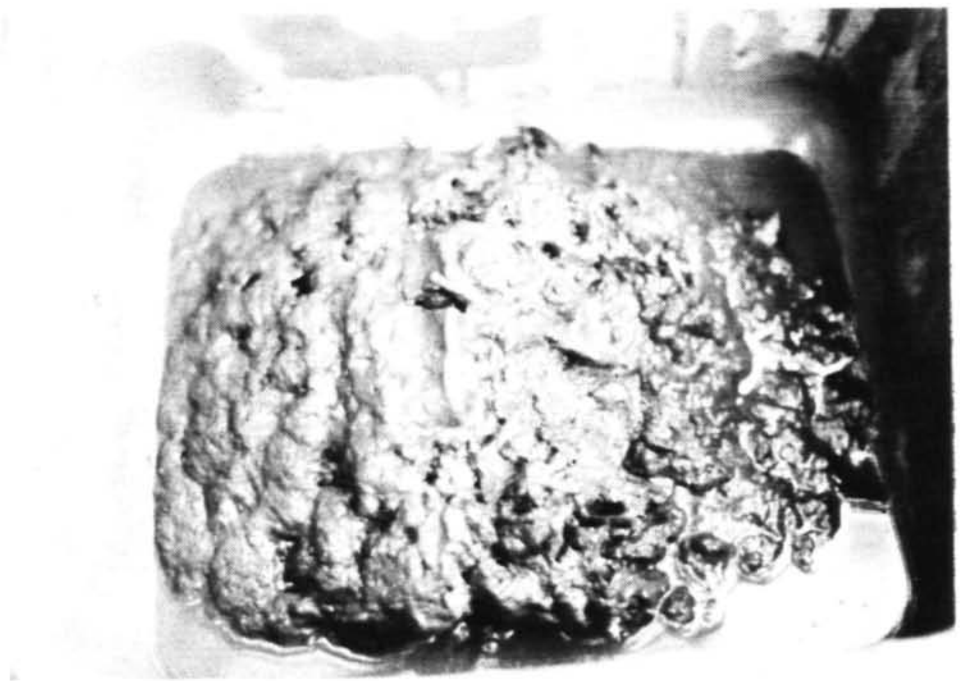

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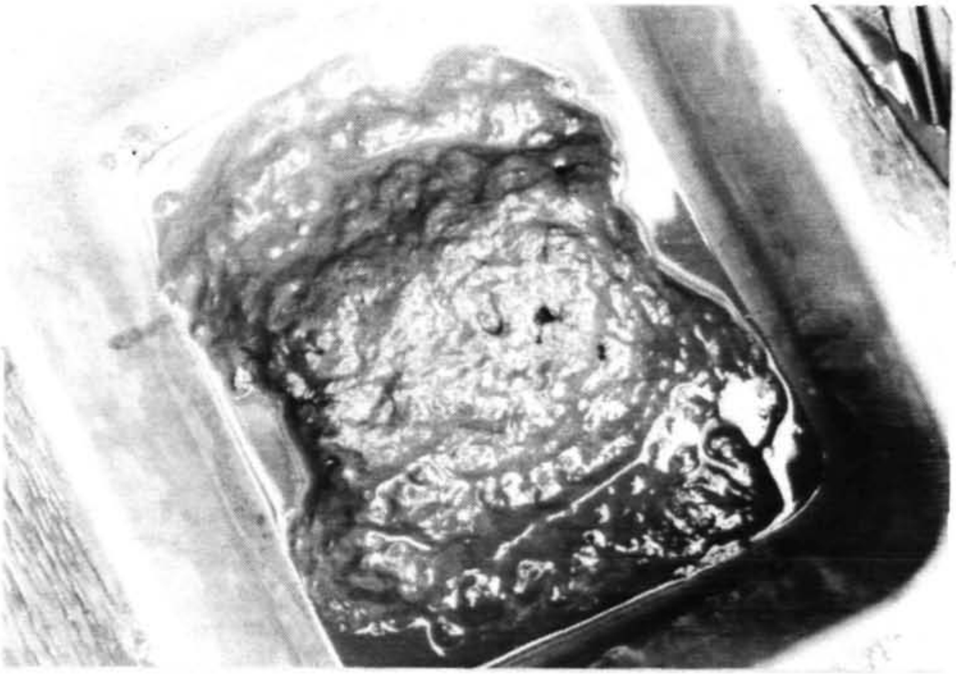

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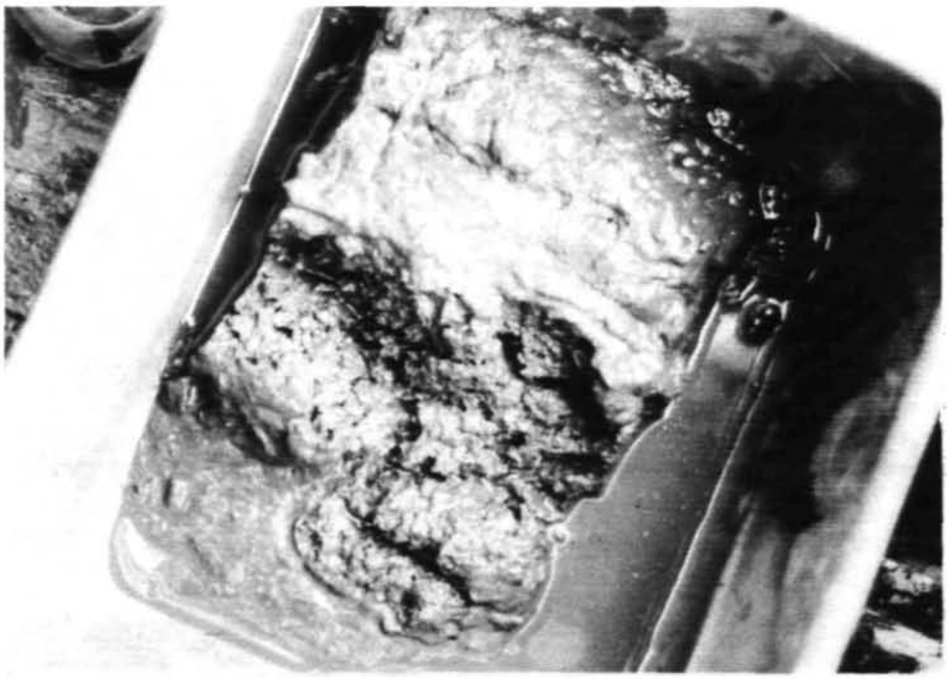

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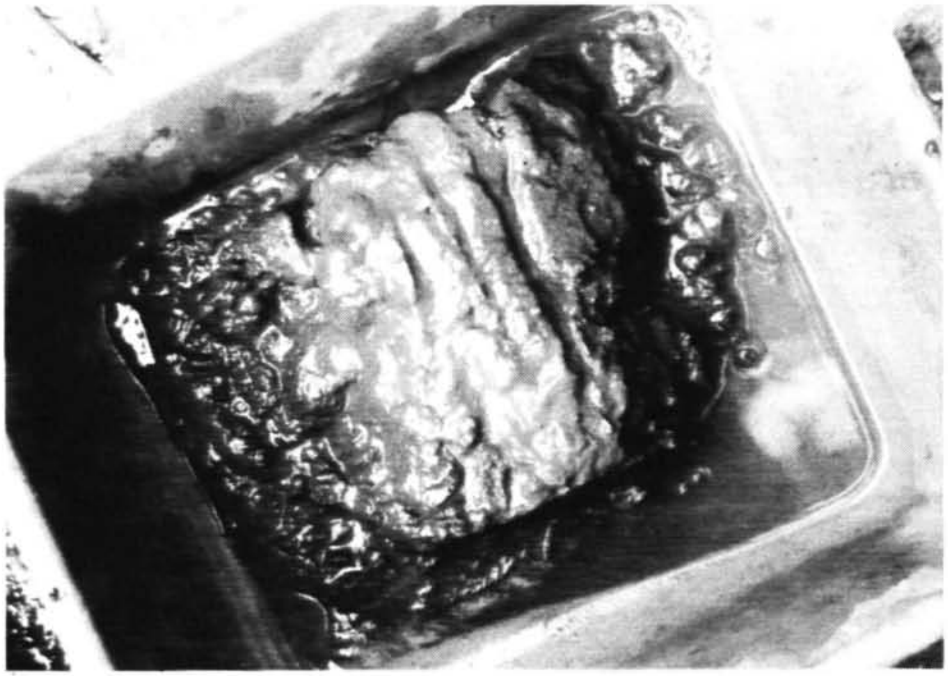

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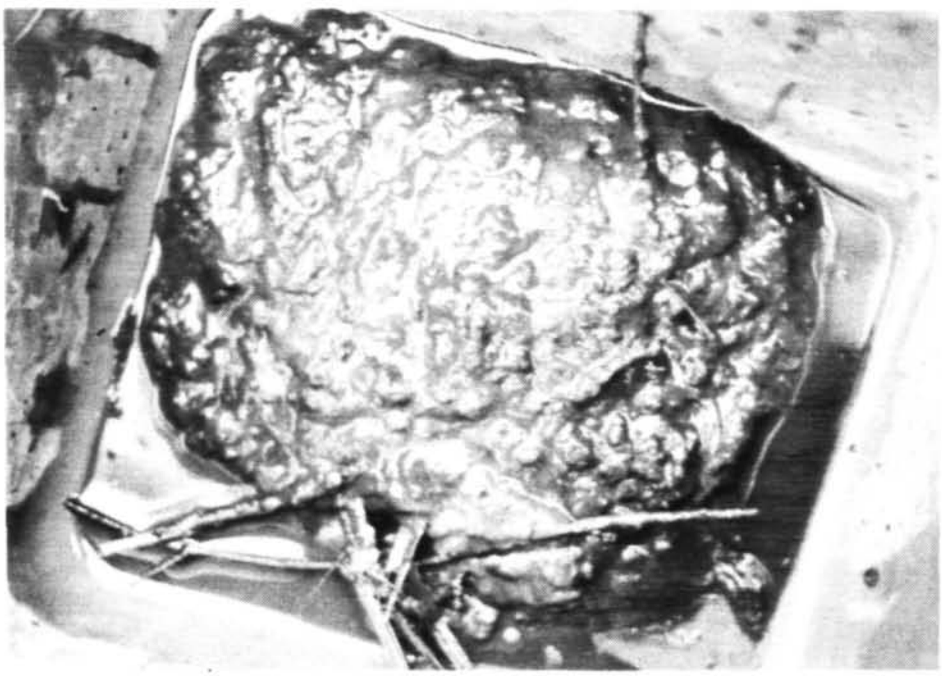

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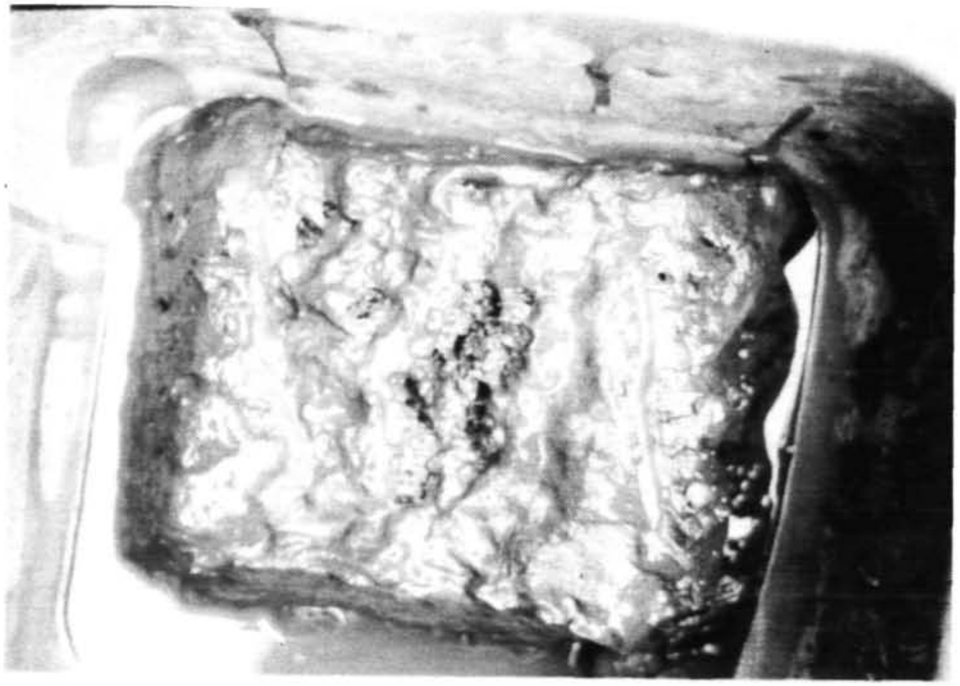

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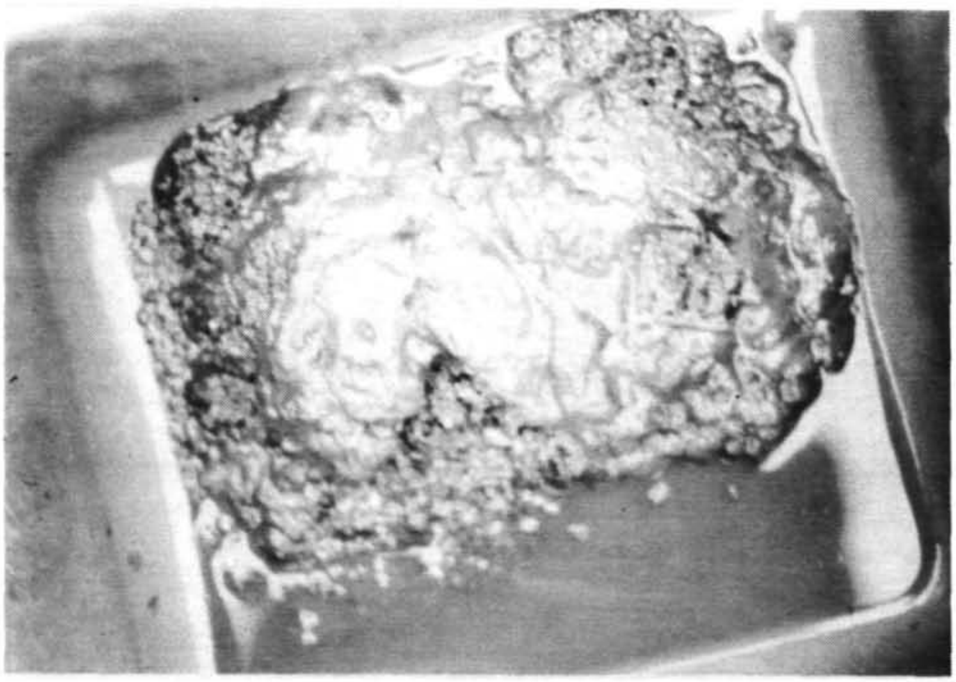

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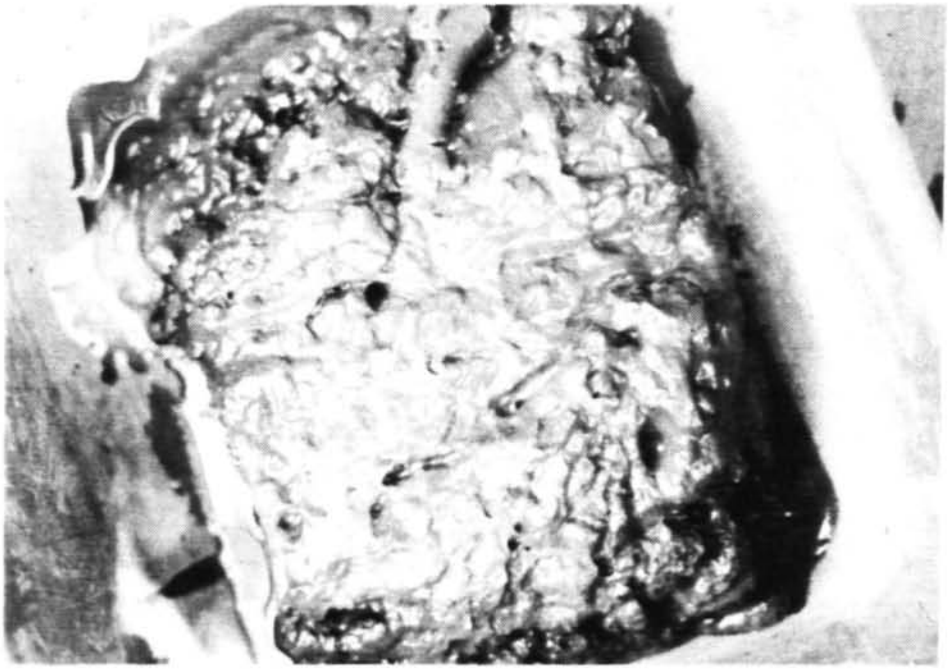

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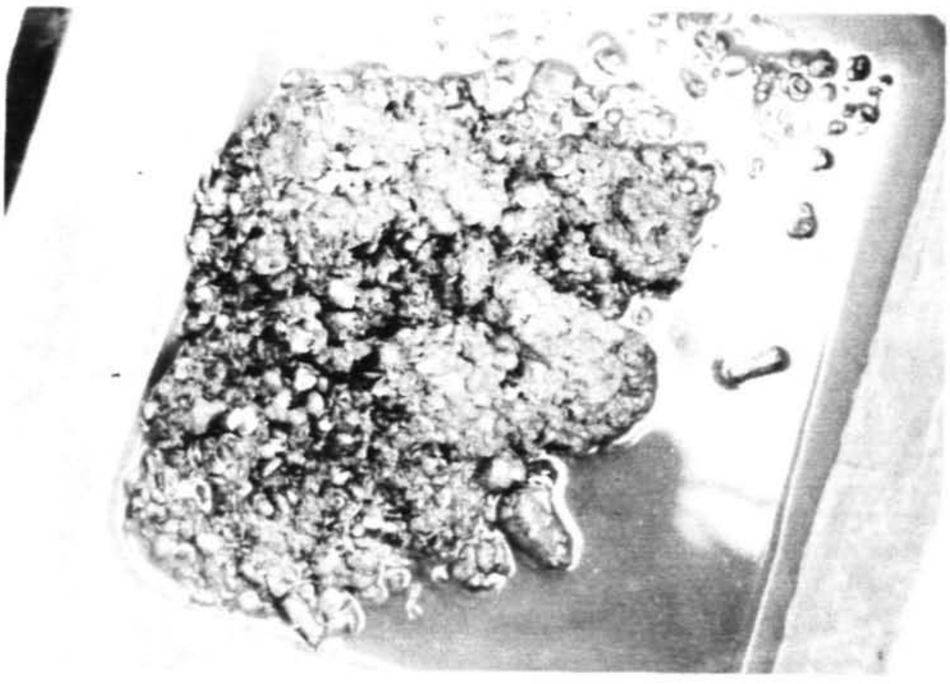
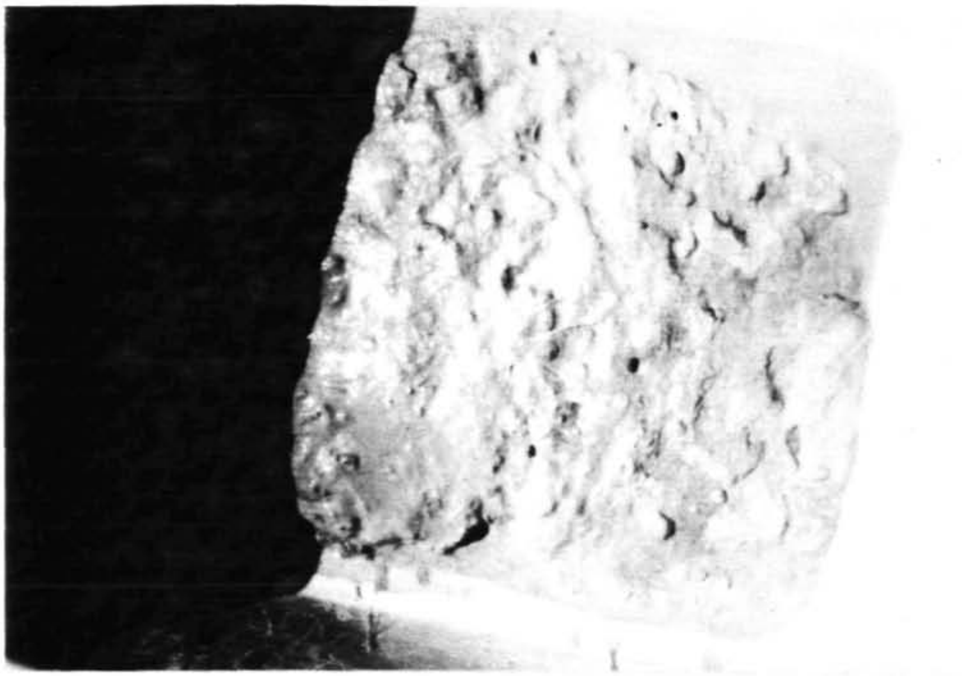
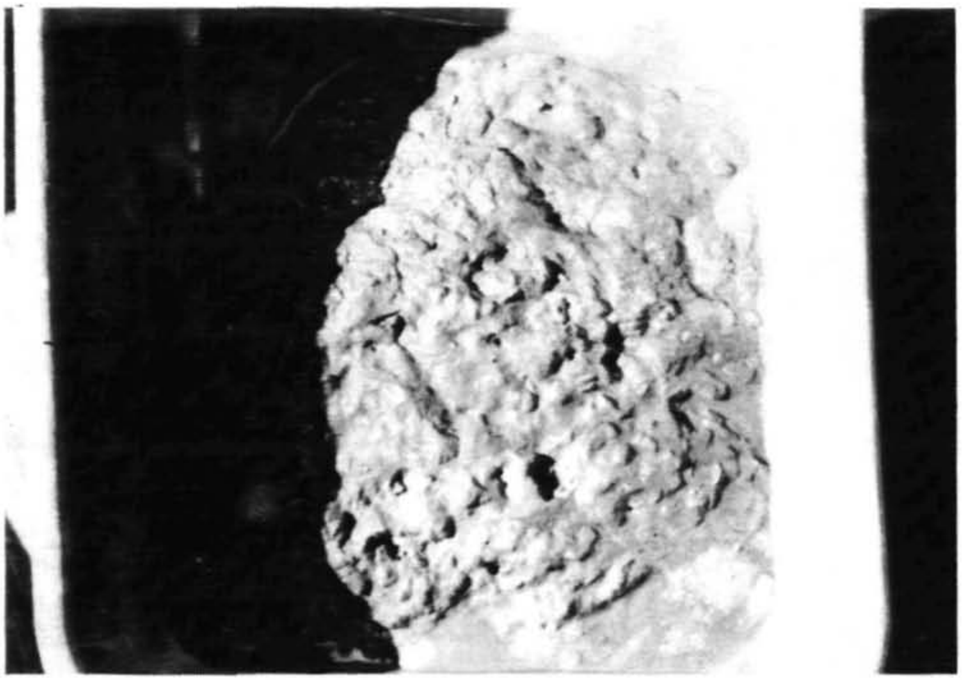


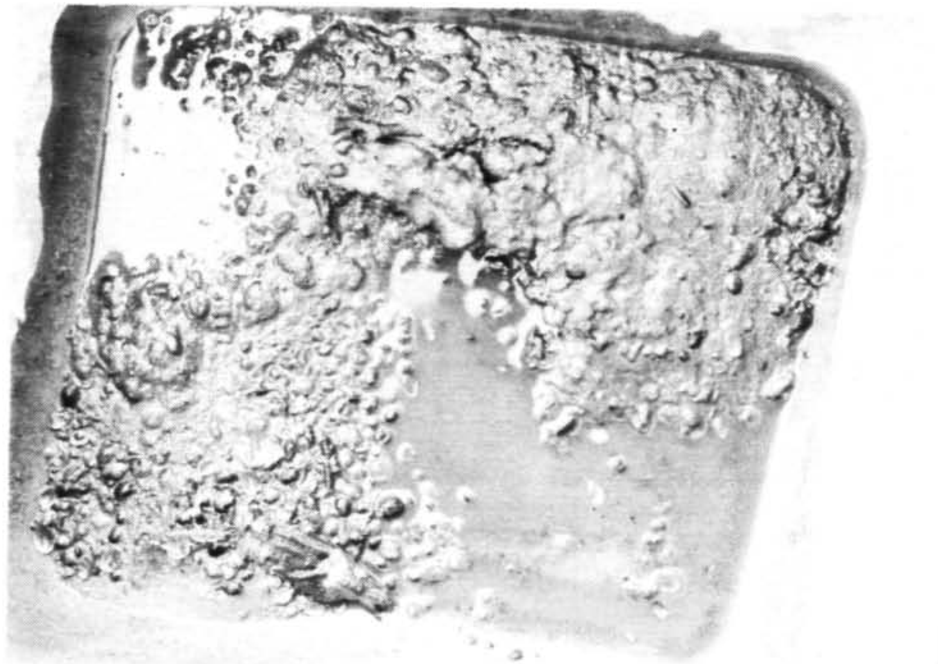
DP 8.50C



DP 8.75L



DP 9.00R



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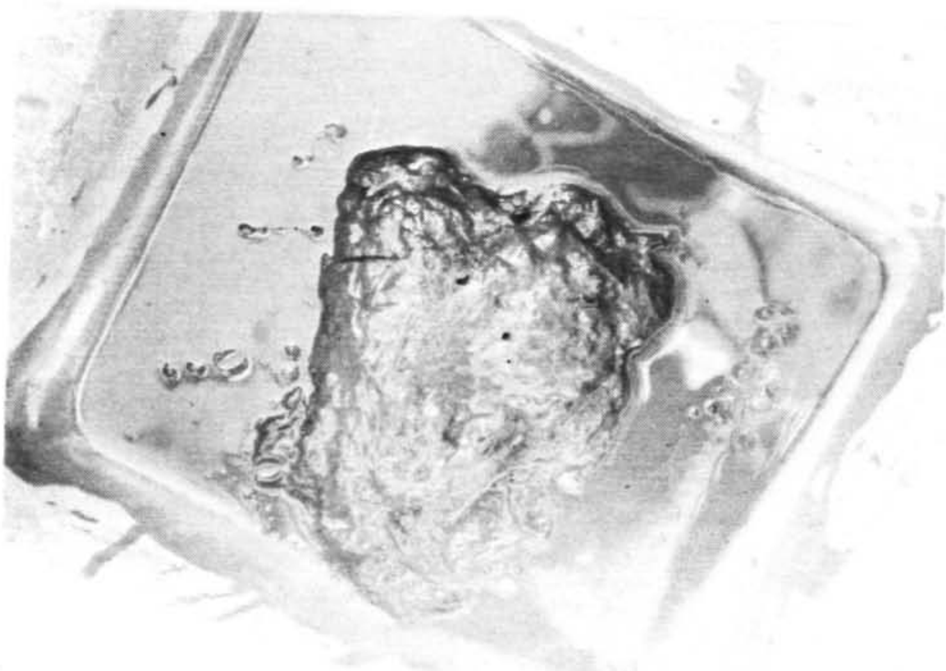
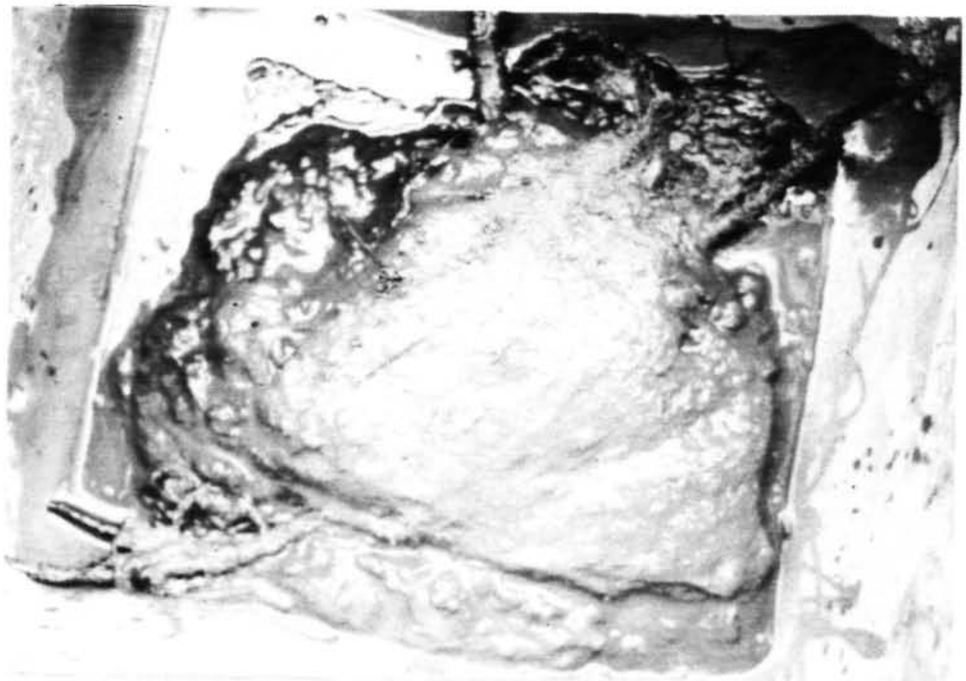


DP 9.50R



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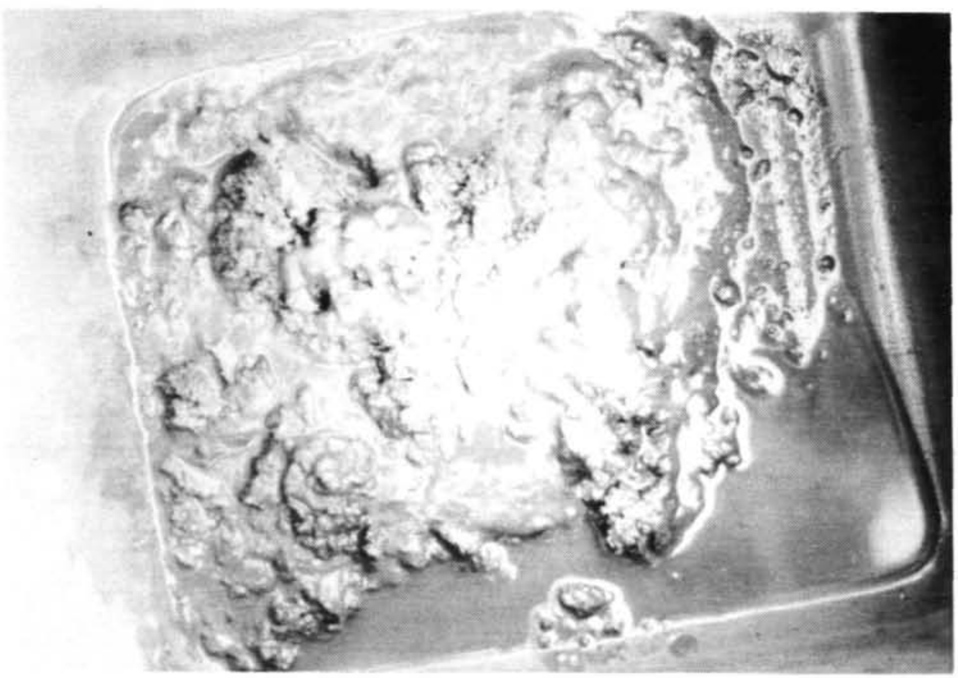
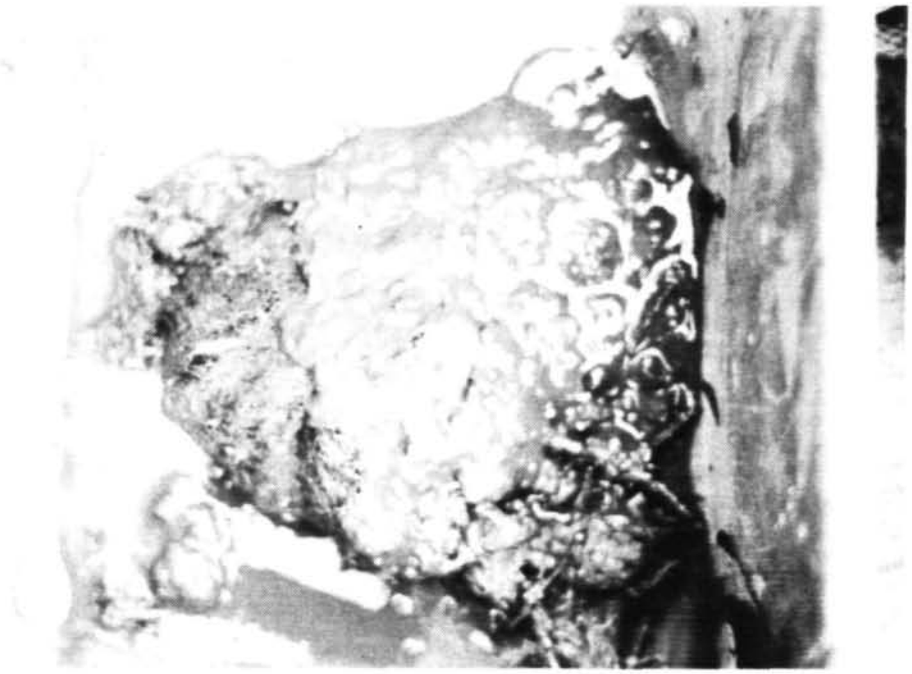
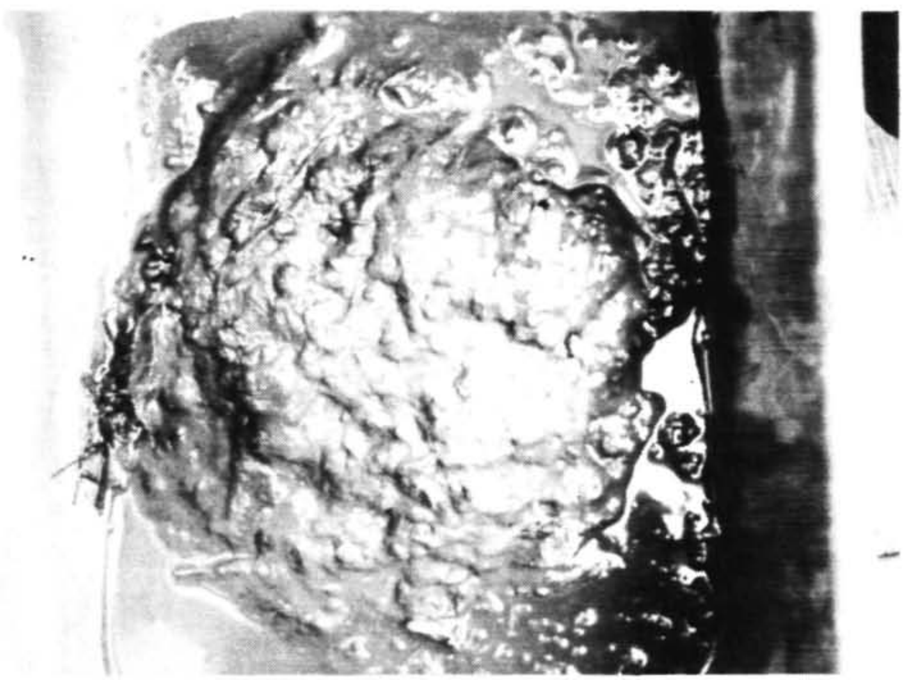


DP 10.00L



DP 10.25R



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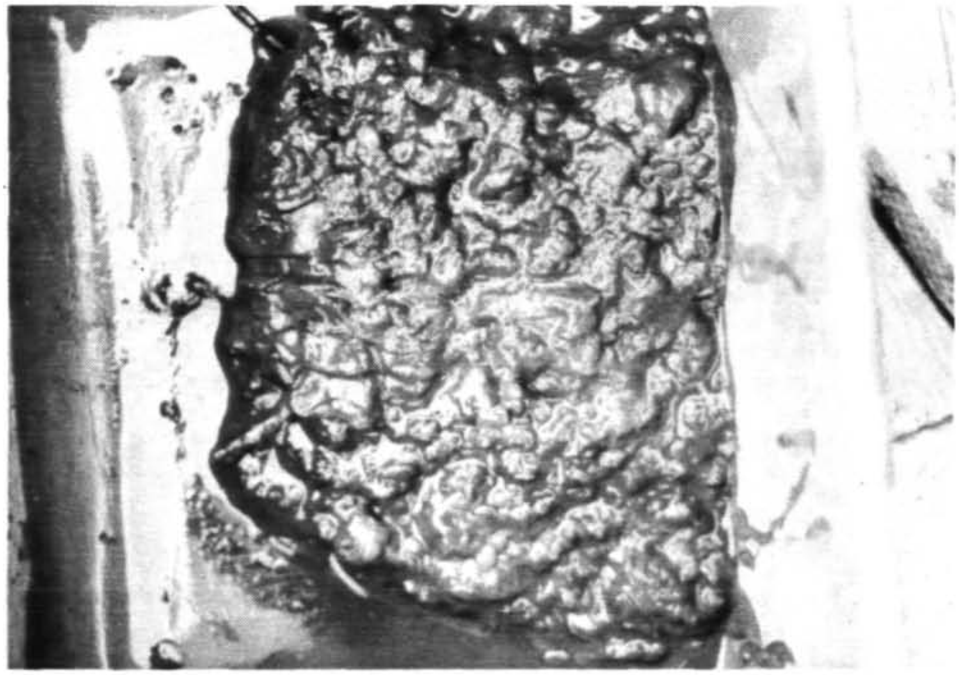
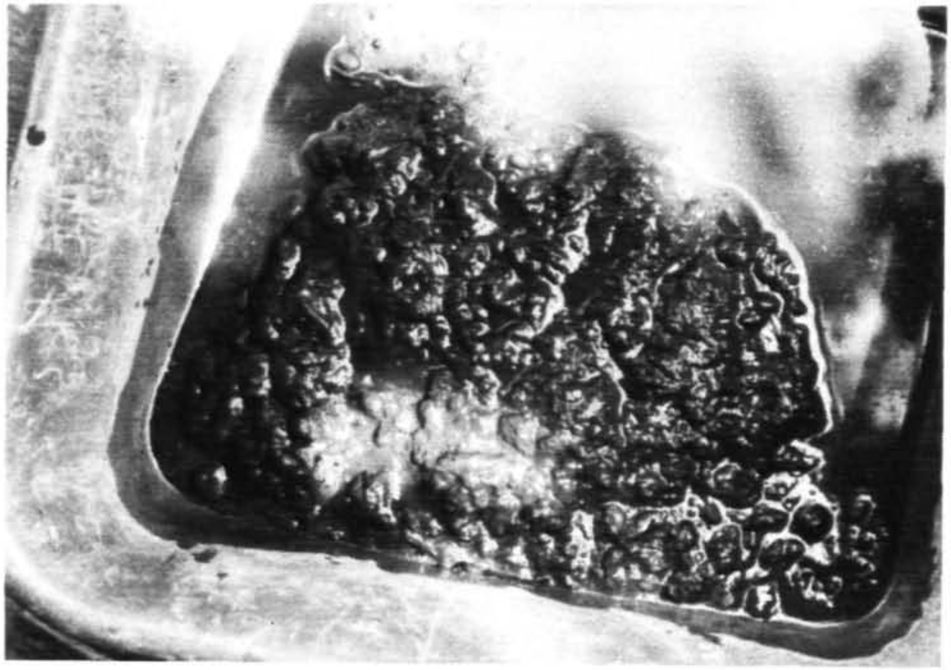
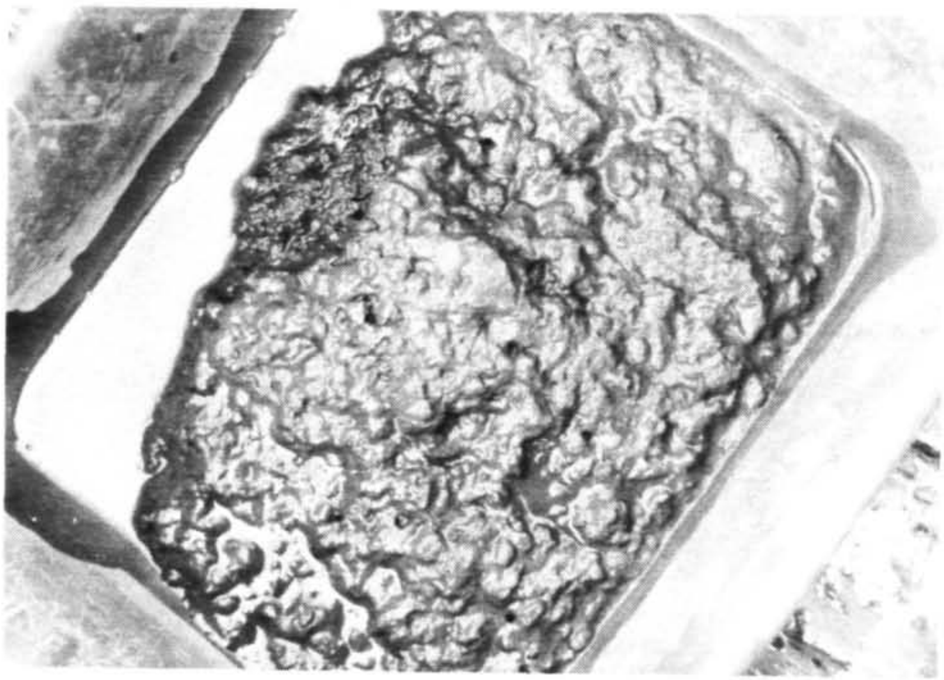


DP 10.75L

DP ll.OOL

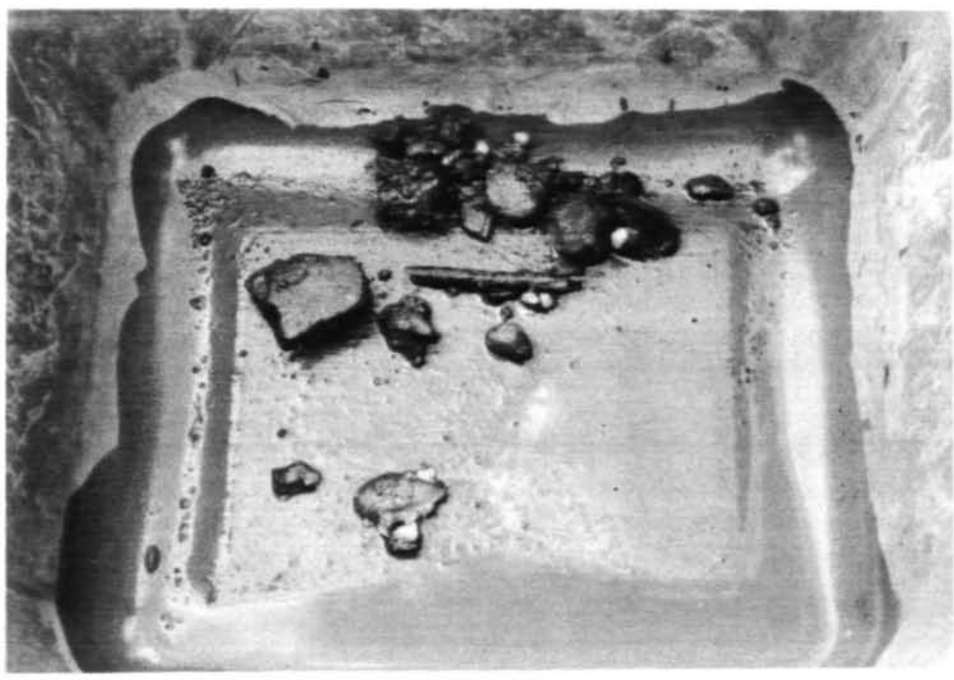


DP 11.25L



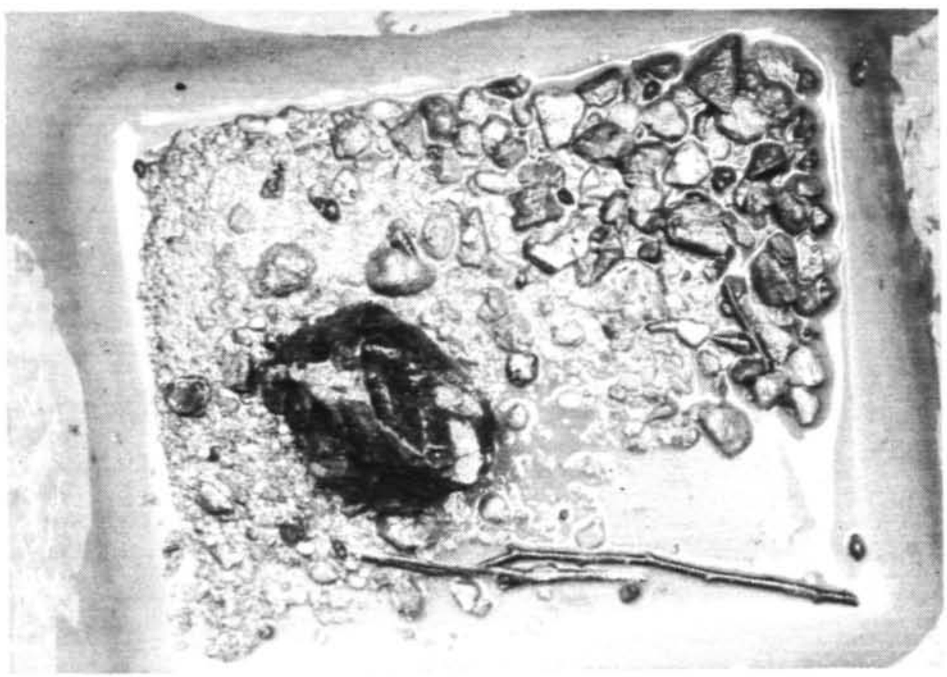
DP 11.50R

DP 11.75R

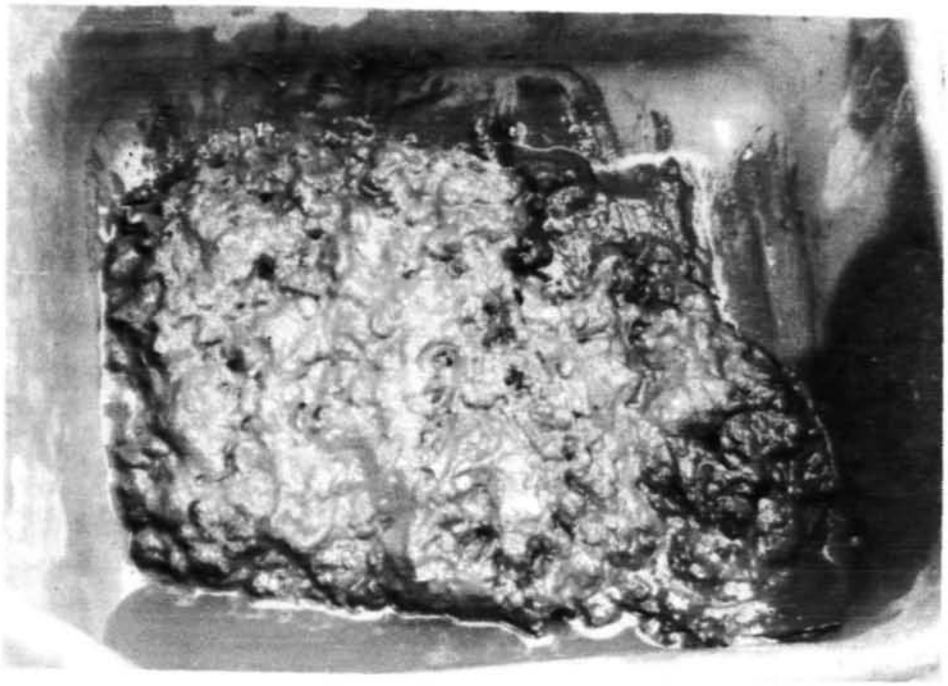


DP 12.00C

DP 12.25R

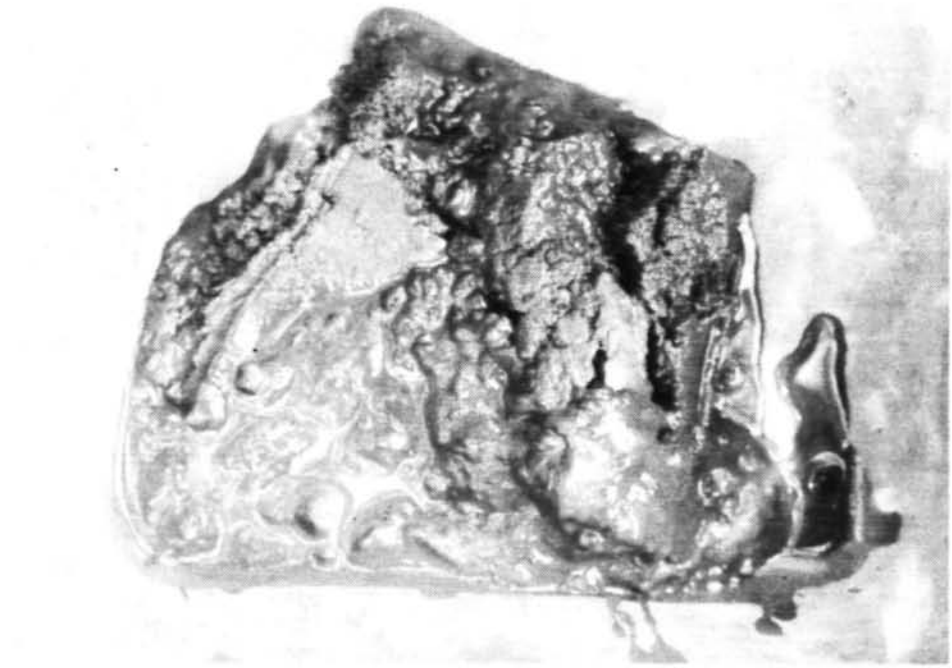


DP 12.50C

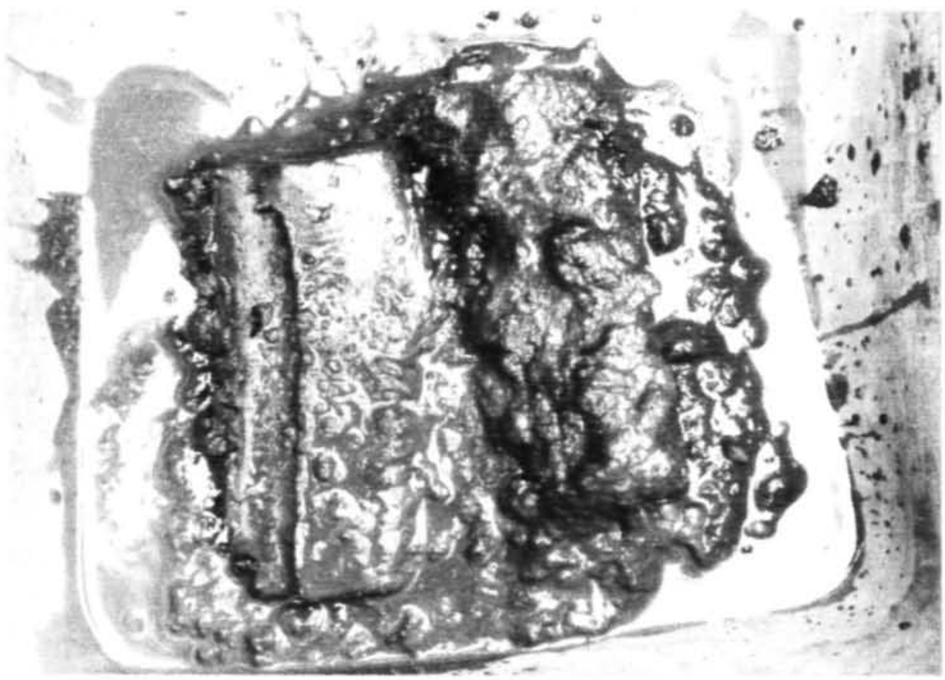


DP 12.75L

DP 13.00R

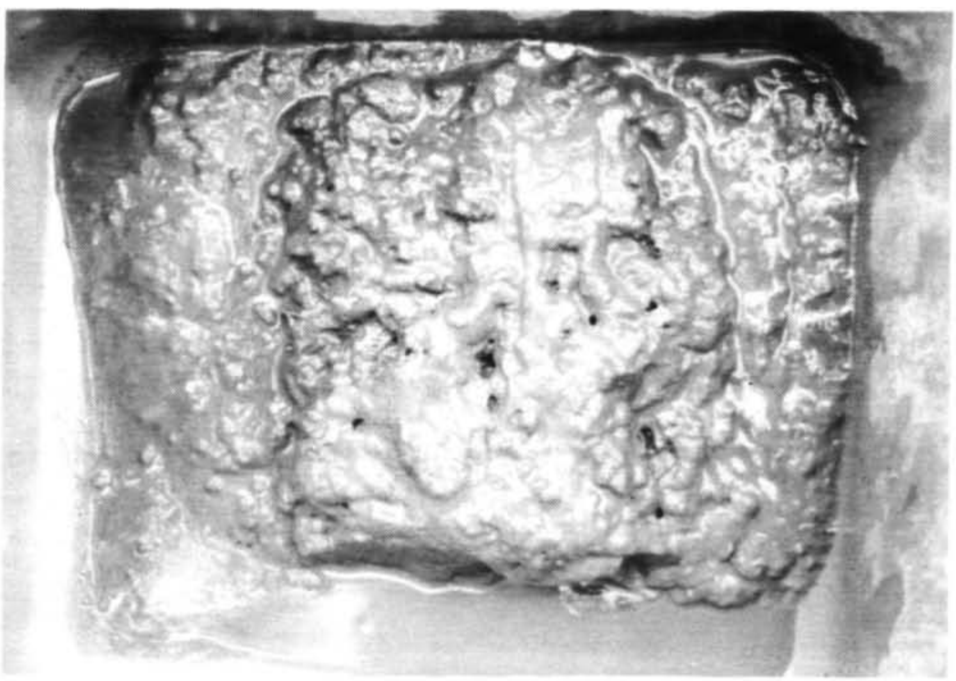


DP 13.25R

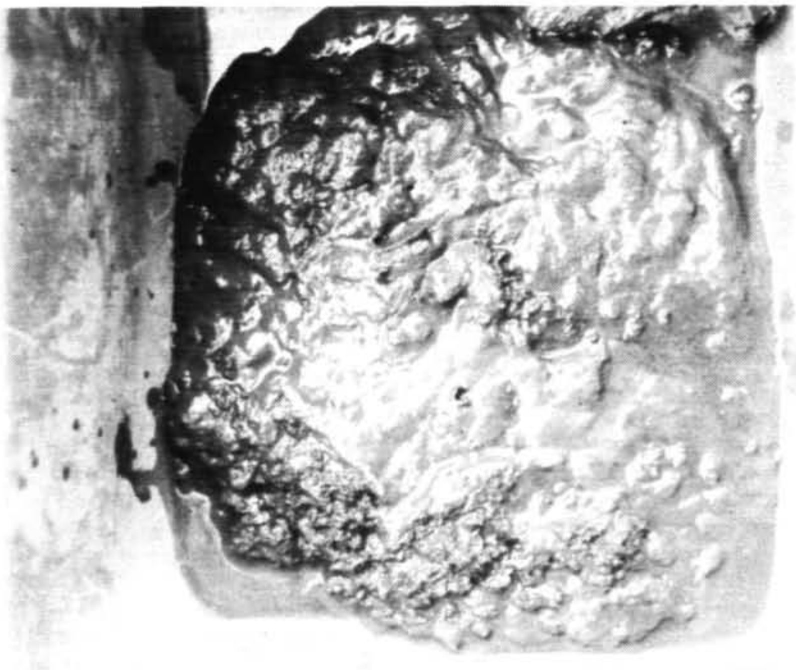


DP 13.50R

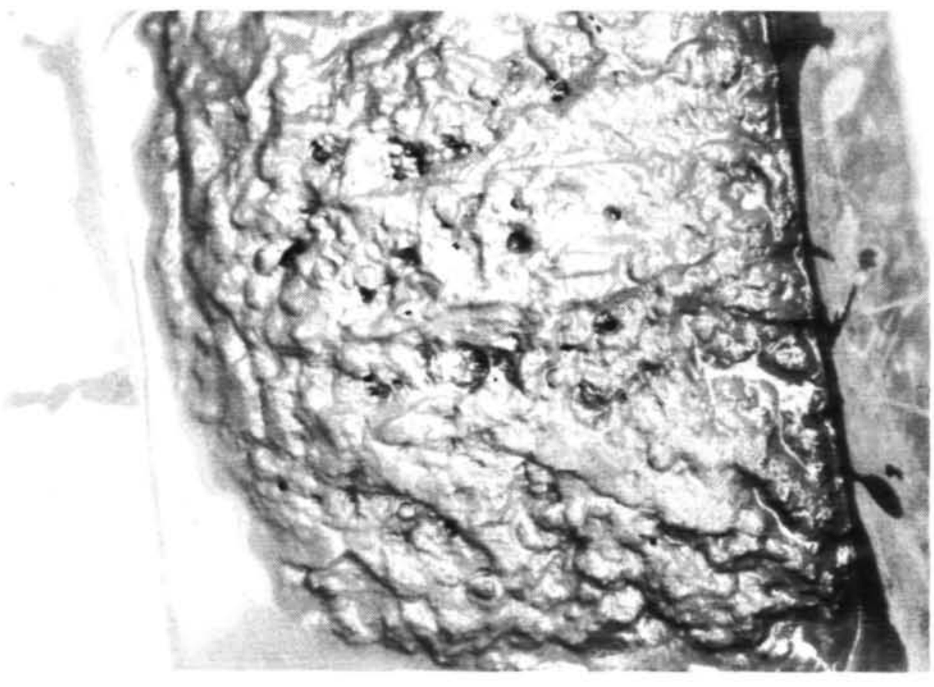
DP 13.75R



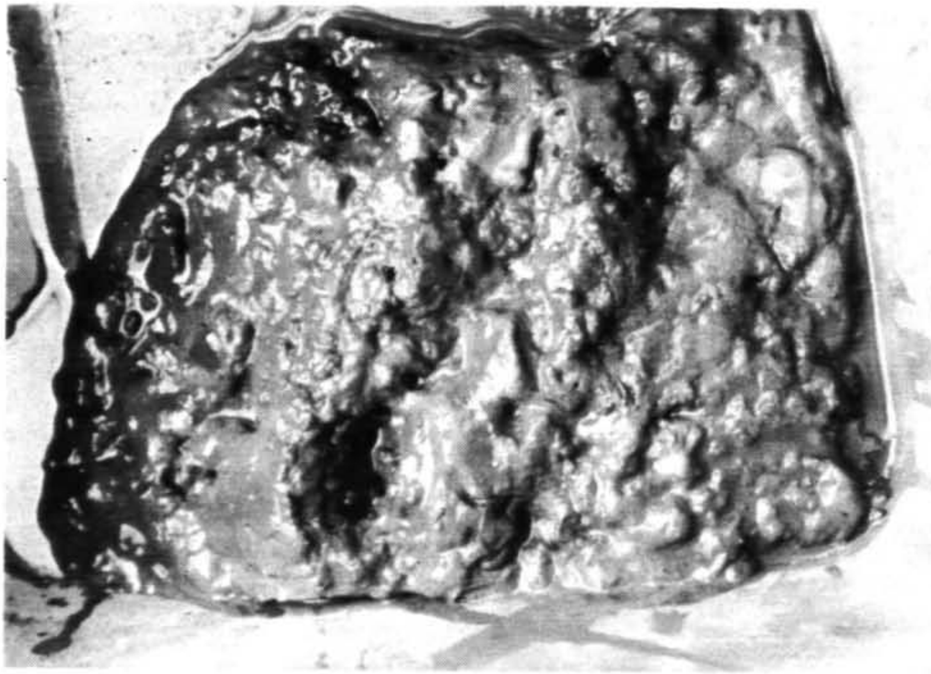
DP 14.00L



DP 14.25L

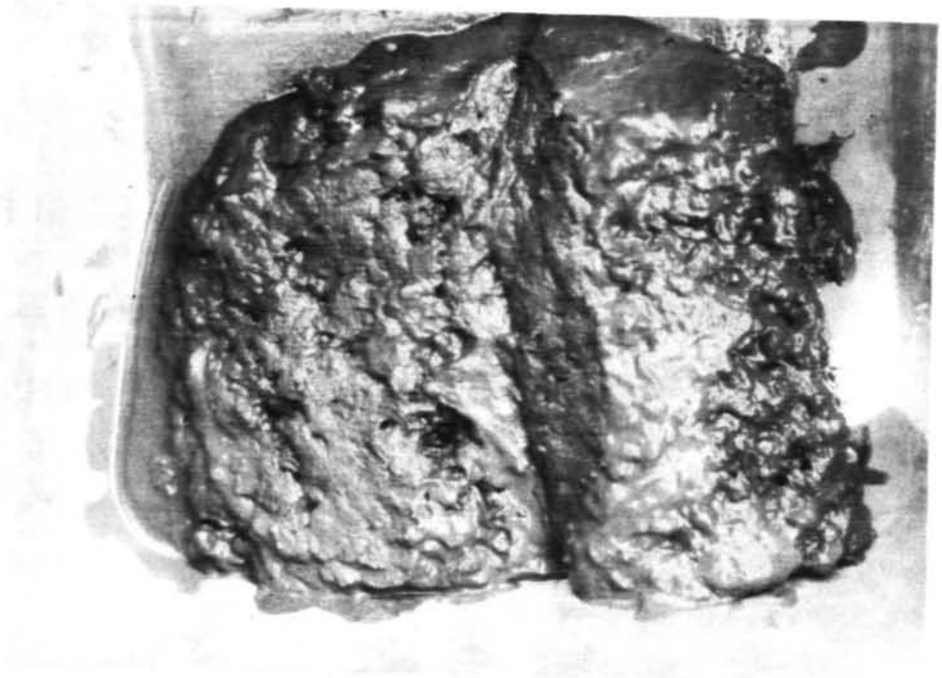


DP 14.50R

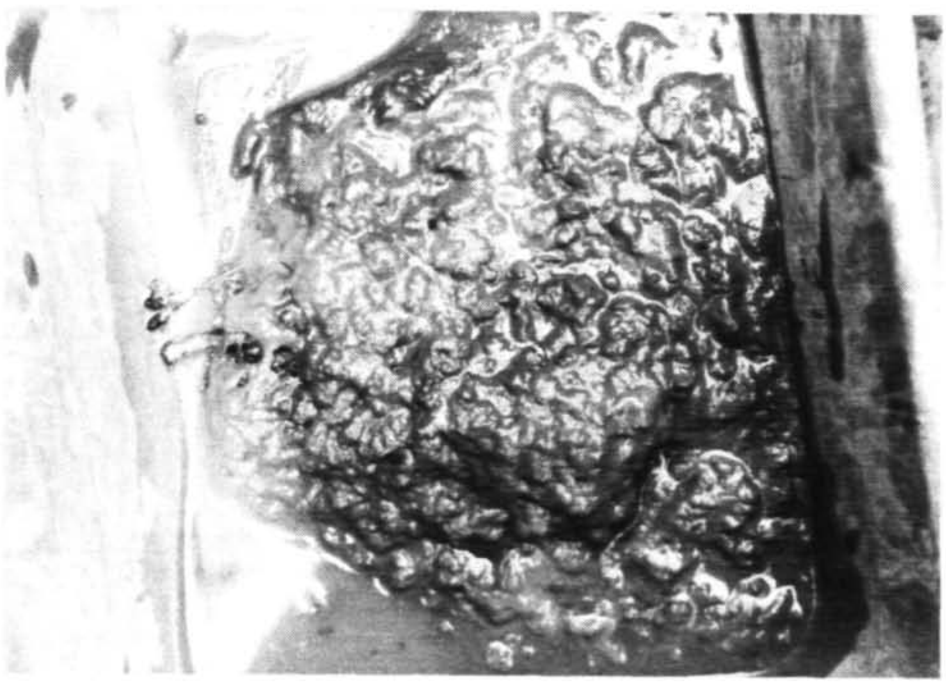


DP 14.75L

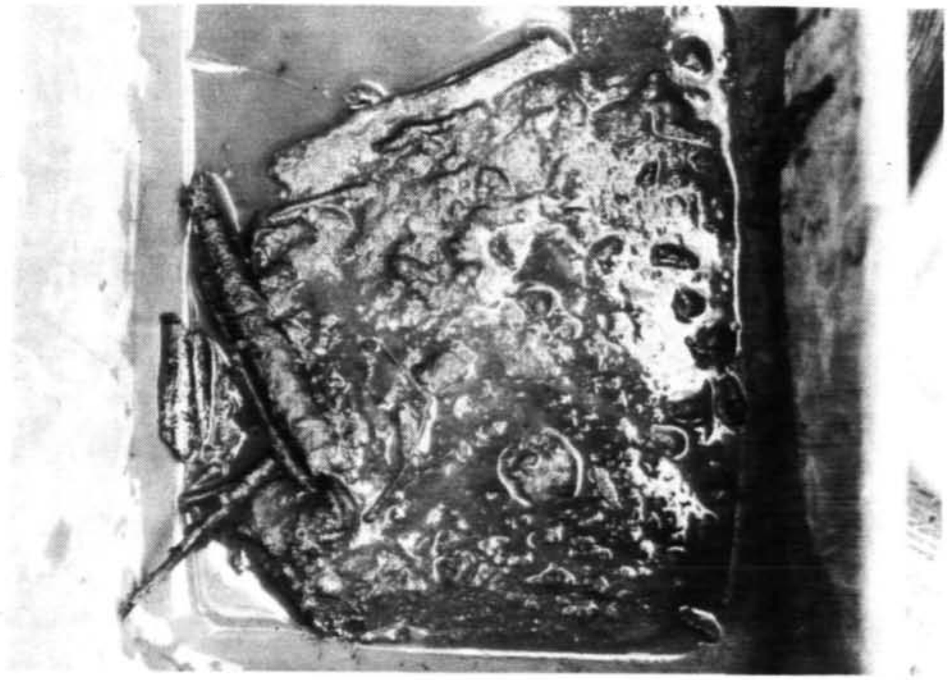
DP 15.00L



DP 15.25L

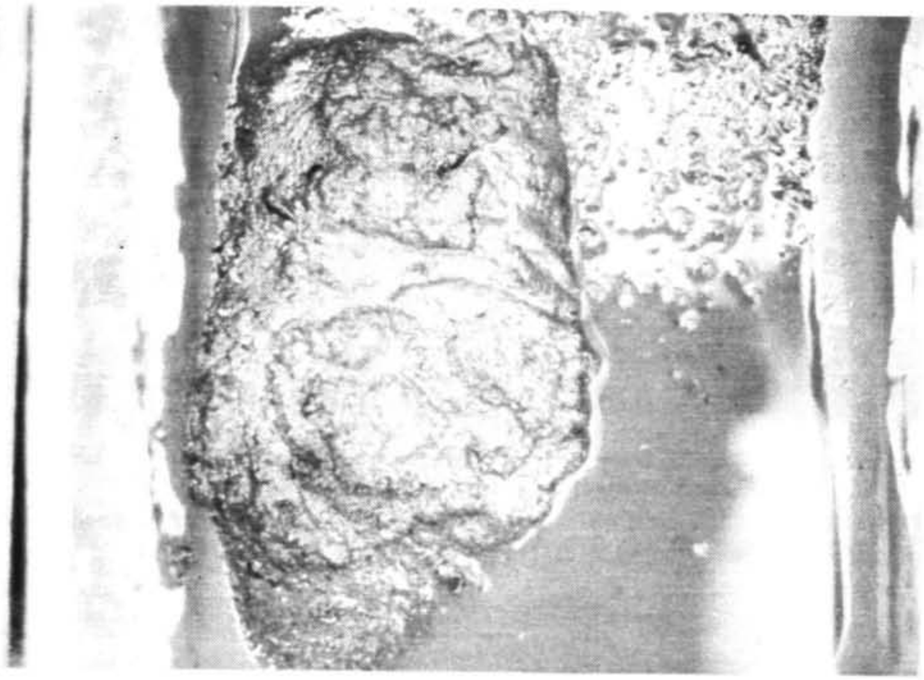


DP 15.50L

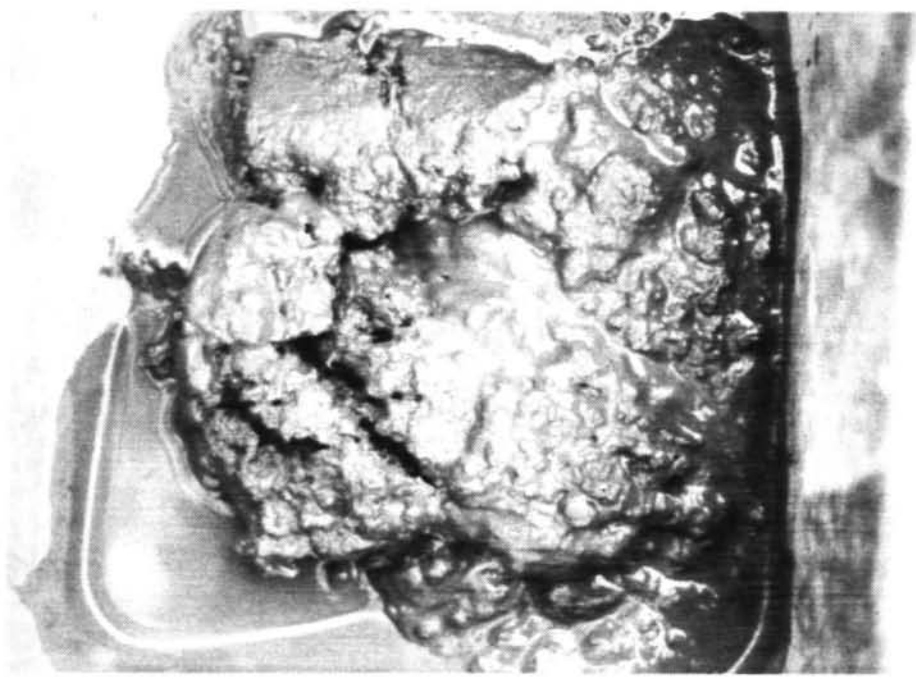


DP 15.75R

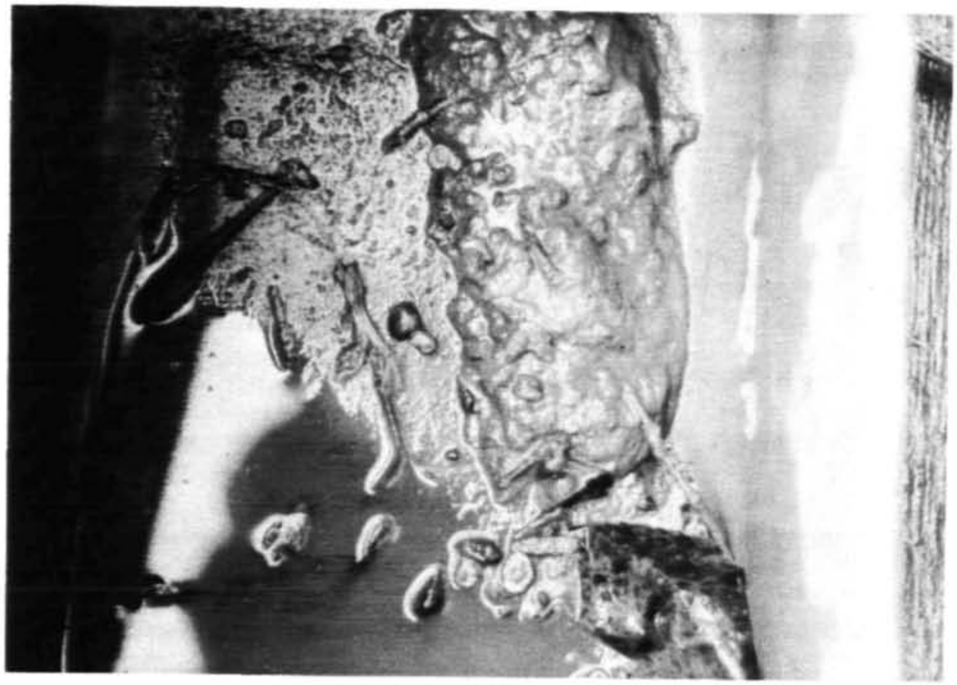
DP 16.00R



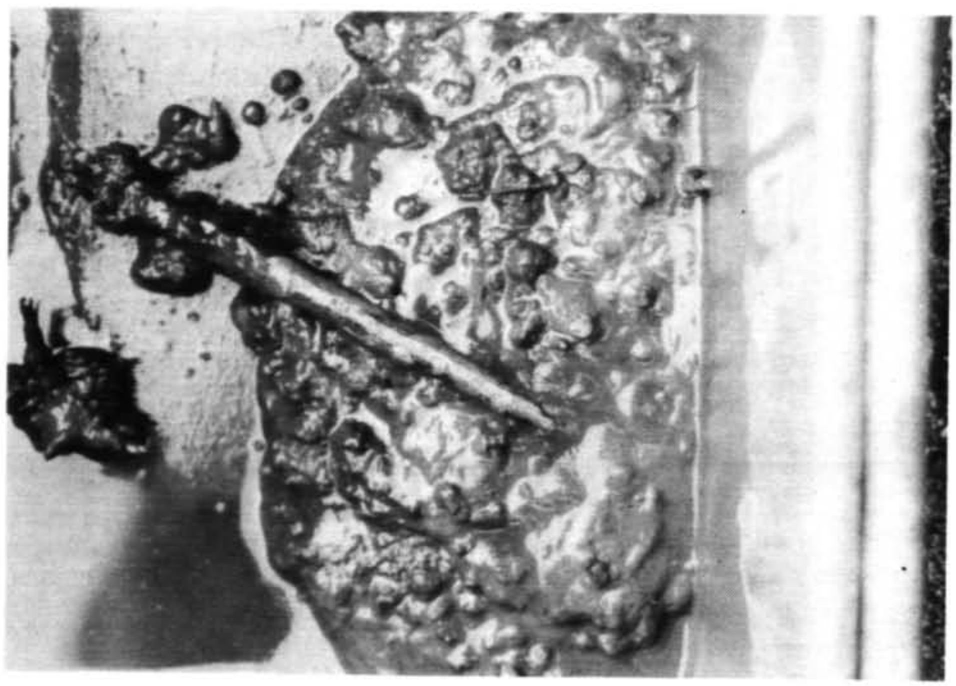
DP 16.25L



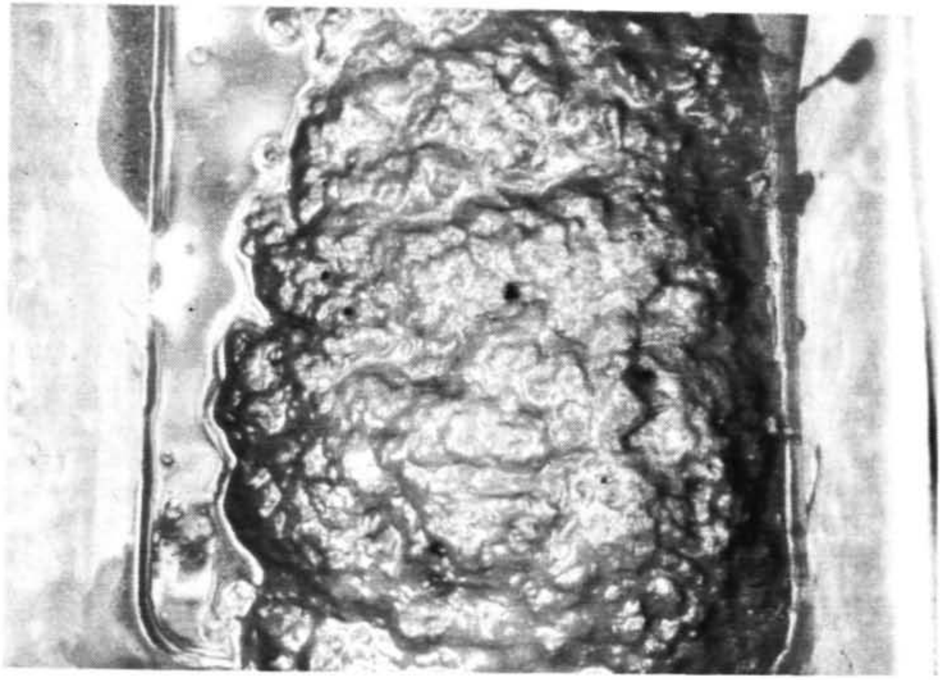
DP 16.50R



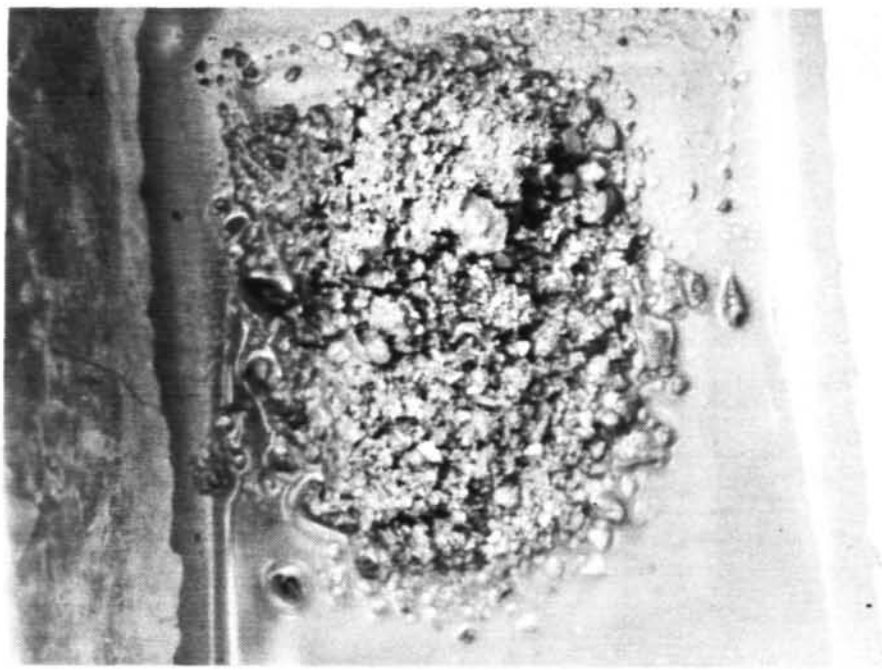
DP 16.75L



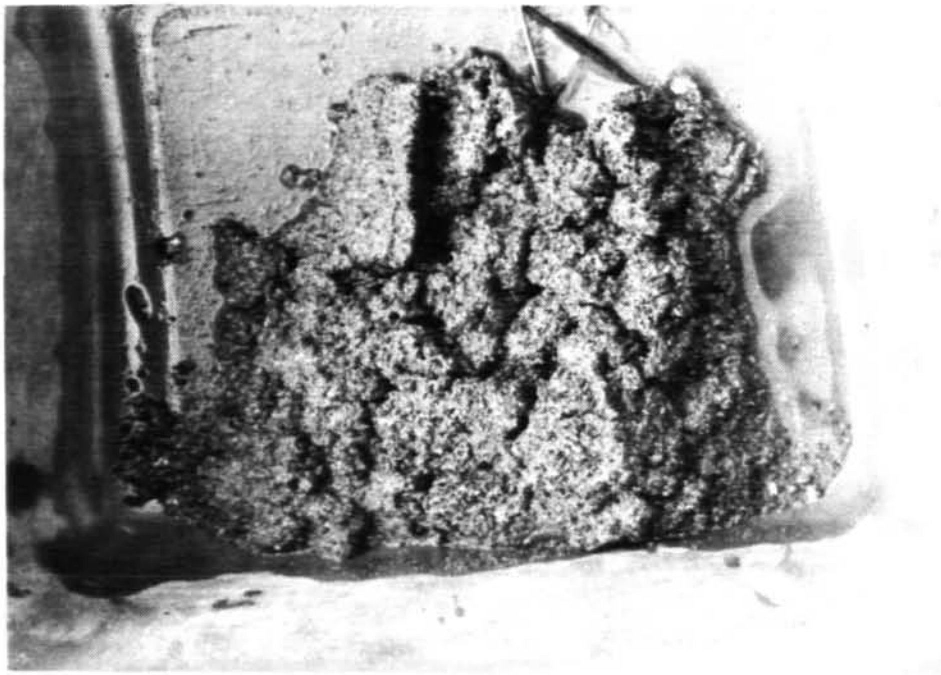
DP 17.00R



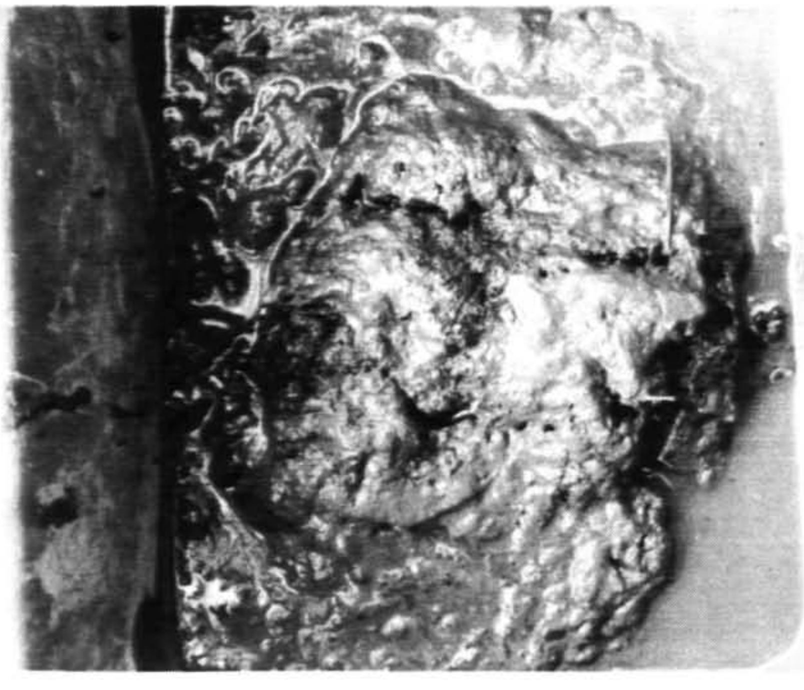
DP 17.25R



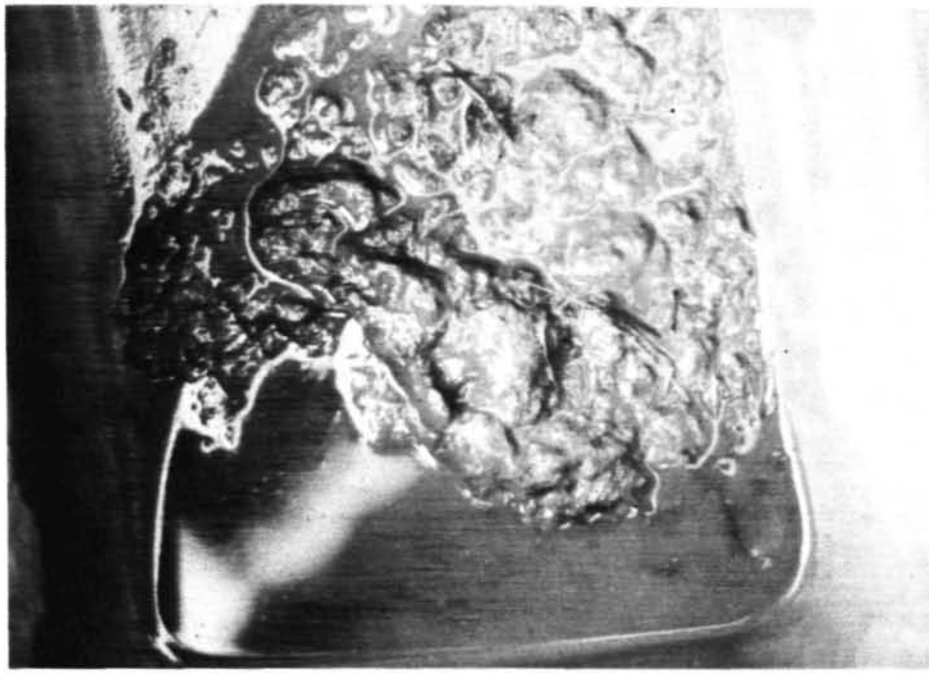
DP 17.50C



DP 17.75L



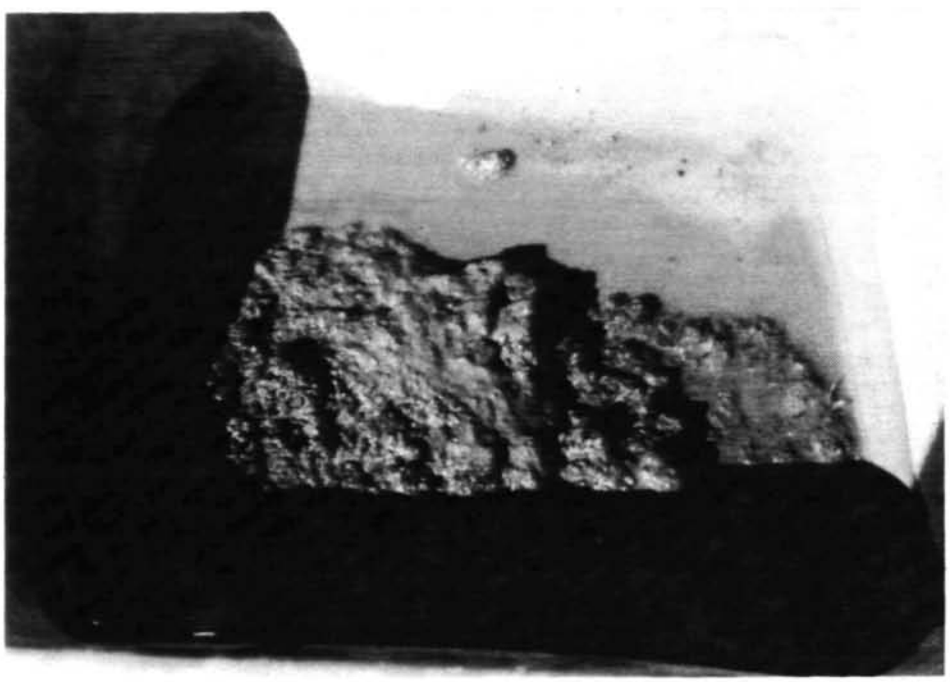
DP 18.00R



DP 18.25L

DP 18.50L

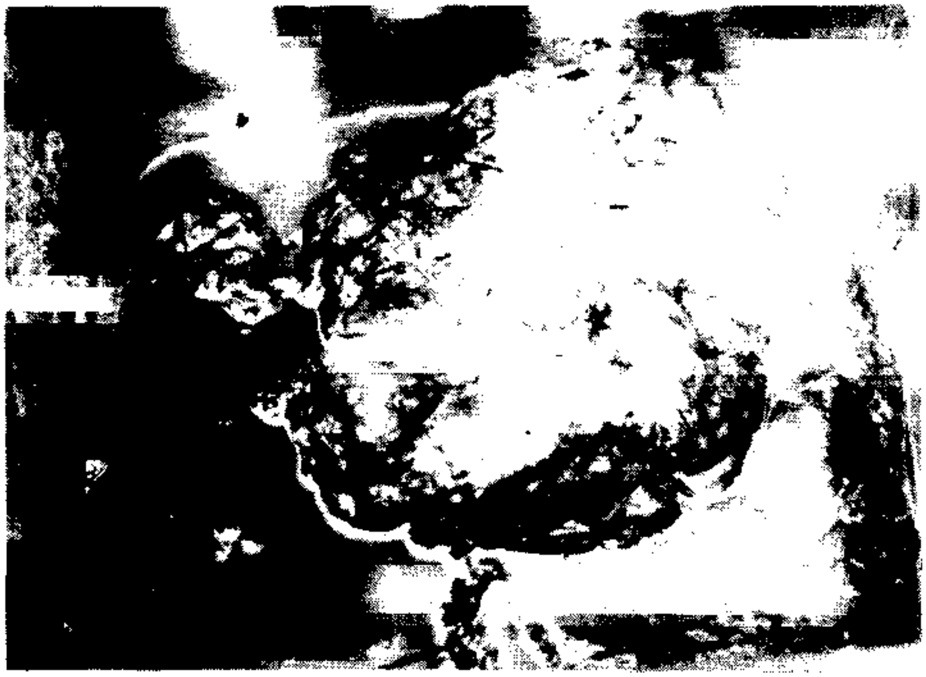
DP 19.00L



DP 19.50C

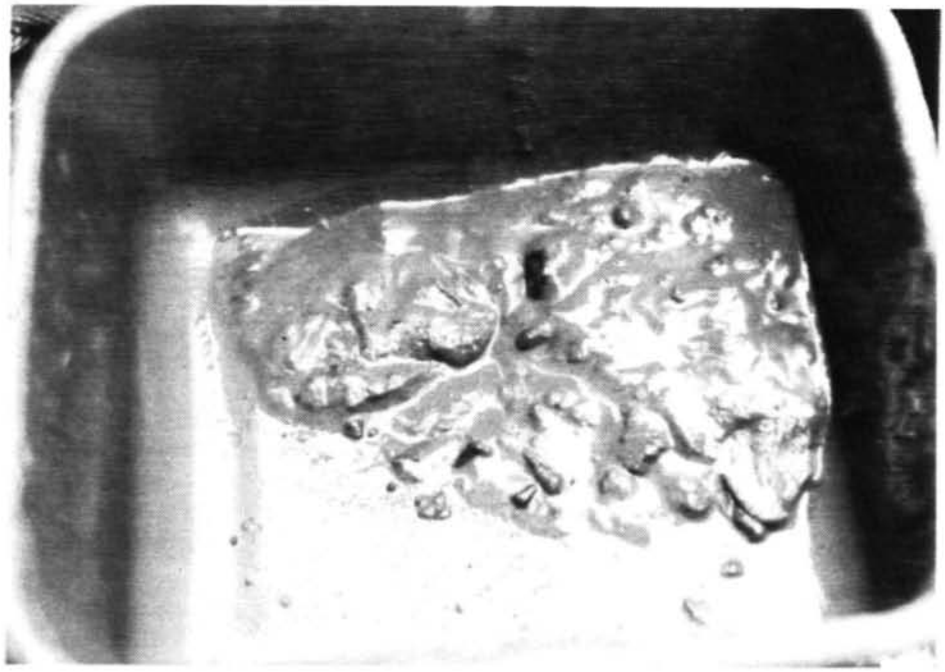
DP 19.75L

DP 20.00R

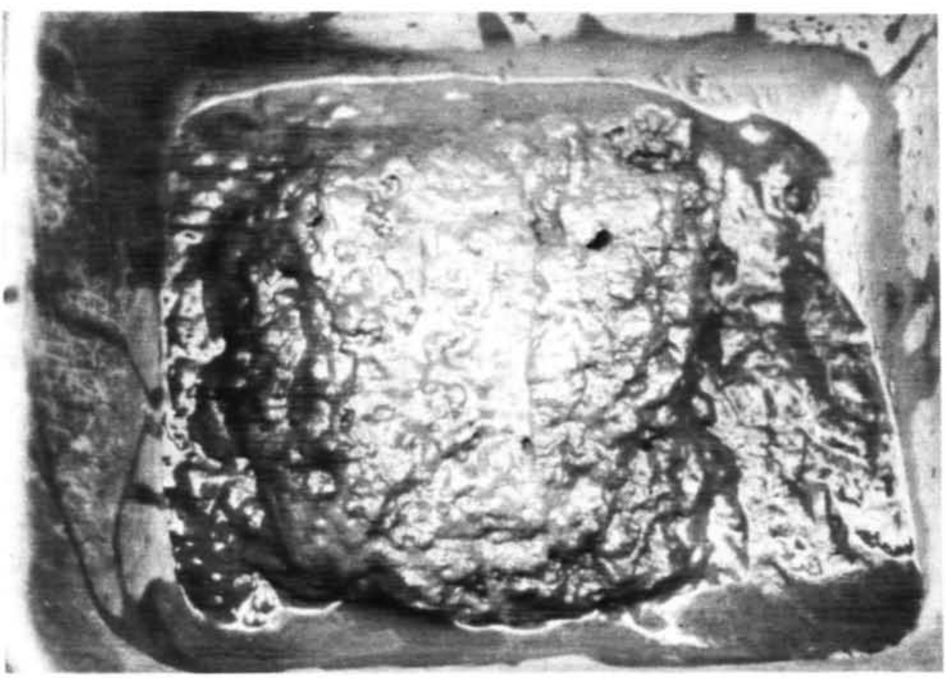


DP 20.25L

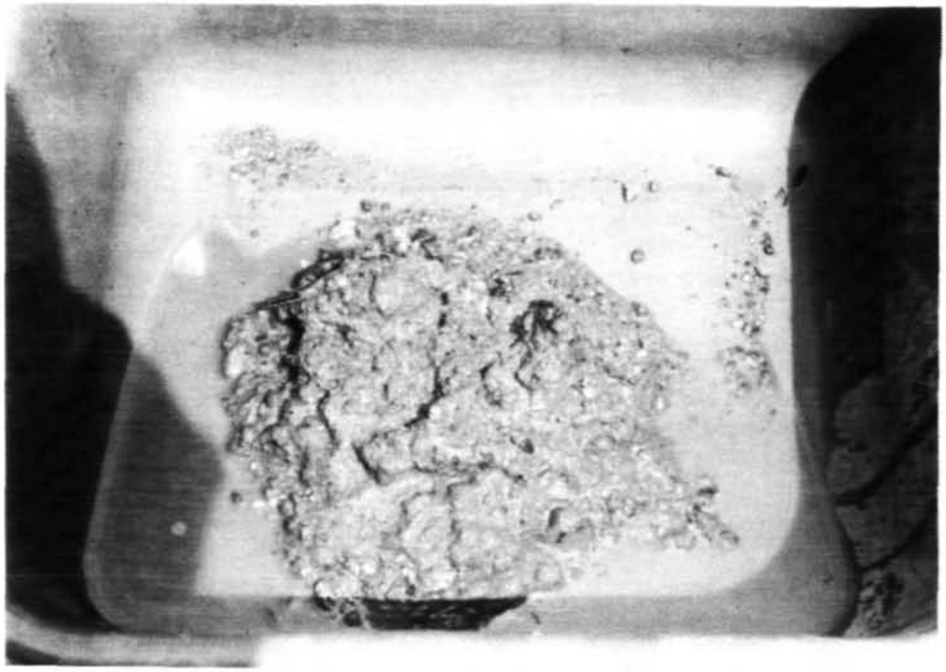
DP 20.50R



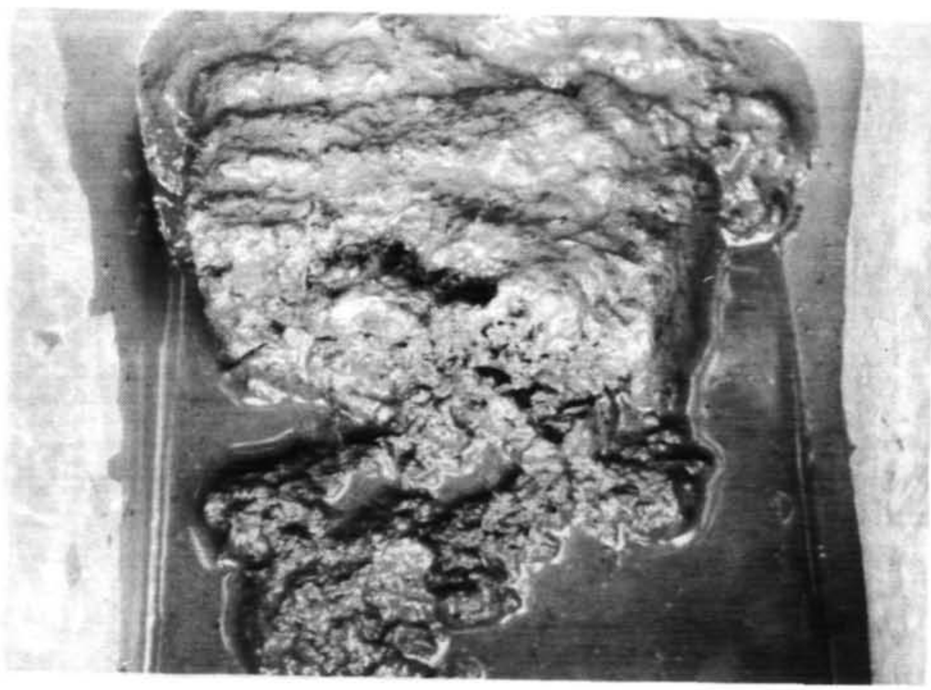
DP 20.75L



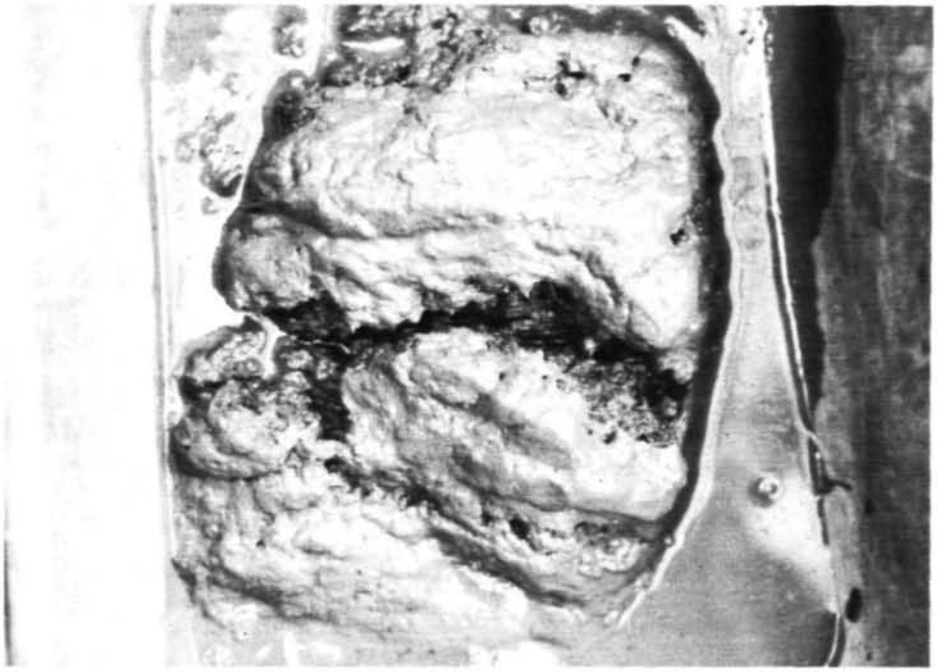
DP 21.00L



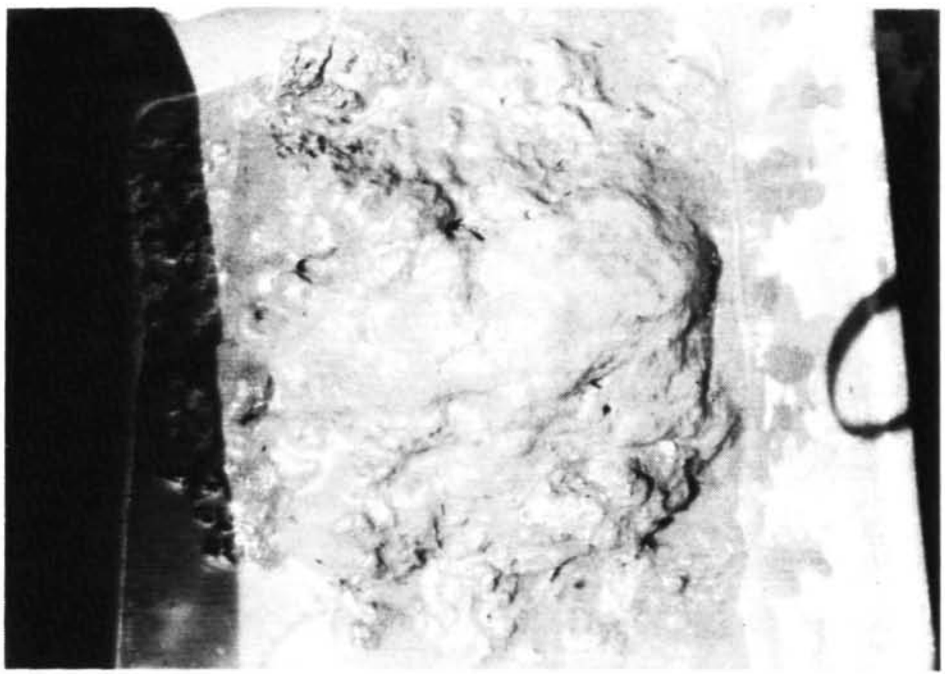
DP 21.25C



DP 21.50R

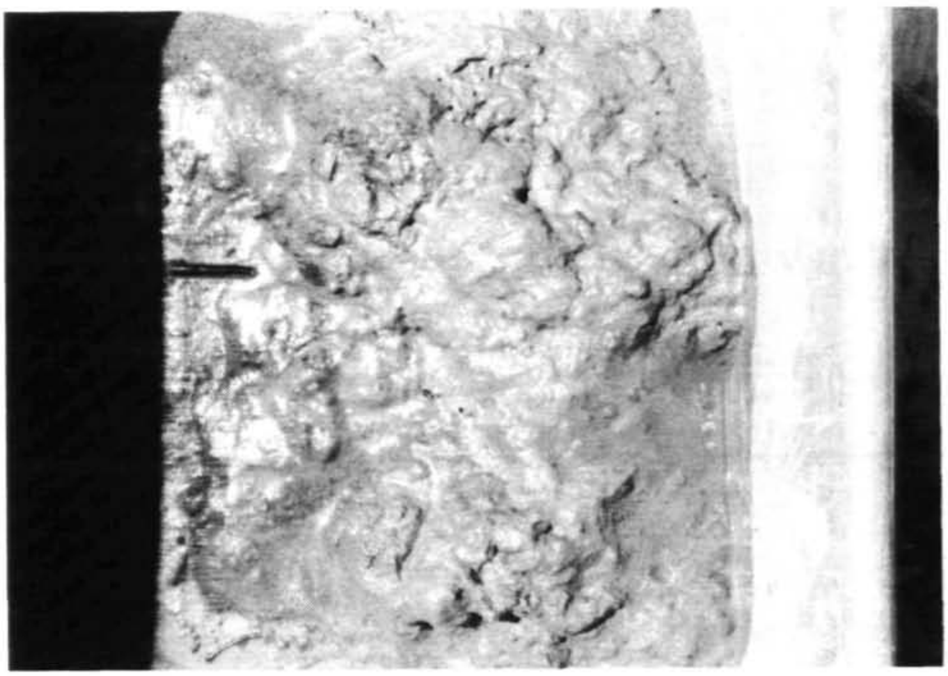


DP 21.75L

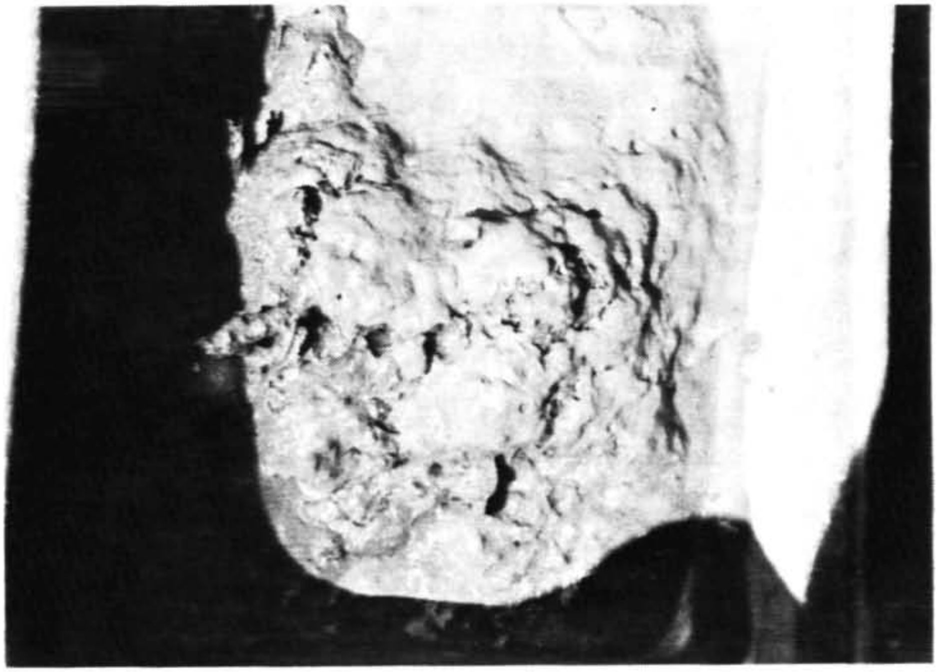


DP 22.00L

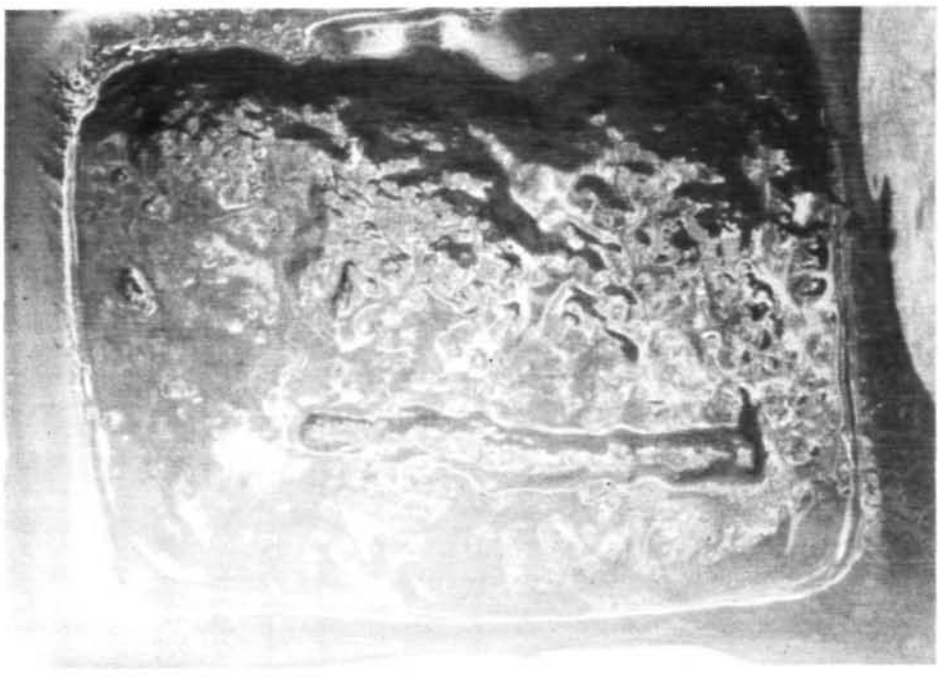
DP 22.25R



DP 22.50L

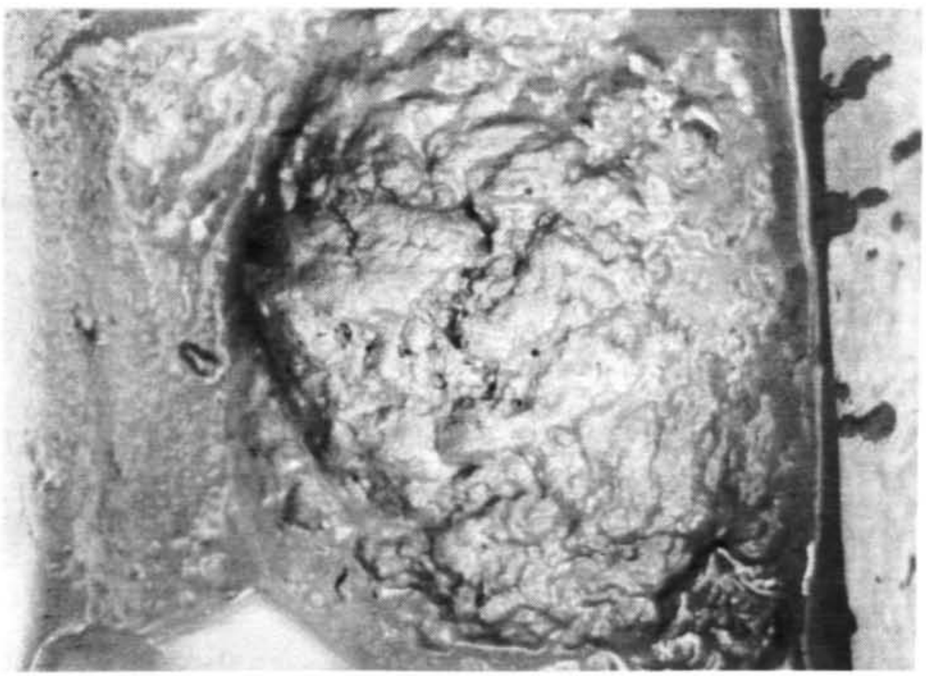


DP 22.75L

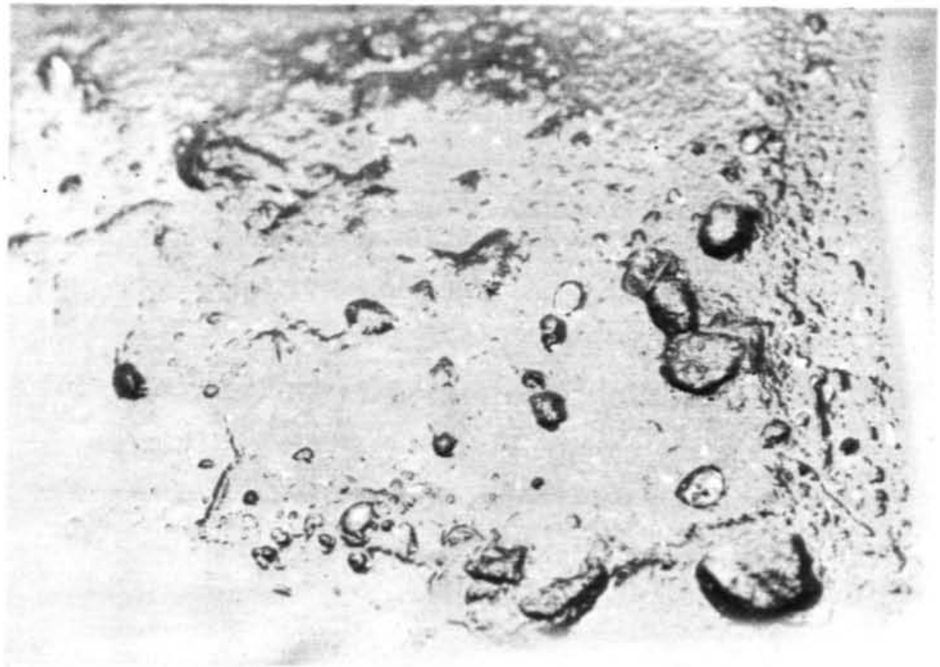


DP 23.00R

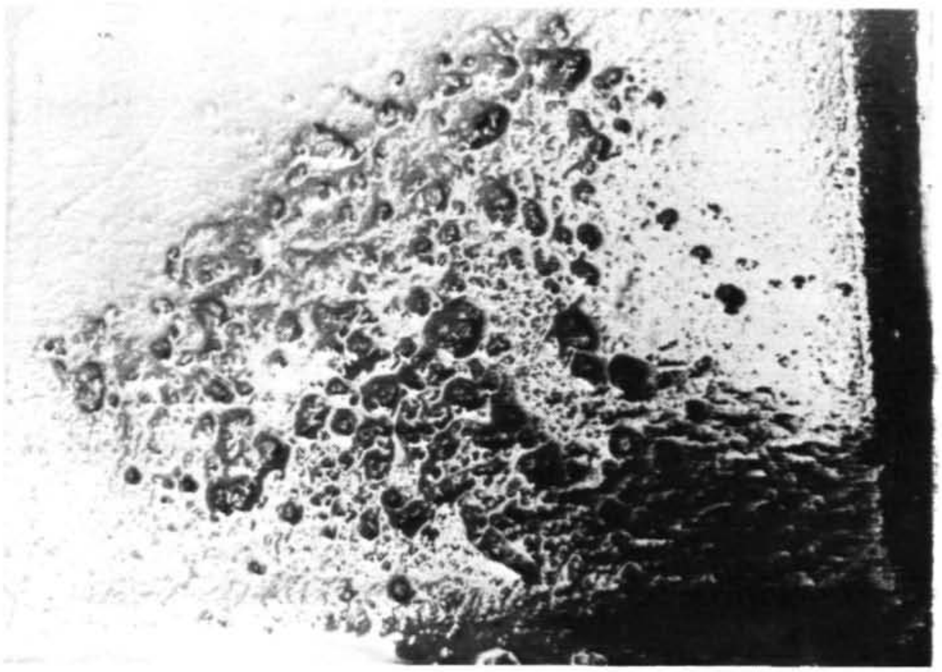
DP 23.25R



DP 23.50L

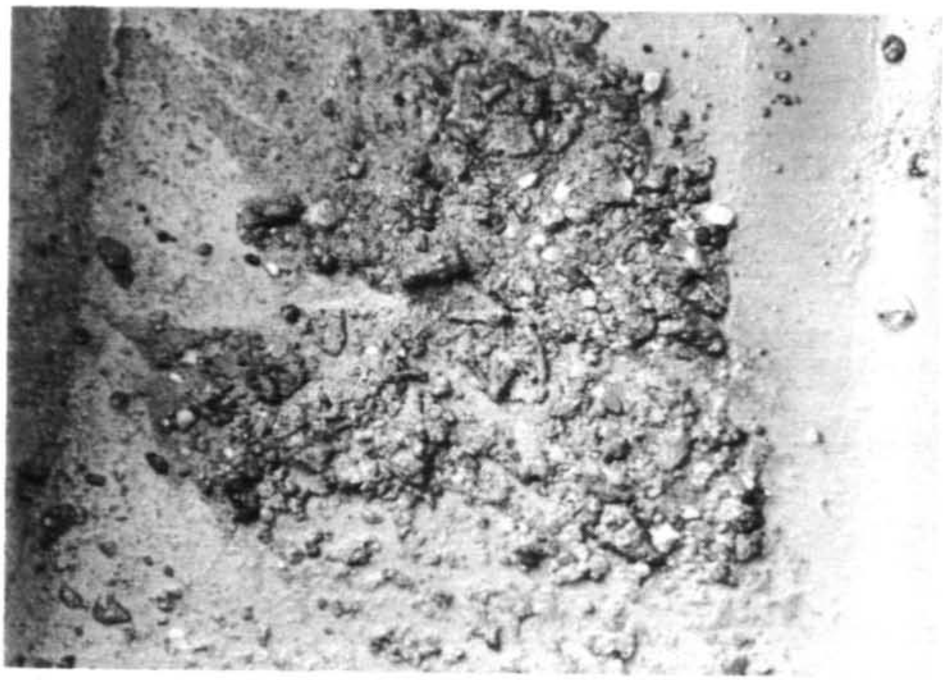


NB 0.00C

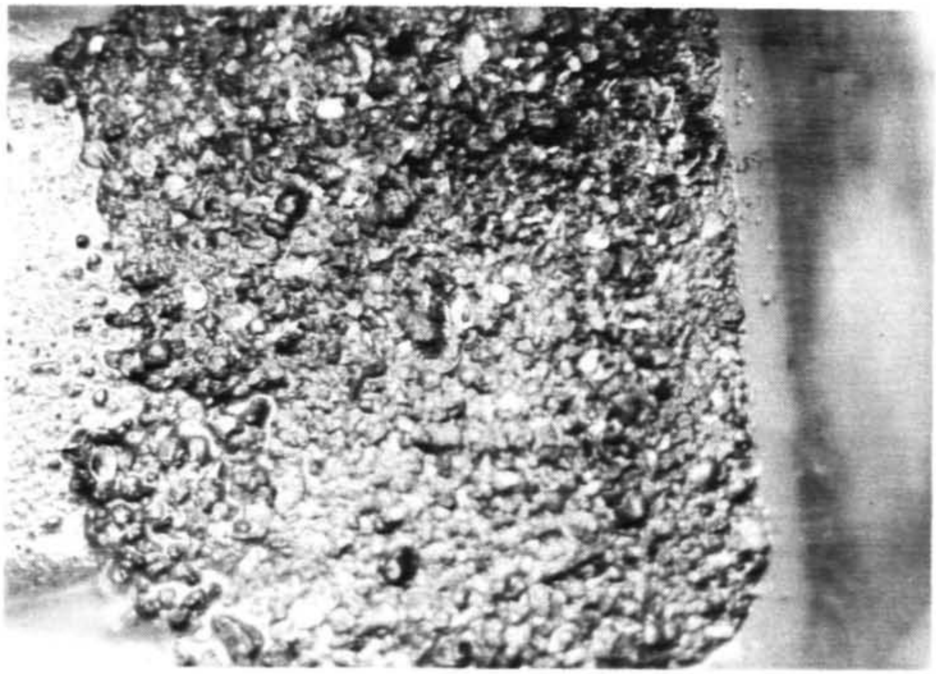


NB 0.25C

NB 0.50C

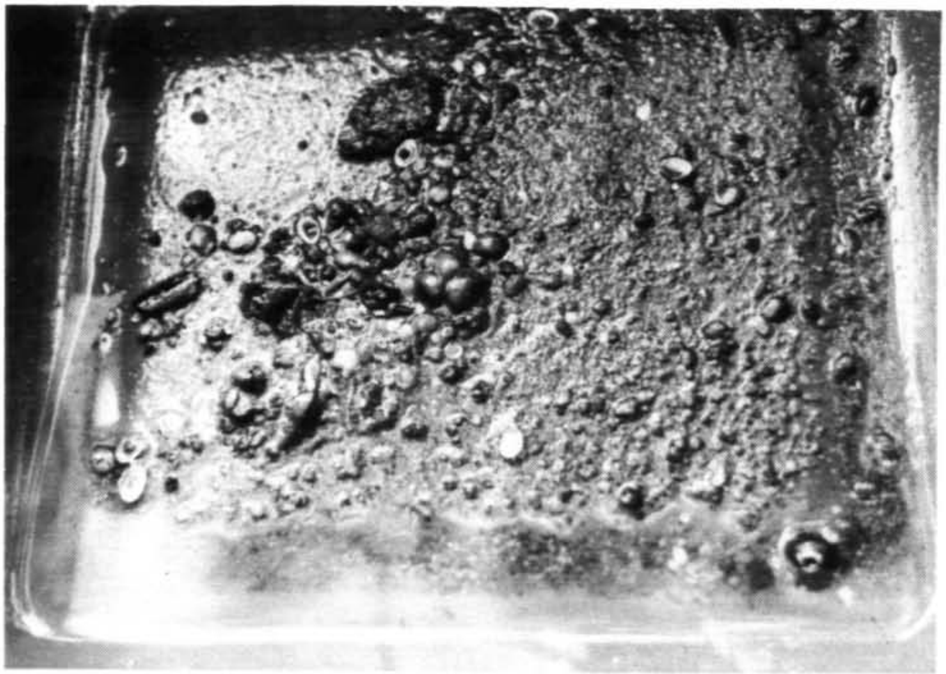


NB 0.75C



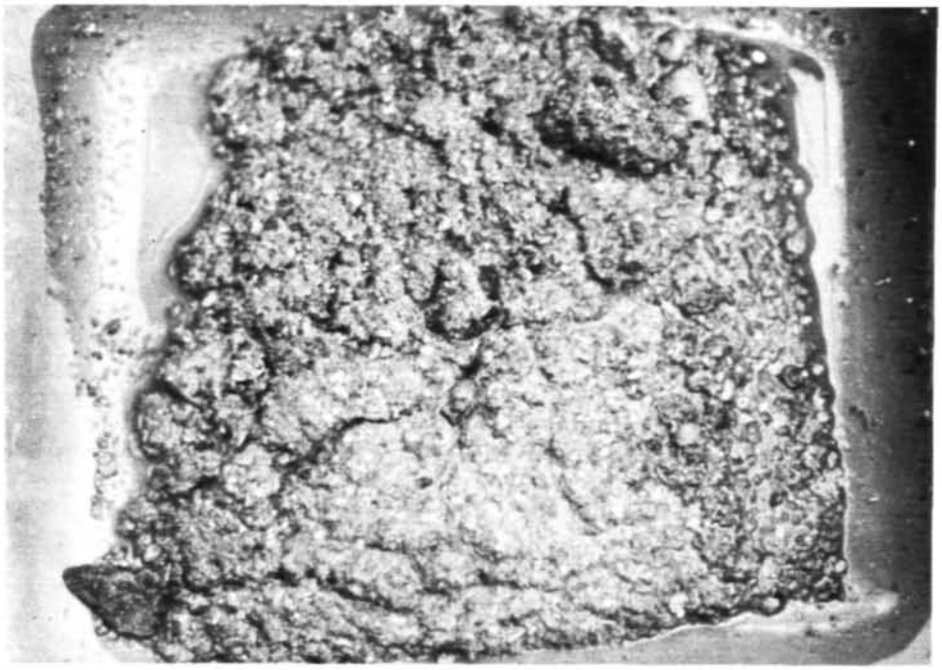
NB 1.00C

NB 1.25C

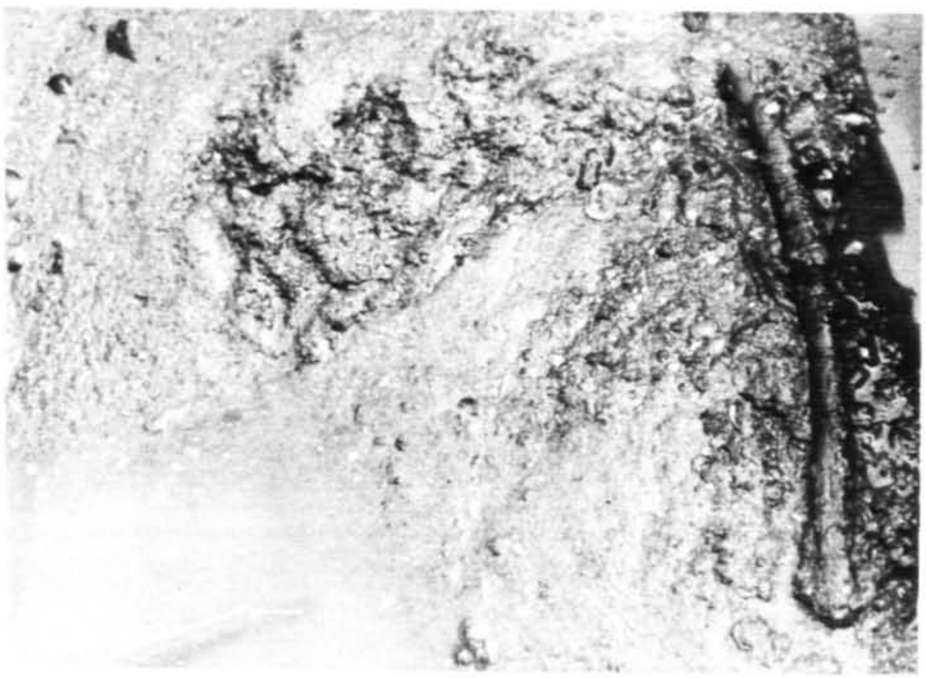


NB 1.50C

NB 1.75C

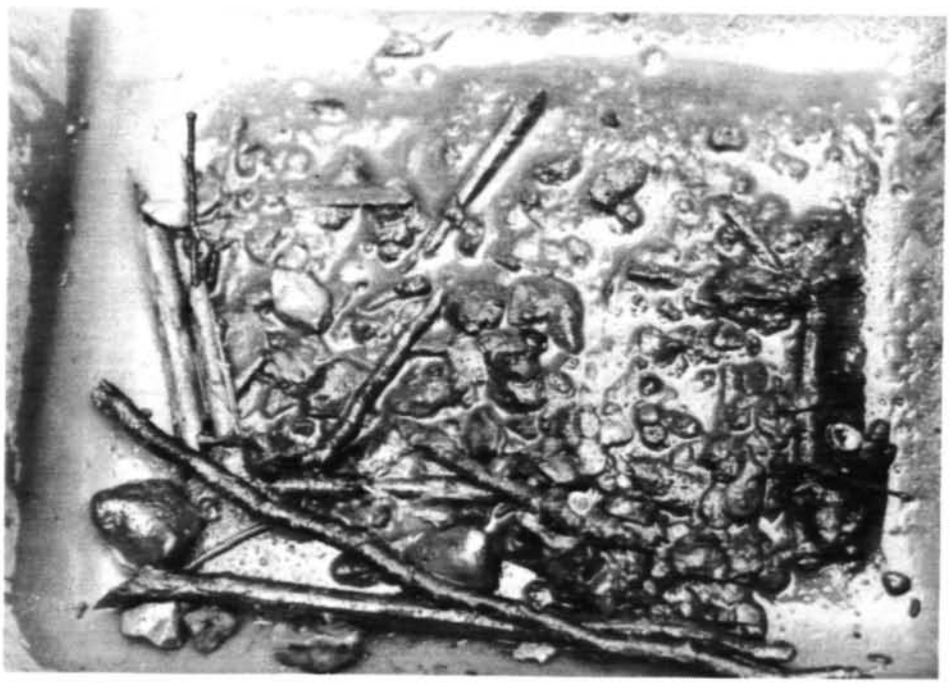


NB 2.00C

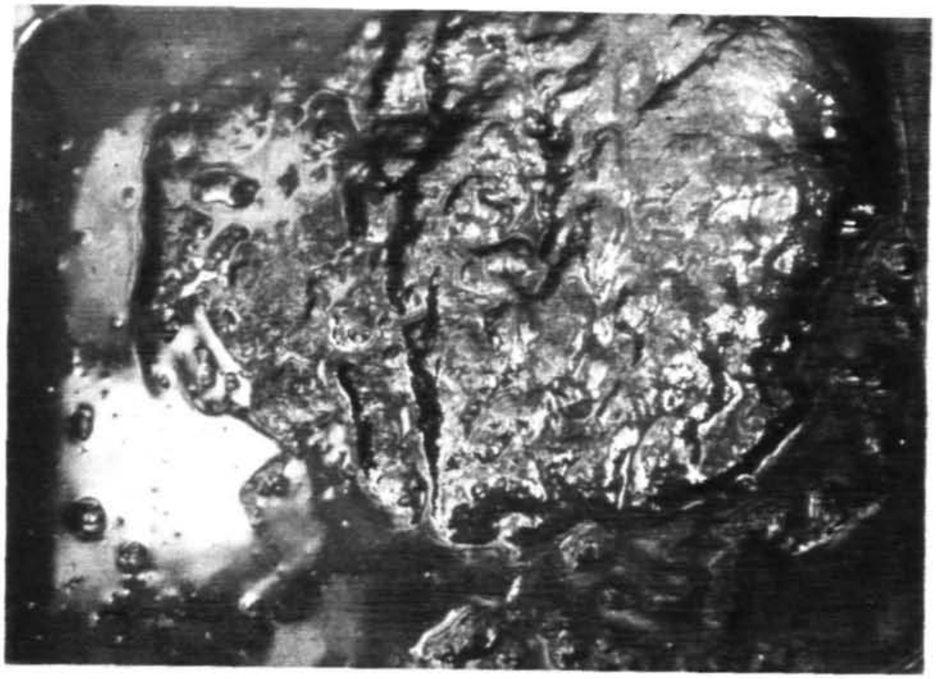


NB 2.25C

NB 2.50C



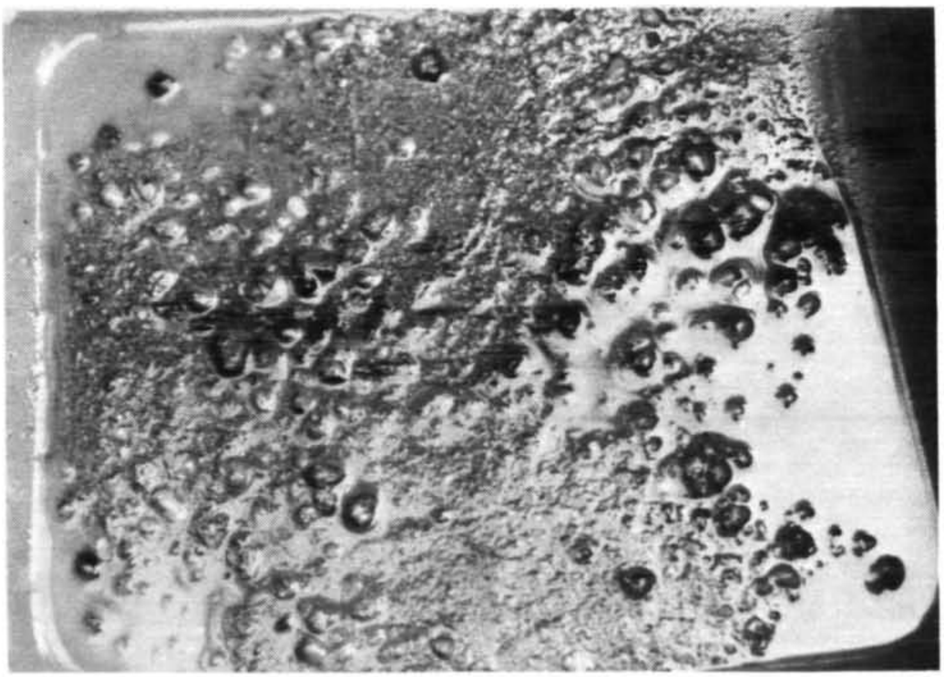
NB 2.75C



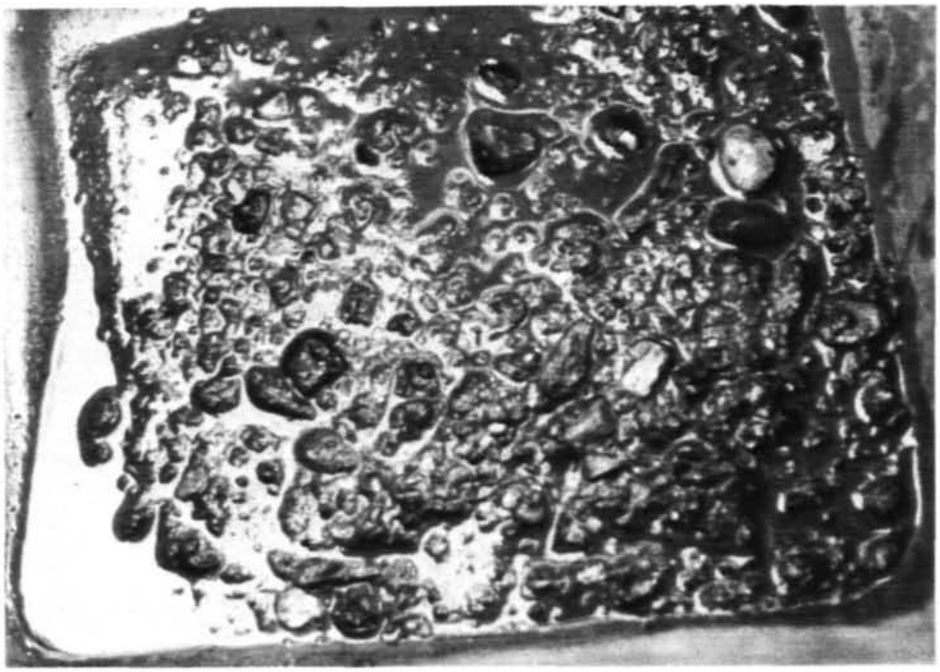
NB 2.75L

NB 3.00C

NB 3.25C

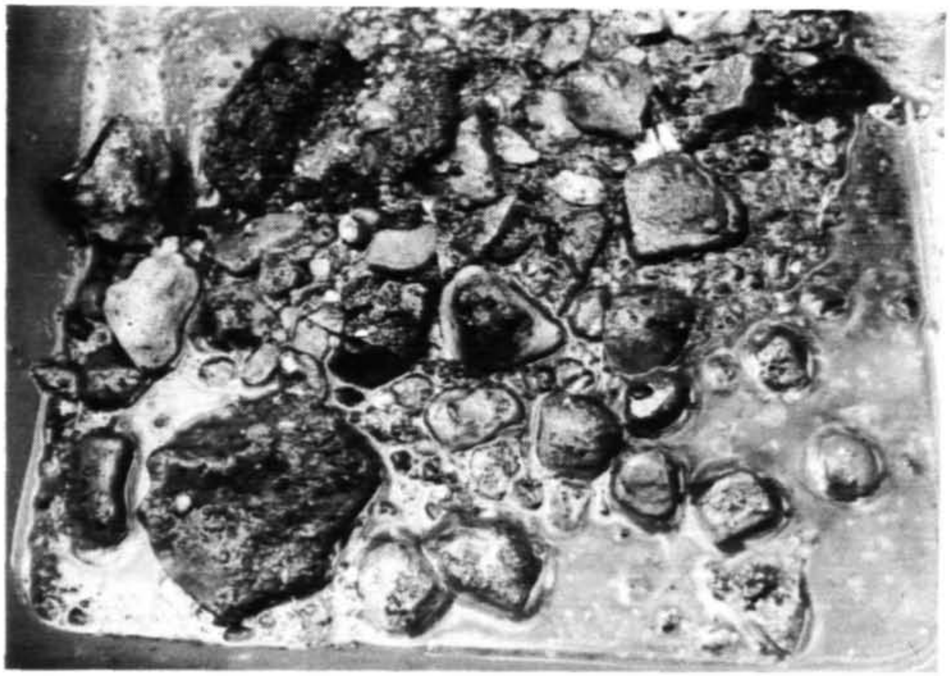


NB 3.50C



NB 3.75C

NB 4.00C



NB 4.25C

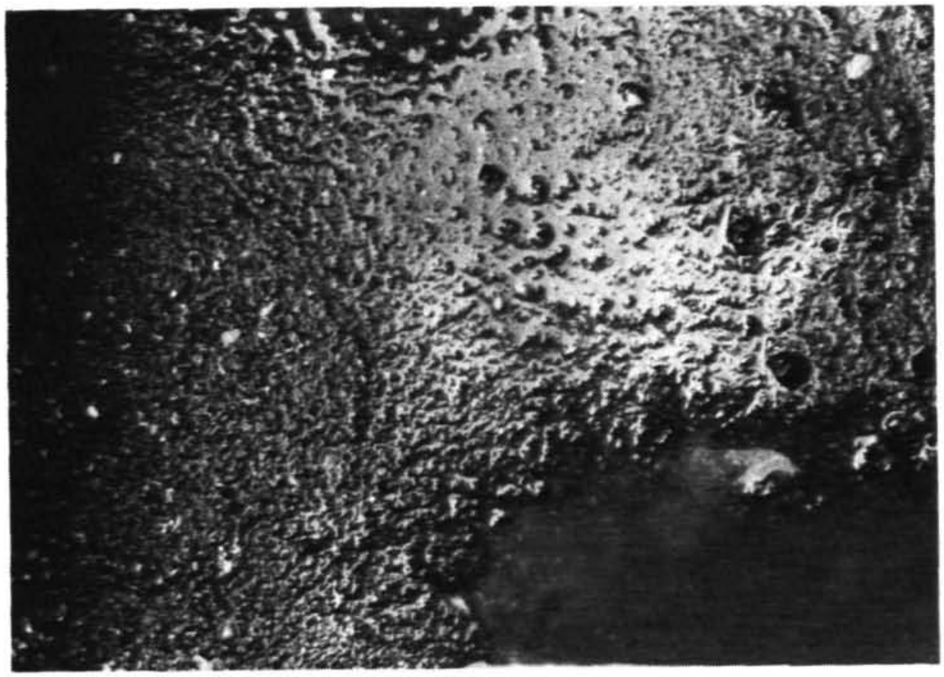
NB 4.50C

NB 4.75C

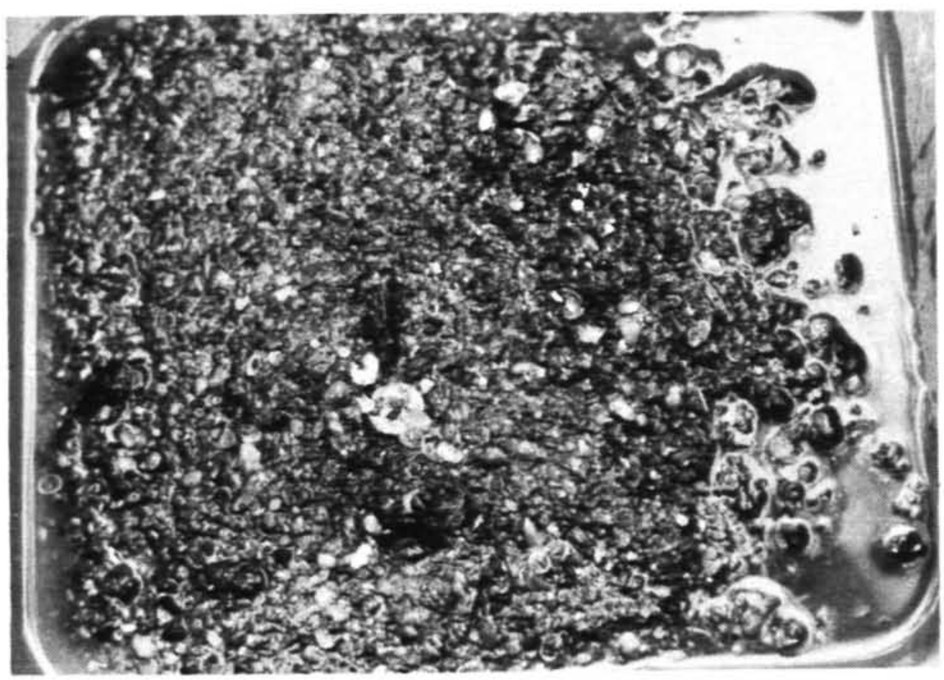
NB 5.00C

NB 5.25C

NB 5.50C



NB 5.75C



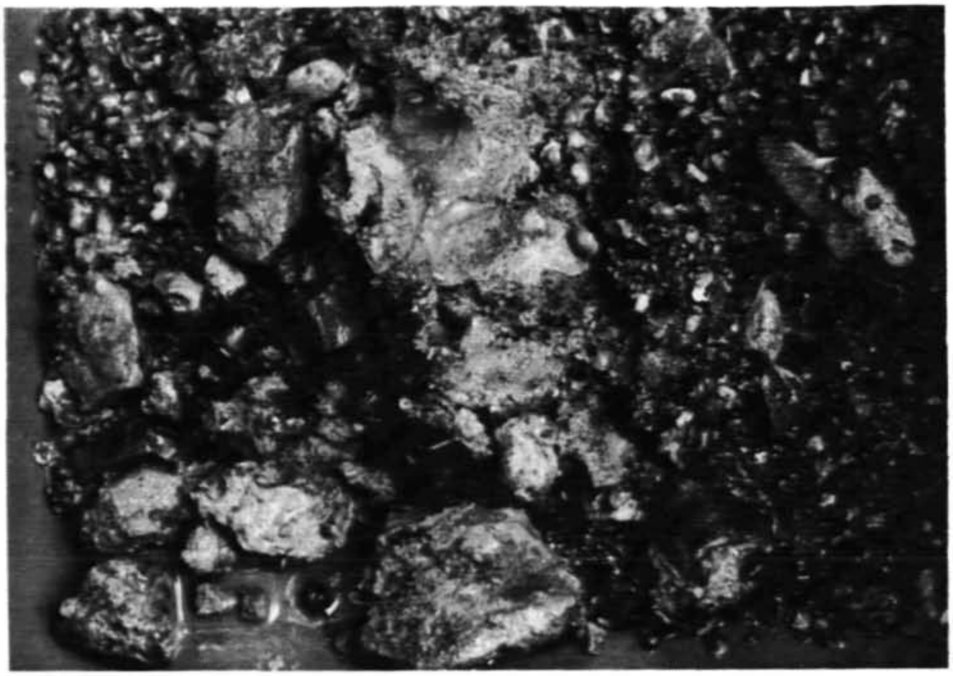
NB 6.00C

NB 6.25C

NB 6.50C

NB 6.75C

NB 7.00C



NB 7.25C

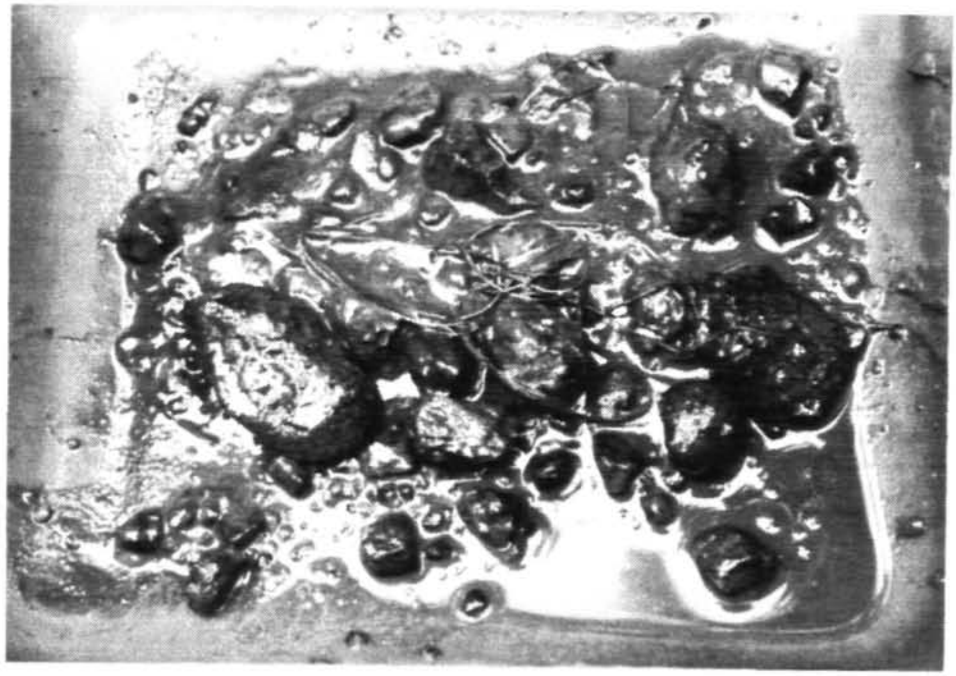
NB 7.50C

NB 7.75C

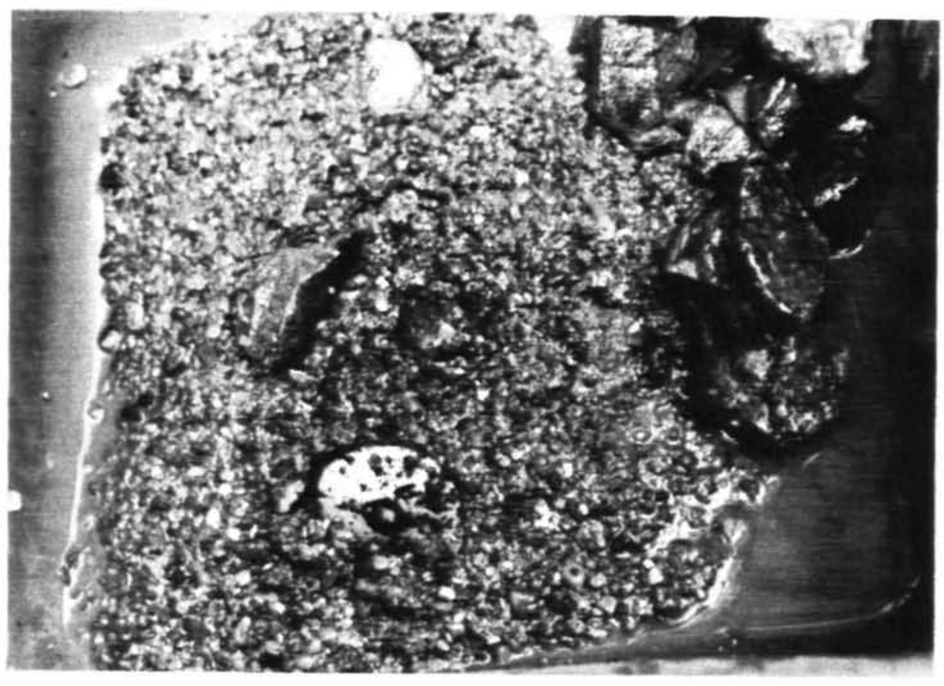
NB 8.00C

NB 8.25C

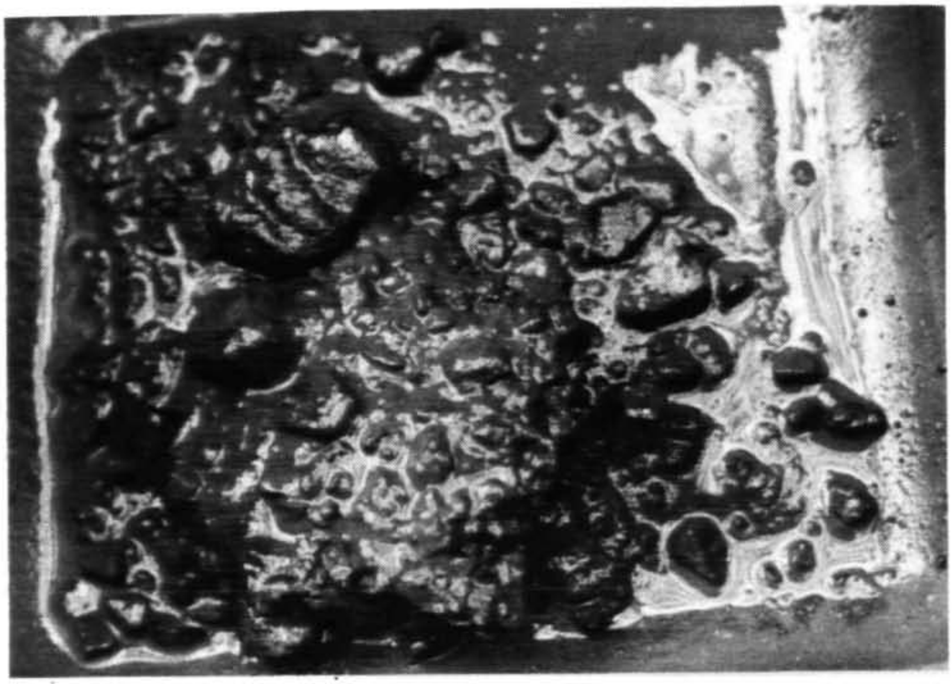
NB 3.50C



NB 8.75C



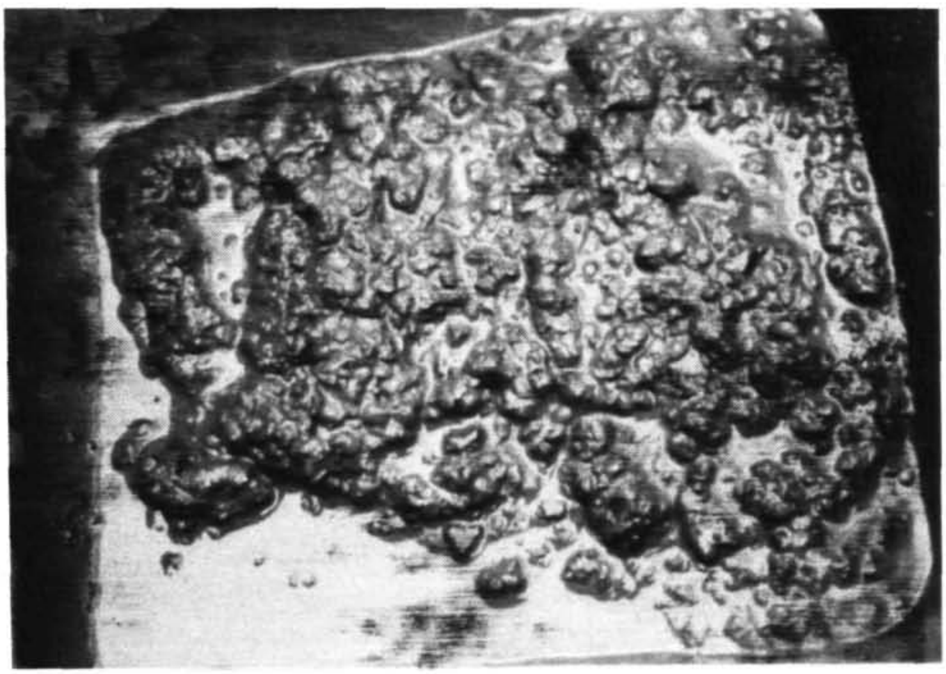
NB 9.00C



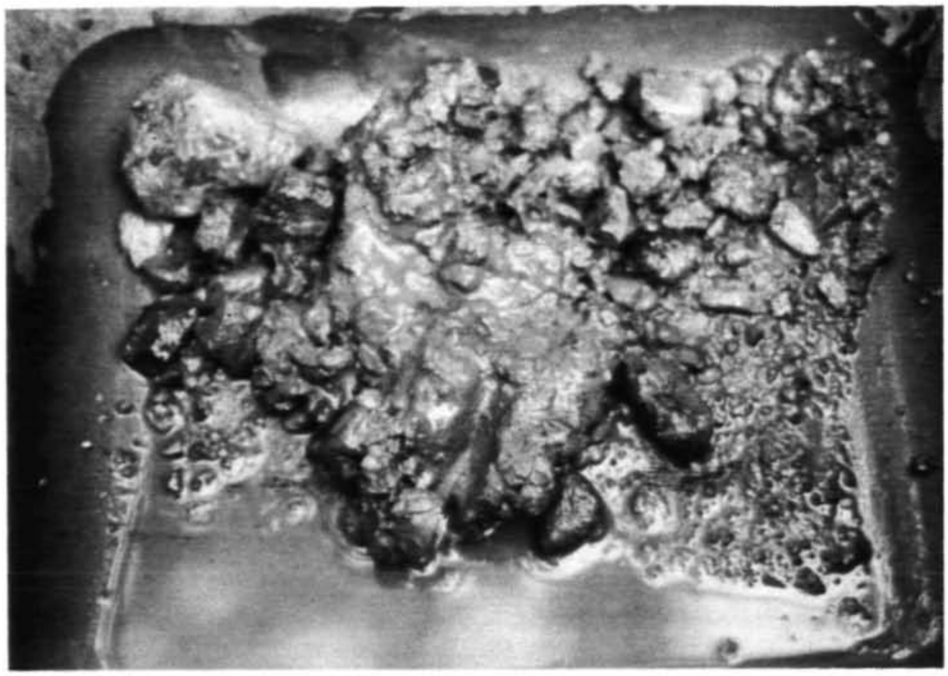
NB 9.25C

NB 9.50C

NB 9.75C



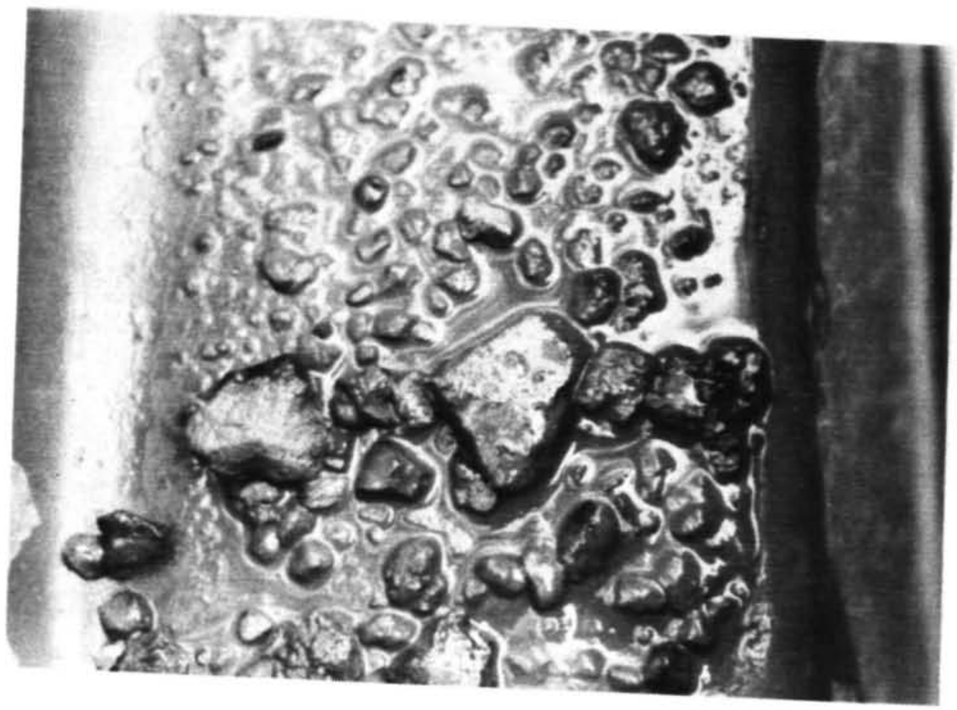
NB 10.00C



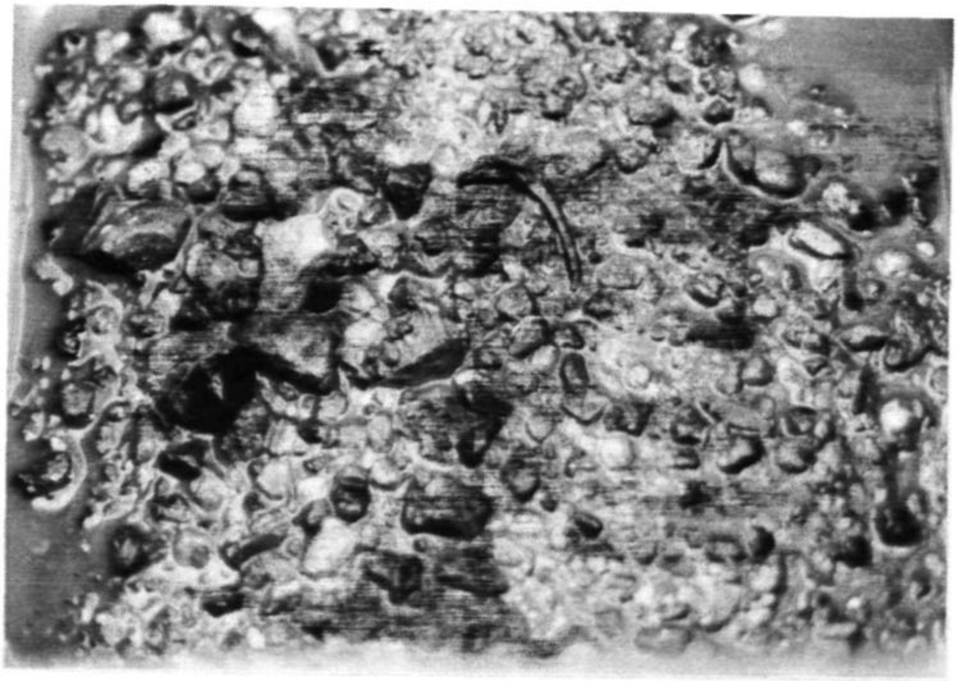
NB 10.25C

NB 10.50C

NB 10.75C



MB 11.00C



NB 11.25C

Appendix E

Stream, Bank, and Land Use Characteristics at Each Station

Appendix E-l. Measured and Observed Stream and Bank Characteristics

Station	Center station depth (ft.-in.)	Stream width (ft.)	Bank erosion right (R) left (L)	Logjam partial (p) complete (C)	Aquatic macrophvtes	Oil in sediment
CR 0.00	36-11	360				
CR 0.25	36-2	250				
CR 0.50	36-6	260				X
CR 0.75	33-3	750				X
CR 1.00	34-8	270				x
CR 1.25	34-11	380				X
CR 1.50	35-2	350				X
CR 1.75	32-7	400	L			x
CR 2.00	34-0	340	L			X
CR 2.25	35-7	265				x
CR 2.50	37-2	360				x
CR 2.75	34-7	350				X
CR 3.00	33-6	325				X
CR 3.25	34-3	365				X
CR 3.50	33-6	325				X
CR 3.75	34-3	340				X
CR 4.00	38-8	310				X
CR 4.25	33-8	510				x
CR 4.50	35-3	420				x
CR 4.75	32-2	575				x
CR 5.00	34-7	475	L			x
CR 5.25	33-4	775	L			x
CR 5.50	31-4	360				x
CR 5.75	19-4	590	R			x
CR 6.00	16-2	450				x
CR 6.25	18-2	450				x
CR 6.50	15-1	575			X	X
LC 0.00	12-8	500			X	X
LC 0.25	13-11	405			X	X
LC 0.50	14-6	330			X	X
LC 0.75	13-8	500			X	X
LC 1.00	12-11	390			X	X
LC 1.25	14-0	585	L		X	X
LC 1.50	15-3	580			X	X
LC 1.75	14-3	480			X	X
LC 2.00	14-4	550	R			X
LC 2.25	15-1	455	L		X	X
LC 2.50	15-1	500			X	X
LC 2.75	13-2	475	R		X	X
LC 3.00	15-6	425	R		X	X
LC 3.25	15-9	440			X	X
LC 3.50	15-1	480	L			X
LC 3.75	16-1	460				X
LC 4.00	14-7	500				X
LC 4.25	15-3	430				X
LC 4.50	14-3	930			X	X
LC 4.75	15-10	515				X
LC 5.00	14-1	385	L			X
LC 5.25	13-2	400				X
LC 5.50	14-3	420				X
LC 5.75	13-2	355				X
LC 6.00	15-9	305			X	X
LC 6. 25	7-10	140			X	X
LC 6.50	9-8	125			X	X

Station	Center station depth (St.-in.)	Stream width (ft.)	Bank erosion right (R) left (L)	Loajam partial (P) complete (C)	Aquatic macrophytes	Oil in sediment
LC 6.75	4-0	165		P	X	
LC 7.00	3-2	138			X	
LC 7.25	3-9	82				X
LC 7.50	3-2	74			X	X
LC 7.75	4-7	70			X	X
LC S.00	3-2	65			X	X
LC 8.25	3-10	70			X	X
LC 8.50	2-2	76			X	X
LC 8.75	3-9	50			X	
LC 9.00	2-11	68			X	
LC 9-25	4-0	90			X	
LC 9-50	2-3	70			X	X
LC 9.75	4-5	50			X	
LC 10.00	3-5	68		P	X	
LC 10.25	2-6	70		P	X	
LC 10.50	3-3	62			X	
LC 10.75	2-0	64			X	X
LC 11-00	3-8	70			X	
LC 11-25	4-9	62			X	
LC H.50	4-7	44			X	
LC 11-75	3-5	54			X	X
LC 12.00	3-2	82		C	X	X
LC 12.25	4-0	60		P	X	
LC 12.50	4-5	65			X	X
LC 12.75	4-2	50		P	X	
LC 13-00	6-5	76			X	X
LC 13.25	3-3	67			X	X
LC 13.50	4-1	60			X	
LC 13.75	4-3	64				X
LC 14.00	4-5	61			X	
LC 14.25	3-3	60		P		X
LC 14.50	5-2	56				
LC 14.75	3-5	30			X	
LC 15.00	2-8	24				
LC 15.25	1-4	31		P	X	
LC 15.50	3-2	28		C		
LC 15.75	2-4	30		C		
LC 16.00	1-4	30		P		X
LC 16.25	1-0	32				
LC 16.50	1-10	28				
LC 16.75	2-6	32		C		
LC 17.00	2-9	31				X
LC 17.25	2-2	30				
LC 17.50	1-8	30				X
LC 17.75	1-9	34				X
LC 18.00	1-5	29				X
LC 18.25	1-10	33			X	X
LC 18-50	2-4	27				X
LC 18.75	1-6	26		C		
LC 19.00	1-2	25				
GC 0.25	1-10	250			X	X
GC 0.50	2-4	82			X	X
GC 0.75	2-11	75			X	X
GC I-00	1-8	60				X

Station	Center station depth (ft.-in.)	Stream width (ft.)	Bank erosion right (R) left (L)	Logjam partial (P) complete (C)	Aquatic macrophvtes	Oil in sediment
GC 1.25	2-3	51				X
GC 1.50	2-1	66				X
GC 1.75	2-9	42				X
GC 2.00	2-8	64				X
GC 2.25	3-1	70			X	X
GC 2.50	3-5	58			X	X
GC 2.75	3-8	50			X	X
CU 0.00	1-3	19				
CU 0.25	0-3	14				
CU 0.50	1-2	10				X
CU 0.75	0-11	17				X
CU 1.00	2-8	15		C		
CU 1.25	0-6	15				
CU 1.50	1-5	19				X
CU 1.75	1-1	18			X	
CU 2.00	0-10	17			X	
CU 2.25	1-2	18				
CU 2.50	1-5	13				X
CU 2.75	1-9	17				
CU 3.00	1-6	25				X
CU 3.25	1-2	10			X	
CU 3.50	0-8	7			X	X
AC 0.00	0-10	45				X
AC 0.25	1-2	36		P		
AC 0.50	1-2	36				
AC 0.75	1-3	35				X
AC 1.00	1-8	42				
AC 1.25	1-2	27				
AC 1.50	3-1	28				
AC 1.75	2-6	30				X
AC 2.00	1-0	30				X
AC 2.25	1-5	21			X	X
AC 2.50	1-6	27				X
AC 2.75	0-8	33				X
AC 3.00	1-2	30				
AC 3.25	1-2	14				
AC 3.50	1-2	21				X
AC 3.75	1-1	30				X
AC 4.00	2-0	26		C		
AC 4.25	0-10	23				X
AC 4.50	0-10	20				X
AC 4.75	1-8	23				
AC 5.00	2-10	20				
AC 5.25	3-2	19				
AC 5.50	2-6	27				
AC 5.75	1-10	36			X	
AC 6.00	1-11	18			X	
AC 6.25	1-6	20				
AC 6.50	1-10	30				
AC 6.75	4-0	49				X
AC 7.00	4-5	300			X	
AC 7.25	1-4	15				
AC 7.50	2-3	47			X	

Station	Center station depth (ft.-in.)	Stream width (ft.)	Bank erosion right (R) left (L)	Logjam partial (P) complete (C)	Aquatic macrophytes	Oil in sediment
AC 7.75	1-2	20				X
AC 8.00	0-7	17				
AC 8.25	2-10	20		P		
AC 8.50	0-9	25				
AC 8.75	0-10	25				
AC 9.00	1-3	22			X	
AC 9.25	0-10	26			X	X
AC 9.50	1-3	30			X	X
AC 9.75	1-7	23			X	X
AC 10.00	0-11	12			X	
AC 10.25	0-3	5	R		X	
AC 10.75	0-6	3			X	
AC 11.00	0-9	9			X	
DP 0.00	1-2	220			X	
DP 0.25	1-1	210			X	
DP 0.50	1-8	195				X
DP 0.75	3-2	180				
DP 1.00	1-8	190		P		X
DP 1.25	1-10	151				
DP 1.50	2-2	150				
DP 1.75	1-2	115				
DP 2.00	1-0	165				
DP 2.25	1-4	200				
DP 2.50	1-9	190				
DP 2.75	1-11	185		P		
DP 3.00	3-5	240				
DP 3.25	3-4	145				
DP 3.50	8-4	265		C	X	X
DP 3.75	4-5	190				X
DP 4.00	4-5	115				X
DP 4.25	4-10	160			X	X
DP 4.50	6-3	130				X
DP 4.75	8-1	115				X
DP 5.00	4-2	130			X	X
DP 5.25	3-6	130				X
DP 5.50	3-6	115			X	X
DP 5.75	3-7	85				X
DP 6.00	3-11	105				X
DP 6.25	3-6	100				
DP 6.50	7-6	100				X
DP 6.75	6-2	110		P		X
DP 7.00	6-2	110				X
DP 7.25	6-0	100				X
DP 7.50	7-3	95				X
DP 7.75	9-0	95				X
DP 8.00	9-9	95				X
DP 8.25	5-9	95				X
DP 8.50	9-6	75				
DP 8.75	5-2	60				
DP 9.00	4-0	95				
DP 9.25	4-5	80				X
DP 9.50	3-0	105				X
DP 9.75	4-8	80				X
DP 10.00	3-0	120		P		X

Station	Center station depth (ft.-in.)	Stream width (ft.)	Bank erosion right (R) left (L)	Logjam partial (P) complete (C)	Aquatic macrophytes	Oil in sediment
DP 10.25	6-6	58				
DP 10.50	4-7	82		P		
DP 10.75	4-9	83		P		X
DP 11.00	3-9	100				
DP 11.25	5-2	115				
DP 11.50	4-5	85				X
DP 11.75	4-4	80				X
DP 12.00	4-4	98				
DP 12.25	5-2	95				
DP 12.50	4-8	75				
DP 12.75	5-5	90				
DP 13.00	6-1	75				X
DP 13.25	3-2	100				
DP 13.50	3-0	95				X
DP 13.75	3-2	98				X
DP 14.00	3-0	84				
DP 14.25	3-5	80				
DP 14.50	3-4	98				
DP 14.75	2-6	80				X
DP 15.00	3-3	90				
DP 15.25	3-5	85				X
DP 15.50	4-6	75				X
DP 15.75	4-1	71				
DP 16.00	3-9	85				X
DP 16.25	3-7	75				
DP 16.50	3-2	80				
DP 16.75	3-3	69				X
DP 17.00	2-10	80		P		X
DP 17.25	2-7	70				
DP 17.50	2-7	75				
DP 17.75	2-8	65				
DP 18.00	2-2	95				
DP 18.25	2-2	98		P		
DP 18.50	1-8	95		P		
DP 18.75	1-6	75				
DP 19.00	6-2	85				
DP 19.25	1-3	55				
DP 19.50	5-9	80				X
DP 19.75	4-7	70				
DP 20.00	4-6	98				
DP 20.25	2-10	110		P		X
DP 20.50	4-11	101				
DP 20.75	3-2	64				X
DP 21.00	2-2	130				X
DP 21.25	3-10	118				X
DP 21.50	4-10	110				
DP 21.75	5-0	105		P		
DP 22.00	4-4	100				
DP 22.25	4-8	90				
DP 22.50	4-4	102				
DP 22.75	3-7	110		P		
DP 23.00	5-1	109				
DP 23.25	3-7	120				
DP 23.50	4-2	115				

Station	Center station depth (ft.-in.)	Stream width (ft.)	Bank erosion right (R) left (L)	Logjam partial (P) complete (C)	Aquatic macrophytes	Oil in sediment
NB 0.00	1-9	23			X	
NB 0.25	2-6	41			X	
NB 0.50	2-0	33			X	
NB 0.75	2-4	36			X	
NB 1.00	2-6	38				
NB 1.25	1-6	35			X	
NB 1.50	1-10	42			X	
NB 1.75	1-6	43		p	X	
NB 2.00	1-10	45		P	X	
NB 2.25	2-4	62			X	
NB 2.50	3-0	45			X	
NB 2.75	4-6	55		C	X	X
NB 3.00	2-6	37			X	
NB 3.25	1-10	34		P	X	
NB 3.50	2-6	43			X	X
NB 3.75	1-3	45			X	
NB 4.00	1-6	42		C	X	
NB 4.25	1-10	44			X	
NB 4.50	2-2	40		C	X	
NB 4.75	2-6	30			X	
NB 5.00	2-0	37			X	
NB 5.25	1-4	41		c	X	
NB 5.50	1-10	35				
NB 5.75	1-3	46			X	X
NB 6.00	1-7	41			X	
NB 6.25	1-1	52			X	
NB 6.50	1-5	44			X	
NB 6.75	2-4	42				
NB 7.00	1-11	34			X	
NB 7.25	1-8	36			X	
NB 7.50	1-4	28			X	
NB 7.75	1-8	35			X	
NB 8.00	1-10	38			X	
NB 8.25	1-8	38		c	X	
NB 8.50	4-0	38			X	
NB 8.75	1-7	40			X	
NB 9.00	2-4	35			X	X
NB 9.25	2-3	36		p	X	
NB 9.50	1-0	44			X	
NB 9.75	1-10	37			X	
NB 10.00	1-5	54			X	
NB 10.25	1-6	37				
NB 10.50	1-9	41		c		
NB 10.75	1-9	34				
NB 11.00	2-6	40		c		
NB 11.25	2-0	54				

Appendix E-2. Land Use and Riparian Vegetation at Each Station

Station	Land use								Riparian vegetation							
	Right bank				Left bank				Right bank				Left bank			
	Residential	Commercial-Industrial	Agriculture	Forest	Residential	Commercial-Industrial	Agriculture	Forest	Trees	Shrubs	Grass	Denuded	Trees	Shrubs	Grass	Denuded
CR 0.00		X				X						X			X	
CR 0.25		X				X						X				X
CR 0.50		X				X						X	X			
CR 0.75		X				X					X					A
CR 1.00		X				X						X				X
CR 1.25		X				X						X				X
CR 1.50		X				X						X			X	
CR 1.75		X				X						X				X
CR 2.00		X				X						X			X	
CR 2.25		X				X						X				X
CR 2.50		X				X						X				X
CR 2.75		X				X						X				X
CR 3.00		X				X						X			X	
CR 3.25		X				X					X					X
CR 3.50		X				X					X					X
CR 3.75		X				X					X					X
CR 4.00		X				X						X				X
CR 4.25		X				X						X				X
CR 4.50		X				X				X			X			
CR 4.75		X						X				X	X			
CR 5.00		X						X				X	X			
CR 5.25		X						X			X				X	
CR 5.50		X				X						X				X
CR 5.75				X		X					X			X		
CR 6.00				X		X				X						X
CR 6.25		X				X					X					X
CR 6.50		X				X					X				X	
LC 0.00		X				X			X				X			
LC 0.25		X				X					X		X			
LC 0.50		X				X				X				X		
LC 0.75		X				X						X	X			
LC 1.00		X				X			X				X			
LC 1.25				X				X	X					X		
LC 1.50				X				X			X •		X			
LC 1.75		X						X			X		X			
LC 2.00				X				X		X					X	
LC 2.25		X						X			X			X		
LC 2.50		X						X				X		X		
LC 2.75				X	X				X				X			
LC 3.00		X				X					X				X	
LC 3.25		X				X			X				X			
LC 3.50		X				X			X						X	
LC 3.75		X				X						X				X
LC 4.00		X				X						X				X
LC 4.25		X				X					X					X
LC 4.50		X				X			X				X			
LC 4.75		X				X			X				X			
LC 5.00		X				X			X				X			
LC 5.25				X	X				X				X			

Station	Land use								Riparian vegetation							
	Right bank				Left bank				Right bank				Left bank			
	Residential	Commercial-Industrial	Agriculture	Forest	Residential	Commercial-Industrial	Agriculture	Forest	Trees	Shrubs	Grass	Denuded	Trees	Shrubs	Grass	Denuded
LC 5.50				X	X				X						X	
LC 5.75		X			X					X					X	
LC 6.00				X		X			X						X	
LC 6.25				X				X	X				X			
LC 6.50				X		X			X						X	
LC 6.75				X	X				X				X			
LC 7.00				X				X	X							
LC 7.25				X				X	X							
LC 7.50				X				X			X					
LC 7.75				X				X	X							
LC 8.00				X				X			X					
LC 8.25				X				X			X		X			
LC 8.50				X				X	X						X	
LC 8.75				X				X			X		X			
LC 9.00				X				X	X				X			
LC 9.25				X				X	X				X			
LC 9.50				X	X				X				X			
LC 9.75	X				X				X				X			
LC 10.00		X						X	X				X			
LC 10.25	X				X				X				X			
LC 10.50				X	X				X				X			
LC 10.75	X							X			X		X			
LC 11.00	X					X			X				X			
LC 11.25	X				X				X					X		
LC 11.50		X					X		X					X		
LC 11.75				X	X					X			X			
LC 12.00		X			X				X				X			
LC 12.25	X				X						X		X			
LC 12.50	X				X						X		X			
LC 12.75		X			X				X				X			
LC 13.00	X				X				X				X			
LC 13.25	X				X				X					X		
LC 13.50	X				X						X				X	
LC 13.75				X				X	X					X		
LC 14.00		X						X			X		X			
LC 14.25		X				X					X			X		
LC 14.50		X						X			X		X			
LC 14.75		X				X			X				X			
LC 15.00		X			X						X				X	
LC 15.25		X				X			X				X			
LC 15.50		X				X			X				X			
LC 15.75				X		X			X				X			
LC 16.00		X						X	X				X			
LC 16.25		X						X	X				X			
LC 16.50		X				X			X				X			
LC 16.75	X					X				X			X			
LC 17.00	X					X			X				X			
LC 17.25	X					X			X				X			
LC 17.50		X				X			X				X			
LC 17.75		X				X			X				X			
LC 18.00	X					X					X		X			
LC 18.25	X				X						X				X	

Station	Land use: Right bank: Residential	Commercial-Industrial	Agriculture	Forest	Land use: Left bank: Residential	Commercial-Industrial	Agriculture	Forest	Riparian vegetation: Right bank: Trees	Shrubs	Grass	Denuded	Riparian vegetation: Left bank: Trees	Shrubs	Grass	Denuded
LC 18.50		X				X			X				X			
LC 18.7 5	X				X				X				X			
LC 19.00	X					X			X						X	
GC 0.25				X				X	X						X	
GC 0.50		X						X			X				X	
GC 0.75	X				X				X				X			
GC 1.00		X				X					X				X	
GC 1.25		X				X			X						X	
GC 1.50	X					X					X				X	
GC 1.75		X				X					X				X	
GC 2.00		X				X					X		X			
GC 2.25		X				X					X				X	
GC 2.50		X				X					X				X	
GC 2.75		X				X			X						X	
cu 0.00	X				X						X		X			
CU 0.25	X				X				X				X			
CU 0.50		X				X						X	X			
CU 0.75				X		X			X				X			
CU 1.00		X			X					X				X		
CU 1.25		X			X				X				X			
CU 1.50	X				X					X					X	
CU 1.75	X				X						X				X	
CU 2.00		X				X					X		X			
CU 2.25	X					X					X		X			
CU 2.50	X				X						X			X		
CU 2.75	X				X					X				X		
CU 3.00	X				X				X				X			
CU 3.25		X				X				X				X		
CU 3.50	X				X					X				X		
AC 0.00				X		X			X				X			
AC 0.25		X				X				X			X			
AC 0.50		X				X			X				X			
AC 0.75		X				X			X				X			
AC 1.00		X				X			X				X			
AC 1.25		X				X			X				X			
AC 1.50				X		X			X				X			
AC 1.75		X				X			X				X			
AC 2.00	X					X			X				X			
AC 2.25		X				X						X				X
AC 2.50	X				X				X				X			
AC 2.75	X					X			X				X			
AC 3.00		X				X						X			X	
AC 3.25		X				X				X			X			
AC 3.50		X				X			X				X			
AC 3.75		X				X				X				X		
AC 4.00		X				X				X			X			
AC 4.25		X				X						X	X			
AC 4.50		X				X			X				X			

	Land use								Riparian vegetation							
	Right bank				Left bank				Right bank				Left bank			
Station	Residential	Commercial-Industrial	Agriculture	Forest	Residential	Commercial-Industrial	Agriculture	Forest	Trees	Shrubs	Grass	Denuded	Trees	Shrubs	Grass	Denuded
AC 4.75	X				X					X				X		
AC 5.00	X				X					X						X
AC 5.25	X				X				X					X		
AC 5.50	X				X				X						X	
AC 5.75	X				X						X				X	
AC 6.00	X				X						X				X	
AC 6.25	X				X						X				X	
AC 6.50	X				X					X				X		
AC 6.75		X				X					X				X	
AC 7.00		X				X			X						X	
AC 7.25		X			X					X					X	
AC 7.50	X					X					X				X	
AC 7.75		X				X			X				X			
AC 8.00				X	X				X							X
AC 8.25		X				X			X					X		
AC 8.'50		X				X			X				X			
AC 8.75		X				X				X				X		
AC 9.00		X				X			X				X			
AC 9.25				X				X		X				X		
AC 9.50	X				X						X				X	
AC 9.75	X				X						X				X	
AC 10.00	X				X						X				X	
AC 10.25	X				X					X				X		
AC 10.75	X				X						X				X	
AC 11.00	X				X				X						X	
DP 0.00		X				X			X				X			
DP 0.25				X		X			X				X			
DP 0.50				X				X	X				X			
DP 0.75				X				X	X				X			
DP 1.00				X				X	X				X			
DP 1.25				X				X	X				X			
DP 1.50				X				X	X				X			
DP 1.75				X				X	X				X			
DP 2.00				X				X	X				X			
DP 2.25				X				X	X				X			
DP 2.50				X				X	X				X			
DP 2.75				X				X	X				X			
DP 3.00				X	X				X				X			
DP 3.25				X	X				X				X			
DP 3.50		X			X				X				X			
DP 3.75		X						X	X				X			
DP 4.00				X				X	X				X			
DP 4.25				X				X	X				X			
DP 4.50				X	X				X				X			
DP 4.75				X	X				X				X			
DP 5.00				X	X				X				X			
DP 5.25				X	X				X						X	
DP 5.50		X			X				X				X			
DP 5.75		X						X	X				X			
DP 6.00				X				X	X				X			
DP 6.25		X				X			X				X			

	Land use								Riparian vegetation							
	Right bank				Left bank				Right bank				Left bank			
Station	Residential	Commercial-Industrial	Agriculture	Forest	Residential	Commercial-Industrial	Agriculture	Forest	Trees	Shrubs	Grass	Denuded	Trees	Shrubs	Grass	Denuded
DP 6.50		X							X				X			
DP 6.75		X						X	X				X			
DP 7.00				X				X	X				X			
DP 7.25				X		X			X				X			
DP 7.50				X		X			X				X			
DP 7.75				X		X			X				X			
DP 8.00		X				X			X				X			
DP 8.25		X				X			X				X			
DP 8.50				X		X			X				X			
DP 8.75		X				X			X				X			
DP 9.00				X				X	X				X			
DP 9.25				X				X	X				X			
DP 9.50				X				X	X				X			
DP 9.75				X				X	X				X			
DP 10.00		X				X			X				X			
DP 10.25				X				X	X				X			
DP 10.50				X				X	X				X			
DP 10.75		X						X	X				X			
DP 11.00		X						X	X				X			
DP 11.25				X				X	X				X			
DP 11.50				X				X	X				X			
DP 11.75				X	X				X				X			
DP 12.00				X		X			X				X			
DP 12.25				X				X	X				X			
DP 12.50				X				X	X				X			
DP 12.75				X				X	X				X			
DP 13.00				X				X	X				X			
DP 13.25				X				X	X				X			
DP 13.50				X				X	X				X			
DP 13.75				X				X	X				X			
DP 14.00				X				X	X				X			
DP 14.25				X				X	X				X			
DP 14.50		X				X			X				X			
DP 14.75		X						X	X				X			
DP 15.00				X				X	X				X			
DP 15.25				X				X	X				X			
DP 15.50				X				X	X						X	
DP 15.75				X				X	X				X			
DP 16.00				X				X	X				X			
DP 16.25				X				X	X				X			
DP 16.50				X				X	X				X			
DP 16.75				X				X	X				X			
DP 17.00				X				X	X				X			
DP 17.25				X				X	X				X			
DP 17.50				X				X	X				X			
DP 17.75				X				X	X				X			
DP 18.00				X				X	X				X			
DP 18.25				X				X	X				X			
DP 18.50				X				X	X				X			
DP 18.75				X				X	X				X			
DP 19.00				X				X	X				X			

	Land use								Riparian vegetation							
	Right bank				Left bank				Right bank				Left bank			
Station	Residential	Commercial-Industrial	Agriculture	Forest	Residential	Commercial-Industrial	Agriculture	Forest	Trees	Shrubs	Grass	Denuded	Trees	Shrubs	Grass	Denuded
DP 19.25		X						X				X	X			
DP 19.50				X				X	X				X			
DP 19.75				X				X	X				X			
DP 20.00				X				X	X				X			
DP 20.25				X				X	X				X			
DP 20.50				X				X	X				X			
DP 20.75				X				X	X				X			
DP 21.00				X				X	X				X			
DP 21.25				X				X	X				X			
DP 21.50				X				X	X				X			
DP 21.75				X				X	X				X			
DP 22.00				X				X	X				X			
DP 22.25				X				X	X				X			
DP 22.50				X				X	X				X			
DP 22.75				X				X	X				X			
DP 23.00				X				X	X				X			
DP 23.25	X				X				X				X			
DP 23.50.	X							X	X				X			
NB 0.00		X				X			X				X			
NB 0.25		X				X			X				X			
NB 0.50	X				X							X		X		
NB 0.75	X				X					X				X		
NB 1.00				X				X	X				X			
NB 1.25		X				X					X				X	
NB 1.50				X		X			X				X			
NB 1.75				X		X			X				X			
NB 2.00				X				X	X				X			
NB 2.25				X				X	X				X			
NB 2.50				X				X	X				X			
NB 2.75				X				X	X				X			
NB 3.00				X				X		X				X		
NB 3.25				X				X	X				X			
NB 3.50				X				X	X				X			
NB 3.75				X				X		X			X			
NB 4.00				X				X	X				X			
NB 4.25				X				X	X				X			
NB 4.50				X				X	X				X			
NB 4.75				X				X	X				X			
NB 5.00				X				X	X				X			
NB 5.25				X				X	X				X			
NB 5.50		X						X			X		X			
NB 5.75				X				X	X				X			
NB 6.00				X				X	X				X			
NB 6.25				X				X		X			X			
NB 6.50				X				X	X				X			
NB 6.75				X				X	X				X			
NB 7.00				X				X	X				X			
NB 7.25				X				X	X				X			
NB 7.50				X				X	X				X			
NB 7.75				X				X	X				X			

	Land use								Riparian vegetation							
	Right bank				Left bank				Right bank				Left bank			
Station	Residential	Commercial-Industrial	Agriculture	Forest	Residential	Commercial-Industrial	Agriculture	Forest	Trees	Shrubs	Grass	Denuded	Trees	Shrubs	Grass	Denuded
NB 8.00				X		X			X				X			
NB 8.25				X				X	X				X			
NB 8.50		X				X			X						X	
NB 8.75		X				X					X				X	
NB 9.00				X				X	X				X			
NB 9.25				X				X	X				X			
NB 9.50				X				X	X				X			
NB 9.75				X				X	X				X			
NB 10.00				X				X	X				X			
NB 10.25				X				X	X				X			
NB 10.50		X						X		X			X			
NB 10.75				X				X	X				X			
NB 11.00				X				X	X				X			
NB 11.25				X				X	X				X			

Appendix F

Benthic Macroinvertebrate Sampling Results from 1985 and 1976

	IEPA tolerance value	LC 6.25C	LC 6.25L	LC 10.25	LC 13.00R	LC 16.25	LC 17.75	LC 18.50	CU 1.00
Dates sampled		6/19/85	6/19/85	7/9/85	7/11/85	7/16/85	8/19/85	8/20/85	8/28/85
Dubiraphia (riffle beetle)	5								
Pisidium (fingernail clam)	5				43				
Sigara (water boatman)	5				22				
Sphaerium (fingernail clam)	5	19		43	1,765				
Chironomidae (true midge)	6	1,952	2,775	158	452	9,279	10,915	818	86
Enallagma (damselfly)	6				65				
Asellus (aquatic sow bug)	7		249	7,520	65				
Ceratopogonidae (biting midge)	7							172	
Lymnaea (snail)	7								
Hirudinea (leech)	9								
Physa (snail)	9			14	2,799				
Oligochaeta (aquatic worm)	10	938	1,512	43	431	1,012	2,820	4,370	388
Total number of individuals		2,909	4,536	7,778	5,642	10,291	13,735	5,360	474
Total number of taxa		3	3	5	8	2	2	3	2
IEPA Macroinvertebrate Biotic Index		7.3	7.4	7.0	7.5	6.4	6.8	9.3	9.3
		9/28/76	9/28/76	6/16/76	6/16/76	6/16/76	6/15/76	6/16/76	6/17/76
Psychomiid Genus A (caddis fly)	2								43
Sphaerium (fingernail clam)	5		861	86					
Caenis (may fly)	6								
Chironomidae (true midge)	6	498	670	128	387	23,250	7,061		2,066
Gyraulus (snail)	6								
Asellus (aquatic sow bug)	7		2,392	86					43
Chaoborus (phantom midge)	8								
Hirudinea (leech)	9	38	402	86					
Physa (snail)	9								
Oligochaeta (aquatic worm)	10	18,193	2,794	3,186	294,814	259	12,745	12,961	4,520
Total number of individuals		18,729	7,119	3,572	295,201	23,509	19,806	12,961	6,672
Total number of taxa		3	5	5	2	2	2	1	4
IEPA Macroinvertebrate Biotic Index		9.9	8.0	9.6	10.0	6.0	8.6	10.0	8.7

Note: Numbers are in terms of organisms per square meter

	IEPA tolerance value	DP 4.75	DP 6.00L	DP 9.00	DP 13.25	DP 16.50	DP 19.50	DP 21.25	NB 9.75
		Dates sampled							
		7/29/85	7/30/85	8/1/85	8/7/85	8/8/85	8/13/85	8/15/85	9/16/85
Dubiraphia (riffle beetle)	5							22	
Pisidium (fingernail clam)	5								
Sigara (water boatman)	5								
Sphaerium (fingernail clam)	5	344	187	13,606	3,595	753			20,796
Chironomidae (true midge)	6	732	1,292			151	388	22	43
Enallagma (damselfly)	6								
Asellus (aquatic sow bug)	7			2,885					14
Ceratopogonidae (biting midge)	7								
Lymnaea (snail)	7					66			
Hirudinea (leech)	9	86		258	689	108	43		100
Physa (snail)	9			775					
Oligochaeta (aquatic worm)	10	689	890	172	840	667	603	732	1,880
Total number of individuals		1,851	2,369	17,696	5,124	1,745	1,034	776	22,833
Total number of taxa		4	3	5	3	5	3	3	5
IEPA Macroinvertebrate Biotic Index		7.4	7.4	5.6	6.4	7.3	8.5	9.7	5.4

		9/2/76	8/26/76	8/26/76	9/8/76	9/10/76	9/16/76	9/15/76	9/23/76
Psychomiid Genus A (caddis fly)	2								
Sphaerium (fingernail clam)	5		3,001	2,990	1,990	9,473	473		
Caenis (may fly)	6								43
Chironomidae (true midge)	6	631	1,152	128	862	1,033	4,176	603	171
Gyraulus (snail)	6			43					
Asellus (aquatic sow bug)	7		19	990		128			
Chaoborus (phantom midge)	8								43
Hirudinea (leech)	9	19	407	2,885	387	1,420	129		
Physa (snail)	9	19		43		86			
Oligochaeta (aquatic worm)	10	765	35,952	774	1,076	1,721	1,249	5,468	128
Total number of individuals		1,434	40,531	7,853	4,315	13,861	6,027	6,071	385
Total number of taxa		4	5	7	4	6	4	2	4
IEPA Macroinvertebrate Biotic Index		8.2	9.5	7.3	6.8	6.1	6.8	9.6	7.6

Note: Numbers are in terms of organisms per square meter