Underwater Bark Debris Survey
Winter Harbor Log Transfer Facility
Prince of Wales Island, Alaska

Submitted to: USDA Forest Service, Region 10
Ketchikan Area, Tongass National Forest
648 Mission Street
Ketchikan, AK 99901

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August 14, 2000

Introduction:

An underwater survey requested to determine the extent of bark debris accumulation at the Winter Harbor Log Transfer Facility, Prince of Wales Island, Alaska, was performed on August 14, 2000. The purpose of the survey is to satisfy the requirement for a bark monitoring program as specified by the NPDES permit. The protocol for operating a bark monitoring program is given in the new EPA General Permit, which became effective March 21, 2000.

Methods:

Once on site, the layout of the facility is evaluated to best adapt the standard survey method to the individual site characteristics. A permanent reference point location is selected, ideally in the center of the log bundle input structure. The reference point is positioned as close as possible to the exact center of the structure (regardless of type: bulkhead with A-frame, drive-down ramp, low-angle slide, etc.) and close to the estimated Mean Low Low Water (MLLW) depth to facilitate relocation for future surveys. Initially, five transects are established, radiating from the reference point origin at 30-degree intervals. The center transect is located perpendicular to the face of a bulkhead structure, or in line with the centerline of a drive-down ramp/low-angle slide. Additional transects are added if 100 % bark coverage extends more than 15 feet perpendicular to an edge transect. Magnetic compass bearings are selected for the transects by referencing the transects to the center of the log transfer device. The magnetic compass bearing is also the identifying label for that transect.

Each transect is sampled at 15-foot intervals starting from the origin at the permanent reference point. Debris depth measurements are made with a hand-held ruler at the sample point. The measurement is taken by vertically inserting the ruler into the debris until the natural substrate is felt or its location estimated as closely as possible. Periodically, when the confidence level in the measurement decreases due to the substrate type and/or bark amount, the bark depth is confirmed by digging by hand through the bark layer to the natural substrate. Percentage of areal coverage by bark debris is determined by using the ruler, which is randomly dropped at the sample point, as the base of a visually estimated 3-foot square. The percent bark cover within that square is then visually estimated.

Sample points are established along a transect until a water depth of 60 feet MLLW is reached or the measured bark debris depth becomes insignificant (usually interpreted to mean that less than one inch of bark depth, less than 10 % cover, and a clear decreasing trend are apparent towards the end of the transect). At each sample location several data points are recorded by the diver: water depth; debris depth; percent coverage of debris; debris composition and character; substrate type; species abundance, condition and diversity; direction and strength of current; visibility; and the presence of any significant operational debris. A qualitative assessment of species abundance is made for the overall survey area.

Photographs are taken of representative sample points along the transects (usually the middle and two side transects) to document substrate, bark debris, algal and animal life, and any other debris/objects that may be of concern. Water depth measurements are taken from a Suunto dive computer with an accuracy of +/- 1%. A Suunto compass is attached to a 4-foot measuring ruler and is used to navigate the transect compass headings.

The total survey surface area is determined by calculating the total area of triangles formed by adjacent transects, and the total square footage of the debris field area is a summation of all the triangle areas for the number of transects performed. This figure is converted to acres as required by the guidelines. The calculation method used in this report is outlined in the ADEC publication "**Required Method for Bark Monitoring Surveys under the LTF General Permits**", **June 9, 2000**. The method for calculating continuous and discontinuous areas also follows this prescribed method.

Results:

Reference Point Location: 55°46.274 N, 133°13.769 W GPS position. The GPS position was taken on the top edge of the fill surface, above the reference point on the lower edge of the fill rock slope. The location on the top edge of the fill rock was blazed with orange paint, along with lineup marks on the larger rocks down the slope. The reference point was moved in to the lower edge of the fill rock slope. In past surveys, the reference point had been located under the end of the slide rails.

Weather conditions at survey time were overcast skies, with southeasterly winds at twenty knots and light rainshowers; air temperature was in the upper fifties. The diving started at 1045, taking place during the last half of a flooding tide cycle. Low tide occurred at 0723 with a height of –1.1 feet (corrected to subordinate station # 1607, Tuxekan Passage [south end], from the Sitka reference station) and a tidal range of 10.2 feet. No noticeable current was experienced during the survey dive. Water temperature was measured at 53 degrees. Underwater visibility was estimated at 6 to 8 feet.

A total of 100 sample points were taken on the six transects, and all sample points had some bark debris. The total area covered by the dive survey was 1.9 acres. The area covered by 100 % bark cover was 0.2 acres, and the discontinuous cover area was 1.7 acres.

Bark Deposition Summary		
Total Survey Area	Area with Continuous Bark Cover	Area with Discontinuous Bark Cover
1.9 Acres	0.2 Acres	1.7 Acres

Observations:

The LTF has been decommissioned. The reference point for this survey was moved to a more repeatable position on the lower edge of the fill rock slope, rather than the original location where the end of the slide rail had been.

The LTF is situated in a channel between a chain of small islands, including the larger Gaohi Island, and Prince of Wales Island, forming somewhat of an enclosed embayment. The transfer site was constructed with a considerable amount of fill rock. Out from the reference point the grade is slight down to the flat bottom of the channel. The natural substrate in this area appears to be a very fine, light silt and organic detritus that is rarely if ever disturbed by tidal currents. The slopes down from the intertidal zone are composed of varying mixtures of sand, gravel and rock. Transect 285 terminates when it begins to ascend the rocky, steep slope of the point just past the boat/barge ramp. The middle transects cross the width of the channel and start up the slope to Gaohi Island.

The zone of deposit covers the entire dive survey area, with only the area in the immediate vicinity of the former input point covered by 100 % bark. The bark depth measurement data show a decreasing trend towards the ends of all transects, with the majority of bark accumulation on and surrounding the input area. Character and size of the observed bark debris was clearly separated into two zones. Much of the bark close to the input area could be characterized as bark chips, with a large component of chunks and small wood pieces. The second debris-type zone starts at the edge of the 100% bark cover and continues out until the transects leave the channel bottom and progress upward into the sand and rock of the shoreline slopes. In this zone the bark debris is mixed with the silt in varying amounts, which makes taking bark depth measurements and estimating cover very difficult. The bark that could be seen (and felt by hand when probing into the "muck") consisted mostly of chips. Possibly fine or decomposing bark is there as well, but this is not possible to ascertain visually (by appearance or color) or by feel. For a distance of approximately seven sample points out from the reference point, in the area of deepest bark accumulation, the debris layer exhibited a "jiggling" movement when the measuring ruler was inserted. A few sunken logs were encountered during the survey, mostly along transects 255 and 285.

My impression of the survey area is that the marine life observed appears to be generally healthy and is not being adversely affected by the bark, other than the smothering effect on benthic infauna when bark accumulation reaches a depth of approximately ten centimeters or more. The habitat type was typical of that associated with a soft substrate for most of the area, except for the fill rock sample points and the ends of transects extending up into the shoreline rocky substrate. This substrate would not normally be expected to support a great abundance and diversity of organisms.

The abundance and diversity of plant life observed in the survey area were low. The large-bladed Laminarians were present in patchy fashion; in some areas the coverage was as high as 100 %, but only in the areas with rocks for attachment, and the detrital algal

patch in the center of the bay. Sessile benthic diatoms were dense enough to form an observable surface layer at some locations. Rockweed, crustose red algae, and green algae were attached to the rocks on the shallow shoreline sample points.

Molluscan abundance and diversity were low. No bivalve siphons were observed, and the shell component of the substrate was low. Feces of the wood-boring bivalve *Bankia setacea* bordered the larger wood pieces and sunken logs.

Echinoderm abundance and diversity in the area were low. The sea star species observed were *Dermasterias imbricata, Evasterias troschelli,* and *Pycnopodia helianthoides*. Low numbers of *Parastichopus californicus* were observed only on the shallow slopes of the channel.

Crustacean abundance and diversity were moderate. Juvenile *Cancer magister* were commonly observed, in densities of up to six per square meter. Another cancer crab, *C. productus*, was also observed. Small crabs of the Majidae family, commonly observed at LTFs on both the bark and natural substrate, were present in low abundance. Another crab, *Telmessus cheiragonus*, was noted several times. Hermit crab abundance and diversity were low. Using both natural substrate and bark chips for crevice habitat, individuals of *Pandalus sp.* were observed in some areas.

Other invertebrates, including a variety of openings or dens of unidentified benthic infauna, were observed in low to moderate densities. These benthic infauna inhabit the bark/silt mixed substrate, and also the 100% bark zone (see photographs 4 and 5). The tunicate *Corella willmeriana* was observed attached to a cable protruding out of the substrate. The white sulfur bacteria *Beggiatoa sp.* was present in thin patches. The anemone *Metridium spp.* was present occasionally.

Fish were observed in moderate abundance and diversity in the area. Individuals of *Pholis sp., Hexagrammos stelleri, Lumpenus sagitta,* and unidentified members of the Cottidae family were observed occasionally over the entire survey area. At least two species of *Sebastes sp.* were observed. A small number of flatfish were noted actively swimming just off the substrate surface. A school of *Cymatogaster aggregata* followed me around the survey area.

In addition to the typical, minor operational debris, several unidentified large metal structures were located in the vicinity of the end of transect 255. These objects are acting as artificial habitat, attracting many organisms, as evidenced by the schools of *Sebastes sp.* An 8D battery was observed at sample point 225/13 (see photograph 23).

Conclusion:

The most important factor affecting bark accumulation and the habitat appears to be the enclosed, protected nature of the shallow bay in which the LTF is located. This location is not subjected to much of either storm action or tidal currents, which produces the deep silt substrate of the bay bottom.

It is my opinion that the accumulated bark at this site is making a faster than average transition back to a "normal" substrate, which can be utilized by a wider range of organisms. It appears that the introduced bark is mixing with the existing silt of the bottom and, with time, newly deposited silt and organics to make a substrate mix acceptable to more organisms sooner. Evidence for this conclusion includes the relatively small zone of 100 % bark cover (given the history of use of the LTF) and the signs of benthic infauna in the zone of bark/silt mix close to the 100% zone and even in the 100% bark.

If there are any questions regarding this report, please contact me at 907-826-3481 or by email at craigdiv@aptalaska.net. Thank you for allowing Craig's Dive Center to be of service.

Respectfully submitted,

Craig Sempert
Diver

November 11, 2000

TABLE 1
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (in)	Percent Coverage	Substrate Type
Ref. Pt.	+3	<1	50	Rk, Gr
135/1	1	3	50	Rk, Gr
135/2	5	2	25	Rk
135/3	11	16	100	Sa, Rk
135/4	13	18	100	Si, Sa
135/5	14	7	100	Si, Sa
135/6	17	3	90	Si, Sa
135/7	18	2	75	Si, Sa
135/8	19	2	75	Si, Sa
135/9	21	2	75	Si, Sa
135/10	21	3	75	Si, Sa
135/11	22	1	10	Si, Sa
165/1	6	11	100	Rk, Gr
165/2	10	14	100	Rk, Gr
165/3	13	24	100	Rk
165/4	17	24	100	Sa, Si
165/5	21	10	100	Si, Sa
165/6	23	6	90	Si, Sa
165/7	25	2	75	Si, Sa
165/8	27	2	50	Si, Sa
165/9	28	2	50	Si, Sa
165/10	29	2	50	Si, Sa
165/11	29	2	50	Si, Sa
165/12	28	2	50	Si, Sa
165/13	27	1	25	Si, Sa
165/14	27	1	25	Si, Sa
165/15	27	1	25	Si, Sa
165/16	27	1	25	Si, Sa
165/17	27	1	25	Si, Sa
195/1	7	15	100	Rk, Gr
195/2	11	7	100	Rk
195/3	14	20	100	Sa, Si
195/4	18	18	100	Si, Sa
195/5	23	14	100	Si, Sa
195/6	27	20	100	Si, Sa
195/7	30	12	75	Si, Sa
195/8	33	10	50	Si, Sa

TABLE 1 (cont.)
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (in)	Percent Coverage	Substrate Type
195/9	34	6	50	Si, Sa
195/10	35	6	50	Si, Sa
195/11	33	4	50	Si, Sa
195/12	32	4	75	Si, Sa
195/13	31	2	75	Si, Sa
195/14	28	2	75	Si, Sa
195/15	26	1	50	Si, Sa
195/16	27	1	50	Si, Sa
195/17	27	1	75	Si, Sa
195/18	28	<1	25	Si, Sa
195/19	31	<1	25	Si, Sa
195/20	32	<1	25	Si, Sa
195/21	28	<1	25	Si, Sa
195/22	20	<1	25	Si, Sa
225/1	7	17	100	Si, Sa
225/2	12	9	100	Si, Sa
225/3	15	19	100	Si, Sa
225/4	20	21	100	Si, Sa
225/5	27	14	100	Si, Sa
225/6	31	14	100	Si, Sa
225/7	34	17	90	Si, Sa
225/8	37	17	90	Si, Sa
225/9	38	8	50	Si, Sa
225/10	39	4	50	Si, Sa
225/11	39	4	50	Si, Sa
225/12	39	3	50	Si, Sa
225/13	37	2	50	Si, Sa
225/14	35	2	75	Si, Sa
225/15	32	1	50	Si, Sa
225/16	27	<1	25	Si, Sa
225/17	24	<1	25	Gr, Si, Sa
225/18	22	<1	10	Rk, Si, Sa
255/1	7	4	100	Gr, Sa
255/2	12	3	75	Gr, Sa, Si
255/3	17	16	100	Si, Sa
255/4	21	26	100	Si, Sa
255/5	24	25	100	Si, Sa
255/6	28	14	100	Si, Sa

TABLE 1 (cont.)
Transect Data

Transect/Sample Pt.	Depth from MLLW	Debris Depth (in)	Percent Coverage	Substrate Type
255/7	31	6	75	Si, Sa
255/8	33	6	75	Si, Sa
255/9	35	4	50	Si, Sa
255/10	36	4	50	Si, Sa
255/11	37	4	50	Si, Sa
255/12	38	4	50	Si, Sa
255/13	37	3	25	Si, Sa
255/14	38	2	25	Si, Sa
255/15	39	1	25	Si, Sa
255/16	39	1	25	Si, Sa
285/1	4	<1	25	Rk, Gr
285/2	6	<1	25	Rk, Gr
285/3	11	3	75	Rk, Gr
285/4	15	18	100	Sa, Si
285/5	17	6	100	Si, Sa
285/6	18	4	100	Si, Sa
285/7	19	7	100	Si, Sa
285/8	18	2	75	Si, Sa, Gr
285/9	18	8	100	Si, Sa, Gr
285/10	18	4	100	Si, Sa
285/11	17	2	90	Sa, Si
285/12	16	1	50	Sa, Si
285/13	15	1	50	Sa, Si
285/14	14	<1	25	Gr, Sa, Si
285/15	11	<1	10	Rk, Sa, Si

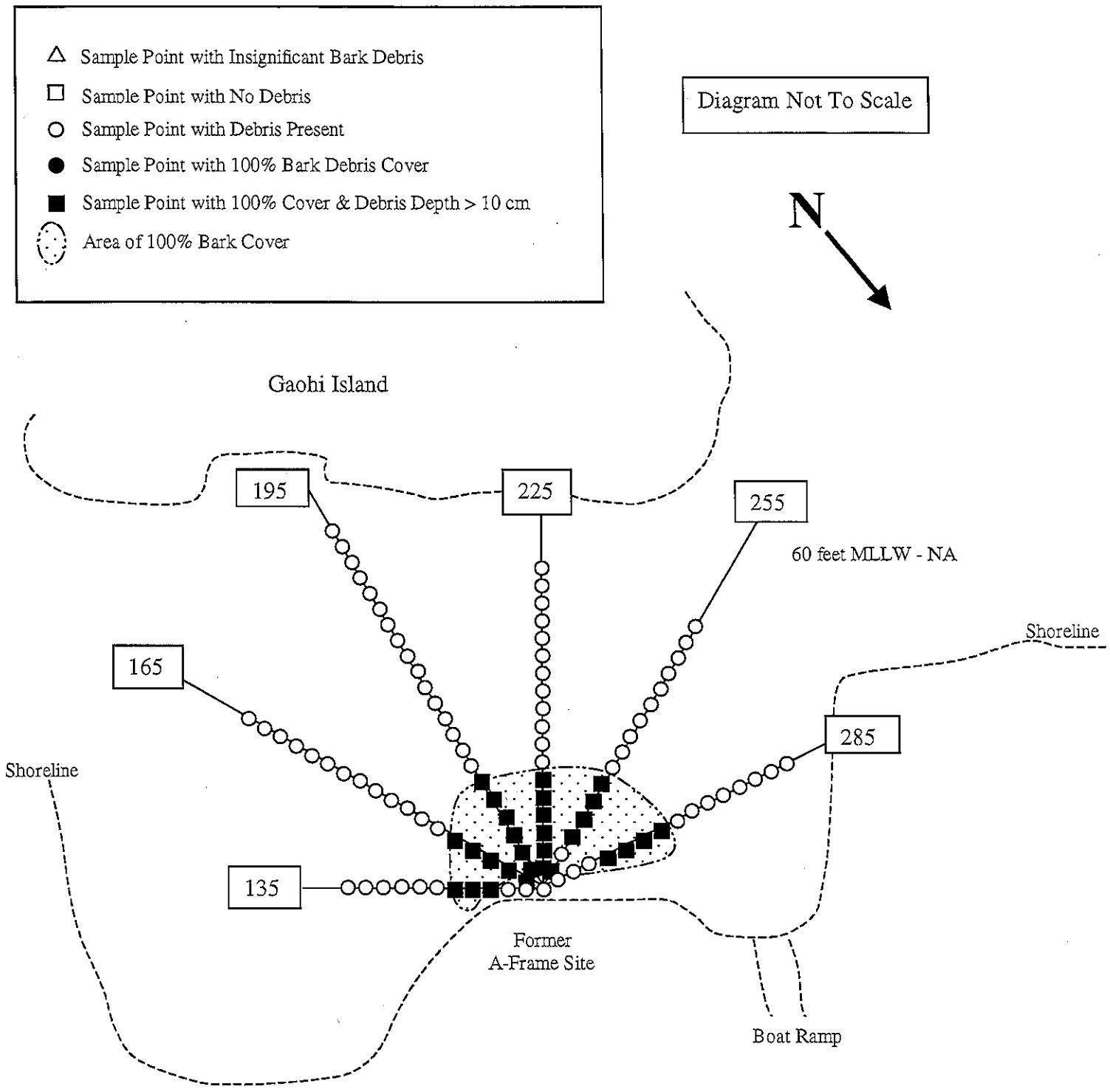
Key to Substrate Type	
Brk	Bedrock
Gr	Gravel
Rk	Rock
Sa	Sand
Sh	Shell
Si	Silt

Table 2

Species Abundance

L = Low C = Common A = Abundant

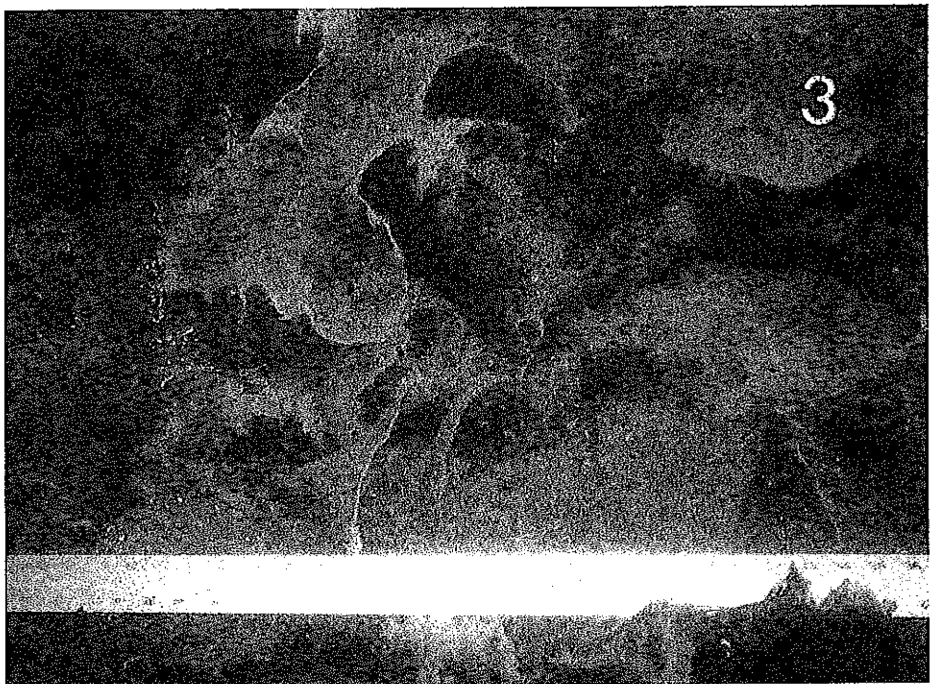
Scientific Name	Common Name	Abundance
Plants		
Chrysophyta spp.	Diatom	L
Laminaria spp.	Kelp	C
Fucus gardneri	Rockweed	L
Cymathere triplicata	Three-ribbed kelp	L
Ulva/Enteromorpha spp.	Green algae	L
Lithothamnion spp.	Crustose red algae	L
Invertebrates		
Beggiatoa sp.	Bacteria	L
Unidentified benthic infauna	Benthic infauna	C
Metridium spp.	Anemone	L
Bankia setacea	Shipworm	L
Parastichopus californicus	Sea cucumber	L
Dermasterias imbricata	Leather star	L
Evasterias troschelii	False-ochre star	L
Pycnopodia helianthoides	Sunflower star	L
Telmessus cheiragonus	Helmet crab	L
Cancer magister	Dungeness crab	L
Cancer productus	Red rock crab	L
Pandalus spp.	Shrimp	L
Balanus sp.	Barnacle	L
Pagurus spp.	Hermit crab	L
Oregonia gracilis	Graceful decorator crab	L
Corella willmeriana	Solitary tunicate	L
Vertebrates		
Cottidae spp.	Sculpins	L
Pleuronectidae spp.	Righteye flounder	L
Lumpenus sagitta	Pacific snake prickleback	L
Sebastes spp.	Rockfish	L
Pholis spp.	Gunnel	L
Cymatogaster aggregata	Shiner perch	L
Hexagrammos stelleri	Whitespotted greenling	L



8/14/00 Winter Harbor LTF Dive Survey

Photograph Key		
Photo Number	**Transect/ Sample Pt.**	**Description**
1	Reference Point	Intertidal edge of bark, old wire
2	135/1	High kelp cover on lower edge of fill rock
3	135/2	High kelp cover on lower edge of fill rock
4	135/3	Benthic infauna bringing sand up through 100% bark
5	135/4	Benthic infauna dens in 100% bark
6	135/5	Kelp attached to scallop shell on 100% bark
7	135/6	Diatom/bacteria layer on bark/silt mix
8	135/7	Infauna den, more silt in mix
9	135/9	Pulley, more bark chips on surface of bark/silt
10	135/11	Few bark chips on silt, sand
11	225/1	Kelp on 100% bark cover
12	225/2	Kelp on 100% bark cover
13	225/3	Sea star on 100% bark cover
14	225/4	Little kelp on 100% bark cover
15	225/5	Detrital algae on 100% bark cover
16	225/6	Detrital algae on 100% bark cover
17	225/7	Diatom/bacteria layer on bark/silt mix
18	225/8	Infauna den, more silt in mix
19	225/9	Infauna den, more silt in mix
20	225/10	More silt on surface of bark/silt mix
21	225/11	Jar, bark chunks on surface of bark/silt mix
22	225/12	Bark chunks on surface of bark/silt mix
23	225/13	Battery, bark chunks on surface of bark/silt mix
24	225/15	Bark chips on silt, sand and shell
25	225/17	Little bark on sand and rocks
26	285/3	Rocks and metal debris with bark debris
27	285/5	Zone of 100% fine bark debris
28	285/7	Sea cucumber feces on varied debris
29	285/9	Old log with shipworm feces
30	285/12	Shell on thinning bark debris
31	285/13	Sun star digging in sand with little bark

Photograph Key – cont.		
Photo Number	**Transect/ Sample Pt.**	**Description**
32	285/15	Ascending into lower rocky intertidal zone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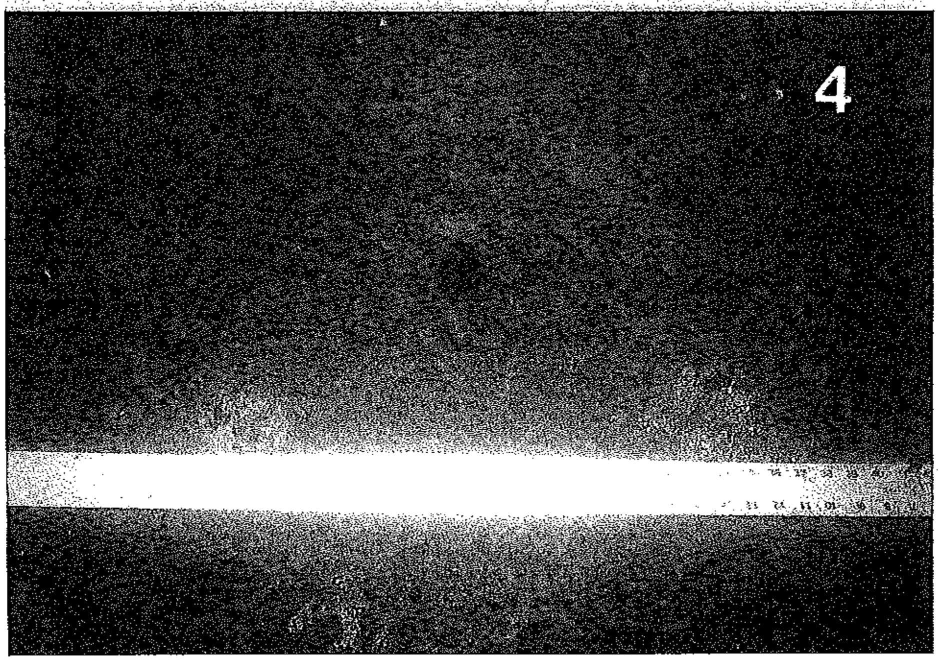
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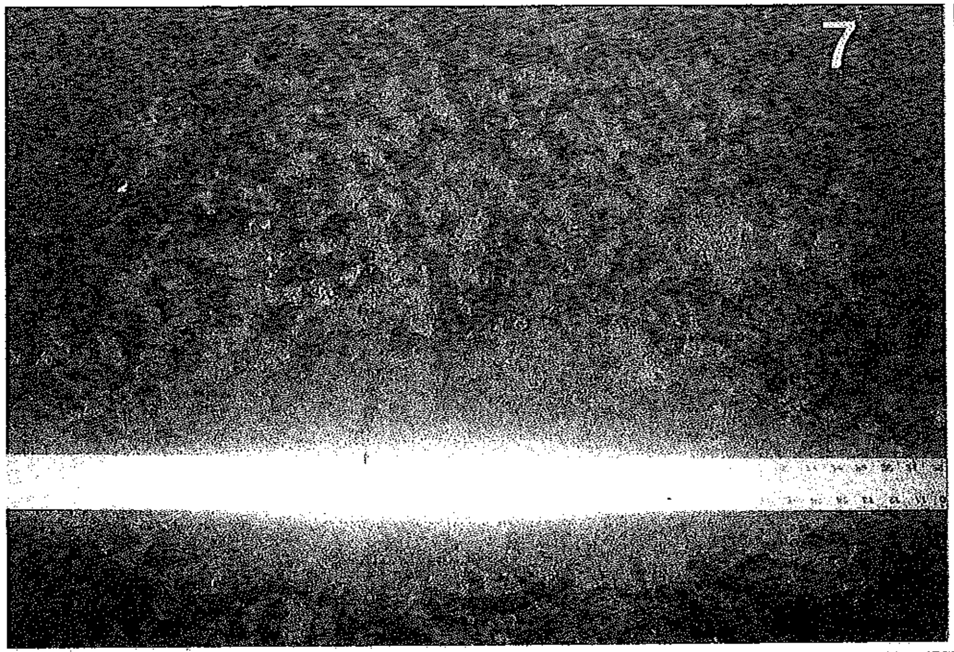
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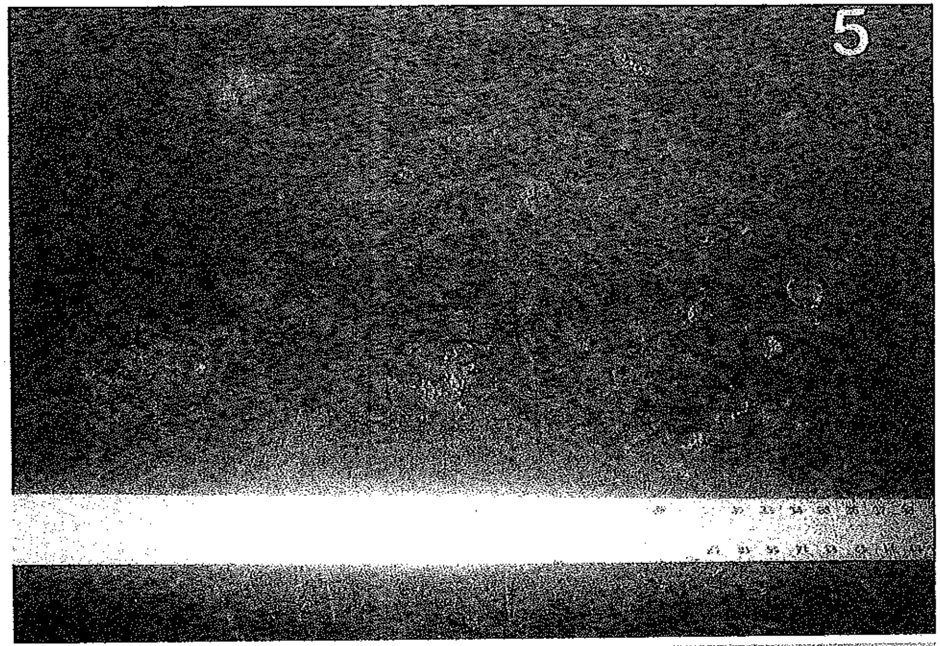
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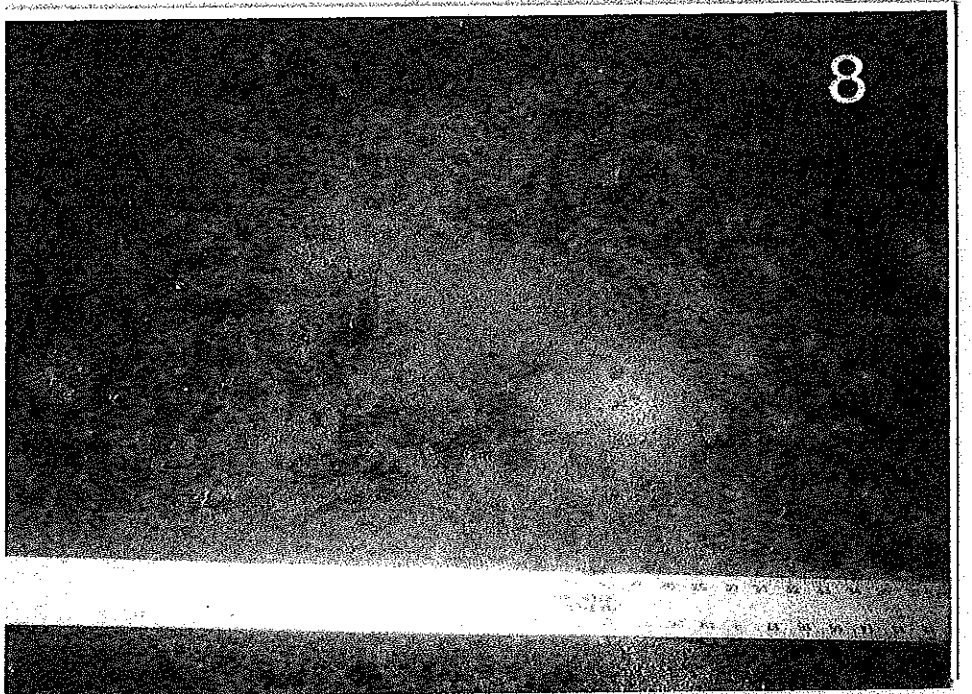
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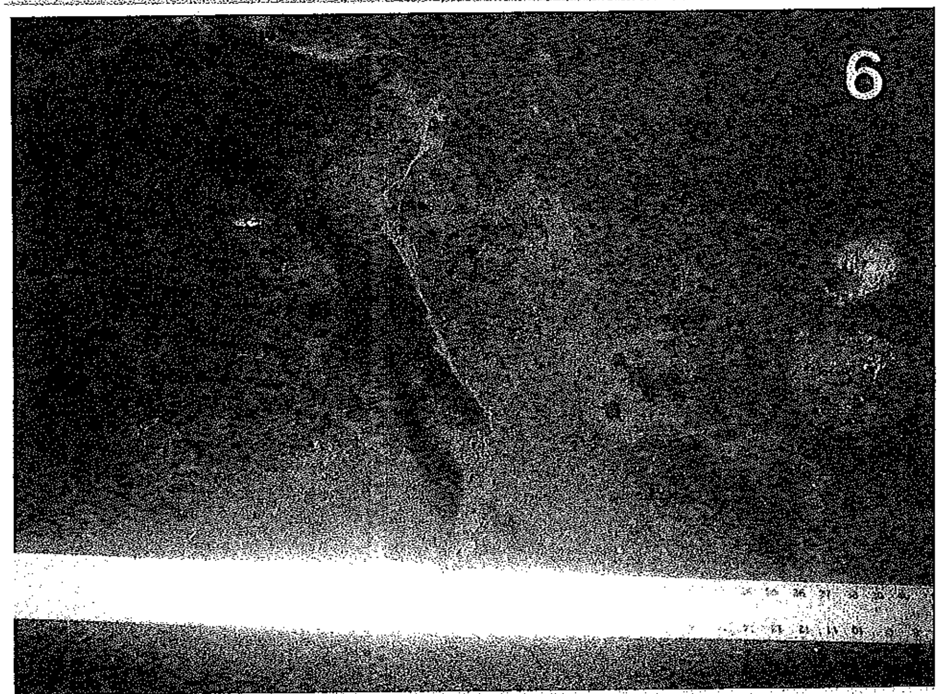
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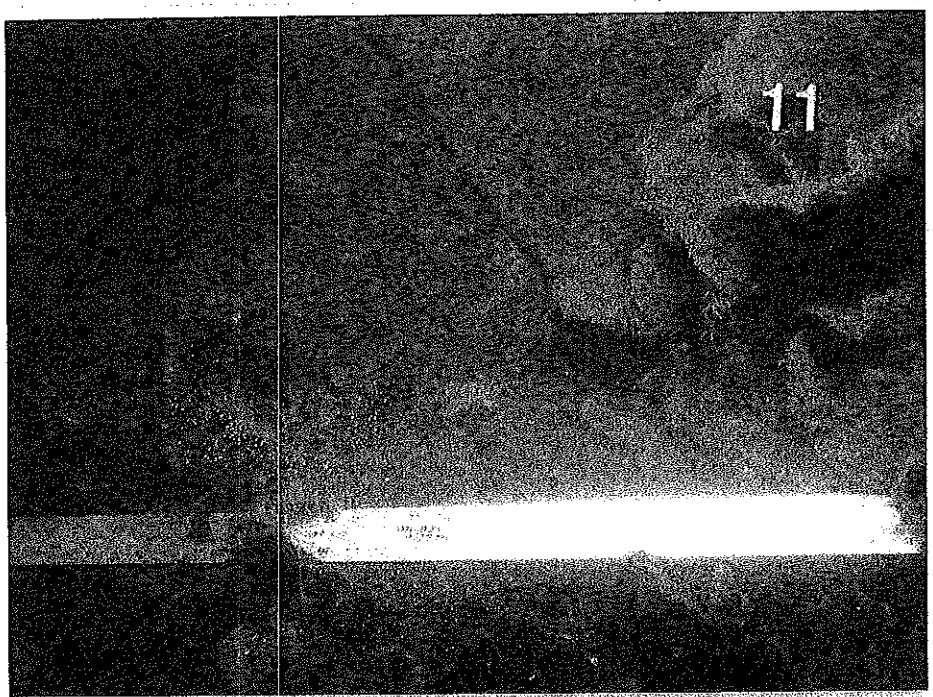
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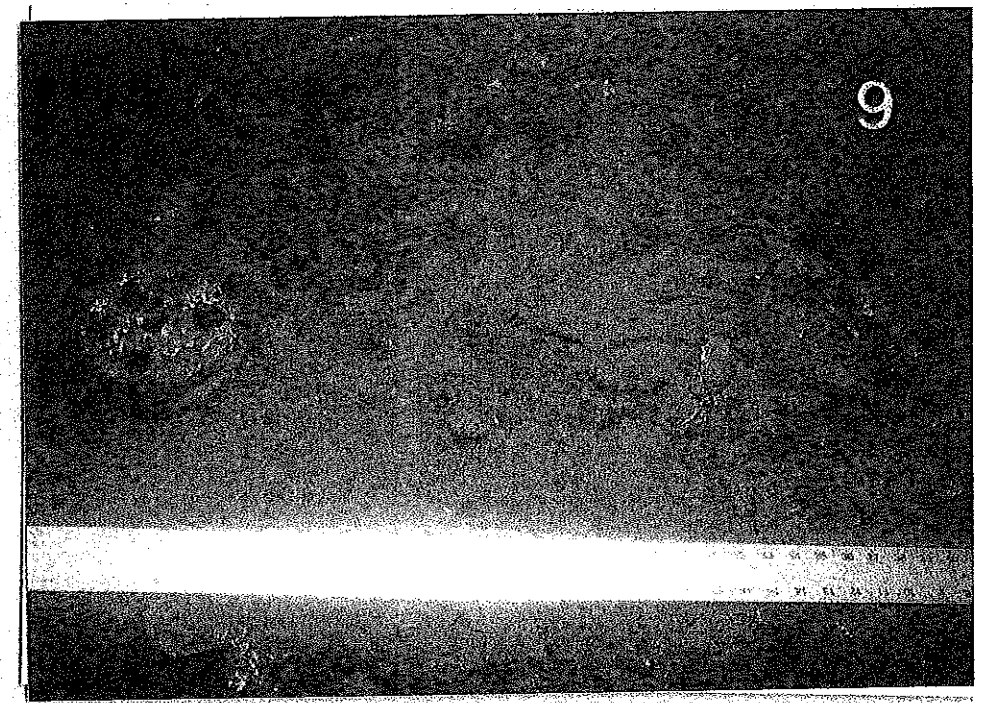
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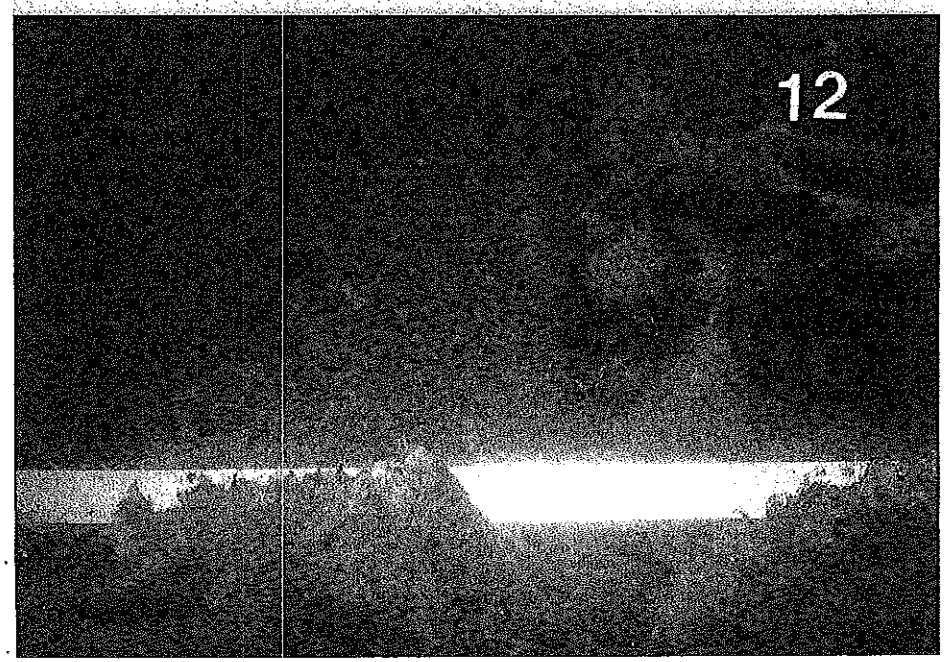
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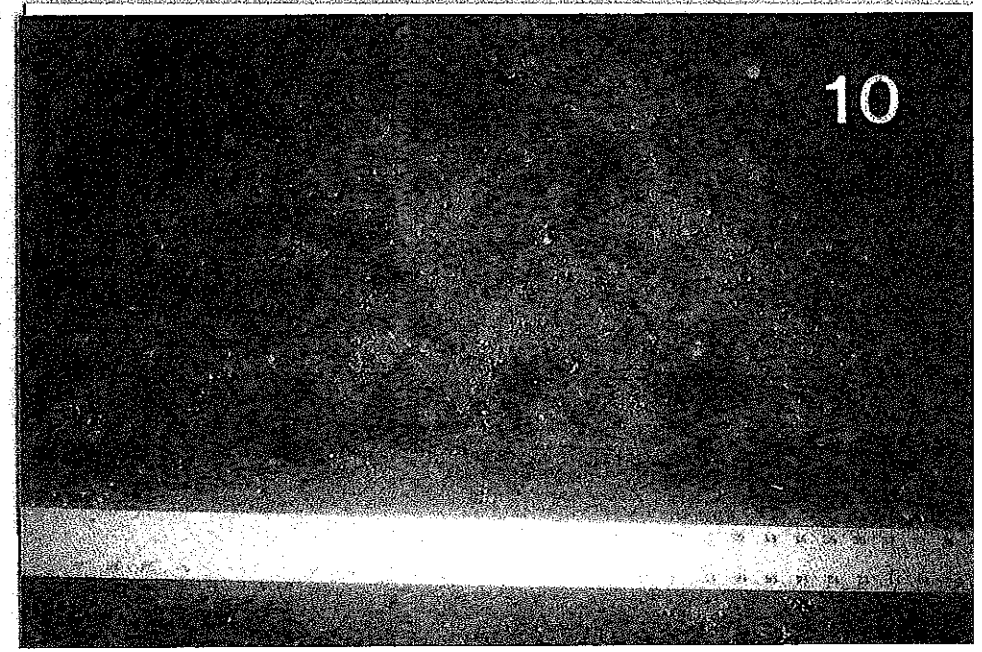
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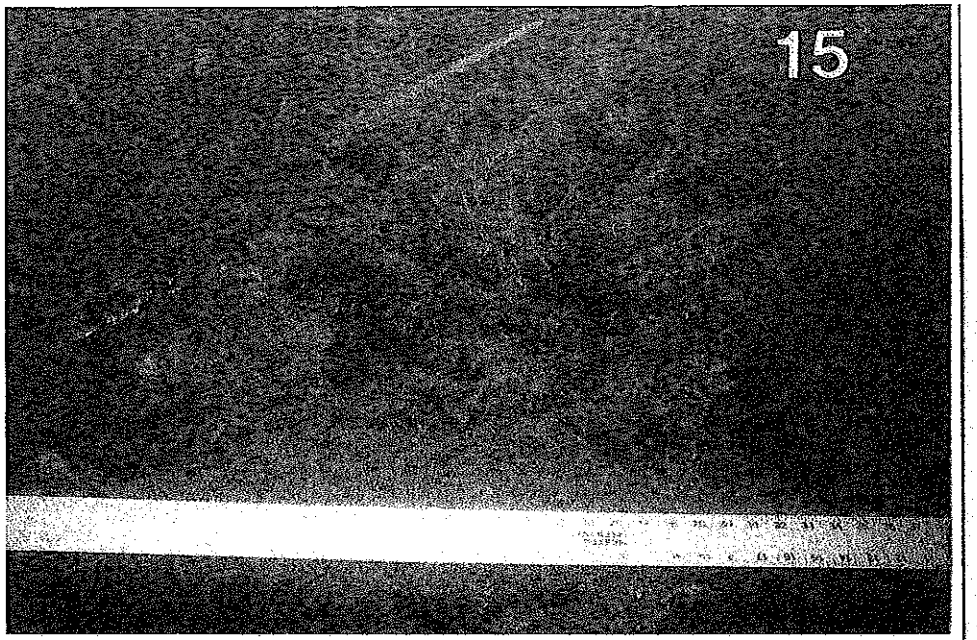
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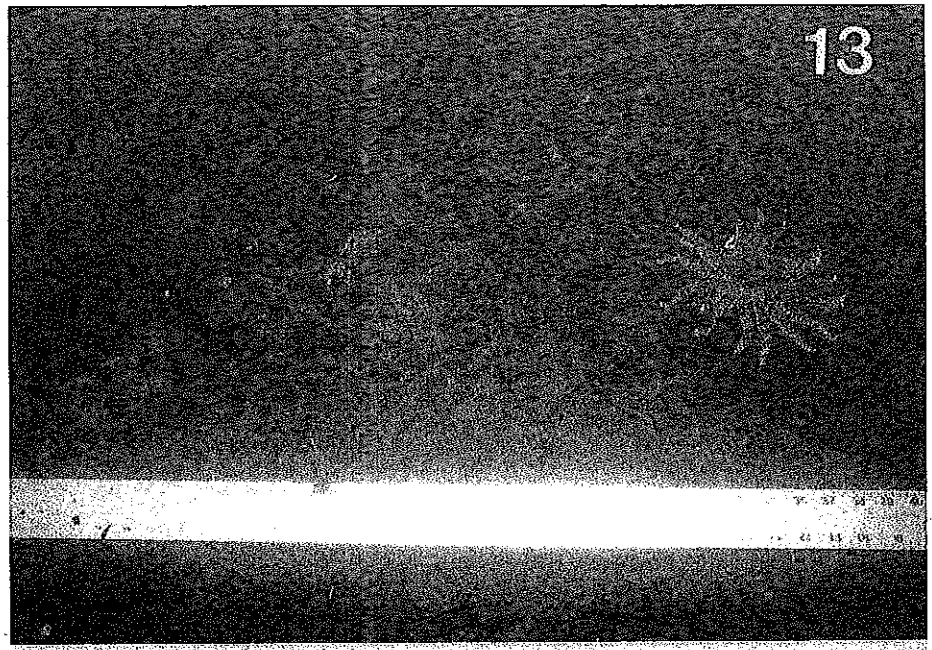
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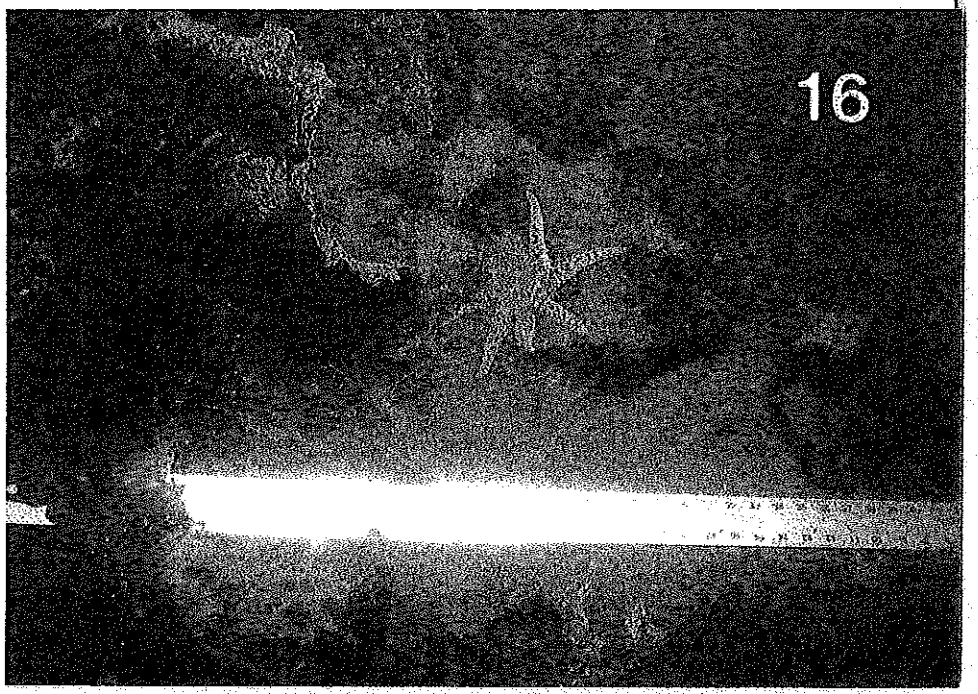
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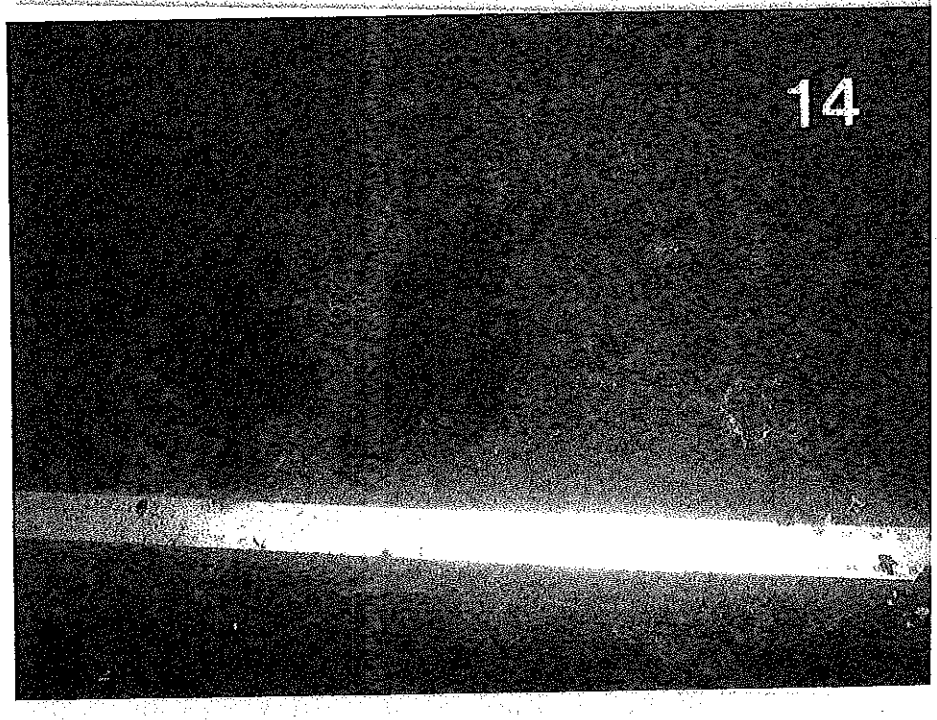
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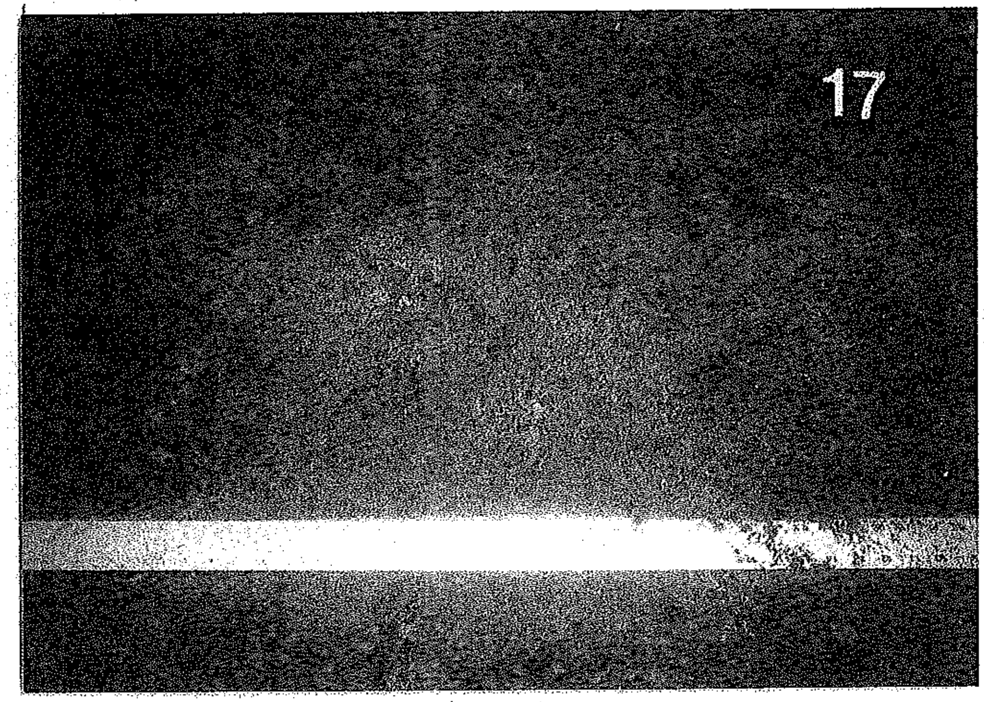
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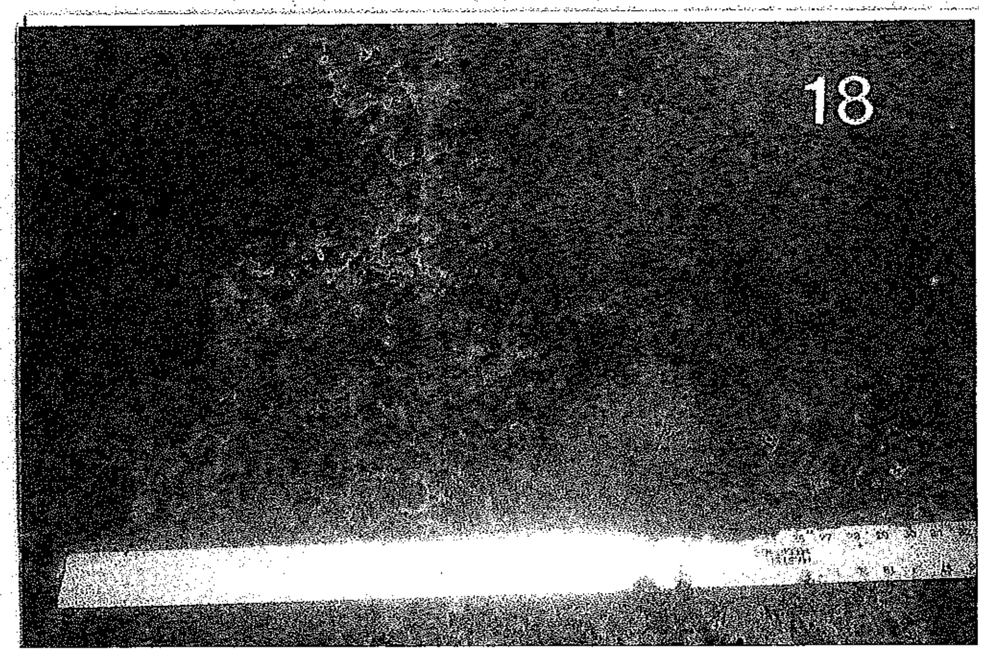
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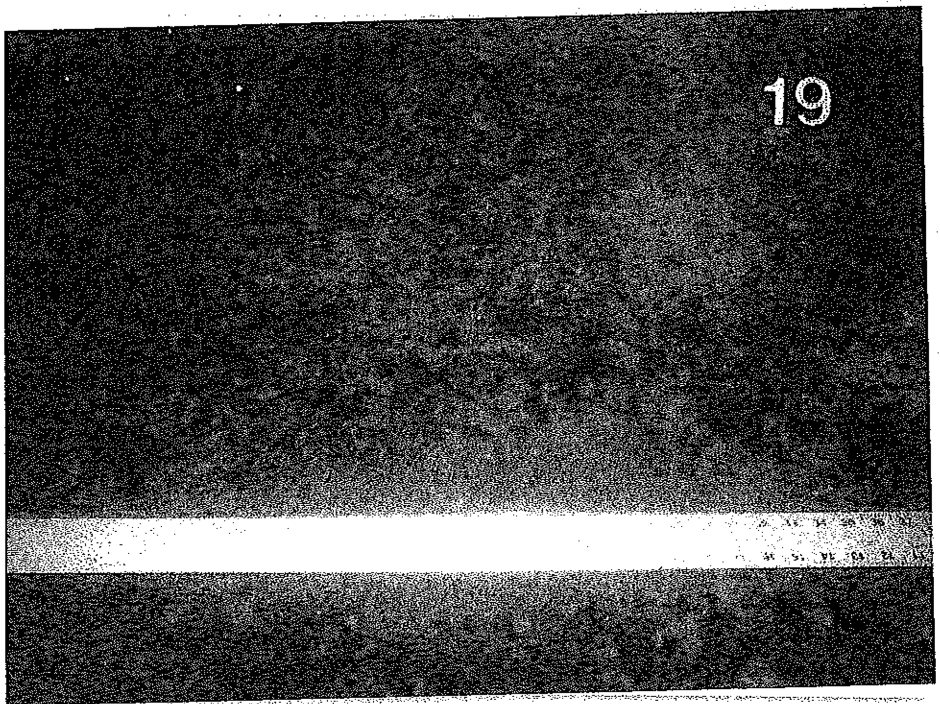
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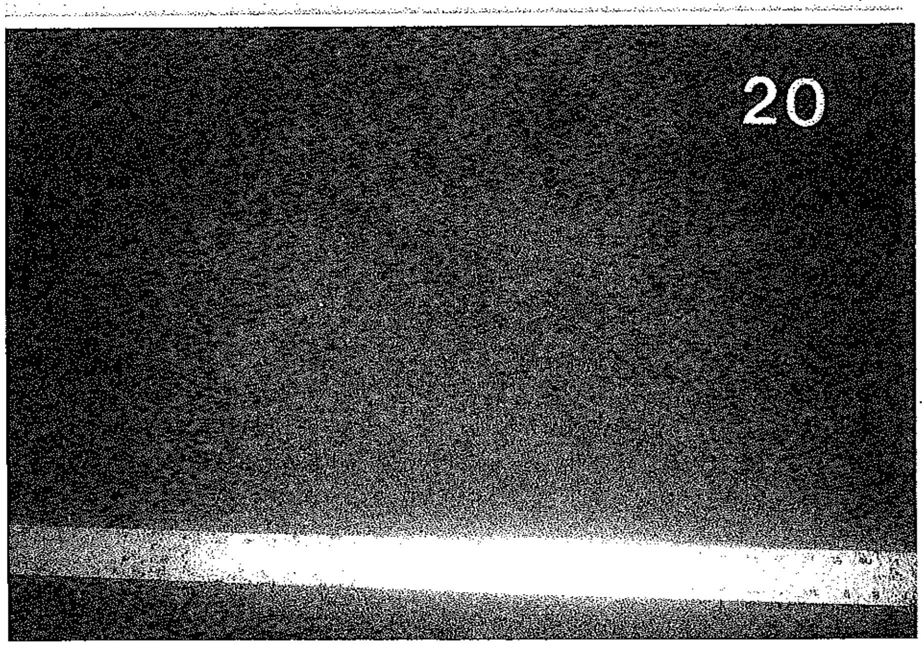
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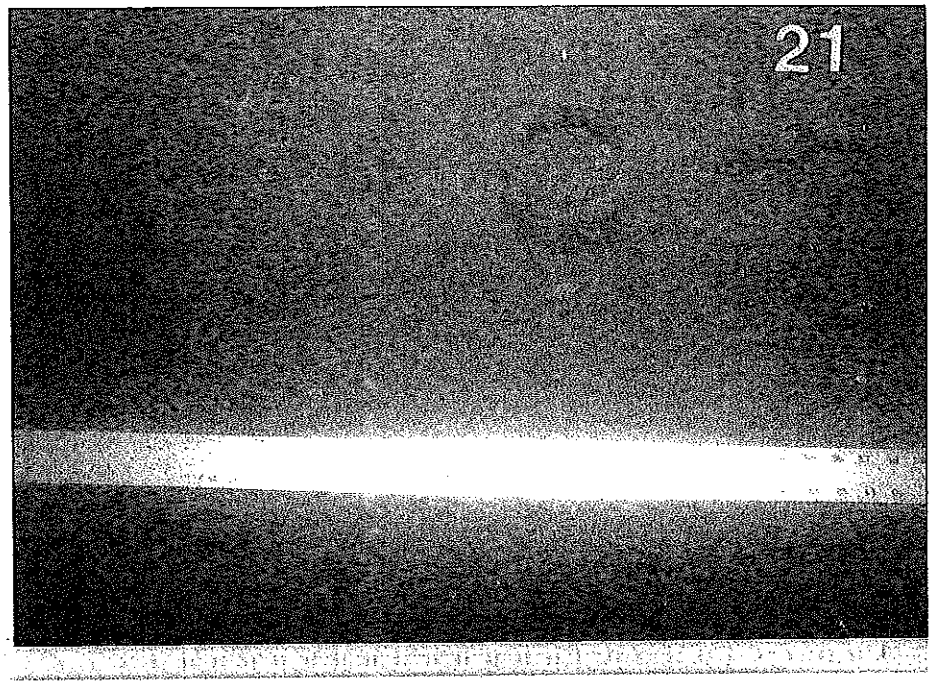
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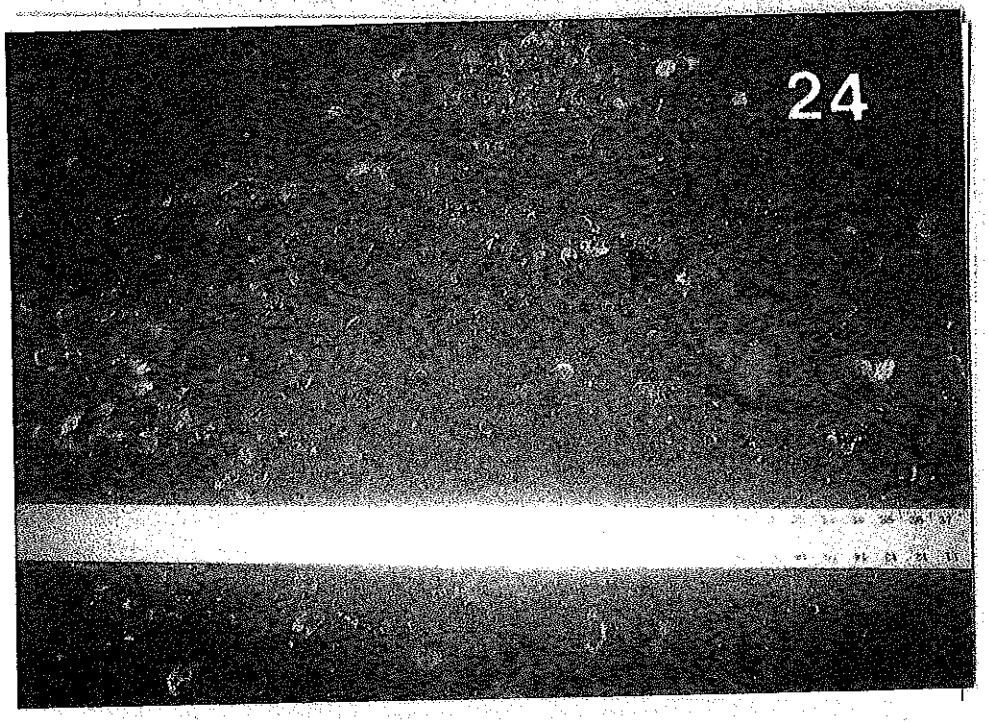
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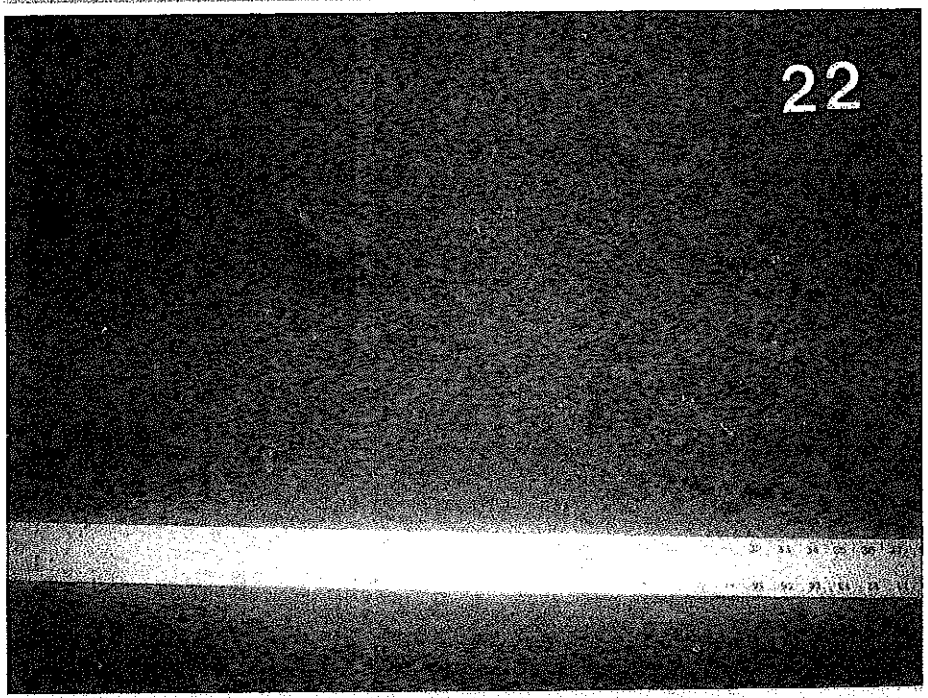
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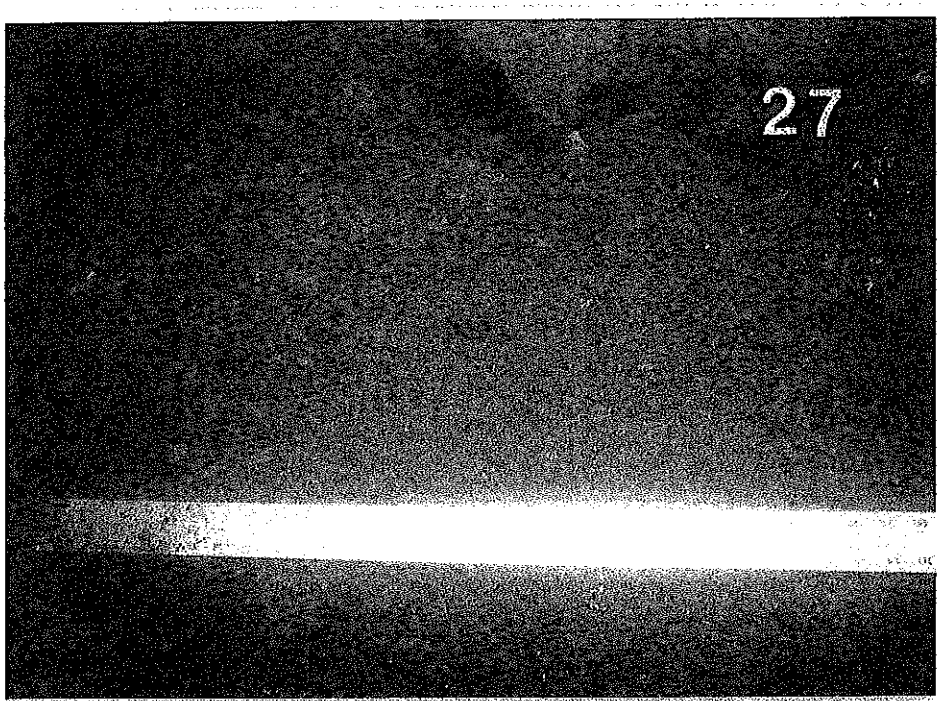
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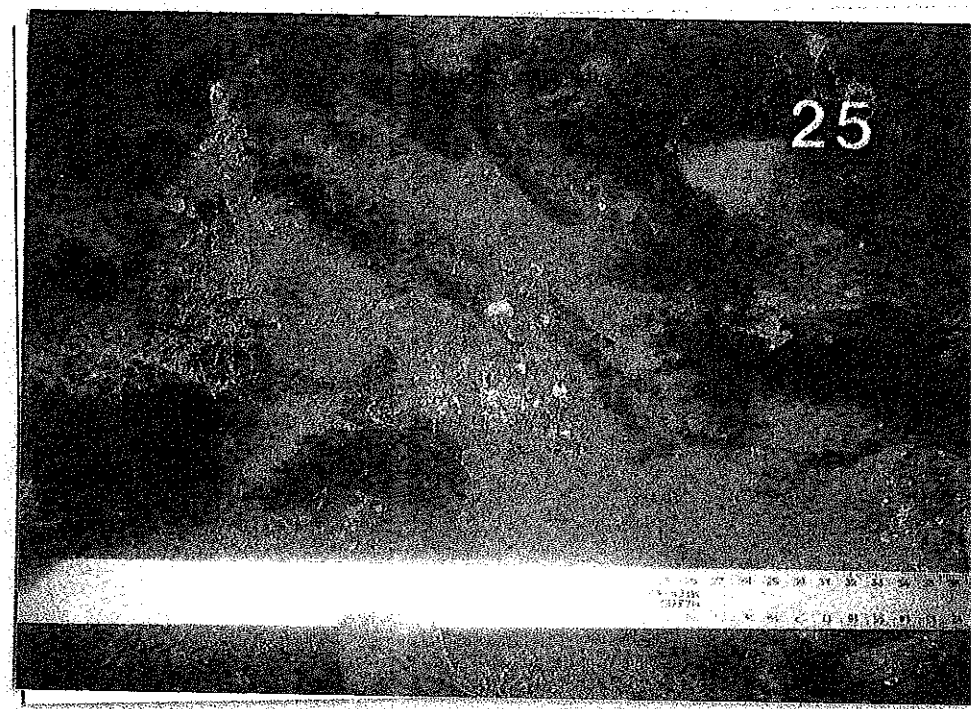
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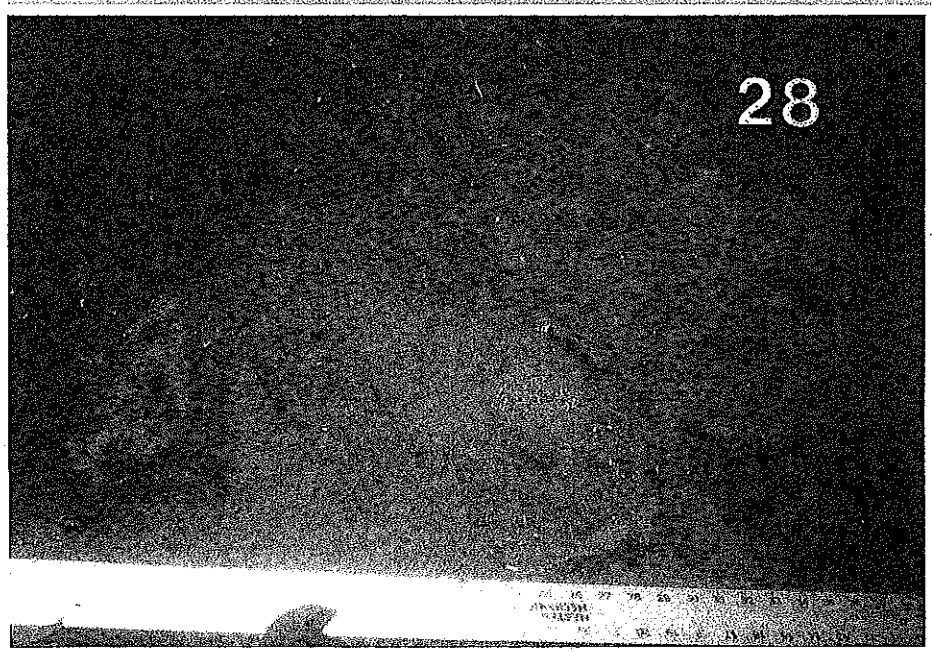
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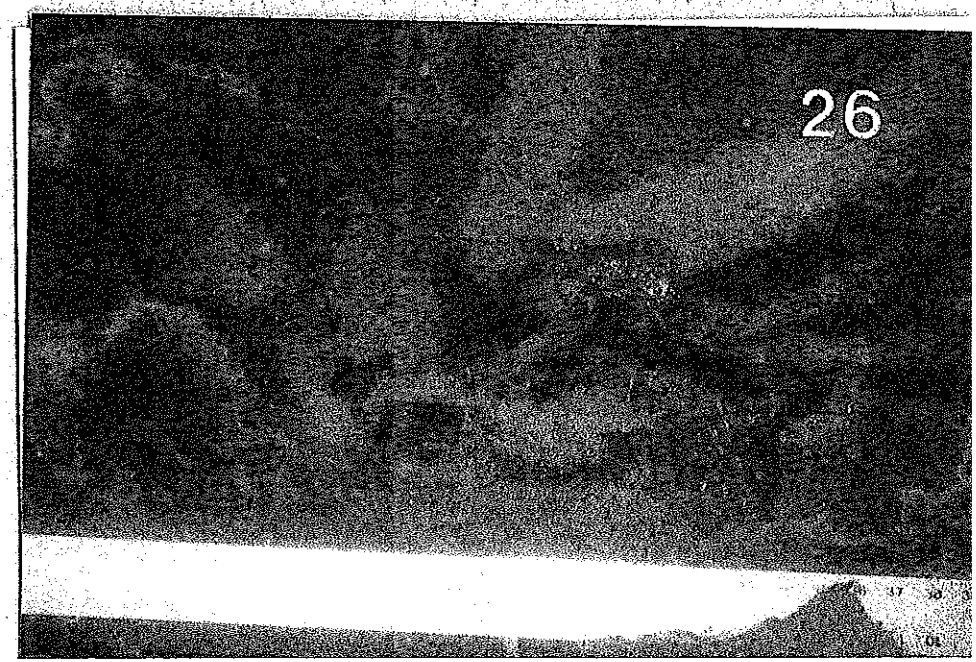
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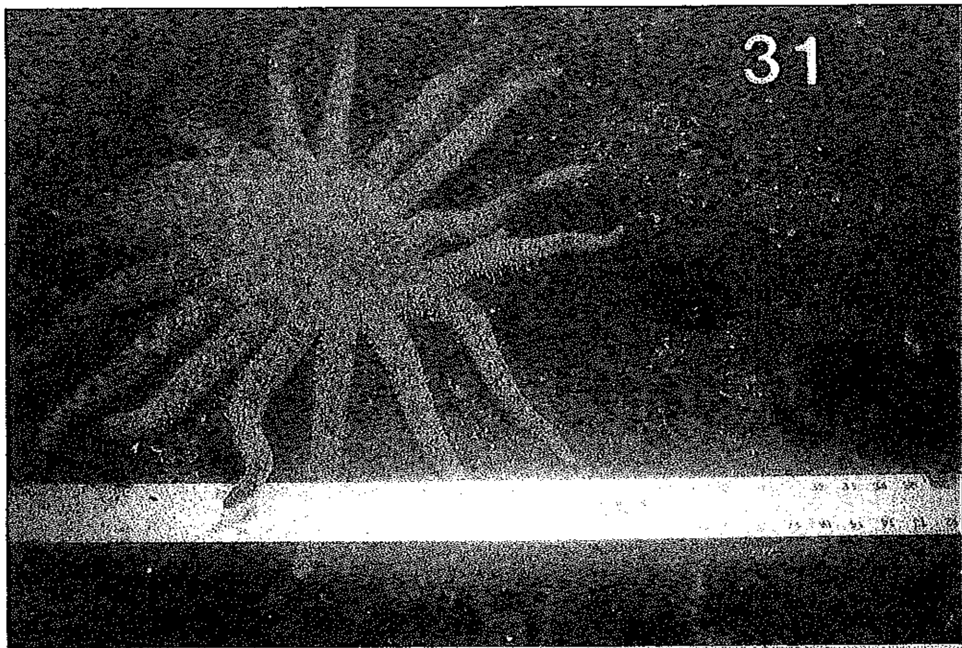
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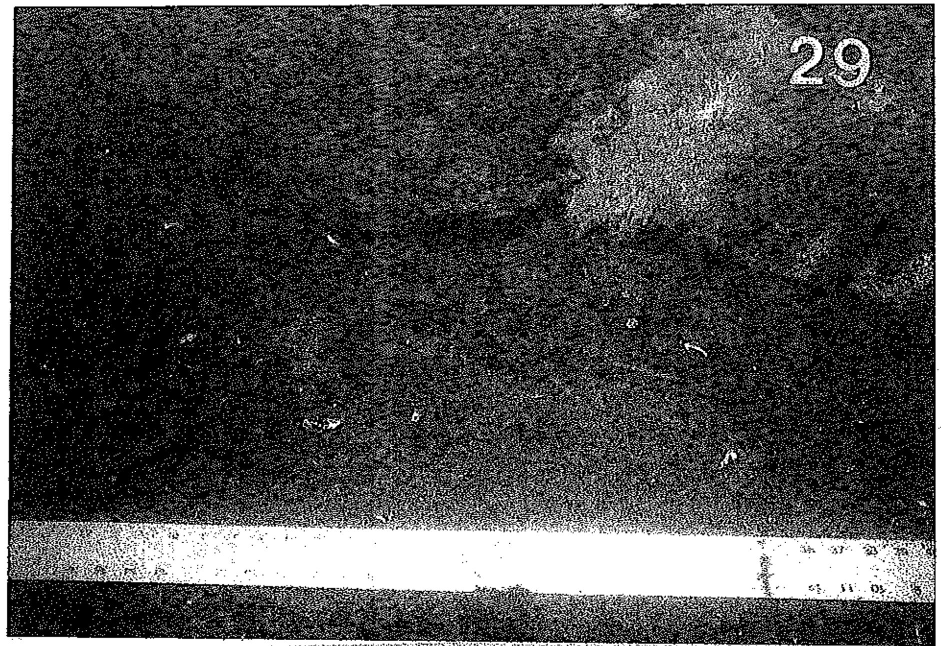
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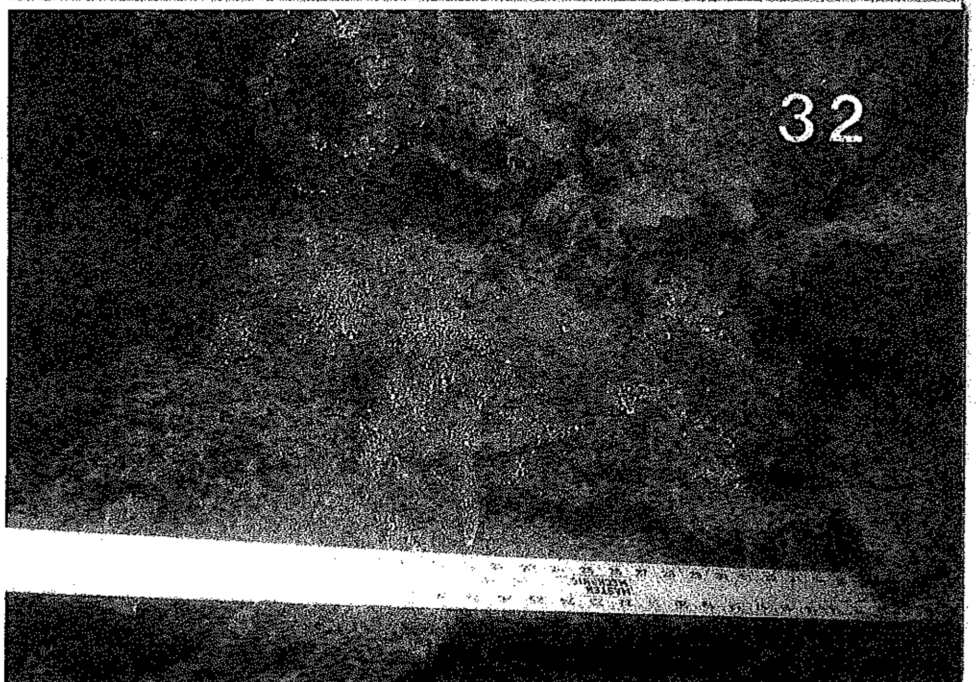
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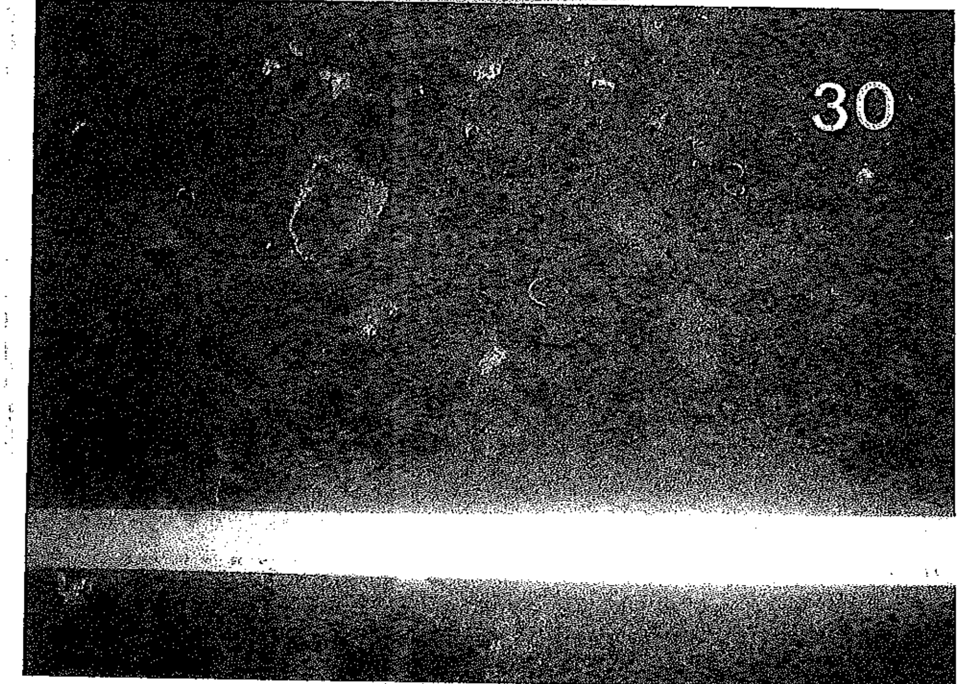
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