TESTIMONY OF JAMES R. ADAMS
ON BEHALF OF
PACIFIC GAS AND ELECTRIC COMPANY
DECEMBER , 1976
DOCKET NOS. 50-275, 50-323

My name is James R. Adams. I am a Senior Biologist in the Department of Engineering Research, Pacific Gas and Electric Company. My address is 3400 Crow Canyon Road, San Ramon, California 94583.

I received a BS degree in Fisheries from Humboldt State University in 1958, and a MS in Fisheries from the same institution in 1960. I received a PhD degree in Fisheries from the University of Washington in June 1975.

I worked as a biologist for the U. S. Bureau of Sports Fisheries and Wildlife in Wyoming for the summer of 1952 and for the U. S. Bureau of Commercial Fisheries in Alaska for different periods in 1953, 1954, 1957, 1960, 1961, and 1962. I have been with Pacific Gas and Electric Company as a Biologist since 1962, and became Senior Biologist in 1971. I am in charge of a group working on the ecological effects of the Diablo Canyon Power Plant on the environment.

I am a member of the American Association for the Advancement of Science, American Fisheries Society, American Institute of Fishery Research Biologists, American Society of Limnology and Oceanography, Association of Power Biologists, California Malacozoological Society, Marine Biological Association

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of the United Kingdom, National Shellfisheries Association, Pacific Fisheries Biologists, and the San Francisco Bay and Estuarine Association. I was a member of the Committee on Power Plant Siting, National Academy of Engineering, and was also a member of the Steering Committee, Heated Water Discharge Study, of the Electric Power Research Institute. I am a founding member of the California Committee for Marine Ecological Survey Standardization.

Between May 1966 and September 1976 I have spent 155 man-days in ecological observations at Diablo Canyon during 70 different field trips. I have logged over 150 SCUBA dives at Diablo, and I have visited the site on numerous other occasions. I have supervised and participated in ecological surveys at operating thermal power plants at Humboldt Bay, Contra Costa, Pittsburg, Oleum, Hunters Point, Petrero, Moss Landing, and Morro Bay, California. These surveys have included the effects of power plant operations on fish, benthic invertebrates, intertidal plants and animals, and zooplankton. I have also conducted ecological studies at nuclear power plant sites at Bodega Bay, Mendocino, and Davenport. My thesis research centered on the effects of thermal discharges on marine flora and fauna at the Humboldt Bay Nuclear Power Plant. I have visited and consulted with ecologists conducting studies at nuclear power facilities at Hanford, Washington; San Onofre, California; Connecticut Yankee near East Haddam, Connecticut; Millstone Point, Connecticut;

and Windscale, United Kingdom; in addition to numerous fossil-fueled power plants.

The Intervenors have cited a number of issues at Diablo which they contend have not been covered adequately by our studies or by the FES Addendum. The particular contentions I intend to cover in my testimony are 1D., 1F., 1G., 1J., and 3. from the list of stipulated contentions.

First, I would like to call attention to Dr. John Wells' Figure 1 for a description of the various sampling locations used in connection with the ecological monitoring programs now in effect at Diablo Canyon. The majority of these stations are inside the 10 fathom (60 ft. or 18 m) line, because we know that the major potential impact of the discharge on benthic organisms will be in shallow water. The smaller white dots represent stations sampled by Dr. Wheeler J. North since 1966, and described by him in the 1973 NEPA hearings. Yellow represents the 16 fixed stations of the California Department of Fish and Game (CDF&G), occupied seasonally since 1970. Purple dots represent the PGandE water quality stations occupied during the NPDES monitoring program, and described in reports to the Regional Water Quality Control Board contained in Supplement No. 6 to the Environmental Report (ER-6). The orange station just off Diablo Cove is a station occupied for fixed current measurements since 1967 (ER-2, 4, and 5) while the large white dots are 6 of the 24 oceanographic stations occupied seasonally in the area extending from Morro Bay to south of Avila (ER-4 and 5).

The 316(a) demonstration study locations are represented by 21 blue intertidal stations, 14 red 10 ft. subtidal, and 18 green 15 ft. and deeper subtidal stations. This represents a total of 111 permanent monitoring stations in the waters around Diablo, including 40 stations within the confines of Diablo Cove itself.

In early 1975, we established a seawater laboratory at Diablo. We now have 3 biologists, a technician and several temporary assistants in residence at that laboratory. The CDF&G also has 2 biologists in residence in their laboratory at Diablo. The 316(a) program, conducted by consultants, has a professional staff of 22 in facilities on site. All of these groups are supplemented by additional people when required. In summary, we have a very substantial program to document the baseline conditions and the potential effects of the discharge on the aquatic environment.

<u>Contention 1D. - Sublethal Thermal Effects</u>

The Intervenors have contended that quantitative data on sublethal thermal effects has not been provided. The FES Addendum contains sufficient information on thermal effects drawn from our ER Supplements to evaluate the impact on important organisms such as abalone, bull kelp, and zooplankton. These ER Supplements treat sublethal as well as lethal effects. In the adult abalone thermal tolerance tests, both the sublethal effect of detachment from the substrate and the lethal death point were quantified (ER-4, pp. 364-368; pp. 373-378; ER-5,

pp. 273-285; pp. 318-322). When an abalone detaches from its substrate, death may not occur directly from the thermal stress, but the animal may become more susceptible to predators. In the 1973 NEPA hearings, I used the temperature of 21.1°C (70°F) as a critical temperature for abalones, although detachment did not occur in any tests until 22°C (71.6°F), and the LD_{50} point occurred at 23°C (73.4°F) (Adams p. 11 following Tr. 600). The CDF&G also looked at sublethal effects in larval abalone. They noted aberrant embryo development, exhibition of feeble ciliary movement, and behaviorial traits such as remaining at the bottom of culture bowls, in addition to the actual lethal death point in their studies (ER-4, pp. 364-368).

Zooplankton cross-condenser mortality tests at operating plants were used to predict zooplankton mortality at Diablo Canyon (ER-4, pp. 142-153). These tests included the sublethal effect of the impaired swimming ability as well as the lethal death point. All zooplankton which had impaired swimming ability were classified as dead, which made the computed mortality figures higher than those which would have been computed for dead zooplankton only. The assessments are described more fully in the reference reports cited in that Supplement.

In related research at other PGandE power plants, CDF&G tested for the delayed effects of rapid temperature rise on reproduction. Gravid female opossum shrimp, <u>Neomysis awatschensis</u>, were subjected to different temperature increases, and held for

5 days until the eggs carried within their body hatched out. The number of viable eggs was compared in the experimental groups and in the control group. The tests were inconclusive in that the number of eggs produced by the controls were between the egg numbers produced by two experimental groups, and the mortalities in the control group were intermediate compared to the experimental group.[1]

We have also studied sublethal effects in copepods which survived passage through the cooling water system of the Morro Bay Power Plant. We found that no delayed mortality due to latent entrainment effects occurred during the five-day test period.[2] In our bull kelp temperature tolerance tests, several sublethal effects were quantified. These effects included blade tip bleaching, stipe and pneumatocyst bleaching, stipe and pneumatocyst detachment, as well as ultimate lethal degeneration of the kelp plant (Figures 4, 5, 8-12).[3]

These data indicate that sublethal effects have been fully considered in determining the survival of important organisms at Diablo.

Contention 1F. - Impingement and Entrainment

The response of Scenic Shoreline Preservation Conference, Inc. to NRC Interrogatory No. 6 (pp. 7, 8) contends that the FES Addendum statement concerning insignificant mortality of abalone eggs should be supported by data. The FES Addendum describes abalone eggs and larvae in Section 2.7.2 (pp. 2-14, 2-15, 2-16).

ER-4 and ER-5 treat abalone mortality in detail. Simulated entrainment tests were conducted on the morula stage (6-7 hrs.), the trochophore stage (20 hrs.) and different veliger stages (40 hrs., 56 hrs., 60 hrs., and 125 hrs.), and mortality observations were continued at intervals up to 48 hours after testing began (ER-4, pp. 364-368, pp. 373-378; ER-5, pp. 273-285). The morula stage is an embryo stage, while trochophores and veligers are larval stages. Scenic cites a paper by Carpenter et al to support the contention that the abalone organisms that survived "impingement"* were held for insufficient time to analyze delayed mortality or sublethal damage. The paper by Carpenter et al, however, dealt not with abalone but with an entirely different class of organisms (copepods). In addition, neither we nor any other investigator has found delayed mortality in zooplankton (including copepods) from thermal entrainment.

In the work at our Morro Bay Power Plant cited earlier, we did not find delayed mortality over a five-day period. The study by Hair cited earlier did not find any delayed mortality in opossum shrimp over a seven-day period. Kelly[4/], who studied the mortality of opossum shrimp entrained in the Pittsburg Power Plant, did not find any delayed mortality over a 36-hour period.

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*"Impingement" refers to those organisms which are too large to pass through the screens of a power plant, and are held against the screen by force of the incoming water. Since the screens at Diablo are 3/8-inch mesh, any larval abalone would be too small for impingement (ER-8).

Davis[5/] did not find any delayed mortalities in two different species of copepods entrained at an East Coast power plant. The Institute of Environmental Medicine[6/] did not find delayed mortality in several different zooplankters entrained at a power plant in the Hudson River.

Preliminary information on the numbers and kinds of fish impinged in the period December 3, 1975 to January 23, 1976 has been supplied (ER-8). Additional data will be obtained when the circulating water pumps are turned on again and is expected to be required by Environmental Technical Specifications. We now have impingement data for the period December 3, 1975 to February 27, 1976, a 3-month period. The impingement rate, using data for 47 days in this period, was 1.51 fish per day, averaging 113 g. (4 oz.) per day. We recovered a total of 71 fish representing 30 species in this time period. The circulating water system has not been operated since that time. Scenic claims that we have not done relevant studies to determine the species which might be impinged or entrained (Scenic response to NRC Interrogatories 6B and 6C). Extensive information has been supplied in the ER Supplements for the evaluations made in the FES Addendum. Zooplankton species and abundance information at Diablo Canyon was compiled weekly for 38 taxonomic categories for a one-year period (FES Addendum, Section 2.7.2, pp. 2-11, 2-14; ER-4, pp. 135-153). Comprehensive larval fish species and abundance data have been provided for a 15-month period[7/].

During this study replicate samples were obtained biweekly at inshore and offshore stations. A total of 5,651 fish larvae and 10,705 fish eggs were collected, and 17 families including 55 larval fish were identified. As stated in the FES Addendum (p. 5-5), the new larval fish information indicates that the average density of fish present ($0.359/m^3$) is only one-third that used to estimate potential impact in the original FES, which used a figure of $1.11/m^3$.

<u>Contention 1G. - Species Loss and Regeneration of Significant Marine Breeding Areas Including Larval Abalone</u>

The significant marine breeding areas in this contention have not been identified by Intervenors. William P. Cornwell, in his responses to Applicant and NRC Staff interrogatories dated June 16 and 21, 1976, respectively, expresses concern about the potential loss of significant areas of kelp beds and the subsequent effect on abalone populations. Cornwell states that there is little or no existing information on the effects of a slight increase in surface temperature on bull kelp sexuality and on the release of mature sori from blades of bull kelp. He also states that no verification of this thermal effect has been made by us.

The questions of species loss and regeneration of significant marine breeding areas are treated extensively in FES Addendum (Section 2.7.2 and 5.3.2). The NRC Staff concluded

that the loss of as much as 10 to 20 acres of bull kelp in Diablo Cove will not adversely affect the regional marine life that is dependent on kelp. Because the populations of abalone and sea urchins within Diablo Cove have been reduced to a small fraction of their former abundance primarily due to factors unrelated to the plant, the additional impact of the thermal plume will be small. (FES Addendum, p. ii, Item 4b (6) & (7) in Summary and Conclusions). According to the California Department of Fish and Game, abalone are no longer a major component of the Diablo Cove subtidal community. If otter foraging were absent and abalone could acclimate to the higher temperature in the Cove, CDF&G predicts a harvestable red abalone population in 5 to 10 years (FES Addendum, p. 5-6).

In addition to describing the basic life history of bull kelp (ER-4, pp. 77-79), and investigating the thermal response of juvenile sporophytes of bull kelp in the study by Warrick cited earlier, we have cited an extensive literature on seasonal changes and on the effect of temperature increases on bull kelp sexuality.

In situ work by McLean (1962)[8/], Ebert (1973)[9/], and Foreman (1970)[10/] on the ecology of bull kelp has shown that the sporophyte generation in northern and central California is first observed between March and April, coinciding with the upwelling period and the lowest annual water temperatures. At Diablo Canyon, surface and bottom temperatures ranging between 7.8-9.5°C

(45-49°F) are not uncommon during upwelling. Vegetative sporophyte growth continues throughout the spring and summer months with peak surface canopy development and zoosporangial sori maturation typically occurring in September, coinciding with the year's warmest ambient seawater temperatures and widest diel temperature fluctuations (Ebert, 1973; ER-4, pp. 89-90; and ER-5, pp. 113-147). Zoospore release and settlement likewise occur during this period of highest annual ambient temperatures when daily readings in Diablo Cove have reached as high as 17.2°C (63°F), at a depth of 10 m. Mean monthly benthic and surface temperatures, however, have generally ranged between 12.8-15.5°C (54-60.4°F) during this Fall period.

Harge (1928)[11/] was successful in inducing zoospore release from sections of zoosporangial tissue, growing fertile female and male gametophytes, and raising juvenile sporophytes to a length of 1.5 cm in water temperatures averaging 16°C (60.8°F) and ranging as high as 18°C (64.4°F). Vadas (1972)[12/] was successful in obtaining gametophyte growth at 20°C (68°F), although pigment bleaching and abnormal development were noted. He concluded that the effective reproductive limits for bull kelp were between 2°C (35.6°F) and 18°C (64.4°F).

The temperature response of bull kelp described in the existing literature and in our studies indicates that tissue bleaching and degeneration can be expected to occur when seawater temperatures range near 17.8°C (64°F) for several consecutive

hours each day for several days.

In Diablo Cove during the spring months (April and May), sporophytes could be exposed to these temperature regimes if located directly in the path of the high velocity discharge plume and in peripheral shallow subtidal areas where the cross-sectional influence of the warm water at lower velocity could extend throughout the water column, thus contacting the bottom. During the later summer and early fall, the size of the areas affected by temperatures above 17.8°C (64°F) would be increased as power plant delta-T's remained fairly constant and ambient temperatures reached annual maxima. Assuming that zoospore release could occur, Vadas' (1972) work indicates that gametogenesis and sexual reproduction would probably be inhibited in these areas of the Cove. Beyond the point in the Cove where the plume lifts off the bottom and in the deeper peripheral areas below the layer of warm water, sporophytes could also develop if fertile zoosporangial tissue was introduced through the cooling water system or by currents from other areas. Ebert (1968) reported observing detached sori accumulated on the sea floor with swarms of zoospores being released.

Recent results of physical model tests conducted by the University of California, Berkeley, indicate that the operation of the shoreline discharge causes large volumes of water to be drawn into Diablo Cove along the bottom between Diablo Rock and the north tip of the Cove. Providing this

entrainment occurs, detached sori from mature bull kelp plants north of Diablo Cove should introduce zoospores into the Cove. These zoospores could develop into bull kelp stands in areas of suitable temperature and light. In addition, results of physical model tests indicate that plume influence is not expected to extend into the northern portion of the Cove, where a substantial bed of bull kelp presently exists.

In summary, the studies and review performed by PGandE support and reaffirm the conclusions in the FES Addendum that the effect on bull kelp and on abalone will be confined to a limited area. Any potential effect of this bull kelp reduction on abalone would be confined to the larger abalone (greater than 1 to 2 inches or 2.5 to 5 cm), since smaller abalone do not feed on bull kelp (FES Appendix A2-6.1). The direct effects of the temperature increase on both larval abalone and on the adults has been summarized in the FES Addendum (p. 2-14 and pp. 5-4 to 5-5), and in the ER Supplements (ER-4, pp. 155-174, pp. 175-179, pp. 364-368, pp. 373-378; ER-5, pp. 273-285, pp. 318-322).

<u>Contention 1J. - Growth and Concentration of Bull Kelp, as Affected by Heat, Chlorine, and Foam Emitted From the Diablo Canyon Discharge Structures, and its Effect on Abalone Which Feed on it</u>

William P. Cornwell, in his response to PGandE and Staff interrogatories dated June 16 and 21, 1976, respectively, asked questions in these general areas, all of which have been

addressed in the FES Addendum. The question of heat effects on bull kelp and the subsequent effects on abalone have already been discussed by me. Other information available in the literature and from our recent studies is set forth below.

As already cited (FES Addendum, Section 5.3.2, p. 5-15), a concentration of 1.0 ppm chlorine had no effect on giant kelp, Macrocystis pyrifera, over a 5-day exposure period. The chlorine discharge limit for Diablo Canyon in the NPDES permit adopted April 19, 1976 specifies a maximum of 0.1 mg/l total available chlorine at the point of discharge, or one-tenth the level cited above. The discharge stream is further diluted by mixing with the receiving water. Each pump system (one-half unit) is to be treated for only 10 minutes per day rather than continuously, as in the experiment described above. Consequently, there should be no effect on the kelp in the receiving water. A chlorine dose limit of 50 kg/day/unit is also imposed by the NPDES permit. Finally, the area where the maximum concentration of 0.1 mg/l could occur at the base of the discharge is so turbulent and of such high velocity (FES Addendum, Fig. 3.1) that no kelp will be able to survive in the immediate area. Thus it is extremely unlikely that chlorine from the Diablo Canyon discharge operating under the NPDES permit limitations could have any adverse effect on kelp in Diablo Cove or beyond the Cove.

The circulating water pumps of the Diablo Canyon Power Plant were operated from June 28, 1974 to October 24, 1974 and

from November 11, 1975 to March 1, 1976. Foam was produced in varying quantities during the pump operation (FES Addendum, Fig. 3.1 and Section 5.2.2, p. 5-1 to 5-2). As part of the NPDES monitoring program, aerial photographs have been taken of the kelp beds with infrared color film (ER-8; FES Table 6.1). These aerial photographs and verification by on-ground inspection reveal a normal pattern of bull kelp growth in Diablo Cove for 1974, 1975, and 1976, including the area of Diablo Cove affected by the foam from the discharge. The extent of the kelp beds in Diablo Cove on October 16, 1975 is shown on Figure 1 attached. This kelp bed originated from zoospores liberated by the 1974 adult plants. Operation of the circulating water pumps in 1974 coincided with the maturation of developing sori on the blades of the adult plants.

The 1976 kelp crop exhibits a pattern of kelp canopy development similar to the record 1975 kelp crop according to the California Department of Fish and Game.[13, 14] The 1976 sporophytes developed from sexual and asexual reproduction starting in the fall of 1975 and extending into early 1976, the period during which the pumps were again operating (FES Addendum, Fig. 3.1). The developing sporophytes were able to grow without apparent inhibition by foam produced from operation of the circulating water system. The extent of the kelp beds on August 25, 1976 is shown on Figure 2 attached. Although taken nearly 2 months earlier than the record crop displayed

on Figure 1 the kelp shows the same pattern of development. In fact, as noted in pages 32-33 of Warrick's kelp report cited earlier, we found a dense stand of bull kelp growing intertidally in both the southeast and northeast corners of Diablo Cove in 1976. The plants appeared healthy, and the blades of most of the individuals contained maturing sporangial sori. Some of these plants were found in the areas where the greatest amounts of foam had been observed during pump operation.

A program of surface foam monitoring was initiated by CDF&G in November 1976, which included wind and swell direction, maps of foam distribution, and photographs (CDF&G, Quarterly No. 10, pp. 8-9). They found foam within southeast Diablo Cove on 50 percent of the survey days. On other days, wind and swell action caused the foam to disperse.

In summary, the kelp canopy in Diablo Cove has increased in each succeeding year, with an 80 percent increase from 1973 to 1974 (FES Addendum, p. 2-11), and a doubling from 1974 to 1975 (CDF&G, Quarterly No. 10, p. 6). This increase has occurred in all areas of the cove, including those regions where foam from discharge operation conceptually could have been a problem. Foam was generated during two critical periods in the life history of the bull kelp, but did not appear to affect the subsequent kelp beds.

The effects of chlorine on abalone have been studied at our Biology Laboratory at Diablo Canyon site. Black abalone

were able to withstand a dose of 9.6 mg/liter total residual chlorine application for a one-hour period, and survived for the entire 15-day test period.[15] This concentration is nearly 100 times that allowed for discharge under the existing NPDES permit. Both red abalone and black abalone survived daily doses of 0.5 mg/liter free residual chlorine for 20-minute periods for an entire 30-day test period. This dose level is 25 times greater than that allowed by the NPDES permit.

The effects of concentrated sea foam on black abalone were also studied at our Biology Laboratory. Foam was scooped up by bucket and then deaerated by agitation which broke the foam bubbles and reduced the liquid fraction to a liquid state. Black abalone and purple sea urchins were able to live in a 100 percent solution of this concentrate for the duration of the 96-hour static bioassay.[16]

Based on the foregoing analysis, the assessment provided in the FES and FES Addendum deals adequately with the questions raised in this contention. The analysis of existing information and new information provided here only reinforces the original assessment that while there will be effects from heat on bull kelp within Diablo Cove there will be no measurable adverse effects on bull kelp and abalone from chlorine or foam.

Contention 3. <u>Whether Adverse Environmental Effects Are Being or Will be Experienced by Abalone Due to Residual Particulate Copper From Previously Installed Condenser Tubing</u>.

William P. Cornwell has expressed concern over the possibility of adverse environmental effects being experienced by abalone from condenser tube copper. We have measured the levels of copper in bull kelp, <u>Nereocystis</u> <u>luetkeana</u>, collected in Diablo Cove and in South Cove in both September 4, 1974 and October 31, 1975. The 1974 data were reported in ER-5, p. 55. Although bull kelp is an annual, any residual copper present in the environment should show up in the tissues of the kelp. As shown in Table 1, the bull kelp plants collected from the 1975 bed in Southeast Diablo Cove contained 2 orders of magnitude less copper than plants analyzed from the 1974 beds in the same location.

We have also measured the levels of copper in black abalone collected on September 4, 1974 and on September 1, 1976. The copper concentrations in both red and black abalone collected in 1974 from Northeast Diablo Cove, Southeast Diablo Cove, and South Cove were reported previously (ER-5, p. 55). Although red abalone are still present in both Northeast and Southeast Diablo Cove in limited numbers we did not collect them for analysis in 1976 because the required number of animals for statistical analysis would have seriously depleted the population. Black

abalone, on the other hand, are still present in substantial numbers in Diablo Cove (CDF&G, 1976(C), Annual Report 1974-1975, p. 74).[17/]

The concentrations of copper found in various tissues of black abalone collected in 1974 and 1976 are shown in Table 2. In general, the levels of copper in the different tissues of black abalone were about the same in 1976 as in 1974.

In summary, there is no evidence that abalone or the bull kelp on which abalone feed are experiencing residual effects from copper in the Diablo Canyon vicinity.

TABLE 1

COMPARISON OF COPPER CONCENTRATIONS, IN PPM DRY WEIGHT, FOUND IN BULL KELP TISSUE IN DIABLO CANYON VICINITY ON SEPTEMBER 4, 1974 AND OCTOBER 31, 1975.

Location	September 4, 1974	October 31, 1975
South Cove		
Number Collected	1	10
Blade	1.93	0.32 ± 0.37
Stipe	0.97	0.37 ± 0.37
Northeast Diablo Cove		
Number Collected	1	10
Blade	4.72	0.31 ± 0.16
Stipe	2.37	0.35 ± 0.26
Southeast Diablo Cove		
Number Collected	1	10
Blade	579.0	0.85 ± 0.48
Stipe	150.0	0.60 ± 0.96

TABLE 2

SUMMARY OF MEAN COPPER CONCENTRATIONS, IN PPM WET WEIGHT, FOR BLACK ABALONE TISSUE COLLECTED IN DIABLO CANYON VICINITY ON SEPTEMBER 4, 1974 AND SEPTEMBER 1, 1976.

	Digestive Gland		Gill		Right Kidney		Foot Muscle	
	1974	1976	1974	1976	1974	1976	1974	1976
South Cove								
Control								
Sample Size	4	10	4	10	4	10	4	10
Copper (ppm) $\bar{X} \pm S$	1.63±1.49	2.97±1.04	14.95±9.54	11.54±11.14	1.85±1.0	4.97±2.98	2.07±1.65	2.16±1.98
NE Diablo Cove								
Sample Size	5	10	5	10	5	10	5	10
Copper (ppm) $\bar{X} \pm S$	2.98±0.98	4.16±1.24	7.71±2.23	9.64±4.38	4.60±1.56	4.32±1.70	2.04±0.85	1.38±0.46
SE Diablo Cove								
Sample Size	5	10	5	10	5	8	5	10
Copper (ppm) $\bar{X} \pm S$	10.23±3.49	7.64±8.27	12.30±5.03	10.23±7.65	4.63±2.30	7.16±3.44	1.88±0.58	2.14±1.52

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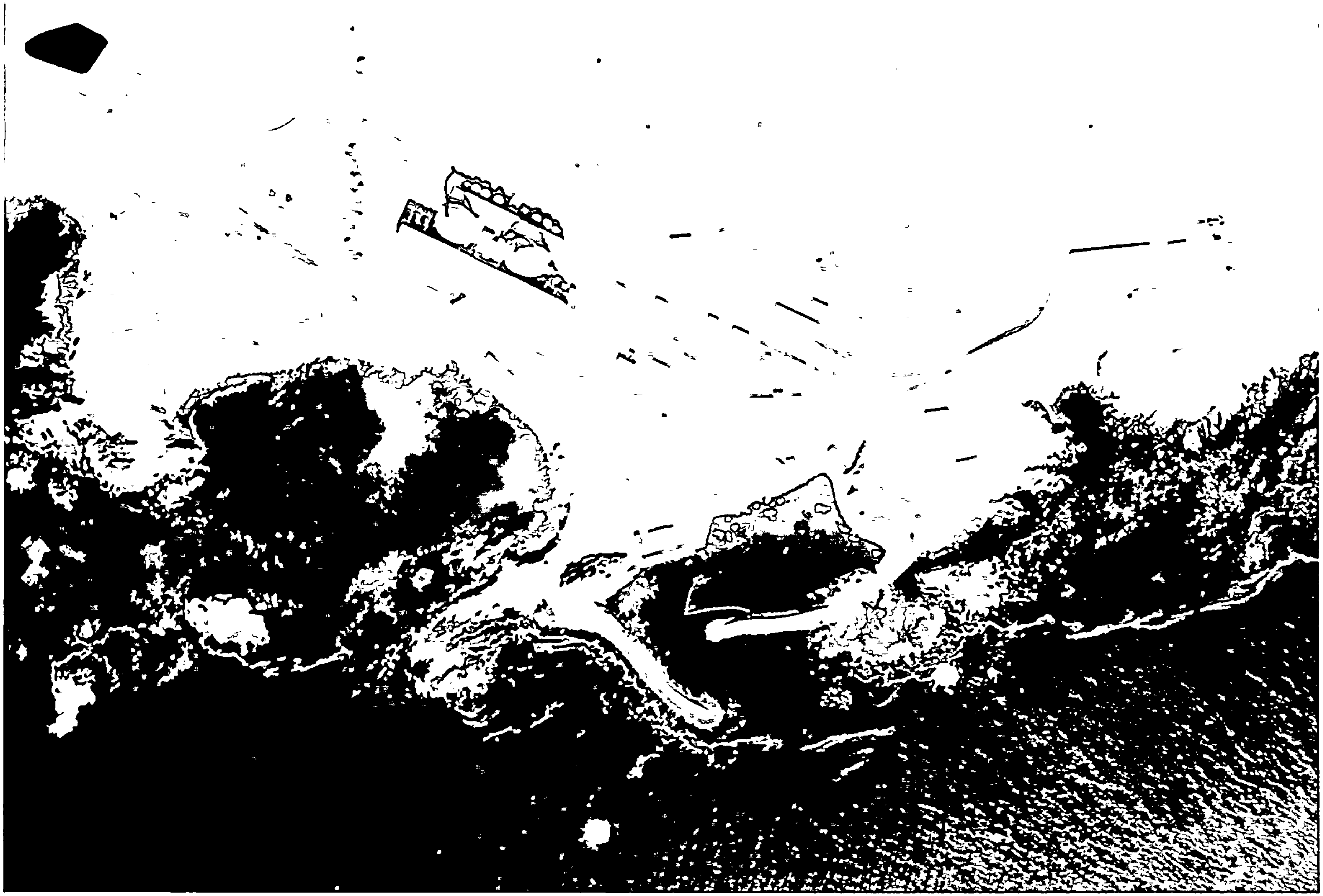

[illegible] Canyon — October [illegible]