

SEDIMENTARY ANALYSIS FOR RIG MONITORING

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## INTRODUCTION

The objectives of this investigation were to determine whether or not changes in the environment adjacent to a sub-sea drilling operation could be detected; and if so, what are they? In order to accomplish these goals, a station grid composed of three concentric rings 100, 500, and 1000 m apart was set up as shown in Figure 1. Stations were occupied before drilling commenced, during the drilling operation and after drilling had ended. Location of the experiment was off the Texas coast near Mustang Island at  $27^{\circ}37'14''\text{N}$ ,  $96^{\circ}57'55''\text{W}$ . Surface sediments in this area are muds.

Samples were collected at each station by a diver filling a ten centimeter diameter by about 1/2 m long PVC core with sediment by scraping it horizontally along the bottom. The core was then capped, brought to the surface, labeled, taped, and delivered to my shoreside laboratory for sediment analysis. Sampling was difficult for the divers because the large amount of fines in the water column reduced visibility to near zero and because of the concomitant difficulty in determining the exact location of the bottom in the sometimes soupy sediments.

In the laboratory, samples were split. One aliquot was wet sieved through a  $63\ \mu\text{m}$  screen. An aliquot of sediments remaining in the screen was dried, weighed, and sieved for 15 min through  $7.62\ \text{cm}$  diameter sieves nested at one phi intervals. Another aliquot of sediment remaining in the  $63\ \mu\text{m}$  mesh was run through the rapid sediment analyzer. Percent silt and clay in the finer than sand sized sediment was determined by pipette analysis. The sand fraction was optically scanned in order to detect well cuttings and barite. Percent  $\text{CaCO}_3$  was determined using standard acid digestion gasification techniques.

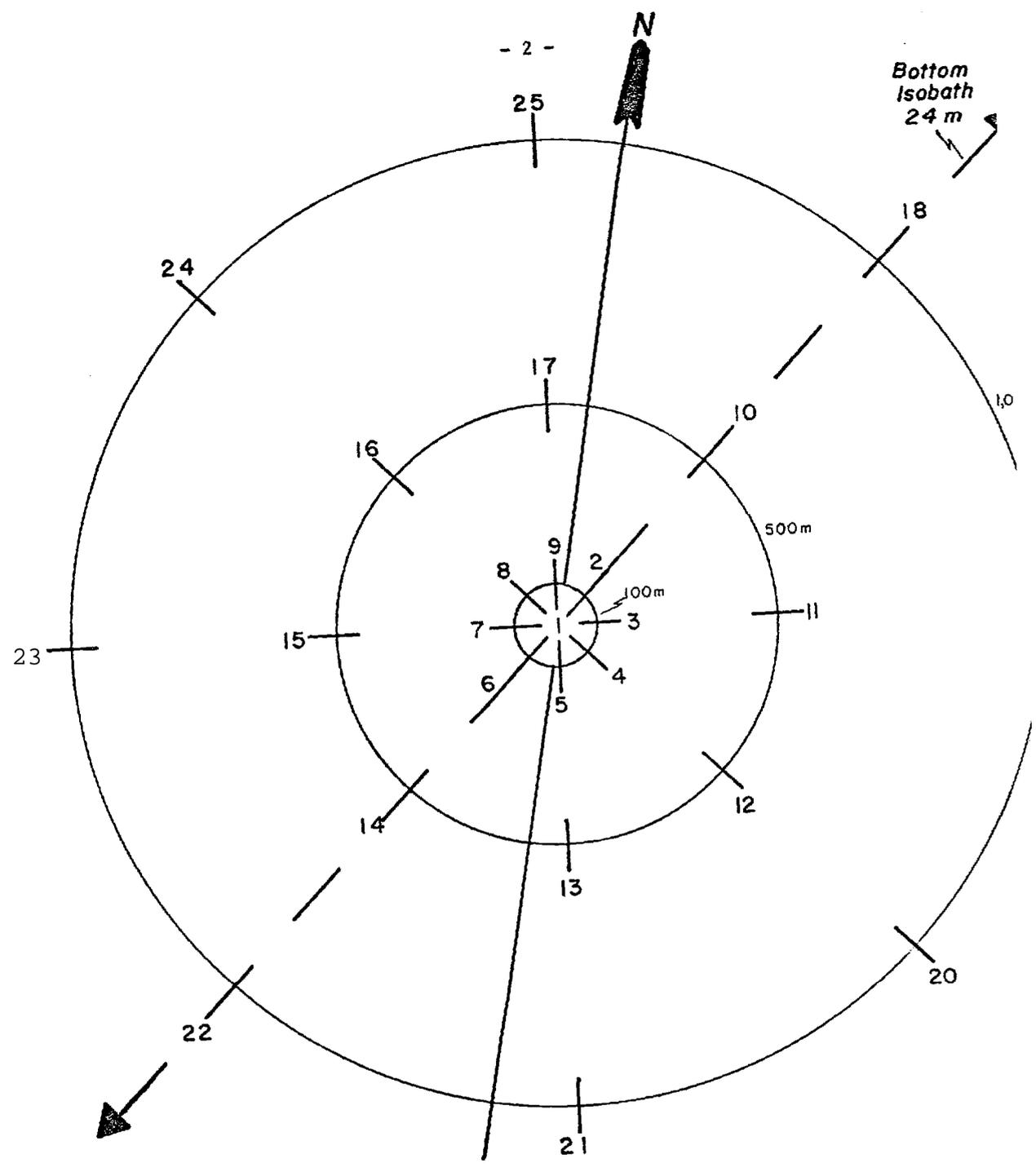


Figure 1

Station Arrangement for Rig Monitoring  
Drilling occurred at Station 1

## RESULTS

Detailed grain size analysis and percent  $\text{CaCO}_3$  of each sample are stored in the DMSAG data bank. Tables 1-4 show the distribution of sand, silt, clay, and  $\text{CaCO}_3$  before, during, and after drilling operations. Within limitations of sampling the substrate, apparent differences are probably related to drilling.

Calcium carbonate increased markedly during the drilling operation at all stations measured. In addition, percentage of sand in the sediments increased in like fashion at nearly all stations. Optical scanning of the sand fractions showed well cuttings to be present at stations 2, 3, 6, 9 and 14 during the drilling operation.

Samples taken after drilling still showed the effects of the operation but to a lesser extent. Percent calcium carbonate in most samples was less than during drilling, but was not back to predrilling levels. Texture showed more variation than the carbonate percentages. Perusal of Tables 1-4 shows that at some stations, percent sand was higher after drilling than during the operation, while at others it was lower. However, percent sand in the sediment was still significantly higher than the uniformly low levels present prior to drilling. Optically obvious well cuttings were less abundant in all post-drilling samples when compared to samples taken during drilling.

## CONCLUSIONS

Effects of the drilling operation are detectable in sediment composition and texture up to the 1000 m limit of the sampling pattern. Obvious well cuttings were found during drilling operations at four stations 100 m from the rig and at one station 500 m from the rig.

TABLE 1  
% SAND BY WEIGHT

Station #	Before	During	After
1	2.1	--	19.6
2	0.6	17.3	6.4
3	0.9	6.3	4.8
4	7.9	4.9	6.0
5	1.1	6.2	16.7
6	0.5	10.2	9.8
7	1.1	8.2	7.0
8	0.9	4.8	8.7
9	0.5	4.2	8.8
10	1.4	5.9	4.9
11	0.7	4.1	9.0
12	1.0	4.9	14.1
13	1.2	5 . 5	26.8
14	0.9	4.8	6.1
15	0.7	6.5	6.1
16	0.7	6.9	11.5
17	1.5	10.5	12.2
18	0.9	6.8	7.7
19	0.6	8.4	6.5
20	0.5	7.5	5.3
21	0.5	4.5	4.1
22	2.0	7.4	7.3
23	1.3	6.4	6.9
24	2.0	6.9	7.1
25	0.9	8.7	4.8

TABLE 2

## % SILT BY WEIGHT

Station #	Before	During	After
1	51*4	--	49.9
2	52.5	6.6	50.9
3	47.6	47.2	55.6
4	45.0	50.5	47.2
5	54.1	53.9	51.0
6	52.6	43.5	36.6
7	57.4	1.3	50.8
8	52.2	44.7	46.3
9	67.8	55.7	56.1
10	50.4	52.0	48.1
11	53.6	52.3	57.9
12	53.1	32.4	55.1
13	53.1	51.3	46.2
14	58.4	4.4	53.0
15	47.8	50.5	50.0
16	54.6	21.3	53.2
17	59.1	51.6	52.1
18	62.4	49.6	51.0
19	55.3	44.6	52.6
20	46.6	47.2	53.6
21	59.1	1.8	54.0
22	98.0	51.1	48.6
23	54.7	52.5	47.0
24	98.0	30.4	47.1
25	47.0	45.7	51.0

TABLE 3  
% CLAY BY WEIGHT

Station #	Before	During	After
1	46.5	--	35.5
2	46.9	76.1	42.7
3	51.5	46.5	39.6
4	46.1	44.6	44.8
5	44.8	39.9	32.4
6	46.9	46.3	36.6
7	41.5	90.3	35.5
8	46.9	50.5	45.0
9	31.6	40.1	35.1
10	48.2	42.1	47.0
11	45.7	43.6	33.1
12	45.9	62.7	30.8
13	45.7	43.2	27.0
14	40.8	90.8	40.9
15	51.5	43.1	43.9
16	44.7	71.8	35.4
17	39.5	38.0	35.7
18	36.7	43.7	39.8
19	44.1	47.1	39.9
20	53.0	45.3	48.3
21	40.4	93.6	41.9
22	.-	41.6	44.2
23	44.0	41.1	46.2
24	--	62.7	45.8
25	52.1	45.6	44.2

TABLE 4  
 % CaCO<sub>3</sub> BY WEIGHT

Station #	Before	During	After
1	3.3	--	5.9
2	9.2	13.1	5.2
3	1.3	15.4	17.0
4	6.2	9.3	7.4
5	3.2	9.9	5.5
6	3.3	13.6	4.4
7	3.2	13.4	5.5
<b>8</b>	2.7	13.0	4.6
9	5.4	10.0	6.0
10	1.0	10.2	4.2
11	7.7	11.9	6.8
12	3.6	10.3	4.4
13	9.3	10.6	43.5
14	1.8	15.4	4.5
15	1.8	14.5	6.0
16	3.3	13.0	5.2
17	3.7	11.4	5.1
18	2.5	17.9	5.8
19	3.5	8.5	4.0
20	0.8	10.2	2.5
21	3.1	12.3	3.3
22	4.0	9.7	1.9
23	7.0	15.3	5.1
24	4.8	12.2	1.4
25	2.2	13.8	4.1

Compositional effects of drilling upon the sediments are muted in the post drilling samples; textural changes are less so.

GEOPHYSICAL INVESTIGATIONS OF THE MAFIA LEASE AREA

Vernon J. Henry

See Thomas E. Pyle