PILSON TR-055

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TR-055

CRUISE REPORT

R/V TRIDENT # 55

"STENCH" CRUISE

Cruise Leader: M.E.Q. Pilson

Duration: 12 Sept. to 11 Oct. 1968

Area: Bermuda to Caribbean - Venezuelan Coastal Waters

PILSON

Schedule

Leg 1	Sept. 12, 1968, 1138, Leave St. George, Bermuda Sept. 17, 1968, 0753, Arrive San Juan, Puerto Rico Sept. 17, 1968, 1535, Leave San Juan, Puerto Rico Oct. 2, 1968, 0630, Arrive Bridgetown, Barbados
Leg 2	Oct. 4, 1968, 1607, Leave Bridgetown, Barbados Oct. 11, 1968, 2140, Arrive Port Everglades, Florida

Summary Statistics

Total time: 30 days
Total time at sea: 26.79 days
Total Station time: 9.53
Station time as % of total time at sea: 35.6%
Hydro-wire lowered: 152 times (172 km)
Dredging wire lowered: 20 times (22 km)
Total number of stations: 49

Personnel

Michael E.Q. Pilson, Chief Scientist, URI, Leg 1,2
Timothy Kennard, Technician, URI, Leg 1,2
George T. Felbeck, Assoc. Prof., URI, Leg 1
Peter Betzer, Graduate Student, URI, Leg 1,2
Kent Fanning, Graduate Student, URI, Leg 1,2
David Johnson, Graduate Student, URI, Leg 1,2
Jason Krout, Graduate Student, URI, Leg 1
Gerard Miller, Graduate Student, URI, Leg 1
Gabe Vargo, Graduate Student, URI, Leg 1
Sandy Vargo, Graduate Student, URI, Leg 1
Kenneth Wolgemuth, Graduate Student, Lamont Geological Observatory, Leg 1

Scientific Objectives

1. Investigation of the chemistry of sea water at the boundary between aerobic and anaerobic water in the Cariaco Trench and in the anaerobic water.

   a. Concentration and speciation of arsenic in aerobic and anaerobic water

   b. Determination of particulate iron concentrations

   c. Concentrations of dissolved and particulate carbon and counting of organic aggregates in aerobic and anaerobic water

d. Collection of large (200 l) water samples for analysis of uranium, thorium and radium

2. Study of silica gradients in cores from an anaerobic basin and in the overlying water.

3. Collection of anaerobic sediment samples of sufficient size that a detailed analytical study of the nature of the organic compounds can be made.

4. Study of the zooplankton which live near the boundary between the aerobic and anaerobic zones.

5. Phytoplankton Studies

a. Collections and counts of phytoplankton from surface waters. Study of the sinking of phytoplankton and their spores in the relatively non-turbulent anaerobic water of the trench.

b. Study of the pigments of phytoplankton, in relation to the total biomass.

6. Collection of magnetometer and bottom profile data from Bermuda to the Cariaco Trench.

7. Investigation of the chemical changes associated with the mixing of Orinoco River water and sea water.

#12, 4, [illegible]

Depth

List of Stations Occupied

Station #	Date	Latitude	Longitude	Activity
1	12 Sept.	31°57'N	64°40'W - 4190	Water Sample
2	13 Sept.	30°03'N	64°58'W - 4896	Water samples and phytoplankton
3	14 Sept.	27°22'N	65°31'W - 5305	Water samples
4	16 Sept.	20°[illegible]6'N	66°58'W ~5800	Core 117cm
5	16 Sept.	19°37'N	67°12'W - 8151	Water samples and phytoplankton
6	18 Sept.	17°09'N	67°19'W	Water samples and phytoplankton
7	19 Sept.	14°56'N	66°29'W - 4930	Core, 122cm water samples and phytoplankton
8	20 Sept.	12°21 N	66°04'W	Water samples
9	20 Sept.	11°30'N	65°37'W - 1247	Core, 95 water samples
10	21 Sept.	11°03'N	65°45'W - 75	Cores, zooplankton, phytoplankton
11	21 Sept.	10°39'N 10° 41	65°37'W - 1375 65° 31	Water samples, cores, 113cm zooplankton, phytoplankton, camera, sediment samples
1026 - 12	22 Sept.	10°24.9'N	65°35.5'W ?	Cores, phytoplankton, sediment samples
13	22 Sept.	10°41'N	65°26'W - 1368	Cores, 123cm water samples, zooplankton, sediment samples
14	23 Sept.	10°50'N	65°18'W	Phytoplankton
15	24 Sept.	10°39'N	65°05'W - 923	Cores, 127cm water samples, camera zooplankton
16	24 Sept.	10°47'N	64°50'W - 263	Cores, 126cm water samples
17	25 Sept.	10°42 N	64°53'W	Water samples
18	25 Sept.	10°32'N	64°45'W - 1390	Cores, check water samples, phytoplankton, zooplankton, sediment samples
19	26 Sept.	10°23'N	64°37'W - 140m UCC 143	Core, 89cm water samples
20	26 Sept.	10°30'N	64°28'W - 1370	Cores, 136cm water samples, phytoplankton, zooplankton
21	27 Sept.	10°28.4'W	64°12.4'W - 1395	Core, 80cm water samples, phytoplankton
22	27 Sept.	10°32'N	64°30'W - 1375	Core, water samples
23	27 Sept.	10°44'N	64°33'W - 566 m	Core, 132cm water samples, phytoplankton

Station #	Date	Latitude	Longitude	Activity
24	28 Sept.	11°32'N	64°37'W	Water samples
25	29 Sept.	10°12'N	60°56'W	Water samples
26	29 Sept.	10°07'N	60°50'W	Water samples
27	29 Sept.	10°02'N	60°43'W	Water samples
28	29 Sept.	9°55'N	60°37'W	Water samples
29	29 Sept.	9°51'N	60°31'W	Water samples, sediment samples
30	29 Sept.	9°45'N	60°27'W	Water samples
31	30 Sept.	9°53'N	59°44.5'W	Water samples, phytoplankton
32	30 Sept.	9°02'N	60°10'W	Water samples
33	30 Sept.	9°02'N	60°08.2'W	Water samples
34	30 Sept.	9°02'N	60°10.5'W 42	Core, 151cm water samples
35	30 Sept.	9°10.5'N	60°16'W	Water samples
36	30 Sept.	9°17'N	60°21'W	Water samples
37	30 Sept.	9°26'N	60°30'W	Water samples, sediment samples
38	30 Sept.	9°34.5'N	60°39'W 45	Core, 134 water samples
39	30 Sept.	9°41.5'N	60°47'W	Water samples
40	30 Sept.	9°40.8'N	60°40'W	Water samples
41	30 Sept.	9°45.5'N	60°32.2'W	Water samples
42	30 Sept.	9°48'N	60°27'W	Water samples
43	1 Oct.	10°17'N	59°45'W	Water samples
44	5 Oct.	15°02'N	59°32'W	Cover test, water samples
45	5 Oct.	16°06'N	58°50'W	Water samples
46	7 Oct.	19°00'N	63°07'W	Water samples
47	7 Oct.	19°56'N	64°58'W	Water samples
48	8 Oct.	20°54'N	66°56'W	Cover test, water samples
49	11 Oct.	25°44'N	77°13'W	Cover test

Preliminary Results

The magnetometer never functioned properly from the first day so no magnetometer or bottom profile data were collected.

Most other programs proceeded more or less as planned, and all will have returned some data by the time the samples are analysed.

As yet, complete reports are not in, and the following comments reflect only preliminary results from some programs.

1. The Cariaco Trench was just as anaerobic in 1968 as it was during the pioneering studies of Richards in 1955. This time two different methods were used to determine the sulfide concentrations, one of which was highly specific for sulfide. The two methods did not agree exactly, and it is probable that the true sulfide concentrations are somewhat lower than have been reported previously.

2. Arsenic concentrations in the anaerobic water of the Cariaco Trench exceed those in surface water, or in deep water elsewhere in the North Atlantic or Caribbean. Concentrations in the surface water in this area ranged from 2 to 8 micrograms per liter, while the deep water concentrations ranged up to 22 micrograms per liter. These values are from the measurement of arsenate, the oxidized form of arsenic. There was a strong indication that much of the arsenic in the anaerobic water is in some reduced form, but this matter is not yet established.

3. It was expected that particulate iron concentrations would be different in the anaerobic water than in oxygenated water due to the strong chemical effects of the reducing conditions on ferric hydroxide, however, the preliminary data suggest that the concentrations in fact were similar to those of other oceanic areas.

Measurements were made at a total of 43 stations on about 200 samples of 20 liters each. Fifteen of these stations were in the Trench area.

4. Concentrations of dissolved and particulate carbon and the numbers of organic aggregates were measured at five stations in the Trench area.

5. Six 400 gallon samples were taken from the surface while the ship was underway and processed on board for subsequent analysis of radium and thorium (Lamont).

6. Five 100 gallon samples were taken at stations 11, 13, 16, 18 and 20 from various depths from the surface to 1300 m, and processed for subsequent determination of carbon-14, cesium-137, lead and strontium-90 (Lamont). Smaller samples were taken for subsequent analysis of uranium, radium, total carbon dioxide, and barium (Lamont).

7. At stations 4, 7, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22, 23, 34, and 38, gravity cores were taken and the pore waters were squeezed from selected sections for subsequent analysis of silica gradients and for other constituents (URI and Lamont)

8. Large samples (several tens of kilograms each) of sediment were collected by the Van Veen grab sampler at stations 11, 12, 13, 18, 29, and 37. They are stored frozen and will be subjected to a detailed analysis of the organic matter content.

9. Zooplankton samples were collected at the surface and near the anaerobic water at stations 9, 10, 11, 13, 15, 18, 20, and 22. Oxygen uptake experiments were made on organisms from some of these samples, under conditions of low oxygen concentration, and their endurance measured in sulfide bearing water.

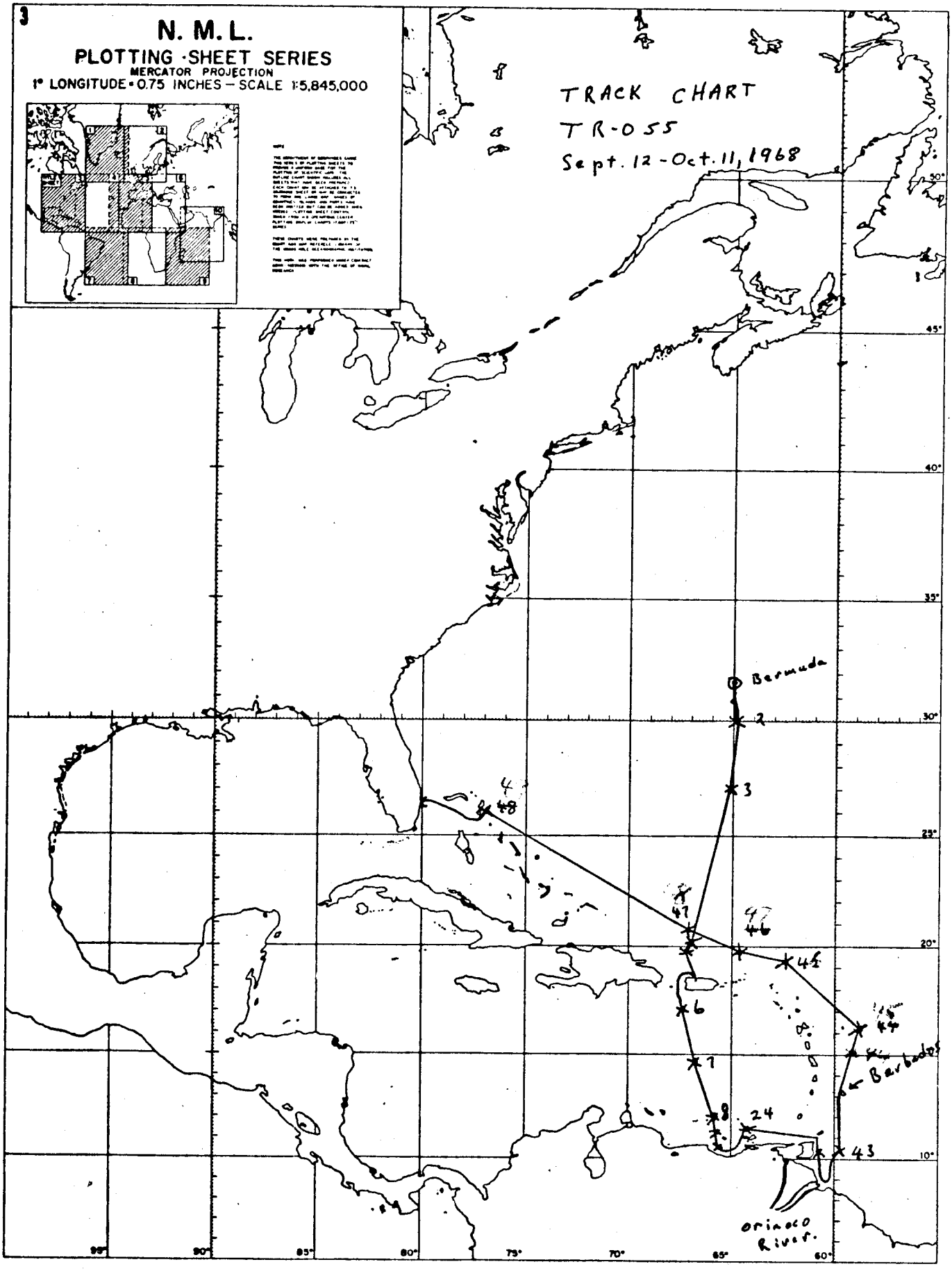
10. Phytoplankton samples and water samples for pigment determinations were collected at 16 stations, and in addition station 14 was occupied for 24 hours for a detailed study of diurnal changes in phytoplankton populations.

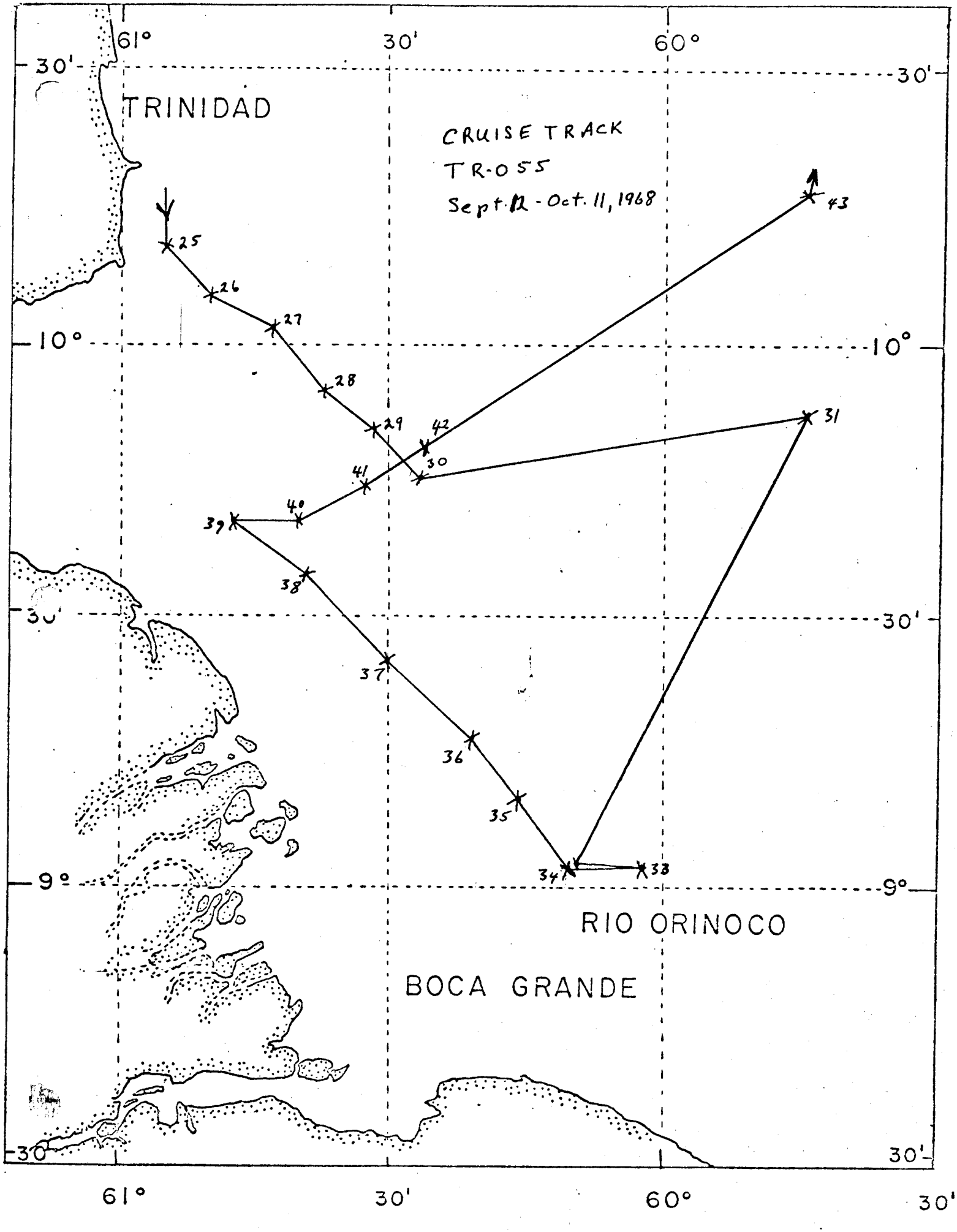
11. Stations 25 to 42 were made during one two day period in the general area of the discharge plume of the Orinoco. Water samples were collected to investigate the chemical processes during mixing of river water and sea water. We were unable to get closer than about 15 miles from land at the river mouth, so we could not get really undiluted river water. Nevertheless, sufficient samples were collected to elucidate some of the main points of interest. We will probably have to go back to get samples of pure river water at some later time.

Bien et al. from work off the Mississippi, suggested that all or most of the silica in the river is precipitated when river water mixes with sea water. Our data show that this does not happen off the Orinoco, and that most (possibly all) of the silica in the river enters the ocean in a soluble form.

Several other kinds of chemical data were also collected.

12. A large amount (more than 1,000,000 tons per year) of particulate iron is carried to the sea each year by the Orinoco. The concentration of particulate iron in the river is about 3 micrograms per milliliter, or at least 4 orders of magnitude greater than in surface sea water. It seems that the concentration of particulate iron may be a very sensitive indication of the presence of river water dilution in surface sea water.


3
N. M. L.
PLOTTING SHEET SERIES
MERCATOR PROJECTION
1° LONGITUDE = 0.75 INCHES — SCALE 1:5,845,000
TRACK CHART
TR-055
Sept. 12 - Oct. 11, 1968
Bermuda
Barbados
Orinoco River
45°
40°
35°
30°
25°
20°
15°
10°
95°
90°
85°
80°
75°
70°
65°
60°


61°
30'
60°
30'
TRINIDAD
CRUISE TRACK
TR-055
Sept. 12 - Oct. 11, 1968
10°
25
26
27
28
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31
41
42
43
40
39
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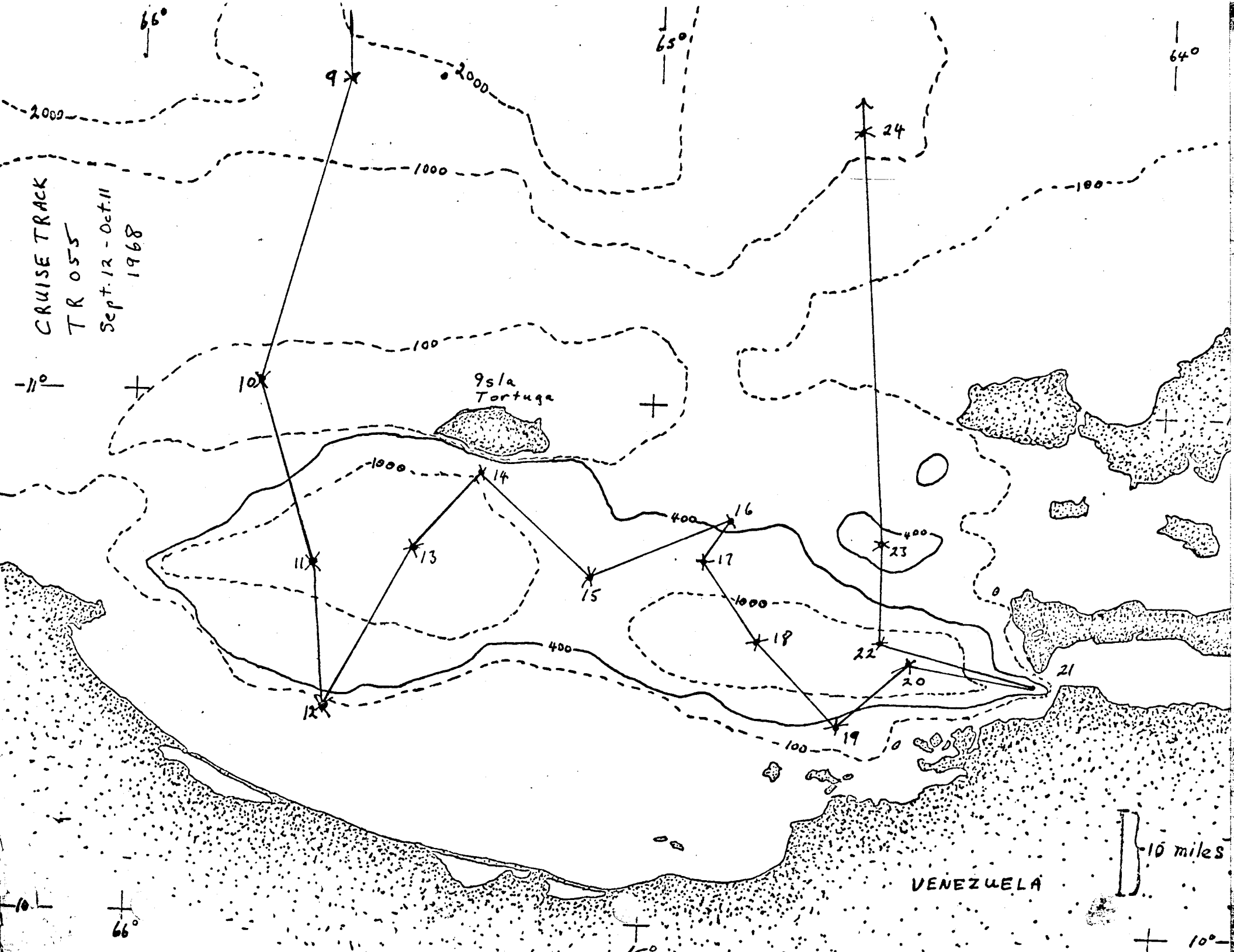
36
35
34
33
9°
RIO ORINOCO
BOCA GRANDE


CRUISE TRACK
TR 0555
Sept. 12 - Oct. 11
1968
66°
65°
64°
11°
10°
2000
1000
100
400
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10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
9s la Tortuga
10 miles
VENEZUELA