

KRAUSE

TR-021

UNIVERSITY OF RHODE ISLAND • KINGSTON

Narragansett Marine Laboratory

Graduate School of Oceanography

KRAUSE

CRUISE REPORT
CRUISE TR -21 (AZORES)

16 September - 3 November 1964

A 49-day cruise was made in the North Atlantic Ocean from 16 September to 3 November 1964. The cruise was devoted to geochemical, geological, geophysical and biological studies.

Leg 1 - 16 September -- 7 October 1964. Narragansett, Rhode Island to Ponta Delgada, São Miguel (Azores Islands) (22 days).

7 - 10 October 1964

Leg 2 - 10 October -- 3 November 1964. Ponta Delgada -- Narragansett (25 days).

Scientific Party

Leg I

Dr. David Schink (scientific leader), geochemistry

Dr. Dale Krause, Geology

James Frey, Geochemistry

Kent Fanning, Geochemistry

John Piety, Geochemistry

Thomas D'Ambra, Geochemistry

Clifford Schink, Geochemistry

D. Schink, J. Frey, and C. Schink disembarked at Ponta Delgada

Leg II

Dr. Dale C. Krause (Scientific Leader)

Kent Fanning

John Piety

Thomas D'Ambra

Robert Hempsted, Master

Operations

Leg I

A sounding line and magnetometer profile were run enroute to the Azores area the following stations were occupied enroute:

001	17 Sept. 1964	39-20, 66-10	hydrocast, near bottom silicates, <u>gravity core</u>
002	22 Sept. 1964	36-45, 44-54	<u>same</u>
003	24 Sept. 1964	36-46, 37-54	hydrocast

TR-021

Daily net tows from 2200 to 2230 local time were made for George Grant. The ship arrived at Station A (36 N., 26 W.) on 27 October and operations thereafter centered about this point.

The following operations occurred at Station A:

- (a) 27 Sept. 64 -- Hydrocast 004 to depth of 700 m.
- (b) 27 Sept. 64 -- Bag sampler lowering -- failed due to freezing of accumulator sheave.
- (c) 28 Sept. 64 -- Bag Sampler lowering to 500 m, 4000 gallons collected and processed.
- (d) 29 Sept. 64 -- Bag Sampler lowering to 1000 m 10,300 gallons collected and processed.
- (e) 29 Sept. 64 -- Hydrocast 005 to depth of 1200 m
- (f) 1 October 64-- Hydrocast 006 to depth of 2900 m
- (g) 1 Oct. 64 - - Trace metal samples taken from Niskin bottles on plastic wire to 100 m.
- (i) 2 Oct. 64 - - Bag Sampler lowered to 2500 m but returned empty.
- (j) 2 Oct. 64 - - Carbon-14 samples taken at 0, 500, 1000, 1500, 1700, 2000, and 2500 m.
- (k) 3 Oct. 64 - - Bay Sampler lowered to 2500 m, 8,200 gallons collected and processed.
- (l) 4 Oct. 64.- - Collected surface silica with sponge dragger.
- (m) 5 Oct. 64 - - Hydrocast 007, near bottom silicate samples.
- (n) 5 Oct. 64 - - Gravity core.

Between these operations bathymetric and magnetic surveys were run in the areas denoted on the track chart.

Leg 2

Numerous rock samples were collected during the Trident's stay in Ponta Delgada from the islands of São Miguel and Santa Maria in order to compare to the ship-collected data.

The track on the return leg was designed to determine the character of the southern edge of the Azores platform, to investigate the relationship of the Azores platform, to investigate the relationship of the Mid-Atlantic rift to the Azores platform, and to test the existence of a fracture zone to the west of the Azores. The echo sounder and magnetometer were used throughout.

Two dredge hauls were made in the Azores region:

Dredge Az-4

13 October 1964

37°09'N.

29°54'W.

1940 meters depth

The sample was taken from the pinnacle or reeflike ridge at the break in slope at the south edge of the Azores platform. Sample consisted of deep-sea octocorals, manganese coated volcanics, a sponge and bryozoal(?). The octocoral is of the Family Isididae according to Donald Squires.

Dredge haul Az-8

17 October 1964

36°31.5'N.

33°34'W.

1800-1650 meters depth

Lithified calcareous ooze dredged from one south side (at the top) of the ridge on the south side of the median rift of the Mid-Atlantic ridge. The rock is recent in origin according to Ruth Todd and composed largely of coccolith plates according to Gino Mearini.

Seven hydrographic stations were occupied during this leg. The nightly biological net tows for George Grant were continued during the leg. Sargassum weed was collected on 23 October for Towne Conover and John Sieburth for antibiotic studies.

An echo sounding and magnetometer survey for James Schwartz was made over the heads of Oceanographer, Gilbert and Lydonia canyons of the New England coast on 1-2 November. Bottom samples were also collected there at 9 stations.

A short reconnaissance survey over an east-west zone of magnetic anomalies in Rhode Island Sound concluded the cruise. (3 days)

The principal results of the geological investigations of the cruise follow:

Two east-west trending fracture zones lie east and west, respectively, of the Mid-Atlantic ridge at the Azores Islands in the North Atlantic Ocean. The East Azores fracture zone at the Azores is marked by ridges and troughs and includes the southern margin of the Azores Platform. Between the Azores and Gibraltar, the East Azores fracture zone also has characters of a median rift. The West Azores fracture zone is distinguished by topography and magnetic profiles as far west as 51°W. long. It marks part of the southern border of the Sohms abyssal plain. The fracture zone splinters in the west with one branch found under the abyssal plain and with the main branch following a great circle and trending south of west. The East Azores fracture zone is seismically active. The Kelvin seamount chain is interpreted as an associated tectonic feature and forms the western segment of a fracture system that exists across the entire width of the North Atlantic between the Straits of Gibraltar and northeastern United States.

Summary of Hydrographic Stations taken on Trident cruise 021 (Azores)

A total of 14 hydrographic stations were taken. Routine temperature, salinity and oxygen measurements were made. At stations 5 and 6 the phosphate concentration was measured. In addition, a 7 sample C-14 profile was made at station "A". Supplementary salinity and oxygen samples were collected from the 3 Si-32 bag samples. Phosphates were collected from the last 2 Si-32 samples. Surface plankton net tows were made on both legs of the Atlantic crossing, and a core taken at each deep station.

No attempt was made to plan the casts before the cruise, therefore, each cast was modified as the situation demanded. However, an effort was made to measure at standard depths. At 10 stations the deep cast consisted of a modified bottle arrangement, made up of a pinger and 5 Nansen bottles, only one bottle carrying thermometers. The distance from the bottom of the pinger to the first bottle was about 235 cm, the distance between bottles was about 130 cm. Rounding off, this placed the last bottle less than 3 m from the bottom, when the pinger was on the bottom, and every other bottle an additional meter above the next.

Because of time limitations only one cast was made for each bottom sample and all were not equally successful. The success of each cast was a function of weather, pinger operation and the intestinal fortitude of the operator.

- Sta. 1. A routine shallow cast; on the deep cast the pinger switch had become tangled and did not turn off, or allow the last Nansen bottle to trip.
- Sta. 2. A routine shallow cast. The pinger was approximately 8 m from the bottom when it turned off.
- Sta. 3. Routine deep and shallow casts. Deep cast was to 3000 m.
- Sta. 4. A modified shallow cast at station "A" with the bottles spaced 50 m apart from 300 to 700 m. Quite an unstable salinity pattern is present from 400 m to 700 m, otherwise a routine cast.
- Sta. 5. Second modified shallow cast at station "A" with the bottles spaced 50 m apart, again an unstable salinity pattern is developed from 500 m to 1200 m, phosphates show a somewhat similar pattern only 180° out of phase.
- Sta. 6. Modified intermediate cast at Sta. "A" with the bottles spaced only 100 m apart from 1300 m to 1600 m, 1800 m to 2100 m and 2300 m to 2700 m.
- Sta. 7. Modified deep cast at station "A" with an attempt to keep the pinger on the bottom.
- Sta. 8. A routine shallow cast, however a pre-trip occurred at about 700 m in the pinger group, turning off the pinger switch.
- Sta. 9. A deep cast was made to augment the bottom part of the area around station 3.

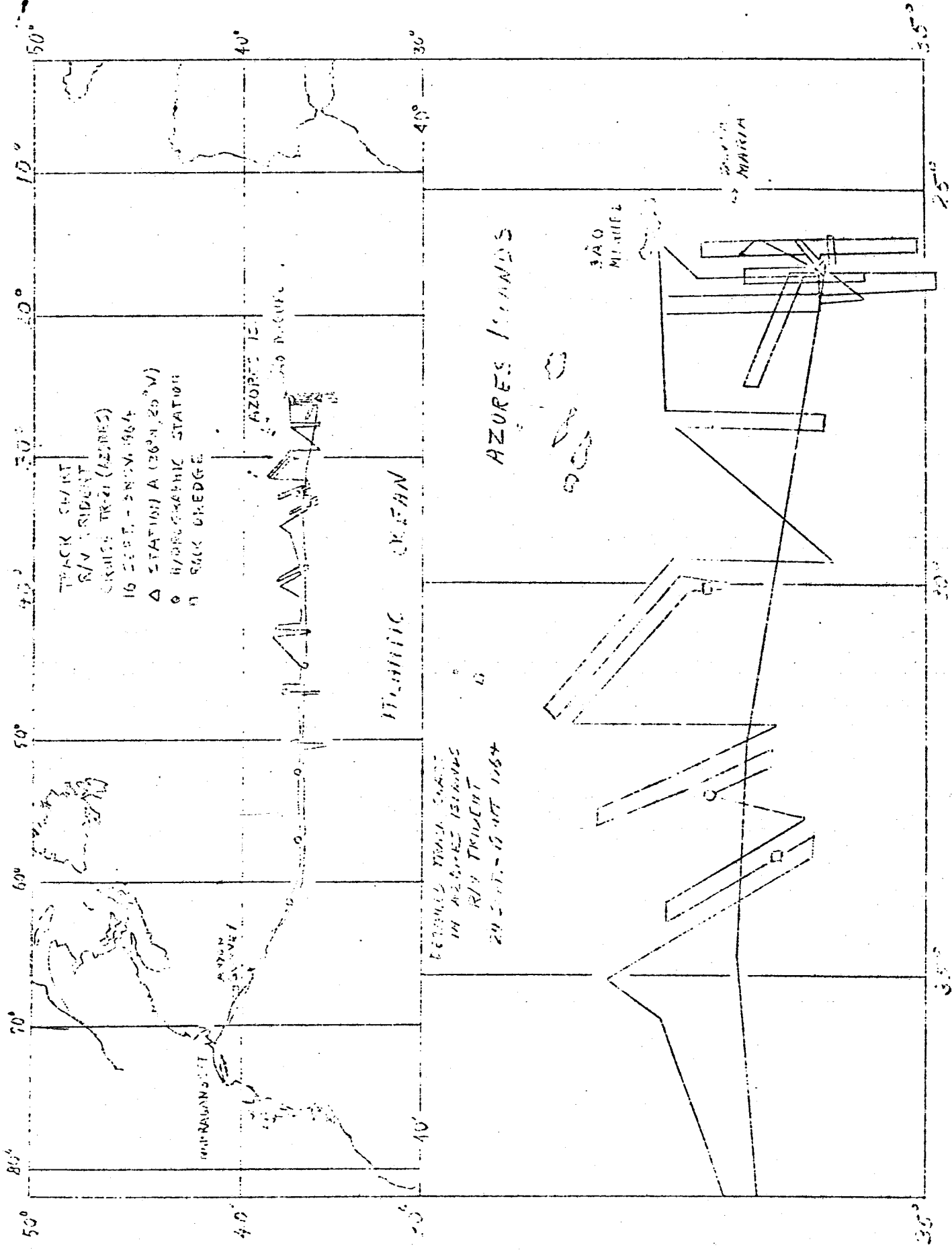
- Sta. 10. A routine shallow cast, weather conditions were quite unfavorable, quite difficult to tell when the pinger turned off, reasonably sure the pinger was on the bottom.
- Sta. 11. Routine shallow and deep casts, however the messenger speed was slower than anticipated and the bottom was missed by a meter.
- Sta. 12. Bottles #2 and #6 leaked on the shallow cast and may have been contaminated, although data look good. Reading the pinger trace two returns were visible, although mud in bottles #19 and #20 indicate they were on the bottom. The pinger went off when the cast was raised from the bottom so doubt exists as to whether all the bottles were tripped before the cast was started up. Data from these bottles indicate they were tripped together and at the bottom, depths should all be good.
- Sta. 13. The shallow cast was repeated, however most of the depths reported are open to question. Good deep cast except a meter off the bottom.
- Sta. 14. A deep cast was taken to augment data taken from the area of station 1.

Hydrographic Stations -- TR-21 (Azores)

Station	Date	Latitude	Longitude	Shallow cast	Depth of deep cast	Bottom depth
1	17 Sept 1964	39° 20' N.	66° 10' W.	yes	4390 m	4407 m
2	22 Sept	36° 48'	44° 55'	yes	5241	5246
3	24 Sept	36° 46'	37° 59'	yes	2968	3190
4	27 Sept	36° 01'	26° 09'	to 690 m	----	4166
5	29 Sept	36° 00'	26° 10'	to 1192 m	----	3970
6	1 Oct.	36° 06'	25° 59'	to 2955 m	----	3820
7	5 Oct.	35° 49'	26° 01'	to 4173 m	----	4181
8	16 Oct.	37° 05'	32° 40'	yes	2685	2875
9	19 Oct.	37° 02'	37° 52'	---	3677	3681
	(Sta. #9 complements sta. #3)					
10	24 Oct.	37° 44'	46° 16'	yes	5253	5256
11	27 Oct.	36° 59'	52° 13'	yes	5432	5436
12	29 Oct.	36° 57'	57° 02'	yes	5331	5331
13	30 Oct.	37° 35'	61° 31'	yes	5078	5082
14	31 Oct.	39° 18'	66° 00'	to 2381 m	----	4454
	(Sta. #14 complements sta. #1)					

Gravity cores -- TR-21 (Azores)

Core	Date	Latitude	Longitude	Bottom depth	Length
✓ AZ-1	17 Sept. 1964	39°20'N.	66°11'W.	4382 m	135 cm Taken at hydro sta. #1. Penetrations: 187 cm.
✓ AZ-2	22 Sept. 1964	36°48'	44°55'	4961 m	116 cm 42 cm Taken at hydro sta. #2. Penetration: 59 cm.
✓ AZ-3	5 Oct. 1964	35°54'	26°05'	4186 m	117 cm Taken at hydro sta. #7 (Sta. A). Light tan calcareous ooze.
✓ AZ-5	16 Oct. 1964	37°11'	32°35'	2940 m ⁵⁰	100 ----- Taken at hydro sta. #8. Disturbed sample.
AZ-6	16 Oct. 1964	37°11'	32°35'	3106 m	102 cm Taken at hydro sta. #8. Complements AZ-5. Tan at top, blue-grey at base
✓ AZ-9	19 Oct. 1964	37°02'	37°52'	3670 m	159 ----- Taken at hydro sta. #9. White calcareous ooze.
✓ AZ-10	24 Oct. 1964	37°43'	46°12'	5269 m	168 cm Taken at hydro sta. #10. Tanish blue clay capped by red clay.
✓ AZ-11	27 Oct. 1964	37°00'	52°09'	5434 m	19 cm Taken at hydro sta #11. Soft brown silt rich in forams and mica.
✓ AZ-12	29 Oct. 1964	36°58'	57°02'	5322 m	173 145 cm ----- 728 cm Taken at hydro sta. #12. Red to buff clay.
AZ-13	30 Oct. 1964	37°34'	61°30'	5082 m	catcher sample 4 Taken at hydro sta. #13. Very soupy micaceous silt with abundant forams. Similar to AZ-11.



TRACK CHART
R/V TRIDENT
CRUISE TRACK (AZORES)
16 SEPT. - 2 NOV. 1964
Δ STATION A (36°N, 25°W)
○ HYDROGRAPHIC STATION
□ SACK WRECK

RECORDED TRACK CHART
IN AZORES ISLANDS
R/V TRIDENT
29 SEPT. - 3 OCT 1964

AZORES ISLANDS

ATLANTIC OCEAN

340
METERS

SANTA
MARIA