Lamont - Doherty Geological Observatory of Columbia University | *Palisades, N.Y. 10964*

Cable: LAMONTGEO
Palisades New York State
TWX-710-576-2653

Telephone: Code 914, Elmwood 9-2900

CRUISE REPORT

Ship Name: VEMA Cruise No. 34-11

Departure: 3 January 1978 from Capetown

Arrival: 2 February 1978 at Capetown

Days at Sea: 30 Days Foreign Port: 10 (projected)
no. of days in arrival port

Area of Operation: Agulhas Plateau

Program Description: Geological and geophysical studies of the Agulhas Plateau: OBH and long-range sonobuoy seismic refraction, current-meter and ocean-bottom nephelometer measurements, camera/nephelometer, piston coring, dredging, standard underway geophysics.

Participants: (all L-DGO unless otherwise specified)

NAME	SHIPBOARD TITLE
Tucholke, Brian	Chief Scientist
Houtz, Robert	Seismic Refraction
Holland, David	OBH Technician
Graham, Jery	Current-meter Tech. (Scripps Inst. Oc.)
Barrett, Douglas	Seismic Refraction (U. of Witwatersrand)
Holland, Michael	Camera Tech.
Roth, Mark	Core Describer
Mossman, Dwight	E. T.
Ostrowski, Brian	E. T.
Mossman, Brian	E. T.
Menke, William	Computer Tech.
Menke, Dallas	Computer Tech.
Banuve, Malakai	Core O. S.
Qali, Ropate	Core Bosun
Smith, Hector	Air Gun Tech.

VEMA 34-11 consisted of geological/geophysical studies of the Agulhas Plateau off South Africa. Elements of the cruise are described below:

Current-meter Measurements: Three current meters in three moorings were set 75 m off bottom across the erosional zone on the west flank of the Agulhas Plateau on 6-7 January and they were recovered without incident on 29-30 January. The instruments were rented from S. I. O., and were set and recovered by an S. I. O. technician. They are similar to Aanderra meters, with a Savonius rotor, a large vane to orient the instrument in the current, and an internal compass. Recording is on a Rustrak paper recorder. Timed releases were used in pairs on each mooring for added assurance that the instruments would be released. In each case both releases performed flawlessly. The releases are small (4" dia., 14" long), lightweight, and can be used for periods up to six weeks. For any kind of short-term moorings where timed releases can be used, these would be ideal. Preliminary inspection of the Rustrak records shows southerly currents at 2-15 cm/sec. Periodic (tidal) reversals in flow generally are associated with low speeds (1-2 cm/sec).

Ocean-Bottom Nephelometer: This instrument was moored 75 m off bottom near the central current meter in the above array and also incorporated S. I. O. releases. The nephelometer was recovered as scheduled on 30 January, and when brought aboard, the strobe was still flashing at the preset 15 min. interval. Developing and analysis of the film is in progress.

Piston Coring: Twelve piston cores were attempted and eleven recovered sediment. One core did not reach bottom and did not trip. Strong surface currents (3 kts) resulted in a very large wire angle and when a trip was not detected after 600 fm extra wire was paid out, the corer was retrieved. Subsequently, a 12 kHz corehead pinger was used during coring, and hits were observed in each case although wire often had to be paid out several hundred fathoms over the water depth.

One-pipe cores were attempted in the erosional zone around the plateau, and penetration of hard, manganese-paved sediments resulted in several bent core barrels. Most other cores (2-pipe) were taken in areas where older calcareous oozes and chalks crop out. The high shear strength of these sediments also resulted in some bent core barrels, and the chalk/ooze in two cores (150, 153) is so tightly jammed in the barrels that the cores could not be extruded on board. These cores are being shipped to Lamont in the pipes. Tentative ages of the carbonates recovered range from Paleocene to Holocene.

Dredging: Six dredges were attempted, each recovering 50 to 2000 lbs of rock and (invariably) manganese nodules or crust. Dredge 25 was on a small scarp (400m) in smooth acoustic basement within the erosional zone on the west flank of the plateau. Smooth cannonball-size Mn nodules and granite and gneiss boulders were recovered. Dredge 26 in the erosional zone on the SE flank recovered large (tuffaceous?) claystone slabs and boulders, slabs of hard brown chert, highly vesicular pillow basalt, and granitic boulders from smooth acoustic basement. Dredge 27 (south flank) recovered freshly broken acidic rock fragments with large lavender feldspar phenocrysts, as well as manganese. Dredge 28 on a rough basement outcrop on the western plateau was full of highly altered coarse-grained tuffaceous blocks freshly broken from the outcrop, and granitic boulders. Dredge 29 recovered Mn-encrusted shallow-water limestone from the upper flank of a shallow (422 fm) seamount on the central plateau. Dredge 30, on a scarp at the southern edge of the rugged acoustic basement comprising the northern plateau, recovered only thick manganese crust developed on phosphatic bone debris and claystone galls. Basalt in varying quantities was recovered in all of the first four dredges. It is likely that some of the continental rocks recovered from the first four dredges are ice-rafted, but the ubiquitous occurrence of garnet-bearing gneisses in the dredges, and the seismic refraction results both indicate that at least portions of the plateau are of continental origin.

Camera-Nephelometer: Camera-nephelometer work was hampered by two factors. First was strong surface currents (3-4 kts) along the west flank of the plateau, which resulted in very large (up to 50^{o}) wire angles and made camera hits impossible to observe. Bottom contact was not achieved at some stations even though 500-700 fm extra wire was paid out over the bottom depth. On later stations, the 12 kHz pinger was strapped to the camera frame, so that the instrument position in relation to the bottom could be monitored. The second factor was heavy seas. It is dangerous to attempt using the hydrowinch even in moderate seas because the hydrowire jumps out of the winch sheave on a starboard roll and jams between the roller and casing. This sheave is in poor condition and should be replaced. The wire-jumping problem is accentuated by the wild swinging of the counterweights on the Liebus wind when unloaded. A conventional level wind on this winch would be much safer and could probably be used in sea conditions where the Liebus wind is of no use.

Because of currents and sea state, only four stations of a planned 7 station transect across the current-meter array were successful. All stations showed strong contour-following bottom currents, a well-developed near-bottom nepheloid layer, and manganese nodules.

Explosives: Explosives used were SUBAQ, and PENTOLITE boosters, both obtained from AECI in South Africa. Sizes obtained were 2.5, 12.5, and 25 kg. During shooting these were incorporated into 2.5, 12.5 (or 10), 25, 50, 75 and 100 Kg charges by banding or taping. The explosives were extremely reliable and easy to handle, and a few misfires probably can be attributed to detachment of the boosters after the charges were thrown overboard. 12.5 Kg and larger charges are packaged with a mesh cover over plastic. The boosters were anchored between these two coverings. We used nearly all of the approx. 8 tons of explosives purchased, jettisoning twelve remaining 25 kg charges before entering Capetown. Because of the large expense and logistic problems involved in off-loading explosives in Capetown, the small value ($190) of these remaining explosives did not justify keeping them.

Long-Range Sonobuoys: Sonobuoy performance as listed below indicates a wide variation in quality:

Profile No.	Max Range (sec)	Remarks
15	0	No signal; Squib failure.
102	0	Very weak, no useful data.
-	0	Antenna broke off.
16	36	
17	5	Very weak, no useful data.
18	29	
19	5	Very weak, no useful data.
20	26	
21	42	
22	24	Noisy RF. Squib failure.
23	33	Squib failure.
24	40	
25	34	Squib failure.
26	10	Very weak. Squib failure.

All the sonobuoys required the addition of a 2 1/2 lb lead ballast and additional styrofoam buoyancy to maintain an upright position in the water. Each sonobuoy was lowered on a string attached to the antenna base (after the antenna had broken off on the third sonobuoy we launched). The sonobuoys did not require the alterations recommended to us by earlier users: i.e. removal of yellow cannister and spool, replacing hydrophone buoyancy with paraffin.

Except for two noisy amplifiers, the SIE Dresser unit performed beautifully.

At the end of the cruise there remained:

13,800 caps
Plenty of fuse and fuse lighters
1 1/2 cases wide friction tape
2 cases narrow friction tape
10 rolls of KODAK paper for SIE. (Some of these rolls seem to be old and they may develop poorly.)

LRSB results clearly indicated that the central plateau is continental, having a 6.0 km/sec layer with a minimum thickness of 7 km. A 'sliver' of oceanic material was detected within the continental massif. The flanks of the plateau yield oceanic sections with minimum depths to mantle of about 18 km. Continental sections yield minimum depths of about 14 km to an assumed Conrad layer (7.2 km/sec).

Military Sonobuoys: Some deterioration of our sonobuoy records compared to those obtained on V34-7 can be attributed to bad weather, but it does not account for the inferior results we obtained in calm weather and for the inferior results on V34-10.

The sonobuoy data suffered from a loss of low frequency energy, which resulted chiefly in weak refractions. Since we experienced a good deal of rain and wind, it is possible that moisture had entered somewhere in the antenna, co-ax, or the VHF connectors. The loss of signal strength is very slight because explosive charges were recorded out to a distance of 18 sec, and seemed not to be affected by a weak radio link.

We found that the SSQ57-A sonobuoys consistently out-performed the Hermes SSQ41-A.

OBH: Five OBH drops were attempted. In pre-cruise plans, we intended to launch pairs of OBH's to shoot reversed lines. However, because the OBH's were untested we first attempted a single drop. The problems experienced with this and subsequent single drops made it unwise to attempt launching a pair of OBH's. Prior to the first launch, it also was necessary to determine the amount of ballast and floatation needed for the OBH. It was found that using two glass spheres (17" and 13") for flotation and 60 lb of lead for additional ballast on the battery resulted in sinking rates of about 55 fm/min and rise rates of about 20 fm/min.

Drop 1: (1700 fm depth). The OBH released about 3 1/2 hours late. Release wire severed near brass plug rather than above brass bar. Brass was plating wire rather than vice versa. Tape fully advanced - tape recorded seismic signal and approx. 80 Hz noise.

Drop 2: (1466 fm). OBH released from bottom about 9 hours late, although pinger turn-on indicated release command was on schedule. Burn wire exhibited same problem as drop #1. Very strong, approx. 80 Hz noise on fully advanced tape masked seismic signals.

After this drop it was found that the washers isolating the brass bar from the end cap were saturated with salt water and were conductive. They were replaced by teflon washers on later drops and no further release problems were encountered. The hydrophone was also replaced on later drops because it was suspected that the approx. 80 Hz noise stemmed from a saltwater leak. Subsequent records had no approx. 80 Hz noise but only high-frequency signals were detected during playback, and the phone apparently had very poor low-frequency response. The phone also was mounted on one of the plastic hard-hats on these later drops, thus isolating it from the pressure case and potential noise from the tape drive.

Drop 3: (1590 fm). Rapidly deteriorating weather after the launch prevented us from shooting explosives on this drop. Thus we shot the 25 cu in airgun to the OBH on an approximate one minute schedule. The fully advanced tape recorded no detectable seismic signal in shipboard playback.

Drop 4: (1344 fm). The OBH surfaced 88 minutes after launch, apparently having severed the battery wire between the battery and the studs on the pressure case upon bottom impact, and immediately releasing and returning to the surface.

Drop 5: (2200 fm). Release and recovery normal and tape fully advanced. However, shipboard playback indicated only high frequency (D) arrivals recorded.

General: A) Before any more of these units are sent to sea, they should be thoroughly bench and field tested and debugged.

B) Same comment for hydrophones, and spare hydrophones should be available.

C) The mechanics of assembly should be thoroughly worked out - the following problems were encountered:

1) hydrophone plug in end cap incorrectly oriented toward flotation attachment, making it nearly impossible to plug in lead.

2) flotation assembly cumbersome and too flexible.

3) mast for flasher inadequate in height.

4) hydrophone mounting needs consideration.

5) flimsy wires between case and battery easily scarred, and large potential for their breaking or being cut - they should be carefully taped and protected in tygon tubing to prevent failure as experienced in Drop 4. Similarly the release rope should be long enough (3-4 ft) to help prevent collision between the OBH case and the battery upon bottom contact.

D) An adequate playback system should be on board to immediately monitor OBH results.

Seismic Profiling: Upon arrival in Capetown, the V34-10 profiler records were found to be of very poor quality. On V34-11 we did the following:

Streamer: a) ballasted both eels with lead sheet so that they would tow below the surface, thus eliminating some noise.

b) lengthened the towing cable on one eel to about 800'.

c) lengthened airgun tow-rope to reinforce low frequency signals. In either case the airgun tows very shallow (10-15') at full ahead.

d) eventually replaced hydrophones in both eels (one of which was used); this resulted in dramatic improvement in records.

Trip eel: a) replaced connector between eel cable and ship cable.

b) replaced hydrophones in both trip eels (one eel was bad, the other had lost low-frequency response during refraction work. After rebuilding trip eels, we recorded shot instants from 3.5 xducers for refraction work).

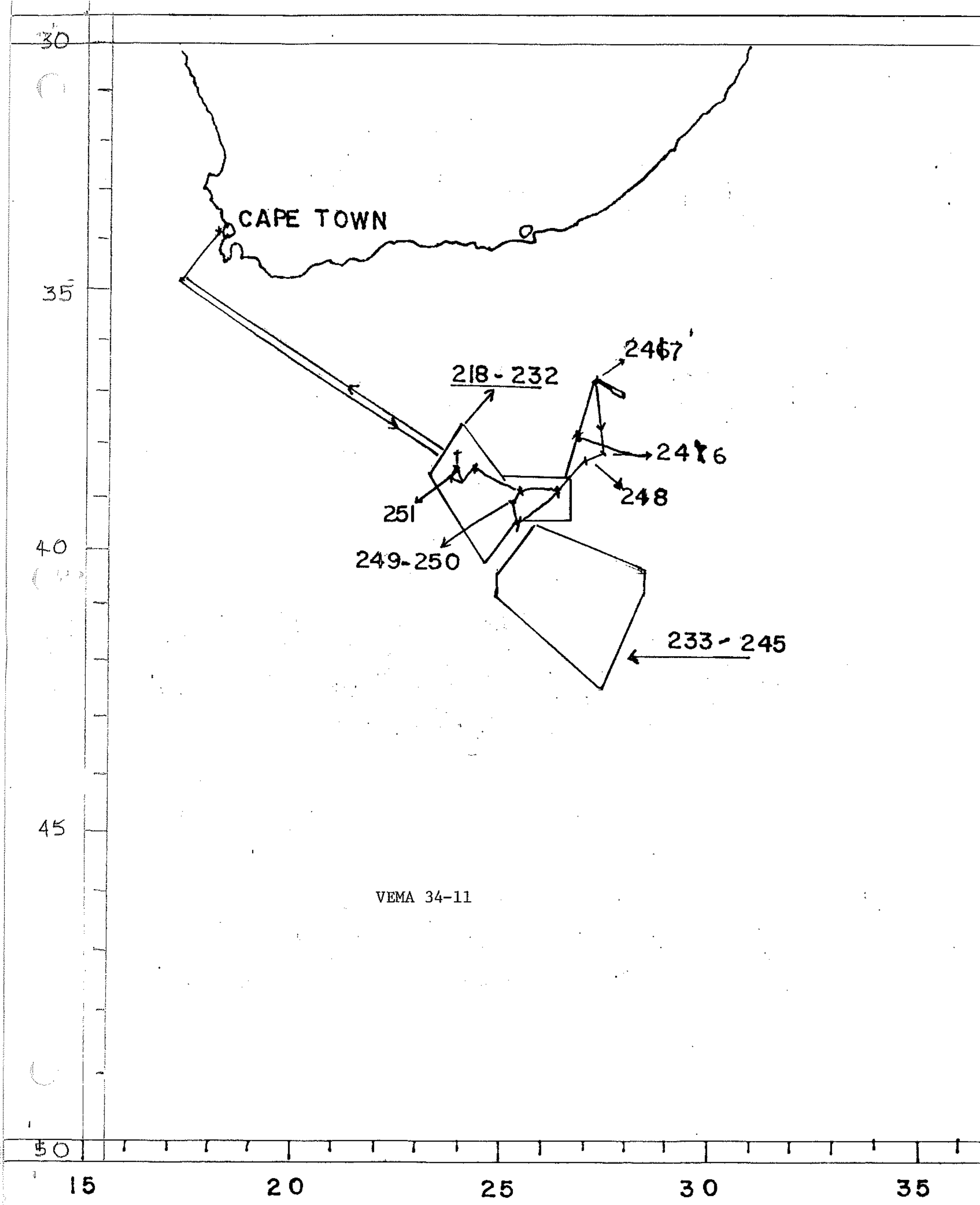
Gravimeter: The gravimeter was shut down during much of the cruise because of heavy sea conditions. Near the end of the leg, the gravimeter failed as detailed by B. Ostrowski in a telegram. The instrument is presently being replaced by A. Envik in Capetown.

Computer: Following extensive overhaul in Capetown, the computer was operational for several days at the beginning of V34-11, after which it failed due to unknown malfunctions. The computer is very poorly isolated from ship's vibration and of course not at all isolated from ship's pitching and rolling.

The stresses exerted by these movements almost certainly are the primary cause of component failure in the machine.

Weather: Although our work on the Agulhas Plateau occurred approximately during the optimum weather window for this area, we still experienced occasionally severe wind and sea conditions (sea state 8). Three to four days of station work were lost because of sea conditions, and at times it was necessary to secure all streamed gear and heave to until sea conditions subsided. Conditions sometimes deteriorated very rapidly, for example from sea state 3 to 8 in the course of 5-6 hours.

Ship Environment: The ship's crew and coring crew were proficient and very helpful throughout the cruise. Morale among the technical staff was low in the early part of the voyage but appeared to improve despite the weather and sea conditions.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