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CRUISE REPORT

Ship Name: VEMA

Cruise No: 34-03

Departure: April 25, 1977 from Guam
Date Port

Arrival: May 24, 1977 at Manila
Date Port

Days at Sea: 29

Days Foreign Port: 3
No. of days in arrival port

Area of Operation: Southeast Asia: Caroline Sea, Southern Philippine Sea, Molucca Sea, Celebes Sea, Sulu Sea, South China Sea.

Program Description:

I -- Underway MG&G plus dredging and heat flow to document existence and nature of boundaries of Caroline Plate.

II-- Heat flow profile across the Molucca Sea collisional zone between Halmahera and Sanghi, plus seismic refraction profiles along axis of deforming pile.

Participants: (All L-DGO unless otherwise specified)

Jeffrey Weissel	Chief Scientist
Charles Gove	Heat Flow Technician
Owen O'Neill	Electronics Technician
Robert Petersen	" "
Van Paisley-Smith	" "
Nicholas Leiser	Computer Operator
Michael Sundvik	Core Describer
Herbert Steeves	Airgun Technician
Brian Taylor	Graduate Student
Ropate Quali	Core Bosun
Malakai Banuve	Core A.B.

All inquiries regarding cruise should be made to the chief scientist.

VEMA 34-03

Cruise Report

Leg 3 of VEMA cruise 34 left Guam on April 25 and arrived in Manila on May 24, 1977. The main purposes of the leg were to make geologic/geophysical reconnaissance of the eastern, northern and western boundaries of the Caroline Plate and to examine the arc-arc collisional zone in the Molucca Sea.

More than 5400 n.m. of underway geophysical data were obtained along track (see accompanying figure), 7 dredges were obtained, 15 piston cores and 12 heat flow measurments made; and 5 sonobuoys were shot (two completed with explosives.

Scientific Narrative

En route to the eastern boundary of the Caroline Plate we dredged the southern margin of the Caroline Islands Ridge (7° 36'N, 146° 40'E) and obtained 700lbs. of carbonate debris.

The survey of the eastern Caroline Plate boundary included the three sets of closely spaced lines shown on the track chart. The boundary is probably a complicated zone of shearing about 30 n.m. wide according to observed morphology, and its trend is N35°W to the nearest 5°. We can trace the E-W trending Oligocene magnetic anomalies from the east Caroline basin eastwards into the shear zone.

Between the eastern boundary and the Sorol Trough - (the northern plate boundary) - the ship crossed Oligocene crust of the east Caroline basin and a heat flow value was obtained on anomaly 11 on the south flank.

The morphology of the Sorol Trough proved very rugged and there is less sediment in the trough than in the surrounding areas. It is difficult to pinpoint spreading segments precisely, even though bare basement was crossed on four profiles. Depths to the bare areas ranged from about 2200 to 2800 fathoms. Three dredges were made in the Sorol Trough. The first at 7°42'N 142°10E recovered fairly fresh basalt. The second on the northern rifted margin of the Sorol Trough at 8°34N' 14°30'E produced mainly breccias and highly weathered ultramafics, and also one fresh speciman of diorite.

The third dredge on a deep (~2800 fathom) bare area at 8°45N' 139°42'E recovered mainly breccias but also 60lbs. of hornblende andesite, quartz diorite, dacites, hornblende schist, micaschist, and pelitic schist. Apparently pervasive shear has accompanied extension in some parts of the Sorol Trough.

En route to the Ayu Trough (western boundary of the Caroline Plate), sonobuoy and heat flow measurements were made on the West Caroline terrace (Bracey, 1976). We also crossed the extinct spreading center in the West Caroline basin, although the magnetic anomalies associated with the extinct system are poorly developed on our oblique profile. Interestingly, the deformation on the northern (and eastern) margins of the Caroline Plate, is not confined to the immediate vicinity of the plate boundary but occurs (to a lesser extent) within the Caroline Plate itself.

Our objectives in the detailed survey of the Ayu Trough (see figure) were to ascertain the trends of any fracture zones within the trough, to dredge material for radiometric analysis, and to obtain some heat flow measurements there. The last two aims were completely met, but at the time of writing I am not certain how successful we were in delineating the structural fabric in the trough. We crossed the active rift on a number of profiles but fracture zone morphology (if developed) seems discontinuous. The sedimentary cover on the flanks increases uniformly away from the rift and may provide an estimate of the age of the trough.

Dredge hauls were obtained from the rift at 1°40'N 132°42'E (fairly fresh basalt); and from the eastern edge of the trough at 2°08'N 133°55'E (Mn-encrusted basalt); and from the western margin at 3°04'N 132°04'E. The last dredge returned intermediate, mafic and ultramafic rocks including quartz diorites, some intruded by olivine-rich veins, massive basalts, and large blocks of peridotite. Apparently, we dredged on a scarp which recorded the break-up of the island arc and the initial intrusion of the oceanic material.

En route to the Molucca Sea the ship made an approximately north-south zig (see figure). We intended to ascertain whether east-west Caroline basin magnetic lineations are present between the Ayu Trough and the Philippine Trench. Although the results are inconclusive, we shot two sonobuoys back-to-back in this poorly explored region.

The work in the Molucca Sea was designed around a profile of heat flow stations with a reversed refraction profile (sonobuoys completed with explosives) along the axis of the deforming melange pile. We obtained six heat flow numbers -- one in the relatively undisturbed eastern fore-arc basin; one on the volcanic axis of the Sangihe island arc; and the rest distributed across the melange zone.

Working conditions were hampered by fierce surface currents from the west. Almost invariably we obtained very low values and gradients which are markedly non-linear. The two refraction profiles showed highly incoherent wide-angle reflections but on the second sonobuoy we received a refracted wave that seemed to emanate from the seafloor itself. The intensity of deformation in the central Molucca Sea is breath-taking and we recorded a good seismic profile from the relatively undeformed fore-arc basin of the Halmahera arc across the chaotic melange pile to the Sangihe island arc on the west.

Due to lack of time, the final four days of the leg were spent underway to Manila. We obtained new information in the Celebes basin and along the Philippine margin of both the Sulu basin and the South China basin.

Equipment Performance and Status

The leg was remarkable because of the lack of serious breakdowns of the scientific equipment (perhaps the excellent weather was a factor).

I. PDRs: Both 12 and 3.5kHz recorders worked well.

II. Eels and airguns: Performed well.

III. Magnetometer: Worked well for such low latitude regions. Only problem was the 60 count glitch which has been occurring since Hakodate.

IV. Seismic profilers: Non-uniform rotation ("chatter") of profiler 'B' drum marred overall good performance. Drum spindle and holding screws badly want re-machining or replacement. Teflon rings discarded from the airgun were used to jury-rig the drum during the leg.

V. Gravimeter: Performance of the gravimeter improved considerably towards the end of the leg, after weeks of experimenting with spares. For about the first three weeks (and the previous three legs) the system functioned poorly. Large amplitude variations with periods ~ few minutes often overwhelmed the gravity signature. I returned one gyro to L-DGO at the completion of the leg.

VI. PDP 11/20: What a joy it was to have the computer up and running during the leg! I was able to leave the ship with depth and magnetics data plotted. Also, this facility was used to advantage during the course of the detailed surveys on this leg.

Jeffrey K. Weissel
Chief Scientist

Epilogue

A fire broke out in the darkroom of the optics lab at about 1130 hours on May 25, 1977 (in Manila). I was in the computer lab at the time and heard three or four explosions and then saw and smelled acrid smoke coming from the cable pass-through at the forward bulkhead. Efficient firefighting by the officers and crew arrested the fire after about an hour.

Exploded and burnt lithium cells were removed from the lab and placed on the fantail. Photographs of the cells were taken by Gove and Petersen. I also instructed Gove to photograph the darkroom to record the extent of the damage to the area. A more comprehensive report on the fire was completed by Captain Kohler and Mr. Cunningham soon after the incident.

I feel that dangerous goods such as lithium batteries should not be confined in the optics lab in company with flammable substances. Maybe a metal cabinet in the airgun shack would be a better storage place. It may even be better if we could phase out lithium cells completely as the power source for the T-grad instrument.

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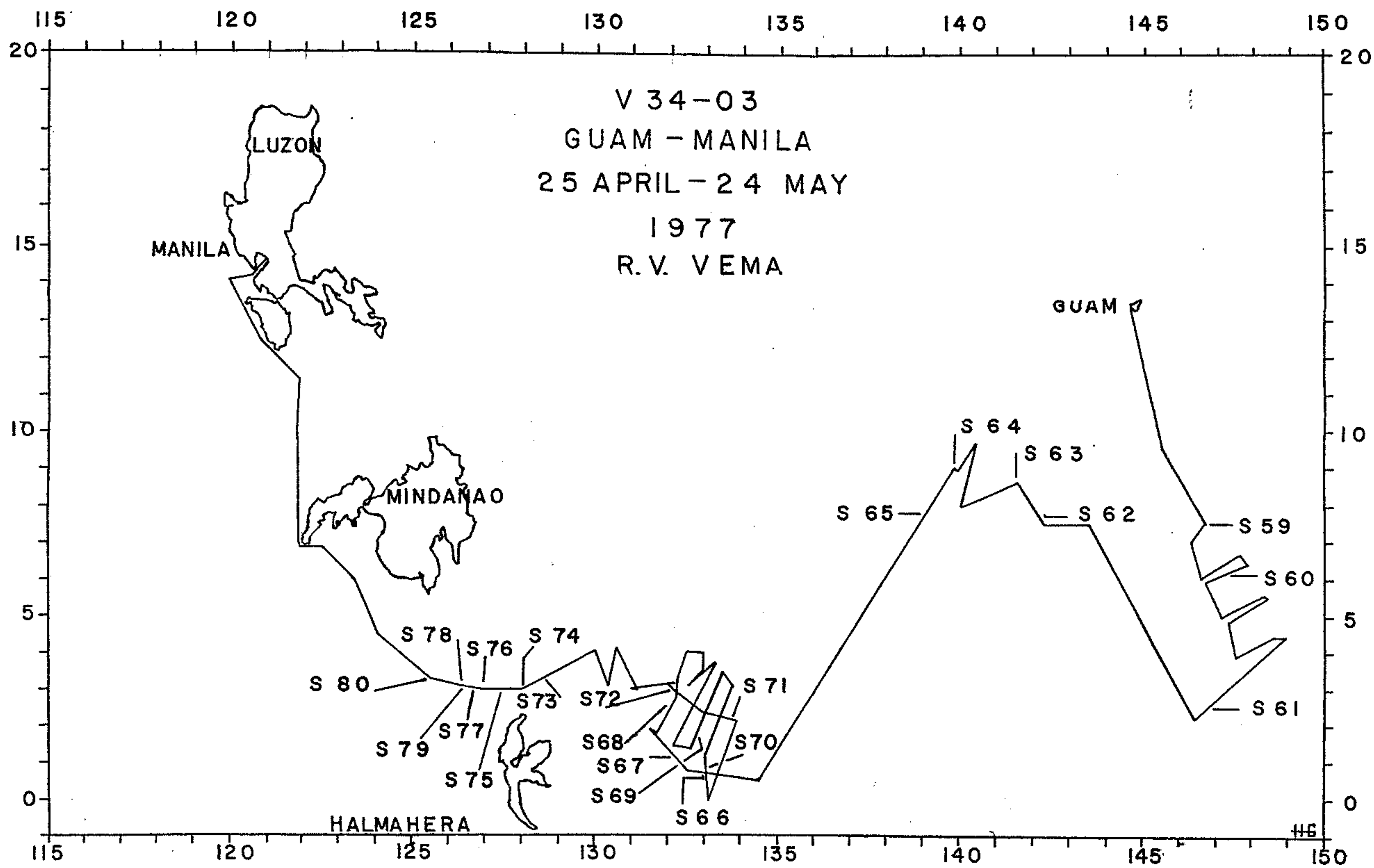
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GUAM - MANILA
25 APRIL - 24 MAY
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S 74	17 MAY	C 22	TG 14	
S 75	18 MAY	C 23	TG 15	
S 76	18 MAY	C 24	TG 16	
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S 78	19 MAY	C 26	TG 18A	
S 79	19 MAY	C 27	TG 18	
S 80	19 MAY	C 28	TG 19	

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