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CRUISE REPORT

Ship Name: R. V. VEMA

Cruise No: 33-11

Departure: 24 Sept. 76 from Yokohama, Japan
Date Port

Arrival: 23 Oct. 76 at Hakodate, Japan
Date Port

Days at Sea: 29 Days Foreign Port: 35 (shipyard)
No. of days in arrival port

Area of Operation: Western Pacific
V33-11 was run in conjunction with Conrad 20-05

Program Description:

Two Ship Reflection and Refraction to:

- 1) Continuously record depth to mantle.
- 2) Record sub-mantle reflections and designated points.

Participants: (All L-DGO unless otherwise specified)

Manik Talwani	Chief Scientist
Toshio Asanuma	Japanese Obs.
Peter Buhl	Computer Tech.
James Cranston	E. T.
Nicholas Leiser	Computer
Van Paisley-Smith	Gravity
Dennis Quick	E. T.
Herbert Steeves	Airgun
Hidekazu Tokuyama	Japanese Obs.
Harry Van Santford	E. T.

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

A summary of the two ship operations, written by Charlie Windisch, is attached to this report and covers the bulk of the work carried out on V33-11. Comments specific to the Vema follow:

Antennas for both the Raydist and SSB shot-instant radio were installed in brackets which cracked during rough weather. The Raydist whip antenna was too flexible and had to be guyed with rope.

About 7.5 tons of explosives and caps had been discharged by CONRAD at end of 20-04 at the U. S. Naval Base at Yokosuka. Little difficulty was encountered by VEMA in having these explosives brought out to Vema at the start of 33-11. However about 6 tons of Haversacks requested earlier from the Navy did not arrive in Yokosuka (via ship from San Francisco) until the end of our cruise. These unused explosives are being held for us in Yokosuka.

The Raydist system created a lot of radiated energy (approx. 1.6 MHZ) in the dry labs of both ships which proved annoying. The Raydist system lost lock several times during normal operations (range approximately 12 NMI) but the resulting "Lane Jumps" appear to be correctable. When VEMA returned to Japan in the middle of the leg, continuous range data from the Raydist was lost at a separation of 80 n. miles.

Range calibration of the Raydist System, proved relatively easy. VEMA would take a position approximately 50 yards abeam of CONRAD's

MCS streamer tail buoy and a "mark" was transmitted via VHF radio to CONRAD.

VEMA shot instants were transmitted to CONRAD by keying the 1 kHz test tone on the SSB radio. Narrow band filtering of this received tone on CONRAD gave reasonably reliable trips even on the occasionally noisy radio channels. At ranges greater than 30 miles, reliable trips were not received on CONRAD.

During normal two-ship operations VEMA would fire 1 lb charges of TNT (two 1/2 lb blocks taped together) every minute. This proved taxing in the beginning when only John Ewing, Manik Talwani and Peter Buhl actually fired the charges. Later it was much easier when H. Tokuyama, V. Sedov, A. Pokryshkin and Herb Steeves shared in the shooting. The core crew assisted all of us in the preparation of charges (one hell of a lot of friction tape, some with a high frustration content). The 50 and 100 lb charges in particular took considerable time to prepare and it proved useful to make up several (unfused) in advance of an ESP shoot.

The VHF radios used for voice communication between scientific labs and bridges proved very valuable but their limited range (approximately 20 NM) proved frustrating during the ESP.

Peter Buhl

Conrad and Vema joined company in Yokohama late in the day of 19 Sept. 1976. The two ships took on personnel and equipment. Vema departed on the morning of the 24th to load explosives at the U. S. Naval base in Yokosuka. Conrad followed the day after, joining Vema late on the morning of the 25th off Yokosuka. A transfer of personnel was completed. The ships then weighed anchor and set out to sea to begin the step-by-step procedures that would lead up to expanding-spread profiling of the sub mantle. These exercises included streaming and testing airguns, and seismic arrays, calibrating the Raydist system, testing communications systems, and evaluating shot break detectors and data transmission links. Completing these tasks the ships set sail for a pre-arranged point, Point A, east of Tokyo where good mantle reflections had been observed on sonobuoy profiles made during multichannel seismic studies on the previous cruise leg (RC20-04).

An expanding spread profile near point A, though planned as an evaluation of the ESP technique, provided usable data. Possibly the most impressive part of this introduction to ESP was that refraction velocities could be measured along the MCS array almost instantaneously. Compressional and shear wave arrivals were readily observed, and changes in amplitudes of first arrivals could be easily noted allowing observers ample time to take note of when to increase shot size. Nevertheless, most ESP profiles are undershot due to a

general tendency to conserve explosives - not knowing whether more would be available during the latter part of the experiment.

A continuous flux of tropical storms forced us to abandon work near point A and move either north or south. A northerly direction was chosen in order to avoid a large low pressure front. We continued constant offset profiling until a second front forced us to break off work, recover our streamer and prepare for heavy weather. The ships continued northward, however, to point E where the first major ESP profile, ESP #1, would take place - weather permitting.

At about $39^{\circ}30'N$, $147^{\circ}00'E$ the ships began their first major ESP profile. Finishing this they continued southeast to about $33^{\circ}50'N$, $153^{\circ}30'E$ to do a second ESP profile, and then moved west to about $34^{\circ}25'N$ $146^{\circ}15'$ to complete ESP #3. Constant-offset profiling with #1 blocks was almost continuous between these points.

Upon completing ESP #3 VEMA broke off work with CONRAD to head into Yokosuka to put M. Talwani and others ashore. She also hoped to pick up more explosives but without luck. S. Murauchi transferred to VEMA to return to Japan while H. Tokuyama, A. Pokvyshkin, and V. Sedov boarded CONRAD to help with MCS work until VEMA returned.

CONRAD then set sail to the southwest completing two MCS crossings of the Bonin trench before rejoining VEMA on the gravity high along the crest of the seaward trench wall. The ships completed two more ESP profiles on the gravity high. The weather was excellent, correspondingly sea-noise levels

were very low. MCS monitor records in this area showed weak but distinct mantle reflections. After completing ESP's 4 and 5 a short constant-offset line was run on the gravity high until VEMA's explosives were exhausted. Both ships exchanged salutations upon completion of the experiment before going their separate ways - Vema to Hakodate and Conrad to Yokohama after completing a final oblique MCS crossing of the Bonin trench and western Bonin arc.

R/V Conrad arrived at Yokohama late on Oct. 19 - in time to make contact with the ship's agent and the various repair facilities engaged to tend to her problems over the succeeding five days. As far as I could determine everything was in reasonable order upon her departure on Oct. 25.

The RC25-05 - V33-11 mantle reflection exercise was by and large a technical success. It will be several months at least before the data can be reduced and analyzed to evaluate the overall scientific merit of the effort. There are tentative plans to gather constant offset and ESP profiles in the Caribbean and Western North Atlantic. At best the methods would be difficult if not impossible without thoroughly competent ship crews.

A. W. Winkler

