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CRUISE REPORT

Ship Name: VEMA Cruise No: 36-02

Departure: August 13, 1979 (Date) from Auckland, New Zealand (Port)

Arrival: September 10, 1979 (Date) at Suva, Fiji (Port)

Days at Sea: 28
(Count day of departure but not day of arrival in port)

Days Foreign Port: 21
(number of days in arrival port before next leg)

Area of Operation: Southwest Pacific

Program Description: Geological and geophysical survey of the Louisville Ridge.

Program supported by what contract: OCE 77-25993

Participants: (All L-DGO unless otherwise specified)

Name	Title
Anthony B. Watts	Chief Scientist
Charles Salcedo	Electronics Technician
Dwight Mossman	Electronics Technician
Martin Iltzsche	Airgun Engineer
Hector Smith	Airgun Technician
John Bodine	LDGO Graduate Student Observer
Paul Woodruff	Electronics Technician

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

CRUISE REPORT

VEMA 36-02

AUCKLAND, NEW ZEALAND - SUVA, FIJI

R/V VEMA sailed from Auckland August 13th, 1979 and arrived at Suva September 10th, 1979 (Fig. 1). The purpose of the leg was to carry out a geological and geophysical survey of the Louisville Ridge in the Southwest Pacific ocean. The weather conditions were fair and sea states averaged 3 to 5. Particularly rough seas were encountered soon after leaving Auckland (Aug. 15th) and towards the end of the leg (Aug. 29th).

The underway geophysical equipment used during the leg included satellite navigation, 3.5 and 12 kHz Precision Depth Recorders, single channel seismic reflection profilers, gravimeter and stable platform and magnetometer. The deep-sea winch was used for rock dredges.

The overall scientific objective of the leg was to determine the nature and origin of the Louisville Ridge. The Louisville Ridge is a nearly continuous NW-SE trending feature on the Pacific ocean floor extending from the Eltanin Fracture zone system to the Tonga trench, a distance of approximately 3500 km. There are currently two models for the origin of the ridge. 1) The ridge is an extension of the Eltanin Fracture Zone system (Hayes and Ewing, 1968). 2) The ridge is a linear chain of seamounts formed as the Pacific plate moved over a deep mantle "hot-spot" (Morgan, 1972).

We carried out 4 main geophysical and geological studies of the ridge during the leg.

1. Magnetic anomaly studies to determine the tectonic fabric of the sea-floor between Valerie Guyot (latitude 41.5° south) and the seamount at 44° south.

2. Bathymetry studies to determine the continuity of the ridge between Valerie Guyot and the 44° south seamount and between 37° south and 38.5° south (the Scripp's bathymetry maps of the South Pacific showed the ridge to be discontinuous in these regions).

3. Gravity anomaly and bathymetry studies to determine the nature of the response of the Pacific plate to the load of the ridge. A total of seven 600km long profiles of the ridge were obtained.

4. Dredge rocks from the ridge to determine the petrology, chemistry and possibly the age of the ridge. Three successful dredge hauls were obtained, at 33.9°, 36.9° and 38.3° South.

The results of these studies will not be known until detailed analysis of the data is carried out at Lamont. Preliminary shipboard studies have been carried out which provide general constraints on the origin of the ridge. Magnetic anomaly studies between Valerie guyot and the 44° South seamount, along with studies from the previous leg (V36-01), suggest anomaly 34 (80 m.y.B.P.) and anomaly 33 (75 m.y.B.P.) extend across the ridge with little offset. This suggests the ridge, at least in this region, is no older

than Latest Cretaceous and that it is a relatively young feature formed on old sea-floor. Preliminary studies of the amplitude and wavelength of gravity anomaly profiles over the ridge suggest the effective elastic thickness required to support the load of the ridge is of the order 10 to 20 km. These values (which are similar to values obtained for the northernmost Emperor seamounts) suggest the Louisville Ridge formed on oceanic crust which was about 35 m.y. old at the time of loading. Thus if the age of the sea-floor underlying the ridge is >75 m.y., then the age of the ridge is >40 m.y.

These studies therefore suggest the Louisville Ridge is a relatively young feature formed on old sea-floor. Thus the ridge is not simply an extension of the Eltanin Fracture Zone system as suggested by Hayes and Ewing (1968). The ridge may have, however, formed along a pre-existing line of weakness such as a fracture zone offset. It is not presently known, however, whether there is a variation in age along the ridge as required by the "hot-spot" hypothesis of Morgan (1972).

We were not able to carry out detailed shipboard analysis of the dredge samples. More than 900 lbs of rocks were obtained from the ridge in three separate dredge hauls. Most of the rocks are comprised of manganese encrusted volcanic rocks. The volcanic rocks consist of a fine-grained type with white phenocrysts and a massive type with a brown and white groundmass. Rock dredge 4, may in addition, have recovered some manganese encrusted fossiliferous rocks.

The geophysical equipment worked well during the leg. The gravimeter and stable platform, which were carefully levelled and balanced in Auckland, worked well even in quite rough seas (up to sea states 6-7). The main problems with the system are

1) The off-level traces (from the pitch and roll accelerometers) are not being recorded on the 12 channel recorder.

2) The cross-coupling computer is not working correctly. The problem with the cross-coupling appears to be a faulty amplifier in the main module. However, attempts to correct the problem during the leg were unsuccessful. Thus although two traces are being recorded on the 2 channel recorder only one trace (the red) should be read until the problem is corrected. Two new pressure transducers were installed while the vessel was in dry-dock in Auckland. The new 3.5 kHz transducer works well but the new 12 kHz transducer does not work. Bathymetry during the leg was obtained with the 3.5 kHz transducer and the old 12 kHz transducer, which had been left in circuit. The magnetometer and single channel seismic profiles worked well. However, only one single channel eel was in working order during the leg. The other eel was tried but proved too noisy at normal towing speeds. This eel is still not in operating condition. The Magnovox satellite navigation system, operated by the officers on the bridge, worked reasonably well. A grocery tape "back-up system" was used in the upper lab although not all the satellite fixes were obtained.

A separate report on the state of the ship's gyro compass and the big airguns are being, or have been, prepared separately by Captain Kohler and Martin Iltzsche respectively.

The overall working conditions on R/V Vema are excellent and morale on the vessel is extremely high.

A. B. Watts
Chief Scientist
Vema 36-02

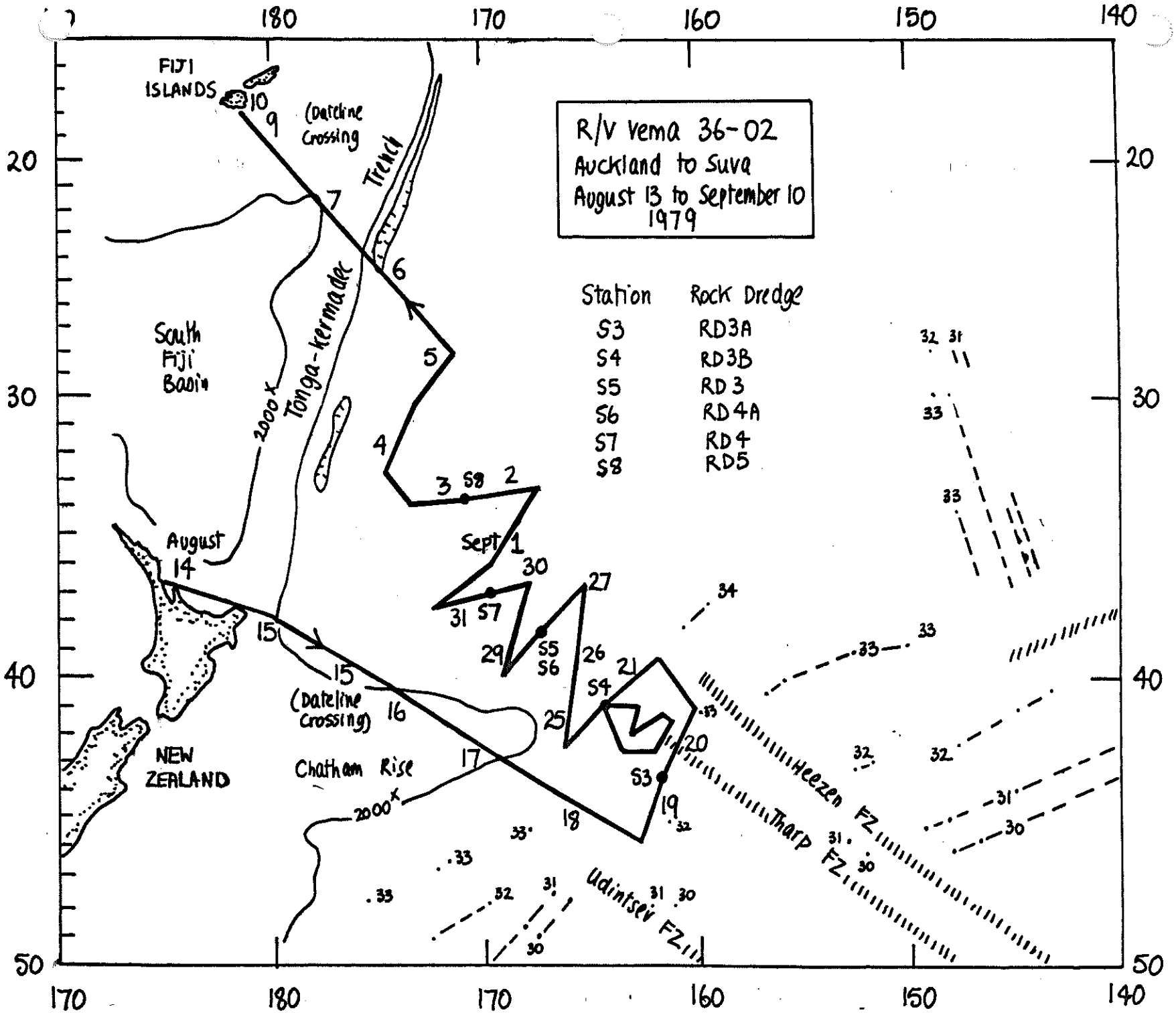
180
170
160
150
140
20
30
40
50
FIJI ISLANDS
(Dateline Crossing
Trench
R/V Vema 36-02
Auckland to Suva
August 13 to September 10
1979
Station
Rock Dredge
S3 RD3A
S4 RD3B
S5 RD3
S6 RD4A
S7 RD4
S8 RD5
South Fiji Basin
2000 K
Tonga-Kermadec
August 14
Sept 1
NEW ZEALAND
(Dateline Crossing)
Chatham Rise
2000 K
Udintsev FZ
Tharp FZ
Heezen FZ

Figure 1