



CRUISE REPORT NO. 49

of PE/SI.12/T.1 and

PE/SI.14/T.1

10 March 1981

CRUISE REPORT

SOLOMON ISLANDS OFFSHORE SURVEY

Cruise SI-81(1)

7-21 January 1981

by

W Gayman

Prepared for:

COMMITTEE FOR CO-ORDINATION OF
JOINT PROSPECTING FOR MINERAL
RESOURCES IN SOUTH PACIFIC
OFFSHORE AREAS (CCOP/SOPAC)
WORK PROGRAMME CCSP-1/SI.12
AND CCSP-1/SI.14

As a contribution by:

UNDP Project Office
Project RAS/79/074
Investigation of
Mineral Potential of
the South Pacific

SOLOMON ISLANDS OFFSHORE SURVEY

7-21 January 1981

CRUISE SI-81(1)

CRUISE REPORT NO. 49

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PE/SI.14/T.1

INTRODUCTION AND BACKGROUND

This cruise was undertaken as part of the CCOP/SOPAC Work Programme CCSP-1/SI.12 (Survey of deep sea areas south of the Solomon Islands to investigate the possible occurrence of manganese nodules), and CCSP-1/SI.14 (The potential of precious corals especially Corallium species in the Solomon Islands).

The cruise initiated the programme of reconnaissance sampling for manganese nodules in the Solomon Island waters and extended the reconnaissance investigation of the precious coral potential begun in 1979 in the Solomon Islands (CCOP/SOPAC Cruise Report No. 38). The latter reconnaissance comprised 67 dredge stations in the main group of the Solomon Islands. Corallium was recovered at 14 stations.

Marine basin areas south of the Solomons are deep enough for the formation of manganese nodules, if terrigenous and volcanic sediments are not being deposited so rapidly that they prevent their growth. Sedimentation rates near those active island chains are probably too high to allow any of the deep sea areas to be regarded as prospective. A possible exception is the basin southwest of the Santa Cruz Islands, which is deep, comparatively large, and cut off from most sources of sediment supply by the Solomons and New Hebrides Trenches.

A summary cruise log is given in the Cruise Narrative, Appendix II, attached.

References:

Eade, J V, 1980: Review of precious coral in CCOP/SOPAC member countries, CCOP/SOPAC Technical Report 8

Eade, J V, 1980: Solomon Island Offshore Survey, 10 October-25 November 1979, CCOP/SOPAC Cruise Report No. 38.

CRUISE OBJECTIVES

The cruise was designed to carry out preliminary surveys for manganese nodules in the Santa Cruz Basin, to the south of Guadalcanal, and for precious coral in the Santa Cruz Islands which is located well to the east of the main Solomon Island group.

The cruise plan called for the sea floor photography and the sampling for manganese nodules at 5 stations in the Santa Cruz Basin in depths of approximately 5000 metres.

The search for precious corals was planned for six areas where existing data suggested that suitable bathymetry and strong currents would favour the growth of precious corals. Bathymetric profiling would better define sampling areas, and tangle net dredging in water depths of 150-500m would sample coral assemblages. Bottom photography would characterize sea floor conditions and organic assemblages where precious coral was found.

PERSONNEL PARTICIPATING

W Gayman: Chief Scientist, UNDP Marine Scientist
 S Motuiwaca: UNDP Geological Technician
 C Midobatu: Geological Chemist, Solomon Islands Division of Geology
 C Daga: Fisheries Assistant, Solomon Islands Division of Fisheries.

EQUIPMENT AND FACILITIES

Magnavox 1102A Satellite Navigation system;
 Raytheon PTR-106C-1 7kHz echo sounder;
 EPC Model 4600 graphic recorder;
 Benthos 12kHz pinger system;
 Benthos deep water wireline camera with flash;
 Benthos Boomerang Grab (BBG);
 Kennecott Free-fall cameras;
 Kennecott Free-fall grab, modified for wire line use;
 Gravity corer (core barrel 60cm long)
 Large Van Veen grab;
 Hand Van Veen grab provided by D Cronan;
 Pipe dredge;

Coral tangle nets;
OAR submersible flashers;
OAR transmitters;
OAR Auto direction finder ADF-210.

The Satellite Navigator was supplemented by the ship's radar for position fixing in the nearshore areas.

Logistical support was provided by the Government of the Solomon Islands through the offices of the Geological Survey.

Equipment lost: no equipment was lost during this cruise, except for two sets of tangle nets and tangle net weights.

Comments on Equipment

Good bottom echos were not always obtained on the EPC in deepwater. This may have resulted from poor operator techniques, poor reflective bottom conditions, or electronic problems. However, a subsequent electronic check found the instrument to be in good order.

Some of the ballast obtained for the Benthos Boomerang Grab (BBG) was found not to pack with sufficient density to give the required negative buoyancy to the instrument. It is recommended that only scrap washer centre plugs or similar material be provided in future.

The Ocean Applied Research (OAR) transmitter-receiver system used to locate the freefall instruments after they re-surface did not work satisfactorily. Subsequently, a new direction receiver has been placed on board. Because of an improved antenna arrangement this is expected to work much better.

It was felt that the MACHIAS was not well suited for precious coral dredging or other shallow water work where very steep bottom slopes are encountered. This conclusion was based largely on the layout of the navigation equipment (i.e. the plotting table, radar, and echo sounder), which makes the rapid plotting of radar fixes and bottom depths rather difficult.

PRELIMINARY RESULTS

A. Manganese Nodules

Attempts were made to collect manganese nodules from 6 stations located about 10 to 15 miles apart in the 5000m deep Santa Cruz Basin (Figure 1). One free-falling Benthos Boomerang Grab (BBG) sampler was dropped at each station. No manganese nodules were found. At 3 stations small pumice pebbles were collected, and at 4 stations samples of the light brown muds were recovered.

In addition, a Kennecott Free fall camera (KFFC) was dropped at 4 stations. However, bottom photos were obtained from only 2 stations, MN-41 and MN-46. These photos show considerable evidence of organic activity (i.e. organism tracks, holes in the bottom, and mounds, and other bottom irregularities). Some of the small lumps of the bottom could be interpreted as manganese nodules covered with sediment. However, it seems more likely that the lumps are of organic origin, or are pumice pebbles covered with sediment. It is concluded that the bottom photographs show no evidence of manganese nodules in the sampling area.

The sampling and bottom photos suggest there are few, if any manganese nodules in the Santa Cruz Basin. For this reason, and because of other geological considerations (i.e. close proximity to land and probable relatively high rates of sedimentation) it is recommended that no further exploration for manganese nodules should be undertaken in this area.

B. Precious Coral

On this leg of the MACHIAS cruise, as on Leg 3 (VA-80-3), most of the areas outlined for precious coral exploration were much too deep for the 500m maximum depth limit specified for field exploration. Therefore these areas were generally disregarded. The search around each island was carried out by heading the ship directly or obliquely toward the shore and running in to 125m depth, or to some deeper point where the Captain thought it was prudent to turn; then the ship was headed seaward, directly or obliquely.

If any flat or gently sloping bank or terrace was discovered on the inshore run, attempts were made on the outbound run to drop the tangle net on the feature. Many areas that were not sampled, and areas where no samples were collected in the tangle net, were characterised by very steep slopes. Very few banks, terraces, or areas of gentle slope were discovered within the target depth range.

The tangle net was dropped at 40 stations in the Santa Cruz Island, at depths ranging from 150 to 500 metres (Figure 2). Coral and/or gorgonia samples were collected at 31 of these stations. At 9 stations no coral or gorgonia samples were found; in 2 of these cases, the absence of a sample was due to the loss of the tangle net. The results of the collection are summarized in Table 1 of Appendix I attached.

None of the samples collected in the Duff Islands, and in the vicinity of Utupua and Tinakula were thought to include corals species which are commercial value.

Coral species of possible commercial value were collected on the southeast side of Vanikolo Island (3 stations: 2, 4 and 6) on the southeast side of Ndendi Island (5 stations: 12, 13, 15, 16 and 19); off the northwest side of Ndendi Island (2 stations: 23 and 24), and near the west end of the Great Reef (1 station: 31) in the Reef Islands.

Seven of the 10 most attractive samples represent all or part of the 200 to 300m depth range, two samples were collected from the 400-500m depth range, and one was from the 100-200m depth range.

Selected samples of the better quality coral and gorgonia will be submitted to a qualified marine biologist for positive identification, and an assessment of the value of the coral species collected. The results of the tangle netting programme should be considered highly tentative until the results of such an examination has been obtained.

C. Bathymetry

Over 1100 nautical miles of bathymetric track data was recorded between Port Vila and Honiara, and in the Santa Cruz Islands (see Figures 3, 4, and 5).

CONCLUSIONS AND RECOMMENDATIONS

Free fall grab sampling and bottom photography at 6 stations in the 500m deep Santa Cruz Basin has failed to produce any evidence of manganese nodules. For this reason, and because of the relatively close proximity of the area to land, and sources of sediment, no further exploration for manganese nodules is recommended in this region.

It is possible that some of the deepwater corals collected in 4 areas of the Santa Cruz Islands may be of the same species as those found elsewhere in the Pacific which have commercial value. However, any recommendations with regard to further exploration must await the identification and evaluation of the samples by Dr R Grigg, the UNDP's precious coral consultant.

WORK REMAINING

Selected samples of the corals collected are being sent to Dr R Grigg of the University of Hawaii for examination, identification and comment.

Eight samples of calcareous crust collected from the tangle net stations in the Santa Cruz Islands are being tested for their prosphorite content.

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STATION DESCRIPTION

TABLE 1
APPENDIX 1

TN = Tangle Nets
 RDRG = Rock Dredge
 FFCm = Free Fall Camera
 W G Cm = Wire lowered Grab/Camera
 PDRG = Pipe Dredge

STATION NO.	SAMPLE NO. & TYPE	DATE (GMT)	LATITUDE (S)	LONGITUDE (E)	WATER DEPTH (uncorrected metres)	AREA	NODULE Density (kg/m ³)	Cover (%)	SAMPLE DESCRIPTION/REMARKS
1	TN-1	9.1.81	11°43.6'	167°01.5'	255-345	Vanikolo-SE			3 3cm & 1 2cm frag. of pink-white coral 3 4cm frag. of white coral (alive) plus 4-6 small frag. of same
2	TN-2	9.1.81	11°41.1'	167°01.4'	325-420	Vanikolo-SE			2 3-6cm brown calcar. crustal rocks 4 1-2cm fine fragments of white coral about 1kg, and 100 plus pieces of white and brown coral, hard and soft, and gorgonia, often 10-20cm long. Also a little <u>Halimeda</u> ; probably not of economic value
3	TN-3	10.1.81	11°34.25'	167°03.0'	115-60	Vanikolo-E			5 4-6cm massive black & white branching coral plus 6 smaller frag. 1 fine brown stained white? coral 3cm, plus 1 fine black coral also 6" brown calc. crust
4	TN-4	10.1.81	11°38.8'	167°04.45'	265-280	Vanikolo-E			1 4cm piece white coral (dead); 1 1.5cm frag. white coral with dark brown sfc coating 2kg dark gray to black calcar. rock
5	TN-5	10.1.81	11°35.55'	167°04.08'	425	Vanikolo-E			1 dozen 1-2cm fragments of white coral No sample; lost net
6	TN-6	10.1.81	11°33.6'	166°59.1'	230-100	Vanikolo-N			1 dozen brown or orange gorgonia to 10cm 2 2cm frag. white coral
7	TN-7	10.1.81	11°33.9'	166°53.9'	275-60	Vanikolo-N			No sample
8	TN-8	10.1.81	11°16.5'	166°35.7'	250-130	Utupua Island			1 massive brown dead coral frag 6cm long 1 small brown dead coral 3cm
9	TN-9	10.1.81	11°19.7'	166°33.5'	320-400	Utupua Island			No coral; only sea urchins
10	TN-10	11.1.81	11°16.5'	166°03.2'	415-385	Utupua Island			1 small white multi-branching dead coral; 3 different solitary coral; 1 very small black coral
11	TN-11	11.1.81	11°05.6'	166°34.9'	280-340	Utupua Island			
12	TN-12	11.1.81	10°44.5'	166°09.8'	285-310	Ndendi-S			

CRUISE: SI-81(1)

TABLE I
APPENDIX I

STATION DESCRIPTION

GC = Gravity Core,
TN = Tangle Nets
RDRG = Rock Dredge
FFCm = Free Fall Camera
W G Cm = Wire lowered Grab/Camera
PDRG = Pipe Dredge

STATION NO.	SAMPLE NO. & TYPE	DATE (GMT)	LATITUDE (S)	LONGITUDE (E)	WATER DEPTH (uncorrected metres)	AREA	NODULE Density (kg/m ²)	Cover (%)	SAMPLE DESCRIPTION/REMARKS
13	TN-13	11.1.81	10°43.0'	166°09.7'	335	Ndendi-S			1 5cm orange coated coral; 3 tiny frag. of white coral
14	TN-14	11.1.81	10°42.15'	166°08.8.1'	235-105	Ndendi-S			2 zig-zag shape fine soft coral or gorgonia; plus numerous soft or friable brown CaCO ₃ crusts and limestone fragments
15	TN-15	11.1.81	10°42.97'	166°09.6'	320	Ndendi-S			2 dozen coral/gorgonia fragments 2 3cm redish/orange coral; 5-10 flexible white coral/gorgonia; 3-5 species fine dark coloured gorgonia; 1 brown solitary coral (dead)
16	TN-16	12.1.81	10°43.3'	166°00.55'	270-285	Ndendi-S			3 2-6cm frag. dead white coral; 2 2-3cm fragments whitish pink coral; 1 5cm massive black and white dead coral; 4 soft coral or gorgonia fragments
17	TN-17	12.1.81	10°43.6'	166°01.8'	205-255	Ndendi Is.-S			No sample
18	TN-18	12.1.81	10°44.4'	166°01.7'	395-350	Ndendi Is.-S			No sample
19	TN-19	12.1.81	10°45.0'	166°02.55'	440-405	Ndendi Is.-S			6 tiny, fine & fragile fragments of white coral to 2cm, possibly alive; 1 attached to 2cm limestone or claystone pebble
20	TN-20	12.1.81	10°49.05'	166°04.85'	365-375	Ndendi Is.-S			3 10cm gorgonia; 1 2cm frag. brown solitary coral (dead)
21	TN-21	12.1.81	10°41.8'	166°44.4'	275-320	Ndendi Is.-N			very small (1-2cm) fragment of dead white coral; 2kg coral rocks from stations 21-26 combined in 1 sample bag
22	TN-22	12.1.81	10°43.0'	165°43.8'	315-360	Ndendi Is.-N			1kg sample solitary coral & gorgonia on claystone or limestone; large 200gm soft coral or gorgonia

CRUISE: SI-81(1)

STATION DESCRIPTION

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GC = Gravity Corer
TN = Tangle Nets
RDRG = Rock Dredge
FFCm = Free Fall Camera
W G Cm = Wire lowered Grab/Camera
PDRG = Pipe Dredge

STATION NO.	SAMPLE NO. & TYPE	DATE (GMT)	LATITUDE (S)	LONGITUDE (E)	WATER DEPTH (uncorrected metres)	AREA	NODULE Density (kg/m ³)	COVER (%)	SAMPLE DESCRIPTION/REMARKS
23	TN-23	12.1.81	10°38.8'	165°46.85'	210	Ndendi Is.-N			100+ pieces of coral & gorgonia to 15cm; mostly gorgonia; some coral red, orange, white, dead
24	TN-24	13.1.81	10°39.8'	165°46.45'	210	Ndendi Is.-N			½-¾kg, 90% dead brown coral and crustal fragments, solitary & branching; 2 3-4cm fragment of reddish pink coral; gorgonia to 10-15cm
25	TN-25	13.1.81	10°39.64'	165°45.5'	415-385	Ndendi-NW			No sample
26	TN-26	13.1.81	10°38.55'	165°47.0'	255-180	Ndendi-NW			2 dozen small brown fragments of dead coral
27	TN-27	13.1.81	10°38.05'	165°48.2'	355-490	Ndendi-NW			No sample
28	TN-28	13.1.81	10°24.5'	165°47.0'	325-400	Ndendi-NW			2 small gorgonia
29	TN-29	13.1.81	10°04.06'	166°	190	Reef Is.			1kg (6 pieces) of dead coral and calc. crust
30	TN-30	13.1.81	10°05.25'	166°03.00'	320	Reef Is.			lost net, no sample
31	TN-31	14.1.81	10°12.8'	166°02.8'	235	Reef Is.			2 4-6cm fragments white coral; 4-6 smaller fragments same; 2 bottle-brush-like gorgonia
32	TN-32	14.1.81	10°13.55'	166°02.35'	295	Reef Is.			4-6 fine gorgonia fragments and 2 2-3cm white coral fragments (dead)
33	TN-33	14.1.81	10°16.3'	166°04.1'	485-450	Reef Is.			No sample
34	TN-34	14.1.81	10°07.9'	166°10.6'	355-360	Reef Is.			1 6" 300g brown coral rock fragment
35	TN-35	14.1.81	9°53.7'	167°09.35'	245-140	Reef Is.			2 3-4cm pieces of friable white coral-like material, plus several smaller fragments; 1 3cm fine dead coral fragments
36	TN-36	14.1.81	9°54.41'	167°10.1'	190-140	Duff Is.			1 20cm fine brown soft coral or gorgonia; 1 fine 6cm black coral or gorgonia with <u>Halimeda</u> fragments

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GC = Gravity Corer
TN = Tangle Nets
RDRG = Rock Dredge
FFCM = Free Fall Camera
W G Cm = Wire lowered Grab/Camera
PDRG = Pipe Dredge

STATION NO.	SAMPLE NO. & TYPE	DATE (GMT)	LATITUDE (S)	LONGITUDE (E)	WATER DEPTH (uncorrected metres)	AREA	NODULE Density (kg/m ²)	NODULE Cover (%)	SAMPLE DESCRIPTION/REMARKS
37	TN-37	15.1.81	9°55.55'	167°12.25'	360-200	Duff Is.			1 4" coralline rock; 1 starfish; no sample saved
38	TN-38	15.1.81	9°58.25'	167°16.5'	375	Duff Is.			6-12 small, easily fragmented pieces of brown, white, and soft coral and gorgonia
39	TN-39	15.1.81	9°59.5'	167°49.5'	225-75	Duff Is.			1 30cm white slightly flexible-stiff gorgonia or soft coral with 10-15 branches
40	TN-40	15.1.81	10°01.1'	167°20.6'	260-175	Duff Is.			No sample
41	FFG-41	16.1.81	11°39.25'	163°29.20'	possibly abt 4425 or 5000*	Santa Cruz Basin	0	0	No nodules; soft light brown mud; bottom photo shows no nodules
42	FFG-42	17.1.81	11°44.21'	163°24.44'	5075*	Santa Cruz Basin	0	0	No nodules; no photo; pumice pebbles and light brown mud
43	FFG-43	17.1.71	11°51.25'	163°14.19'	4625? or 5000?	Santa Cruz Basin	0	0	brown mud; no nodules; no photo
44	FFG-44	17.1.81	11°57.78'	163°05.66'	5370?*	Santa Cruz Basin	0	0	light brown mud, no nodules; no photo
45	FFG-45	18.1.81	11°51.44'	162°58.22'	4675?*	Santa Cruz Basin	0	0	pumice pebbles; no nodules; bottom photograph attempted with negative results
46	FFG-46	18.1.81	12°08.00'	163°04.75'	4600?*	Santa Cruz Basin	0	0	pumice pebbles; no nodules; bottom photo shows no nodules

*very poor bottom record on EPC echo sounder

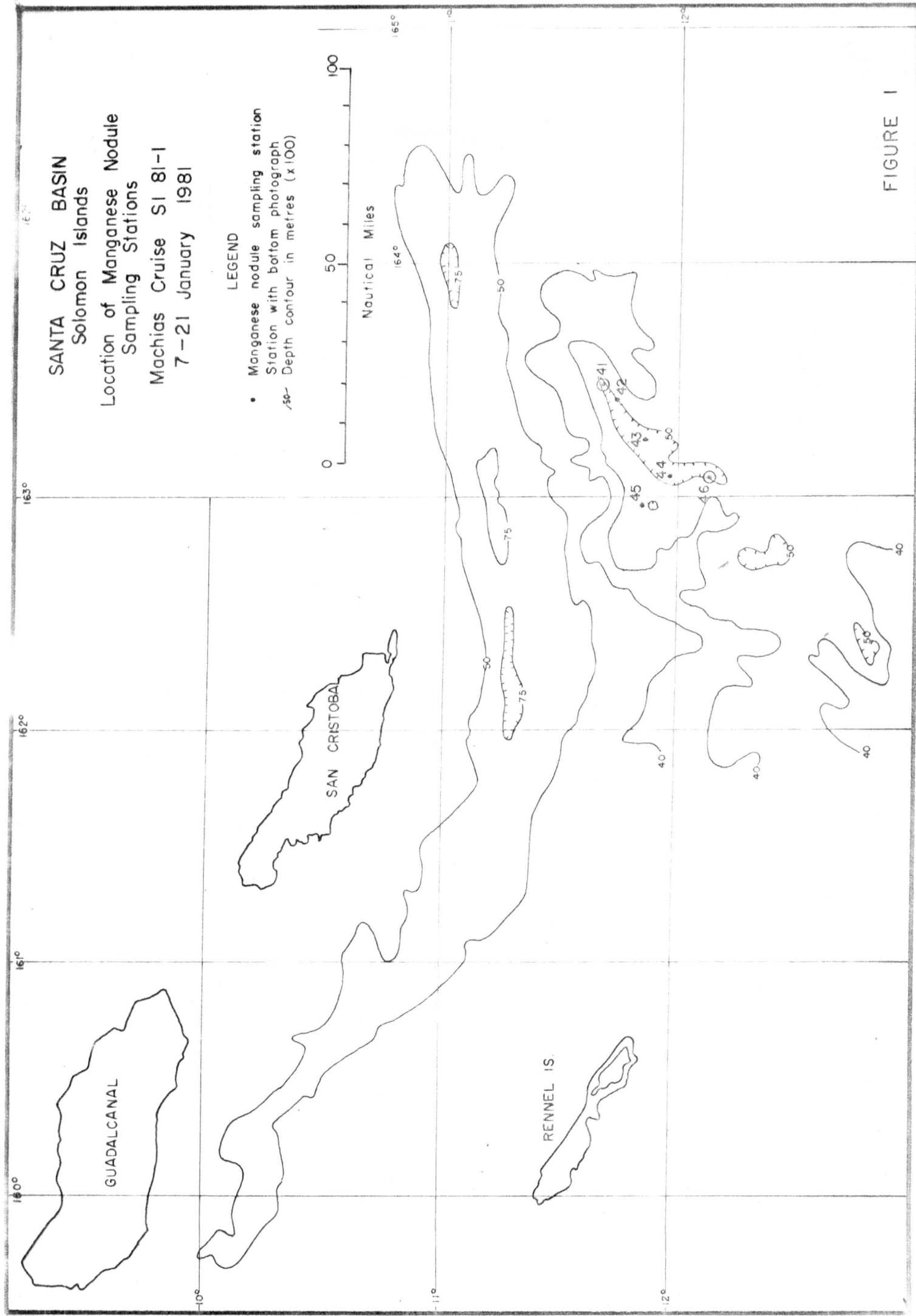
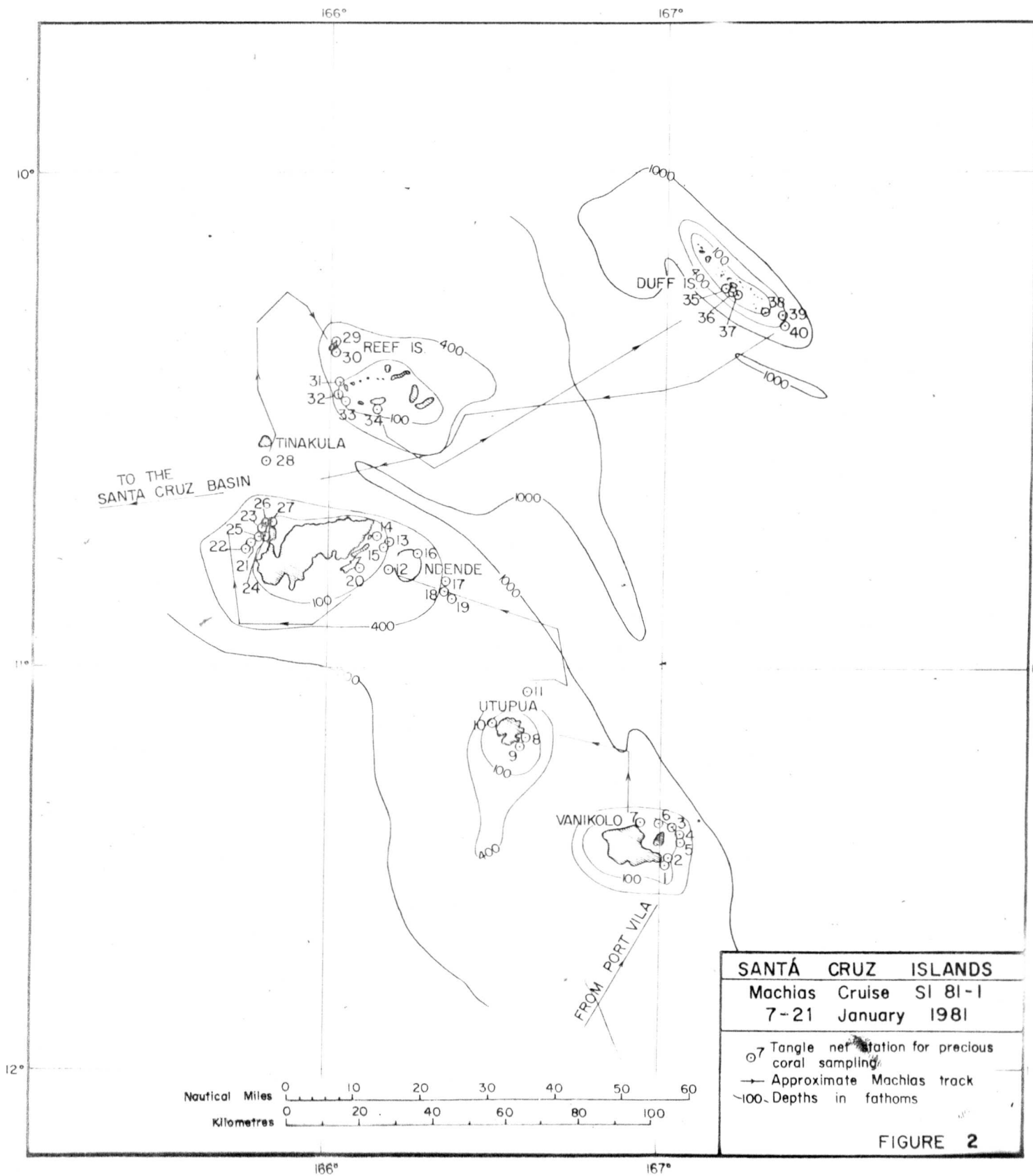
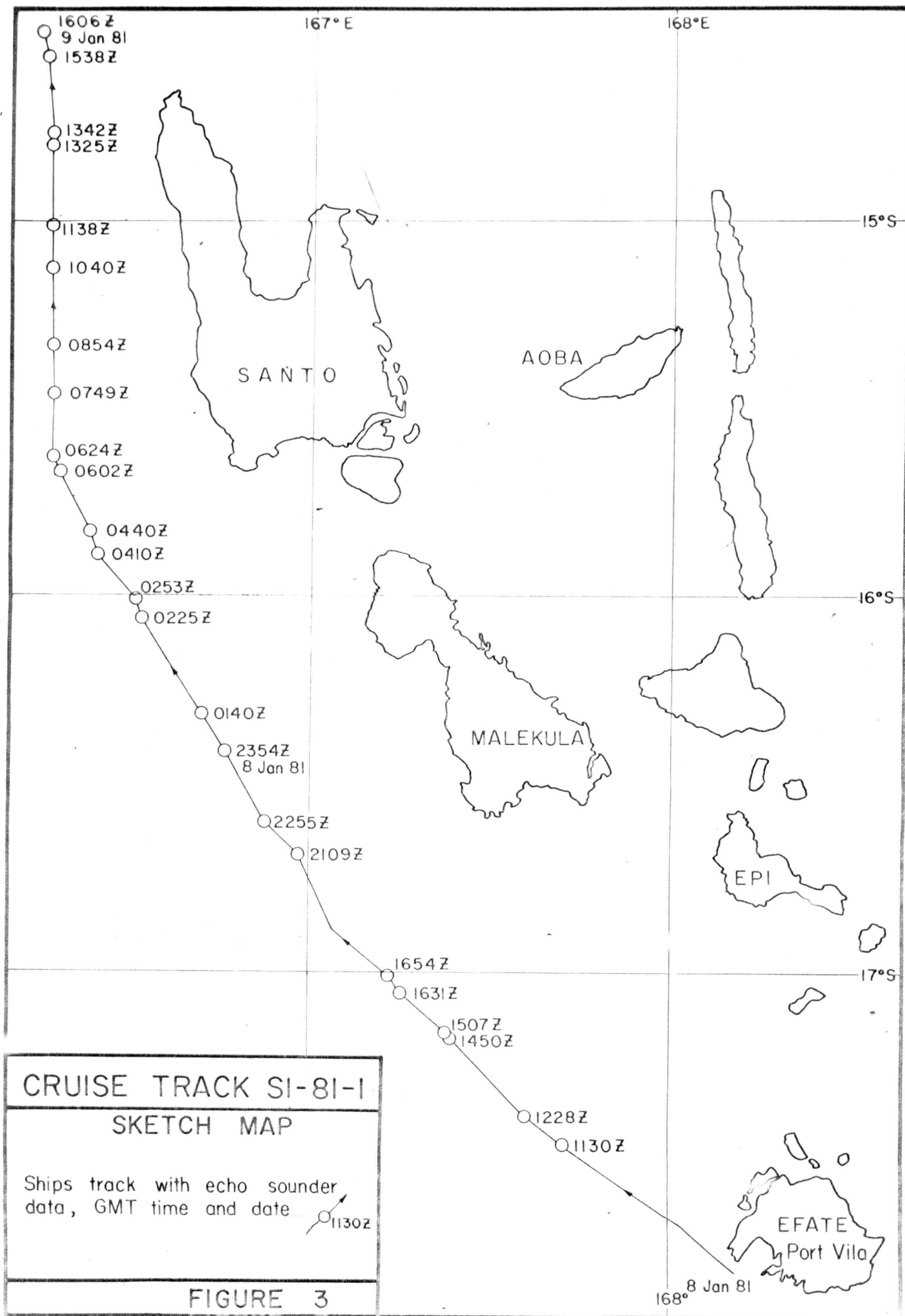
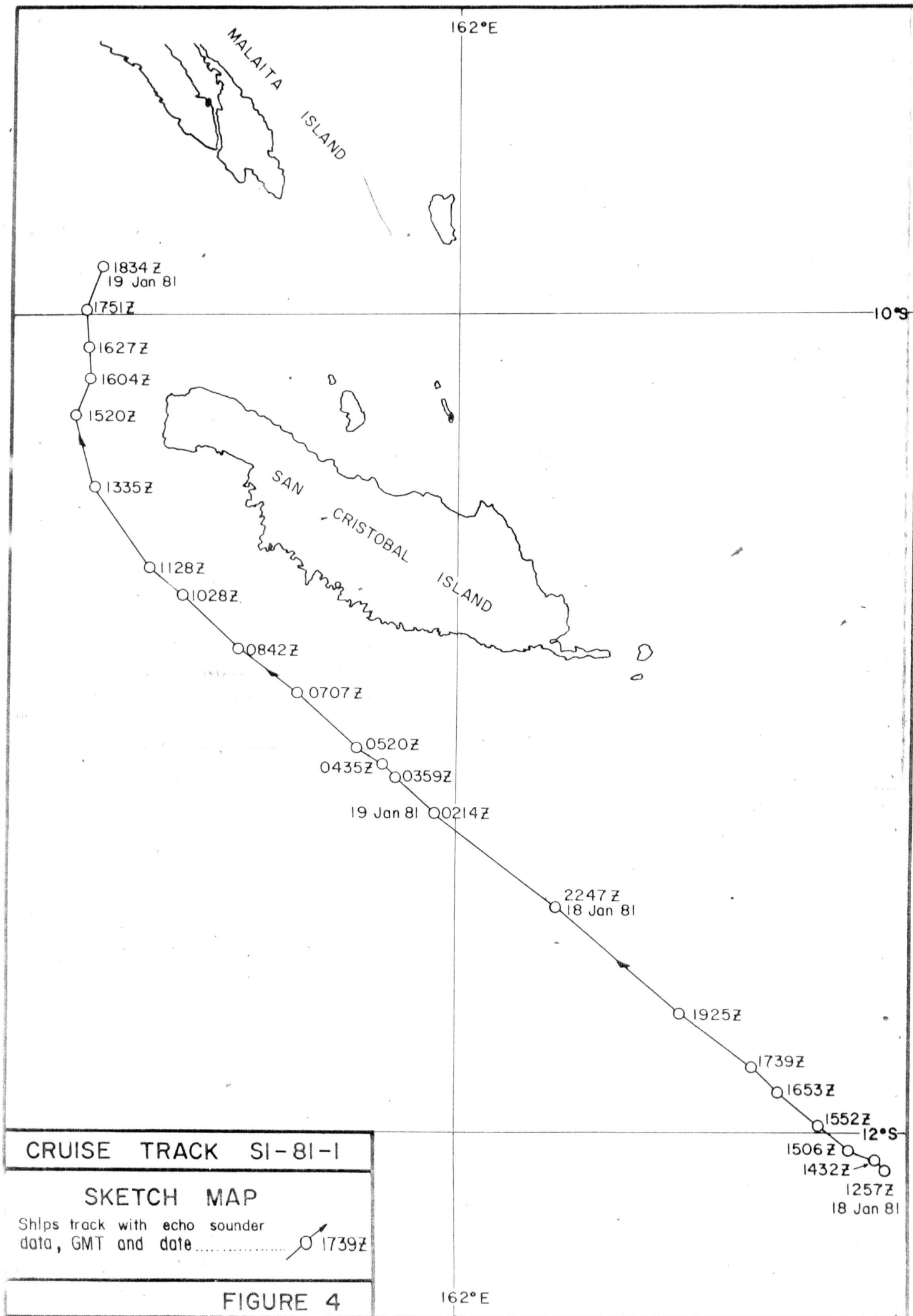
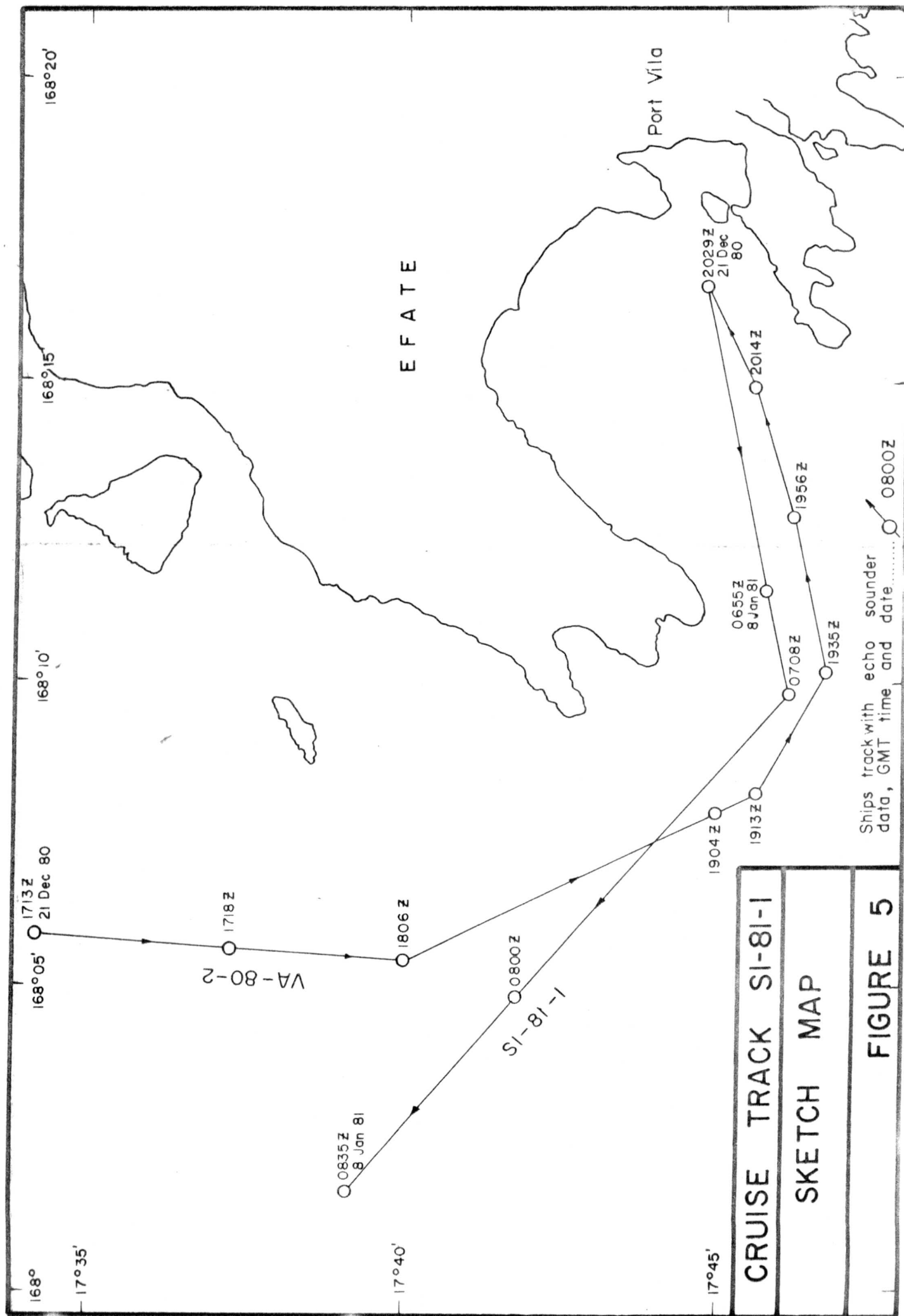


FIGURE 1









APPENDIX 11

CRUISE NARRATIVE

The MACHIAS left Port Vila at 0548Z on January 7, 1981, bound for the Santa Cruz Islands (all times and dates are GMT unless otherwise stated). A course was chosen to the west of the New Hebrides in order to provide a new track, and to avoid the hazardous steaming between the islands during periods of darkness. At about 1500Z on January 7 bottom was gradually lost on the echo sounder (EPC). Presumably this loss was due to the great depth (over 3000m) and to rough topography. Bottom echoes were lost on the echo sounder several times for up to 2-4 hours at a time during the following 24-hour period.

On January 9, 1981, at 1930Z the MACHIAS arrived off the south shore of Vanikolo Island, the first planned sampling area in the Santa Cruz Islands.

The initial bathymetry suggested that all or most of the planned sampling area was deeper than the 500m which is the lower depth limit set for the tangle netting operations. (Later this was found to be also true for most of the other sampling areas.) Consequently, it was decided to proceed counter clockwise around Vanikolo Island, making bathymetric runs, and dropping the tangle net in the areas that appeared relatively attractive. Seven tangle net stations were occupied off the south, east, and north coasts of Vanikolo Island. Most of the offshore slopes of the island are too steep for easy tangle netting.

Beginning at about 1800Z the MACHIAS commenced bathymetry in a clockwise direction around Utupua Island. Slopes were extremely steep, so that the MACHIAS had to come very close to the reef to reach depths as shallow as 150-200m. The Captain suggested that the continuous sawtooth pattern begun around the island was too hazardous to continue, without interruption. For this reason, 3 mile legs parallel to shore were added to the track plan between the dangerous inshore runs. All of the slopes around Utupua were extremely steep. Nevertheless 4 sample stations were occupied. During the night the MACHIAS moved somewhat closer to Ndende.

A sampling and bathymetry programme off the south and east coasts of Ndende commenced about 1800Z on January 11. Relatively shoal waters were found to the east of Ndende and bottom slopes were considerably less steep than those off Utupua and Vanikolo. Nine stations were occupied. During the evening the MACHIAS proceeded clockwise around the south coast and thence to the northwest coast of Ndende.

Sampling and bathymetry commenced at about 1830Z January 12 off the northwest coast of Ndende. It was determined that a shoal area marked on the chart as being adjacent to tidal rips, did not exist, at least not in the area where it was mapped. Some slopes were steep, but several irregular bottom areas found were considered suitable for tangle netting. Very swift currents were encountered close to the shore just north of Te Motu Island. After seven sample stations were occupied in this area, the MACHIAS proceeded northward to Tinakulu Island. It was found that the currents around the island were swift, and the bottom slope was very steep. One tangle net station was attempted, but the material collected was void of precious coral. During the night the MACHIAS cruised northward toward the Reef Islands.

At about 1800Z on January 13 bathymetry and sampling commenced off Nukapu Island in the Reef Island group. Because of the very steep slopes only 2 stations were occupied. The MACHIAS then proceeded south around the West Point of the Great Reef, making bathymetry runs and occupying another 4 stations. During the night the MACHIAS proceeded about 75 nautical miles to the eastward to the Duff Islands.

Bathymetry and sampling in the Duff Islands began about 1900Z on January 14 and was continued for about 11½ hours. Six stations were occupied. Bottom slopes were very steep. No conventional fringing reef was found on the southwest side of the Duff Islands. An uncharted offshore ridge was found to extend well to the southeast of the island chain, at least for several miles. There was no manifestation of this ridge on the surface (i.e. discoloured water or breaking waves), but everywhere the ridge rose to depths shallower than 100 meters. This prevented the MACHIAS from easily obtaining access to the northeast side of the Duff Island Chain.

The tangle netting programme in the Santa Cruz Islands ended when the MACHIAS turned to the westward, at 0630Z on January 15. As the MACHIAS moved into water in excess of 2000 metres the bottom was frequently lost on the echo sounder record.

At 2300 on January 16 the MACHIAS arrived at the first manganese nodule station in the Santa Cruz Basin. The freefalling Benthos Boomerang Grab (BBG) was launched and later the Kennecott Free fall Camera (KFFC). Both were recovered 4-5 hours later. After spending about 5½ hours on station, the MACHIAS moved to the next station. At the second station (MN-42) the BBG and the KFFC were launched again, but the KFFC failed to trigger when the ballast was dropped. Also it was concluded that the radio location system was not working well enough to be useful.