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## Preliminary Cruise Report

**Ship Name:** *R/V Maurice Ewing*  
**Operating Institution:** Lamont-Doherty Earth Observatory, Columbia University  
**Dates:** 24 November 1995 to 24 December 1995  
**Project Title:** Controlled source electromagnetic and seismic investigation of the Valu Fa Ridge, Lau Basin, SW Pacific. Cruise EW95-12.  
**Chief Scientist:** Dr Martin C. Sinha, Department of Earth Sciences, University of Cambridge, U.K.  
**Coastal State:** Kingdom of Tonga  
**Foreign Participants:**

Martin Sinha	U.K.	Chief Scientist
Christine Peirce	U.K.	Co-P.I.
David Booth	U.K.	Engineer
Stephen Riches	U.K.	Engineer
Deborah Navin	U.K.	Graduate Student
Lucy MacGregor	U.K.	Graduate Student
Ian Turner	U.K.	Graduate Student
James Hobro	U.K.	Graduate Student
David White	U.K.	Technician
Michael MacCormack	U.K.	Technician
Peter Carter	U.K.	Technician
Tevita Fatai	Tonga	Observer

### Description of Scientific Programme:

The objective of this project is to investigate the processes of magma generation and emplacement, and crustal generation, at the medium-spreading-rate back-arc spreading centre in the southern Lau Basin known as the Valu Fa Ridge. The Valu Fa Ridge has been the target of a range of previous investigations, using swath bathymetry, gravimetry, magnetometry, seismic profiling, submersible dives, and geochemical sampling and analysis to investigate

both crustal accretion (magmatic) processes and the accompanying hydrothermal circulation and mineralisation systems. The current project aims to build on these previous studies by providing:

- (i) Two crustal seismic velocity cross-sections across the ridge. One is centred on an overlapping spreading centre (OSC) at 22° 10' S. The other crosses the ridge near 22° 26' S, away from any significant ridge discontinuities. These will provide information on crustal thickness and the location and geometry of crustal melt accumulations (magma chambers) beneath the ridge axis.
- (ii) A crustal electrical resistivity cross-section across the ridge, coincident with the more southerly seismic profile. This will provide an alternative image of the crustal magma accumulation, together with better constraints on the physical state and properties (e.g. fluid fraction, pore space geometry) of both the magmatic system and the overlying hydrothermal system.

#### **Data Collected:**

- (i) For each of the two seismic experiments, 6 ocean bottom seismometers were deployed and shots were fired using the ship's powerful airgun array. Single-channel seismic reflection data were collected simultaneously using a short, single-channel streamer.
- (ii) For the controlled source electromagnetic (CSEM) experiment, 12 sea floor electric field instruments were deployed and used to record signals at frequencies of between 0.25 and 8 Hz transmitted from the DASI deep-towed active source instrument.

In addition, gravity, magnetic and bathymetry data were collected from the study area, together with 12 XBT stations and one sound velocity meter profile of the water column.

The seismic data amount to 520 km of wide-angle profile, and comprise some 70,000 seismograms. The CSEM data comprise 68.6 hours of DASI transmissions giving 508.7 source-receiver-hours of useful data.

The attached series of maps show:

- (i) A summary track chart for the cruise
- (ii) Instrument positions and transmitter tow lines for the main CSEM experiment
- (iii) Instrument positions and transmitter tow line for a preliminary CSEM experiment
- (iv) Tracks for which bathymetric data were collected
- (v) Tracks for which total-field magnetic data were collected
- (vi) Tracks for which gravity data were collected
- (vii) Shooting tracks and instrument positions for the seismic experiments
- (viii) The positions of disposable sonobuoys, XBTs and the sound velocity meter dip.

The attached table provides details of all instrument moorings deployed during the cruise.

#### **Information Address:**

The contact point for all queries regarding data collected during this programme is:  
Dr Martin Sinha, Department of Earth Sciences, University of Cambridge, Bullard Laboratories, Madingley Road, Cambridge CB3 0EZ, United Kingdom.

### **Schedule of Delivery for All Data, Results and Reports:**

Underway geophysical data: navigation, gravimetry, magnetometry, bathymetry	digital data files	March 1996.
Hydrosweep swath bathymetry data	digital data files paper - colour chart	March 1996 March 1996
Sound velocity and XBT profiles	digital data files	March 1996
Cruise Report		March 1996
Single-channel seismic reflection data	Processed data, paper sections	January 1997
Wide-angle seismic data: processed sections, velocity models, interpretation and report		October 1998.
Controlled source electromagnetic data: processed/reduced data points, conductivity models, interpretation and reports		October 1998.

Martin C. Sinha  
Chief Scientist, EW 95-12

20 December 1995.

# R/V Maurice Ewing cruise 95-12 Instrument deployment locations

Instrument No	Lat S	Long W	Water Depth m	Deployment Time	Recovery Time
<b>Seismic North</b>					
OBS 1	22.2416	176.4771	2366	339/12:44	341/15:14
OBS 2	22.1973	176.6017	2133	339/10:54	341/13:10
OBS 3	22.1931	176.6124	2147	339/09:33	341/12:38
OBS 4	22.1897	176.6240	2035	339/08:24	341/12:05
OBS 5	22.1283	176.7924	2369	339/06:25	341/09:54
OBS 6	22.0656	176.9648	2355	339/04:24	341/07:24
Sono 1	22.5688	176.3345		335/05:06	
Sono 2	22.3393	176.7579		335/11:24	
Sono 3	22.2415	176.6210		335/14:13	
Sono 4	22.3505	176.6617		335/15:40	
Sono 5	22.2500	177.0333		335/19:00	
Sono 6	22.1809	177.0079		336/00:28	

# Seismic South

OBS 1	22.3106	177.0559	2563	334/12:11	336/06:12
OBS 2	22.3902	176.8310	2768	334/14:36	336/09:14
OBS 3	22.4181	176.7545	2675	334/16:27	336/11:30
OBS 4	22.4391	176.6970	2136	334/18:21	336/13:12
OBS 5	22.4721	176.6055	2799	334/20:03	336/15:23
OBS 6	22.5375	176.4236	1915	334/22:51	336/17:51
Sono 1	22.3140	176.2754		339/21:34	
Sono 2	22.2314	176.6807		340/02:54	
Sono 3	22.3386	176.6565		340/05:01	
Sono 4	22.0862	176.5609		340/08:18	
Sono 5	22.0491	176.5861		340/11:00	

<b>XBTs</b>			
9512-01	22.4310	176.6002	330/04:22
9512-02	22.3313	176.5572	336/23:10
9512-03	22.3482	176.5660	343/21:35
9512-04	22.4409	176.7928	343/21:51
9512-06	22.3751	176.6792	344/20:50
9512-07	22.4764	176.5969	345/20:51
9512-08	22.3727	176.6673	347/02:39
9512-09	22.5220	176.7028	347/21:55
9512-10	22.5175	176.7030	351/23:46
9512-11	22.5279	176.7063	352/00:18
9512-12	22.5242	176.6986	352/00:46
<b>Sound velocity dip</b>	22.4317	176.5986	330/04:16

# Controlled Source Electromagnetic Experiment

## Test Tow

Lemur 12	22.4102	176.5885	2805	330/16:01	lost
Lemur 14	22.4727	176.6063	2806	330/18:18	334/00:23
ELF Pele	22.4653	176.6254	2802	330/12:30	338/22:22
ELF Rhonda	22.4560	176.6504	2410	331/07:47	351/01:18
ELF Trevor	22.4459	176.6783	2245	331/11:36	349/20:54

## Main Experiment

Lemur 11	22.3529	176.7128	2354	342/19:46	350/03:03
Lemur 14	22.4412	176.6911	2146	342/22:32	349/22:30
Lemur 15	22.4657	176.6273	2797	343/01:27	350/09:00
ELF Noddy	22.4334	176.7139		334/08:26	349/19:13
ELF Pele II	22.4717	176.6069		343/03:13	350/21:00
ELF Ulysses	22.3670	176.6697		343/21:47	351/04:57
ELF Quail I	22.4266	176.7375		343/18:22	346/10:56
ELF Quail II	22.4552	176.7375		346/18:41	349/17:29
ELF/Lemur Lolemur	22.4037	176.5837		344/01:39	350/06:51
LEM Kermit	22.4092	176.7817	2619	342/00:42	349/15:33
LEM Opus	22.3925	176.8258	2776	342/10:22	349/13:42

# Acoustic Navigation Transponders

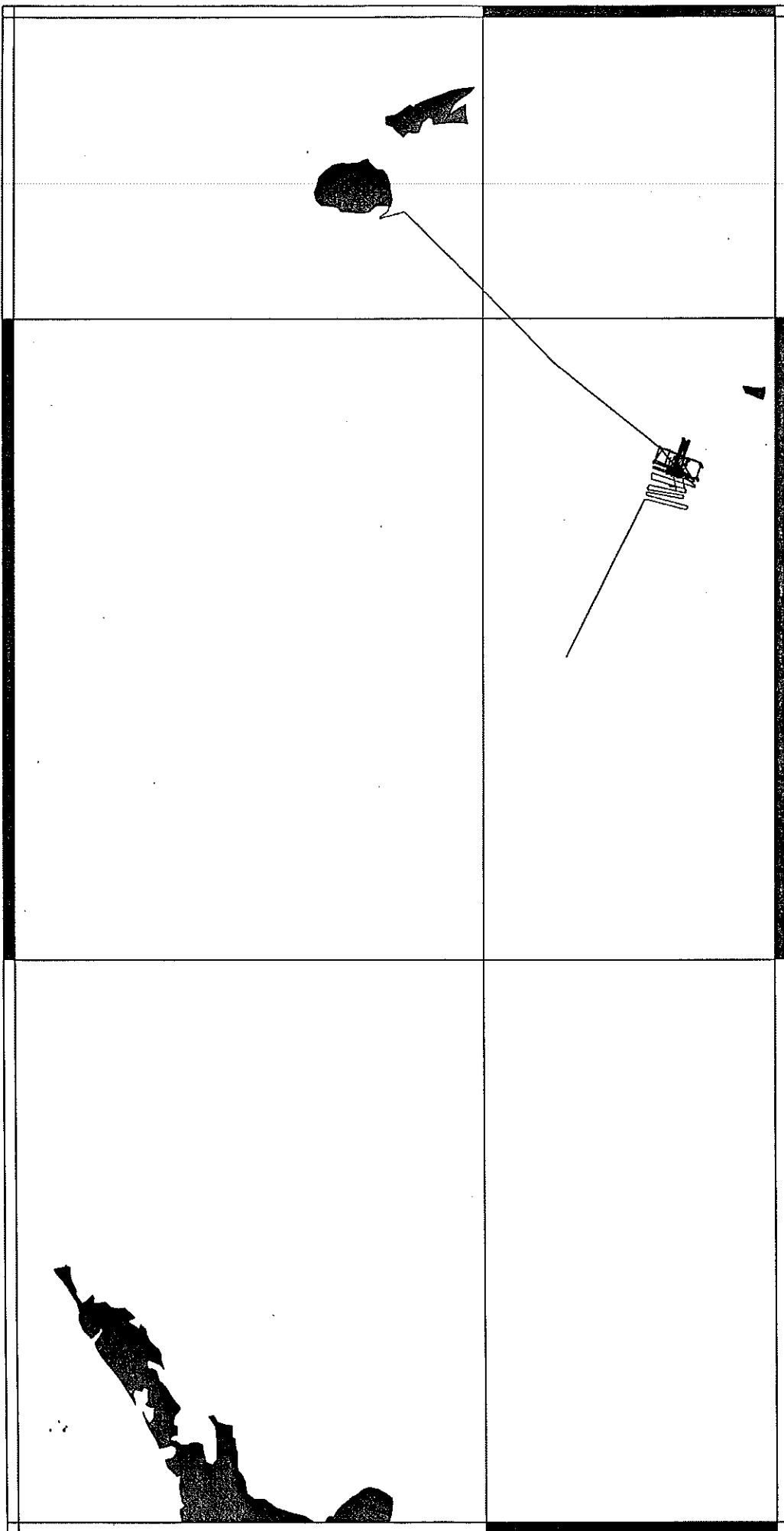
T1	22.3297	176.6710	343/07:53	350/04:30
T2	22.4023	176.6926	343/10:05	350/01:12
T3	22.4696	176.7209	343/11:39	349/23:53
T4	22.4256	176.6129	343/13:38	351/03:12
T5	22.5020	176.6328	343/14:58	350/23:27

Track chart  
ΣW9512

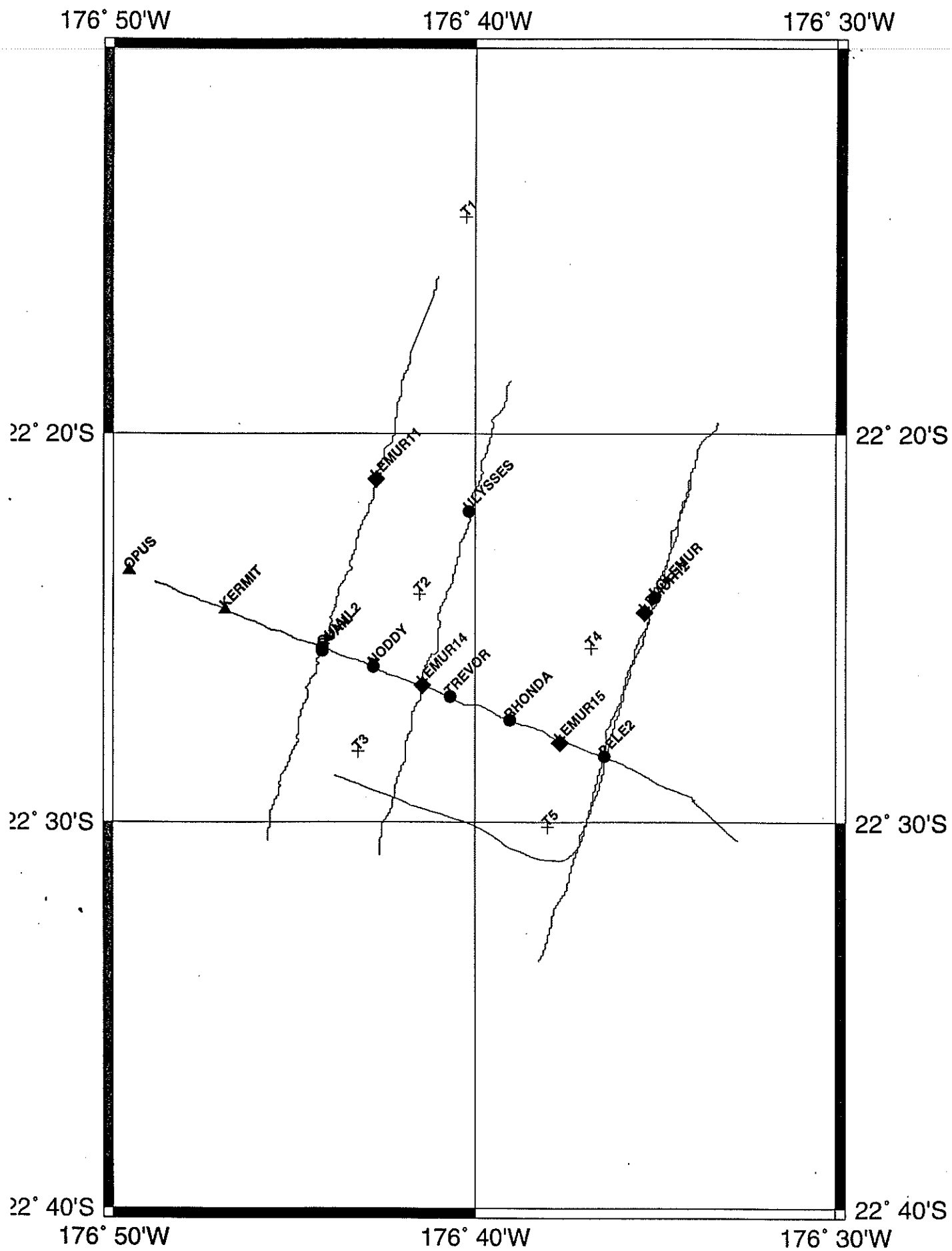
Prelim. Cruise Rpt

20°S

20°S



180°E



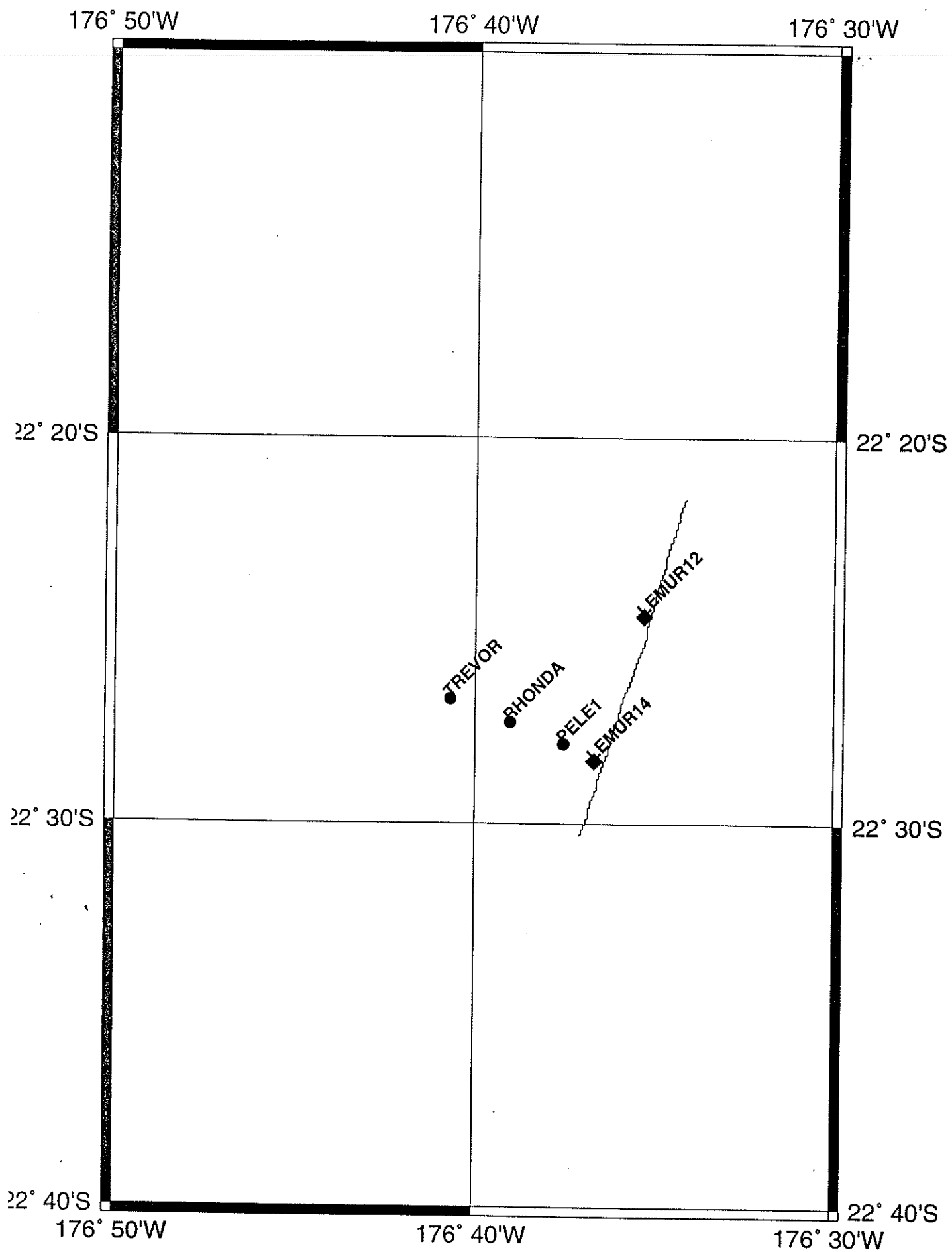
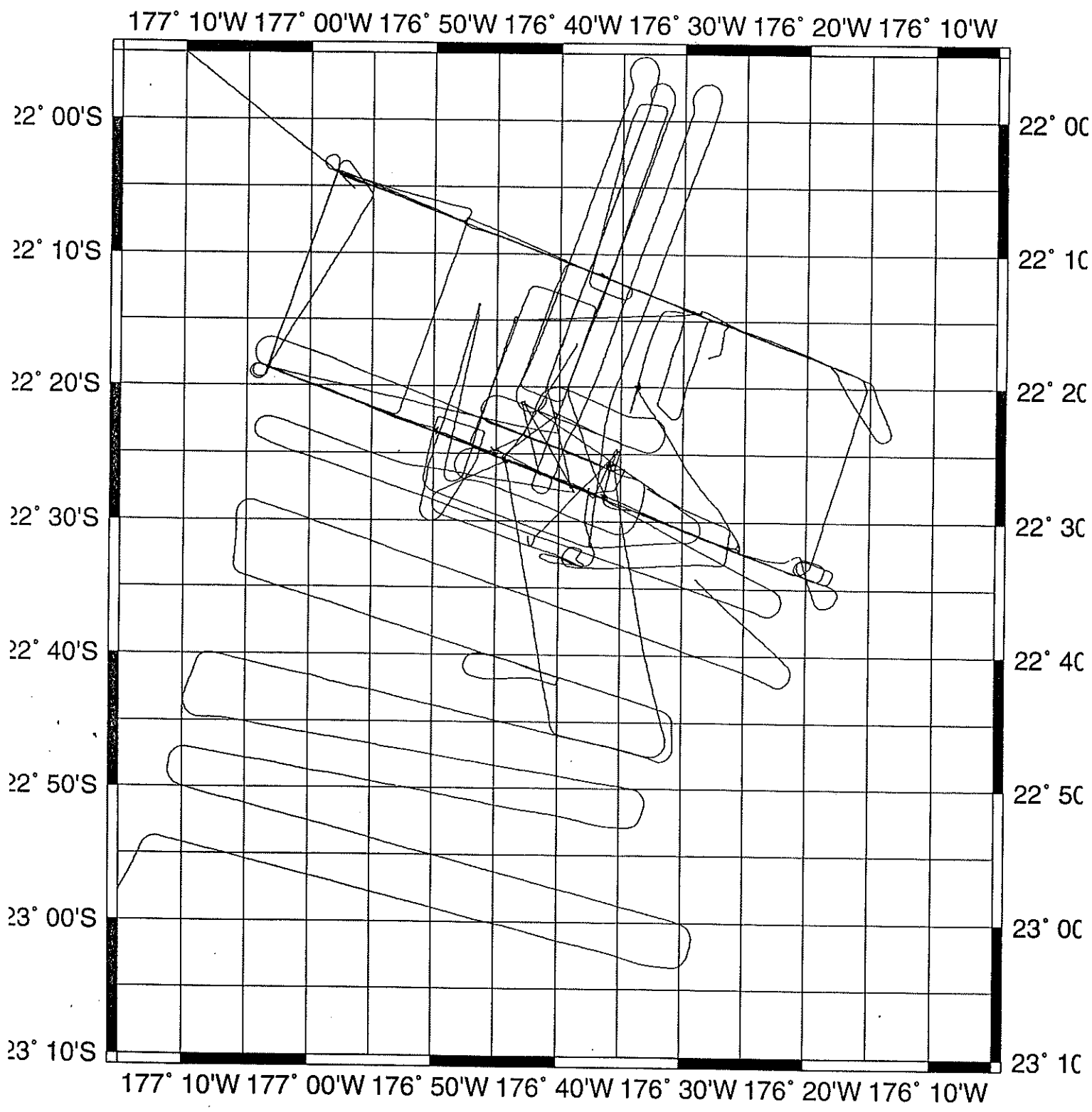
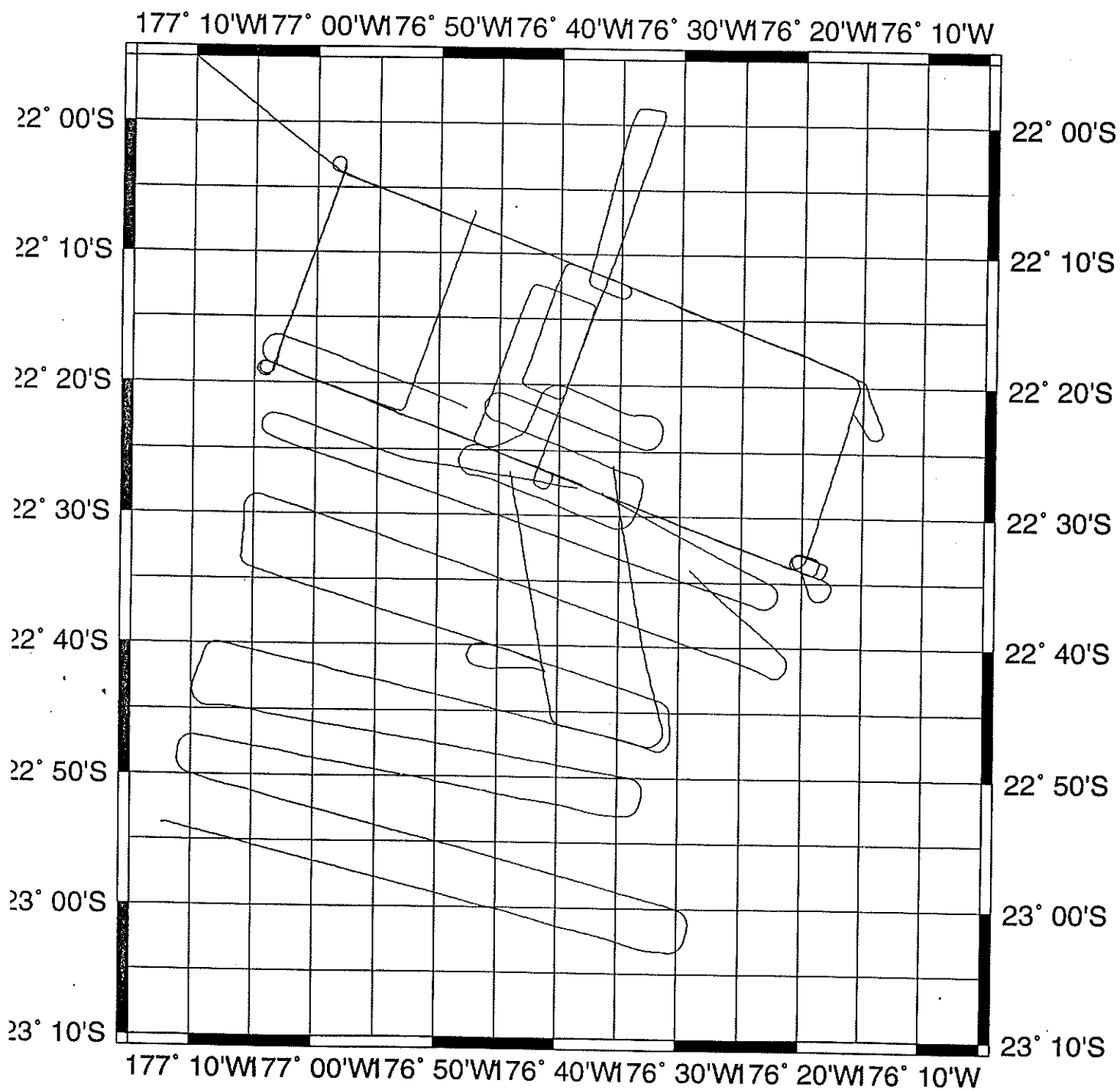
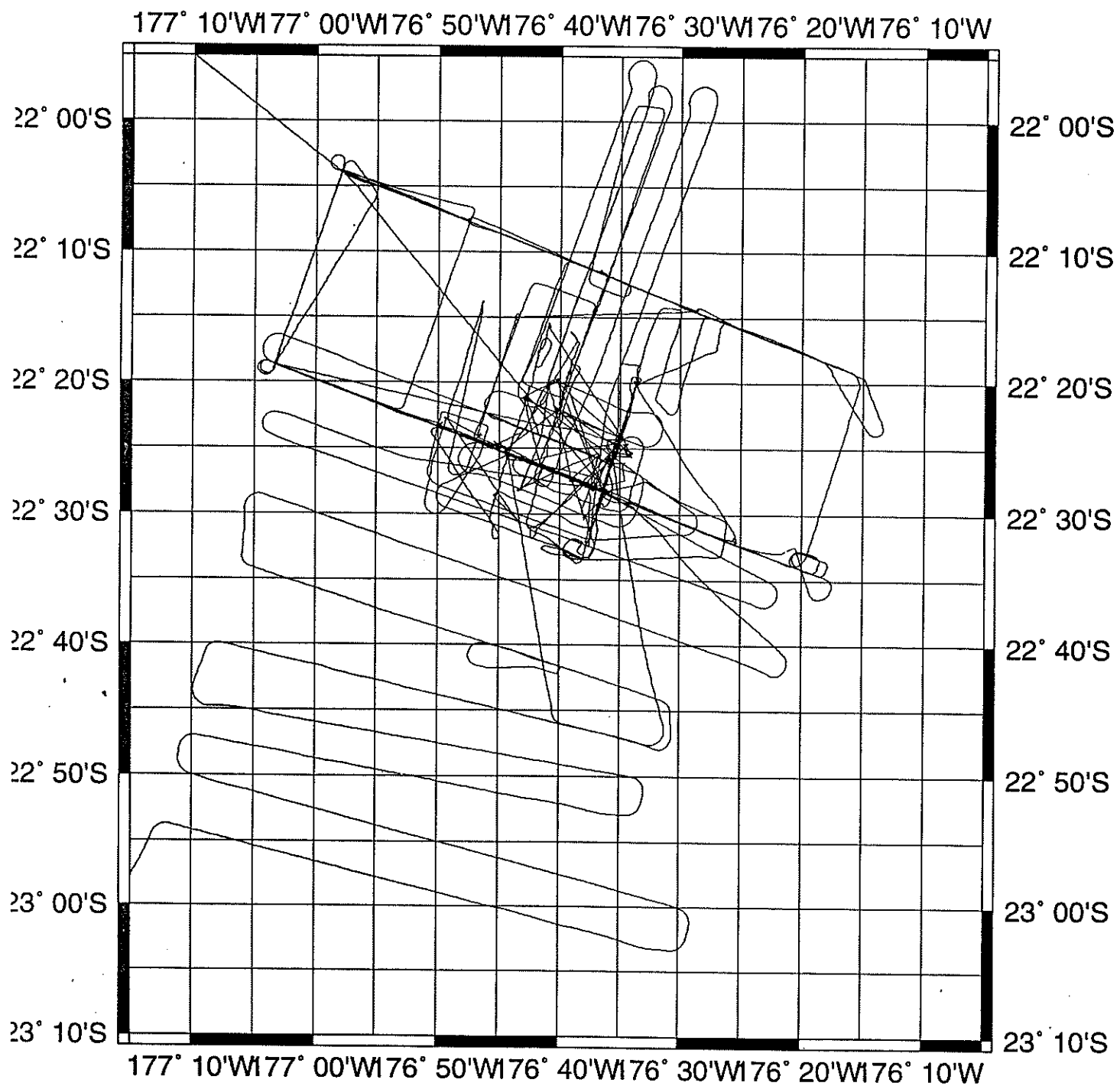
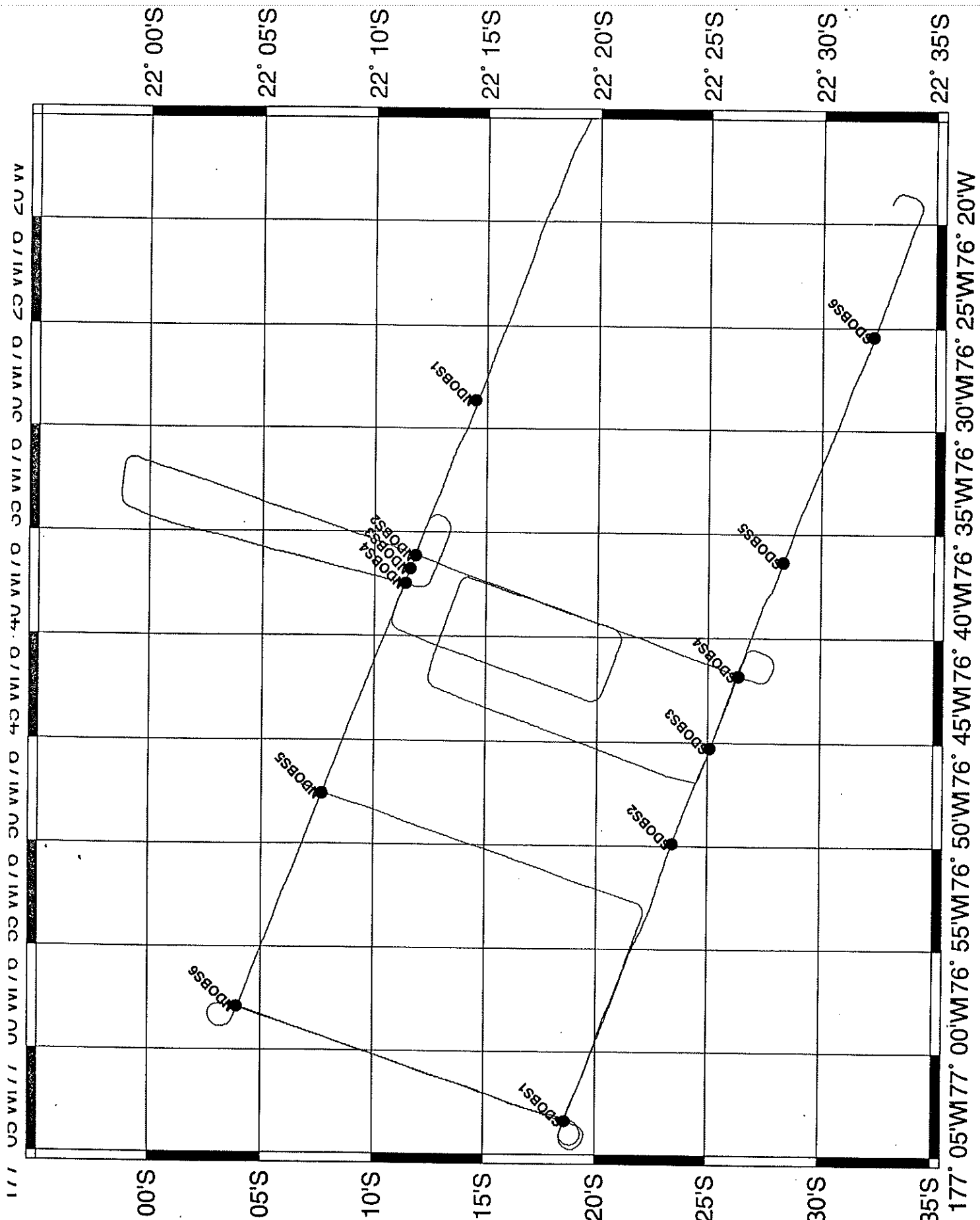


Diagram 1









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