

R/V Kairei KR99-12 Cruise
Onboard Cruise Report

1. Introduction

The R/V Kairei KR99-12 cruise was for 21 days, which started at Papeete port of French Polynesia on 3rd January 2000 and ended at Majuro port of Marshall Island on 24th January 2000. The cruise was supported by the "Superplume Project" of the Science and Technology Agency and the "Study on seafloor dynamics" of the Japan Marine Science and Technology Center.

The aim of the cruise was as follows:

- (1) to collect rock samples for petrological and geochronological studies of the South Pacific Superplume by dredging;
- (2) to obtain sediment cores for paleomagnetic and paleoceanographical studies for last ca. 5 m.y.;
- (3) to measure detailed topography, and geomagnetic and gravity anomalies for studying structure of the crust and upper mantle in the superplume province.

We performed dredging at seamounts of the Cook-Austral Islands (Area A) and the Gilbert Islands (Area E), and sediment sampling by a piston corer on the Manihiki Plateau (Area B).

In the following pages, we present

- List of onboard scientists,
- Outline of the cruise (daily schedule),
- Ship's track,
- Bathymetric map of the South Pacific based on the ETOPO-5 gridded data,
- Free-air gravity anomaly map of the South Pacific from satellite altimetry.

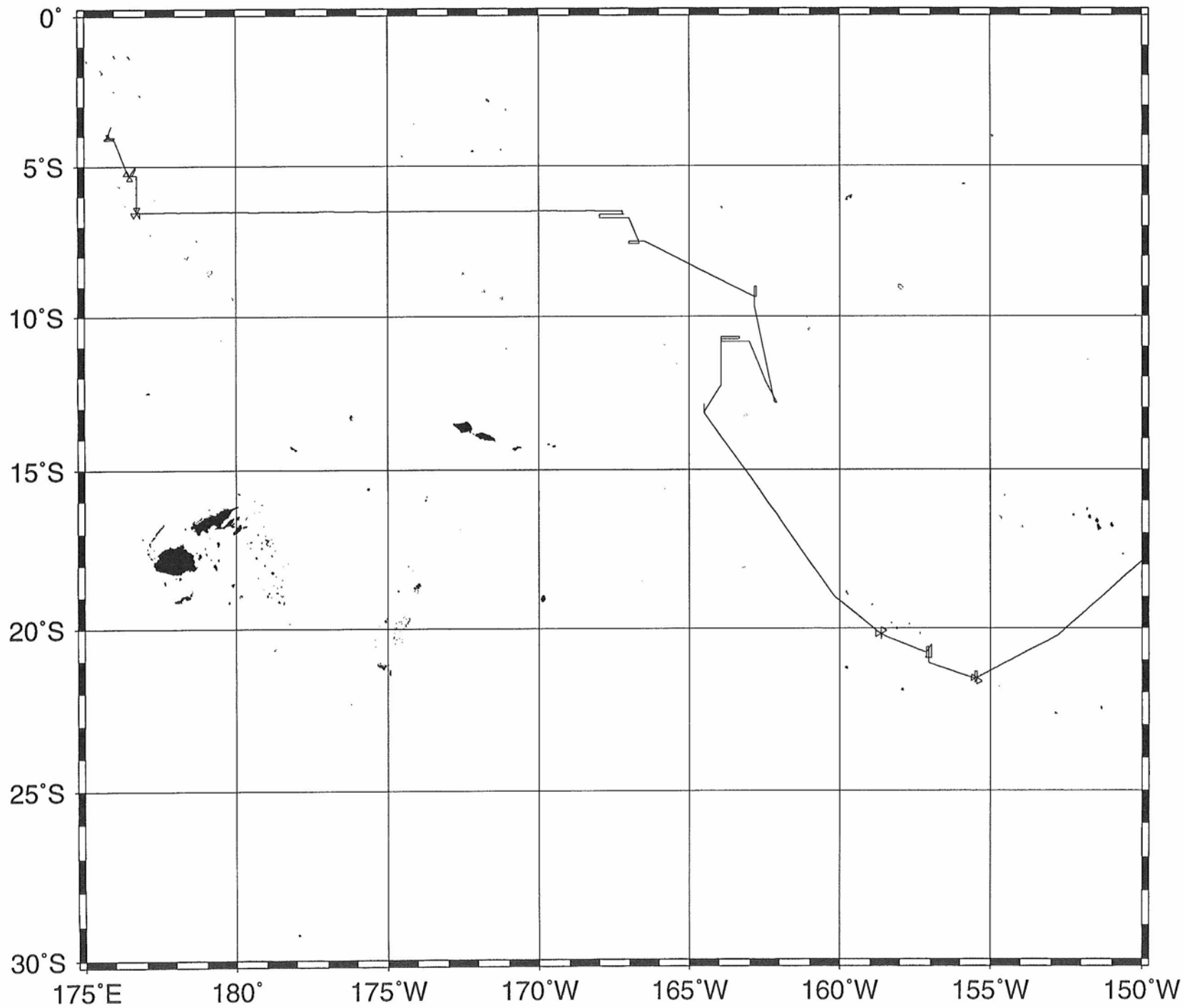
The cruise was very successful. We could collect rocks and sediments as planned, which are described in the following chapters.

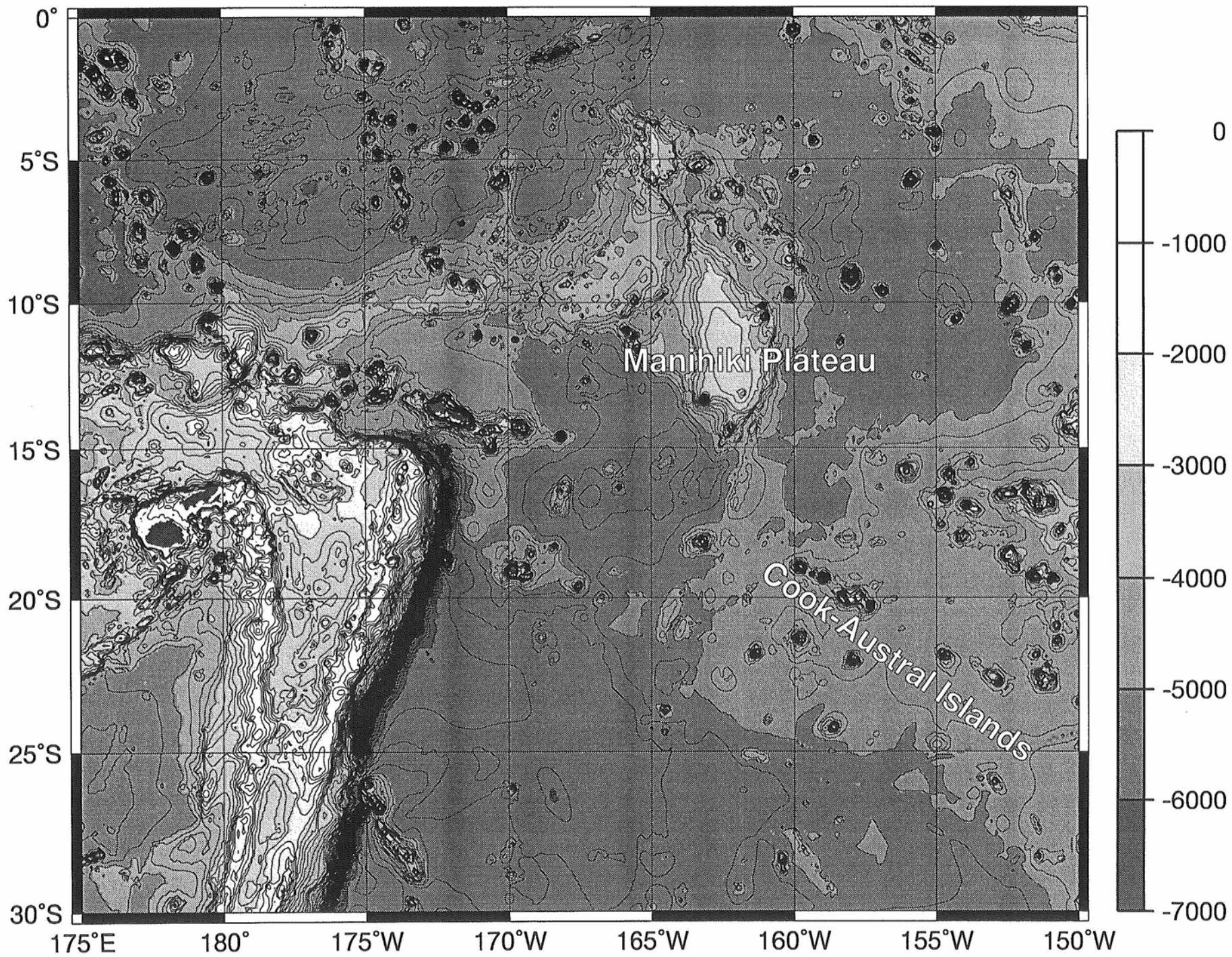
List of onboard scientific team

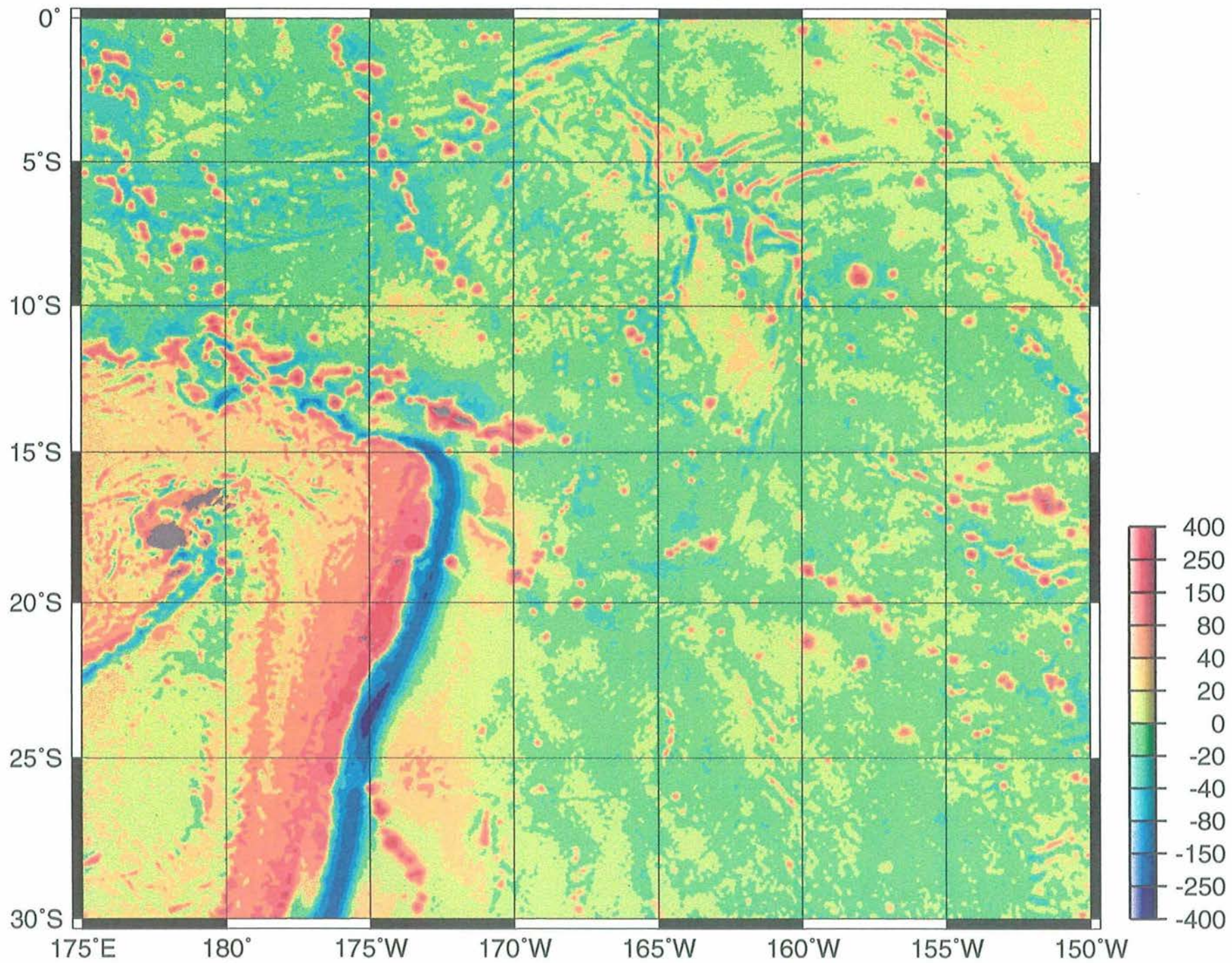
Name		Affiliation
Toshitsugu Yamazaki	Chief Scientist	Geological Survey of Japan
Kozo Uto	Scientist	Geological Survey of Japan
Kazumi Akimoto	Scientist	Kumamoto University
Hirokuni Oda	Scientist	Geological Survey of Japan
Osamu Ishizuka	Scientist	Geological Survey of Japan
Shungo Kawakata	Scientist	Tsukuba University
Shigeaki Yamada	Student	Kumamoto University
Toshikatsu Sugawara	Marine Technician	Marine Works Japan
Motoi Matsuhashi	Marine Technician	Marine Works Japan
Aya Kato	Marine Technician	Marine Works Japan
Toru Koizumi	Marine Technician	Marine Works Japan

Outline of KR99-12 cruise

Date (local)	Area	Operation	Site number
2000.1.3	Left Papeete	Transit	
1.4		Transit	
1.5	Cook-Austral Islands (Area A)	Dredge	D01, D02, D03
1.6	Cook-Austral Islands (Area A)	Dredge	D04, D05
1.7	Cook-Austral Islands (Area A)	Dredge	D06, D07, D08
1.8		Transit	
1.9	Manihiki Plateau (Area B)	Piston core	PC01
1.10	Manihiki Plateau (Area B)	Piston core	PC02, PC03
1.11	Manihiki Plateau (Area B)	Piston core	PC04
1.12	Manihiki Plateau (Area B)	Piston core	PC05
1.13	Manihiki Plateau (Area B)	Piston core	PC06, PC07
1.14	Manihiki Plateau (Area B)	Piston core	PC08
1.15		Transit	
1.16	(Passed the Date Line)	Transit	
1.18	Gilbert Islands (Area E)	Dredge	D09, D10
1.19	Gilbert Islands (Area E)	Dredge	D11, D12, D13
1.20	Gilbert Islands (Area E)	Dredge	D14, D15
1.21	Gilbert Islands (Area E)	Mapping	
1.22		Transit	
1.23		Transit	
1.24	Arrived at Majuro		







2. Site survey

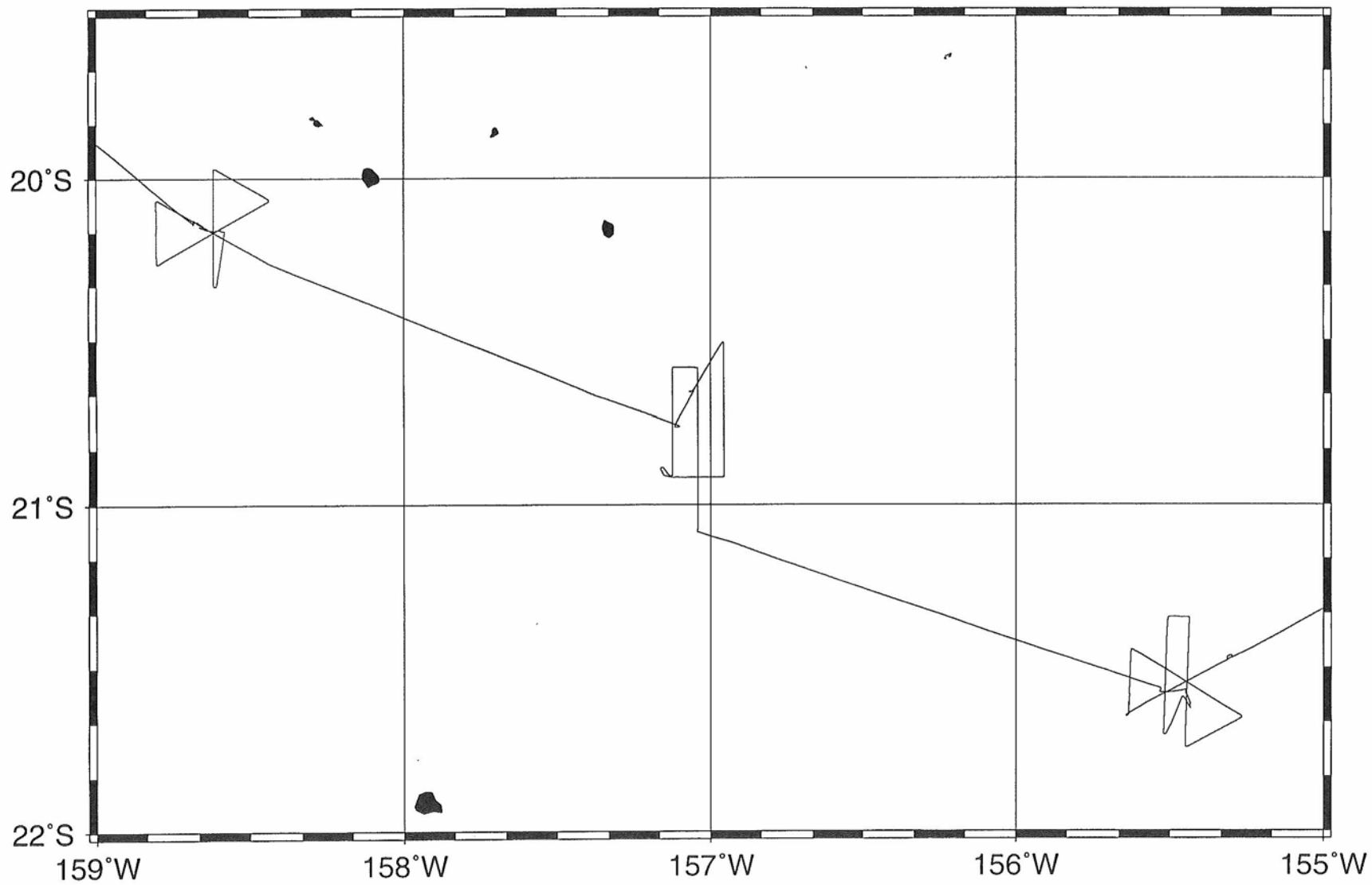
To determine sites for dredging and piston coring, we performed site survey mainly in night time. Measurement items are;

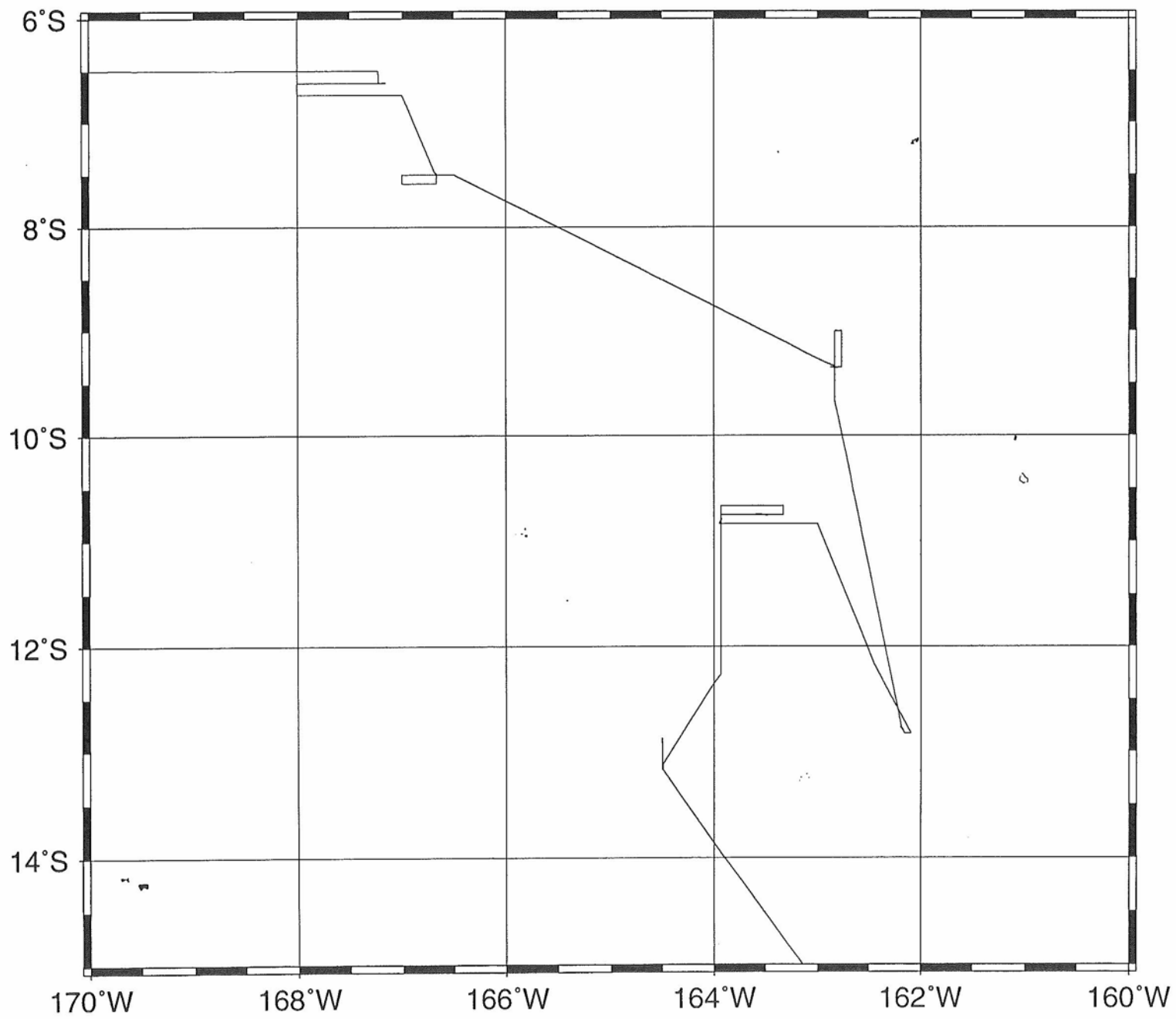
- (1) Topography using a SeaBeam 2112 system,
- (2) Magnetic anomaly using a proton precession magnetometer (Kawasaki Chishitsu PRT010) and a shipboard three component magnetometer (Tierra Technica SFG1214),
- (3) Gravity measurement using shipboard gravimeter (BODENSEEWERK KSS31).

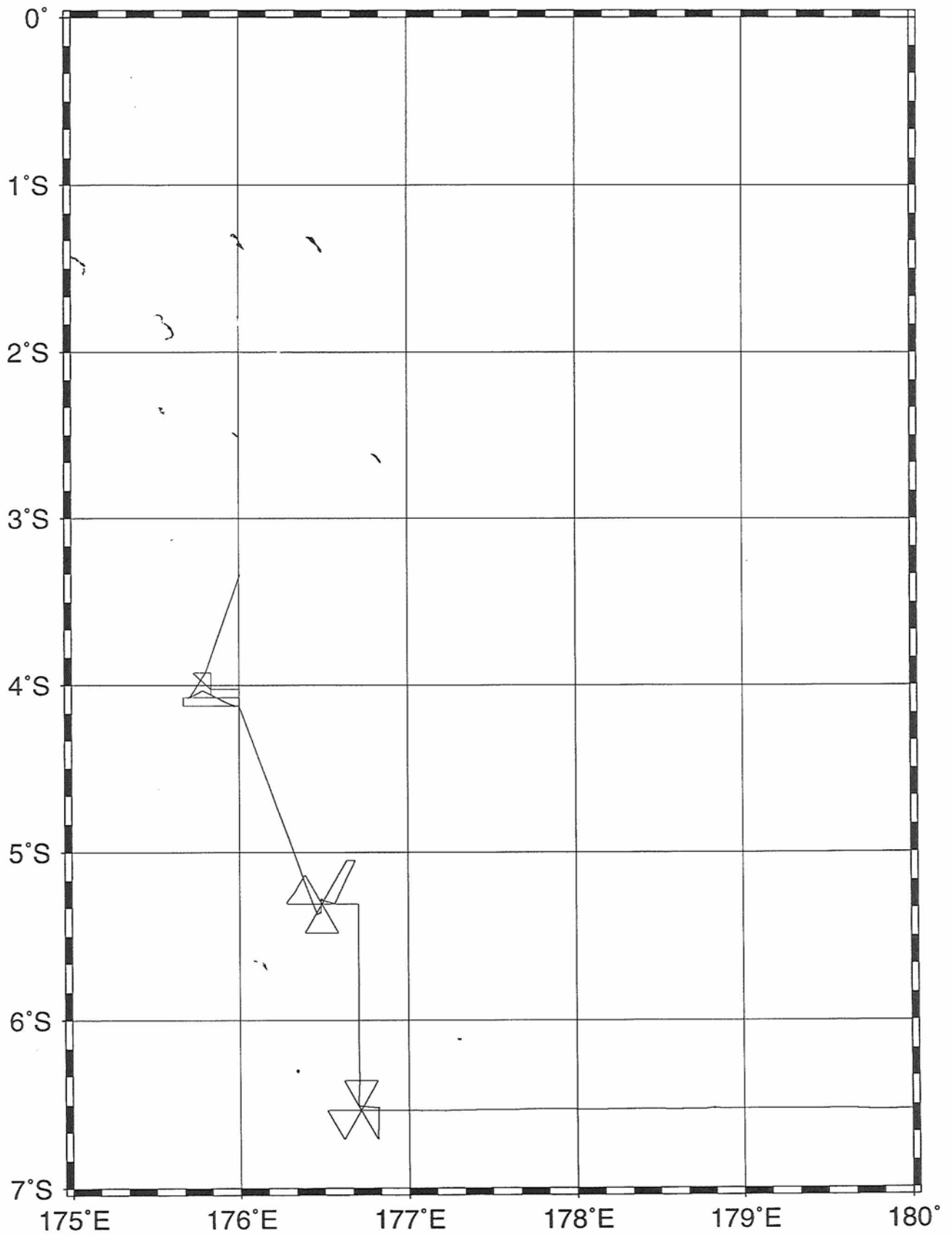
Detailed geological and geophysical studies were not performed before in the most part of the target areas of this cruise, and only bathymetric maps of low resolution such as ETOPO5 were available. Therefore, seamounts for dredging were chosen based mainly on the free-air gravity anomaly map from satellite altimetry.

We carried out XBT measurements at two sites (Areas A and E) to obtain sound velocity profiles in water for correction of bathymetry. Around the sites for piston coring, seismic reflection survey of subsurface sediment layers was conducted using a 3.5kHz subbottom profiler.

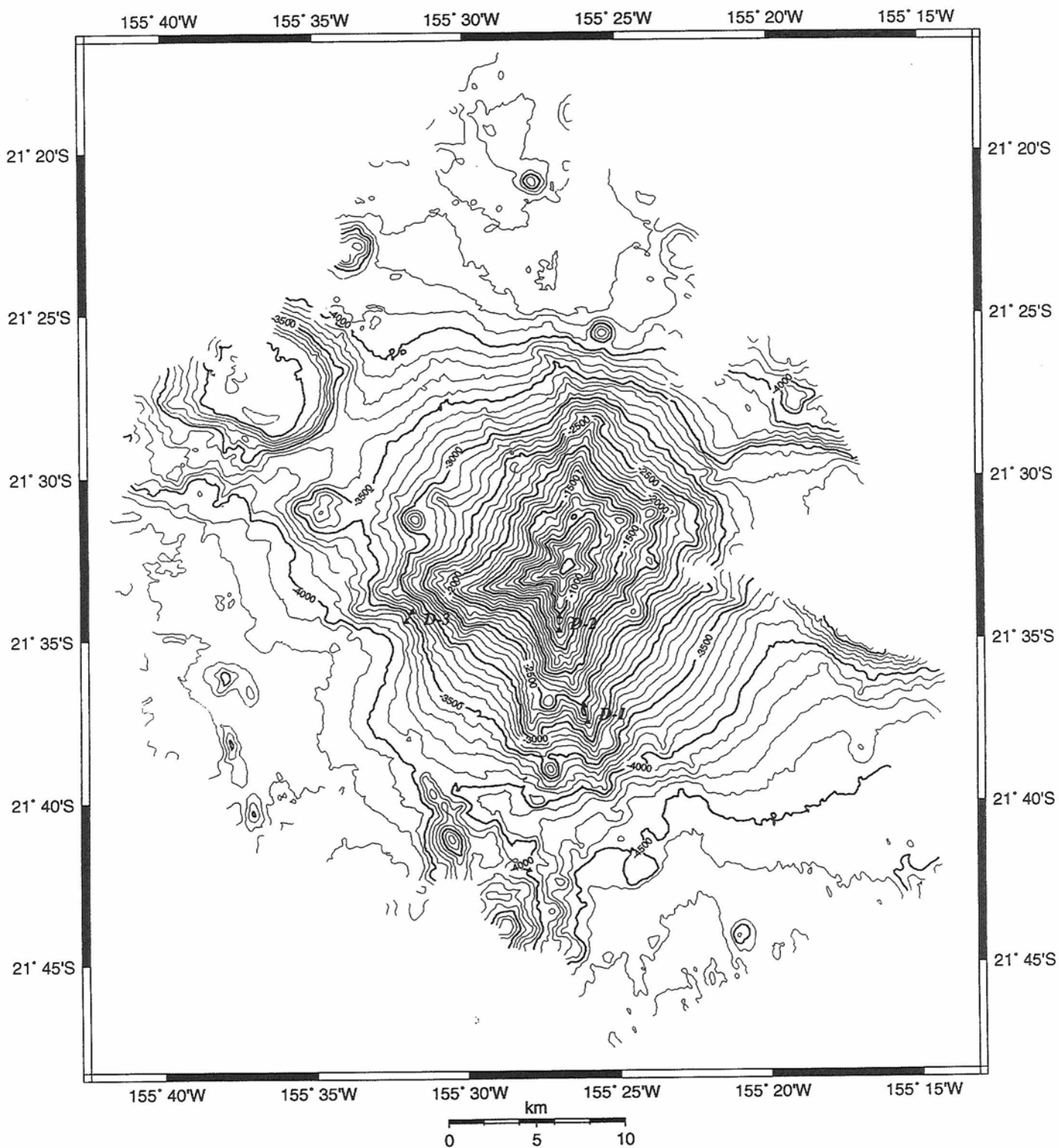
In the following pages, we present (1) survey lines for each survey area (Areas A, B, and E), and (2) topographic map around each sampling site.



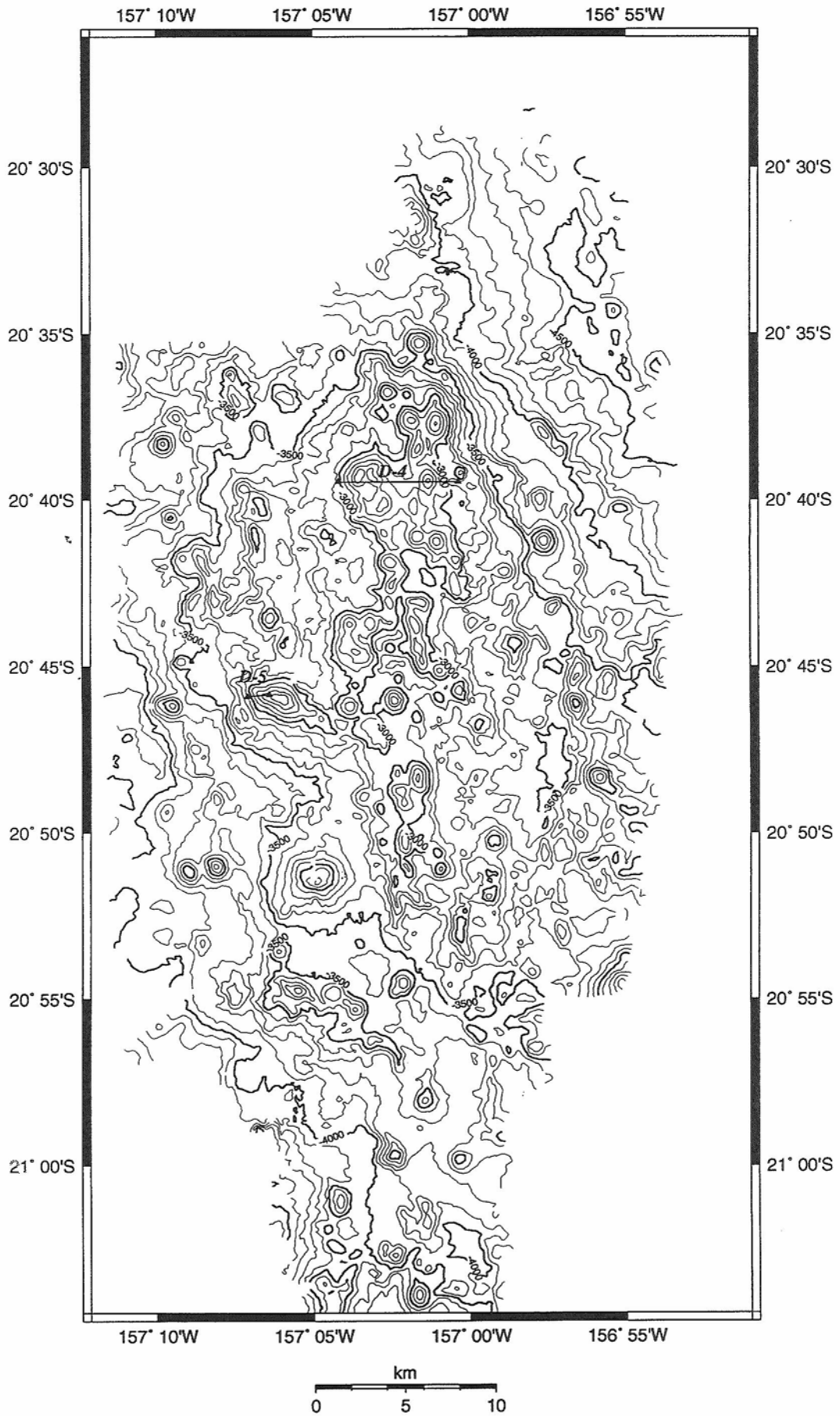




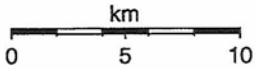
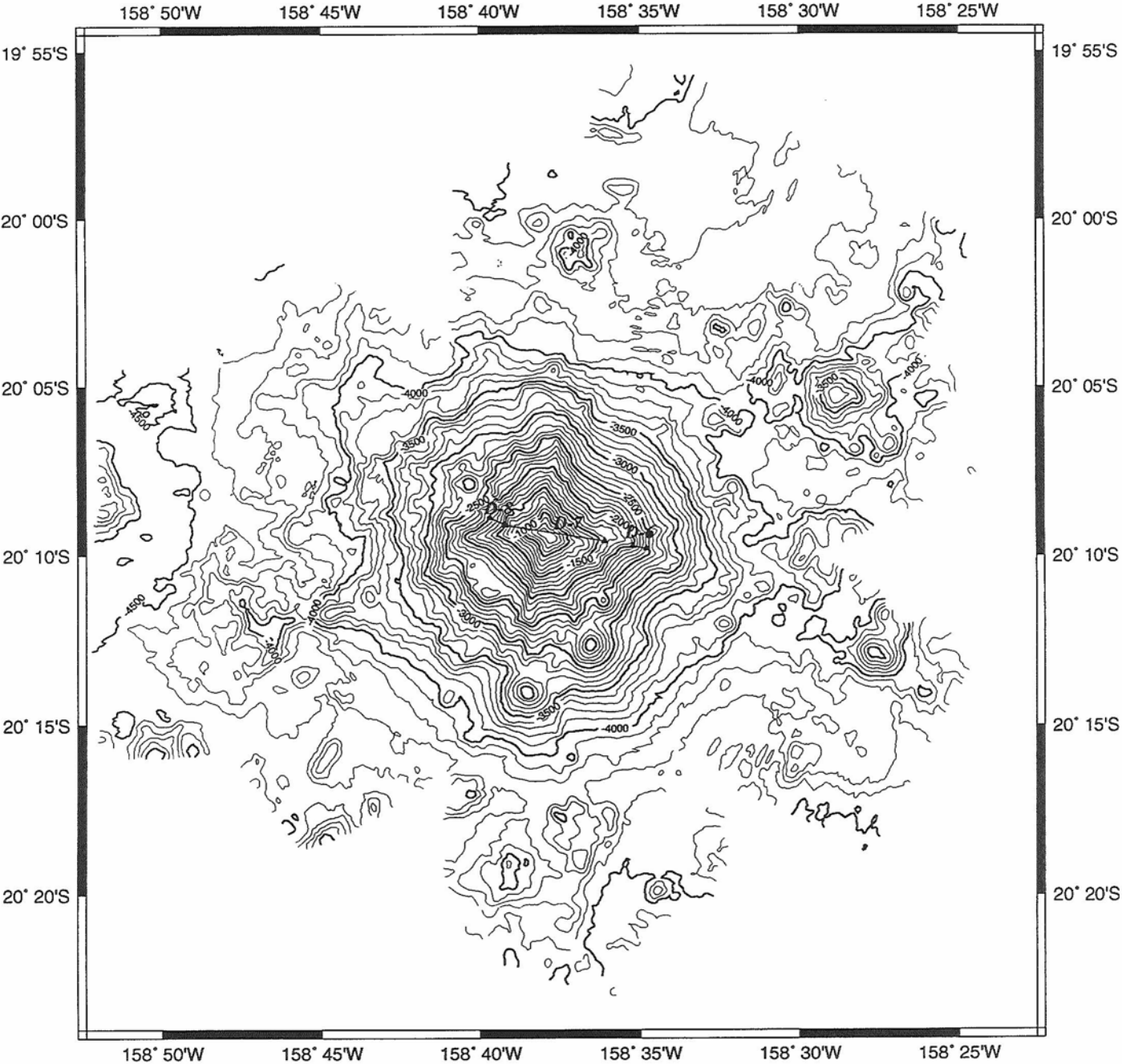
KR9912A_D1,2,3



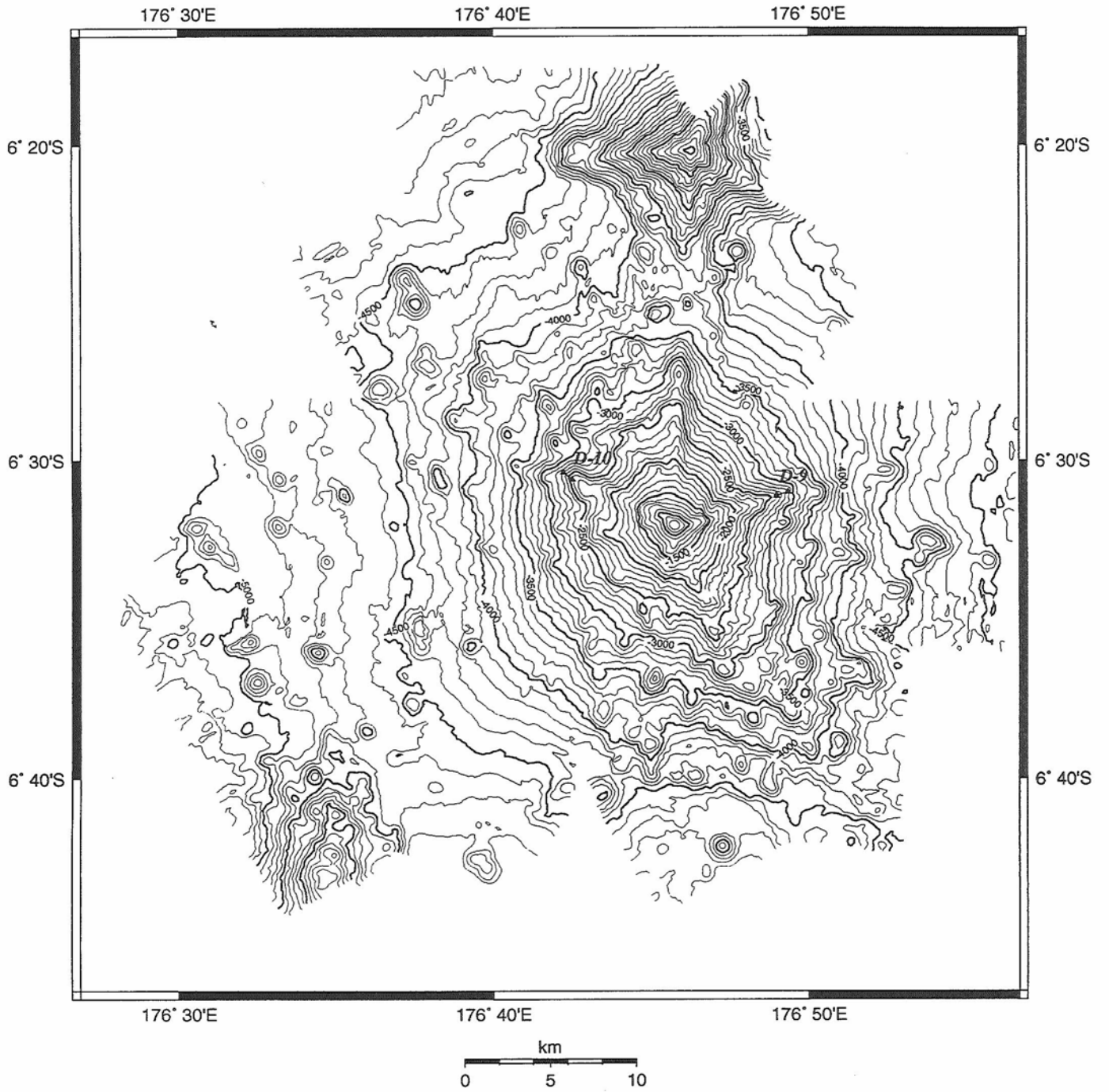
KR9912A_D4,5



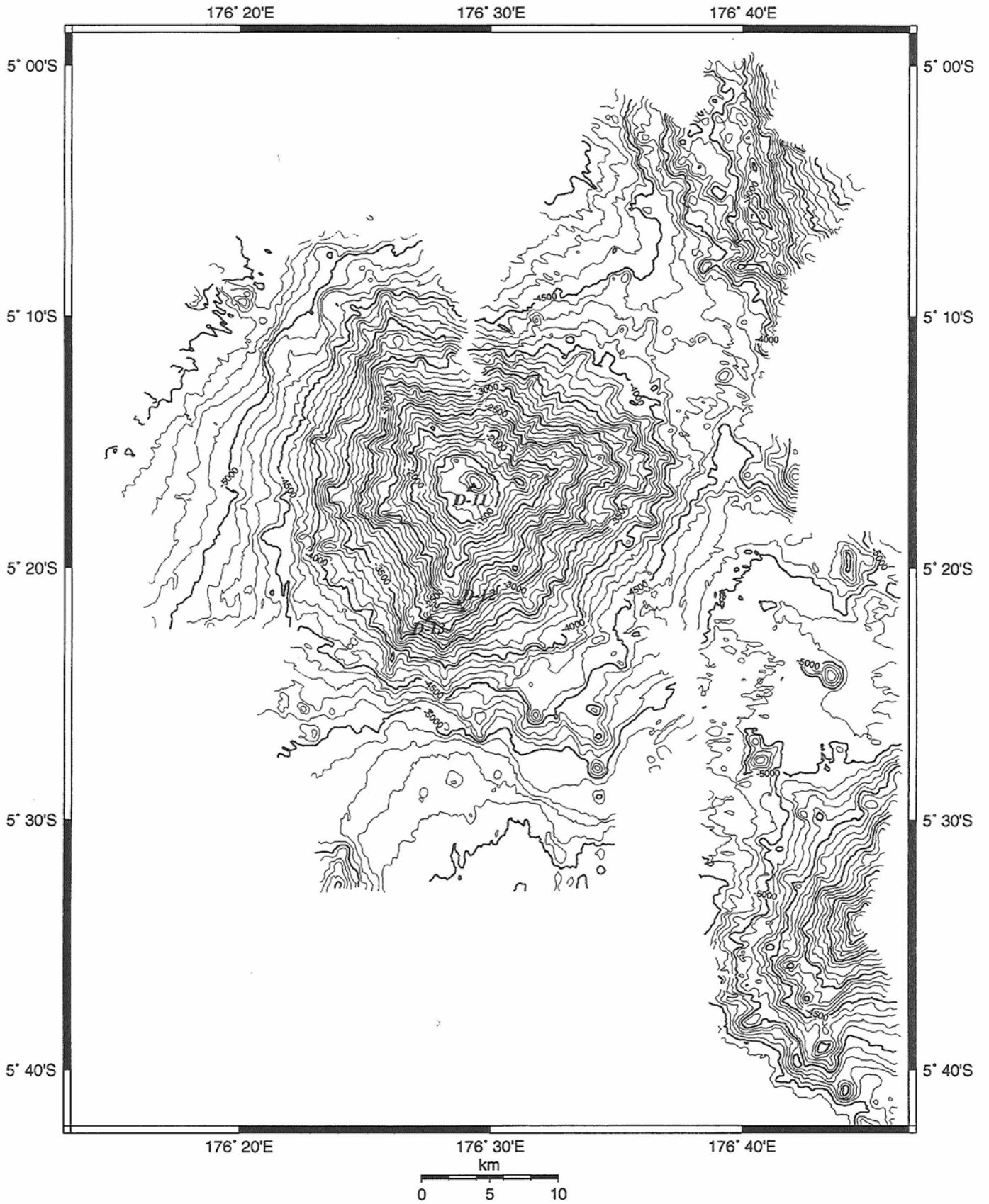
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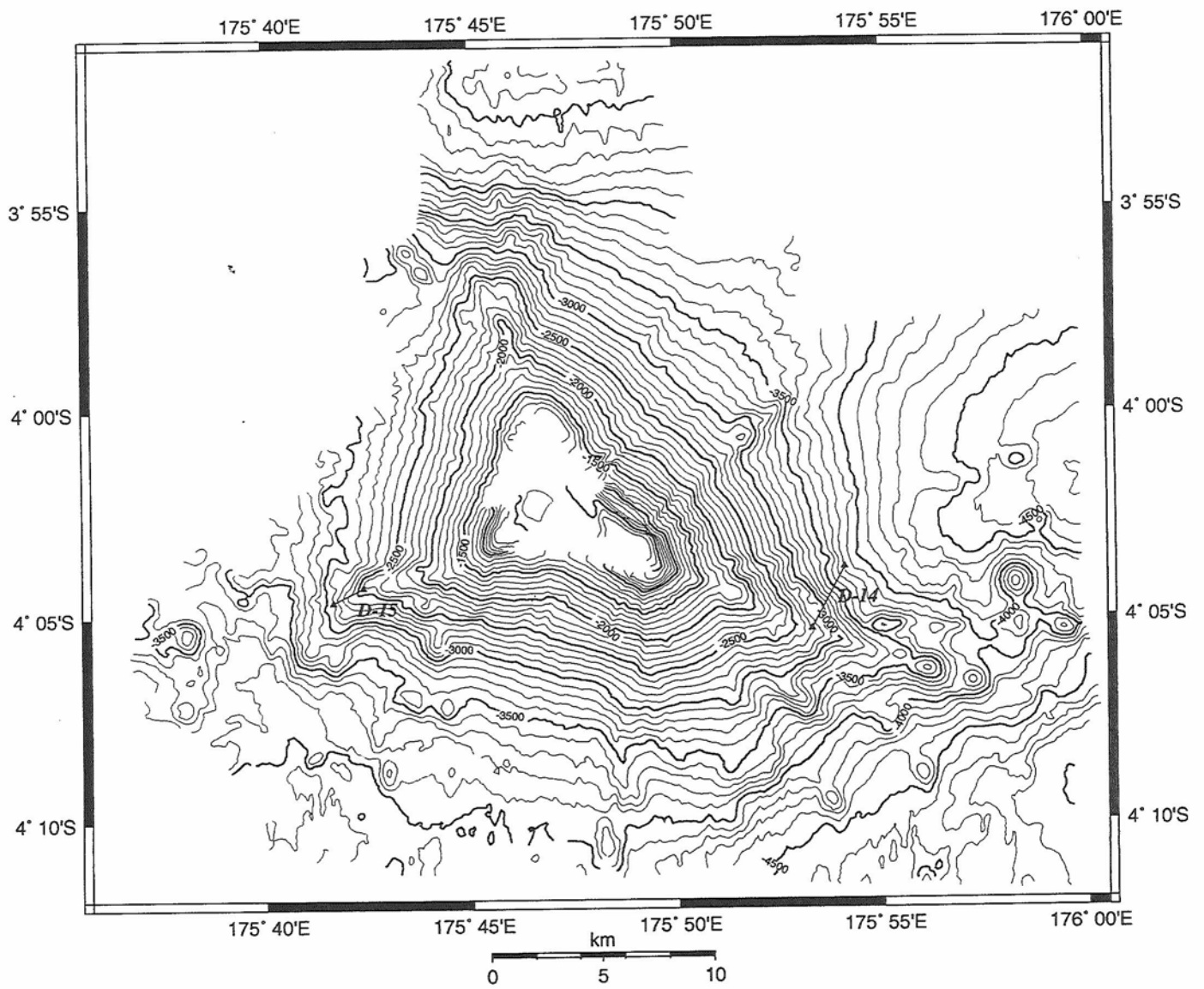
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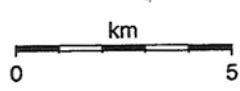
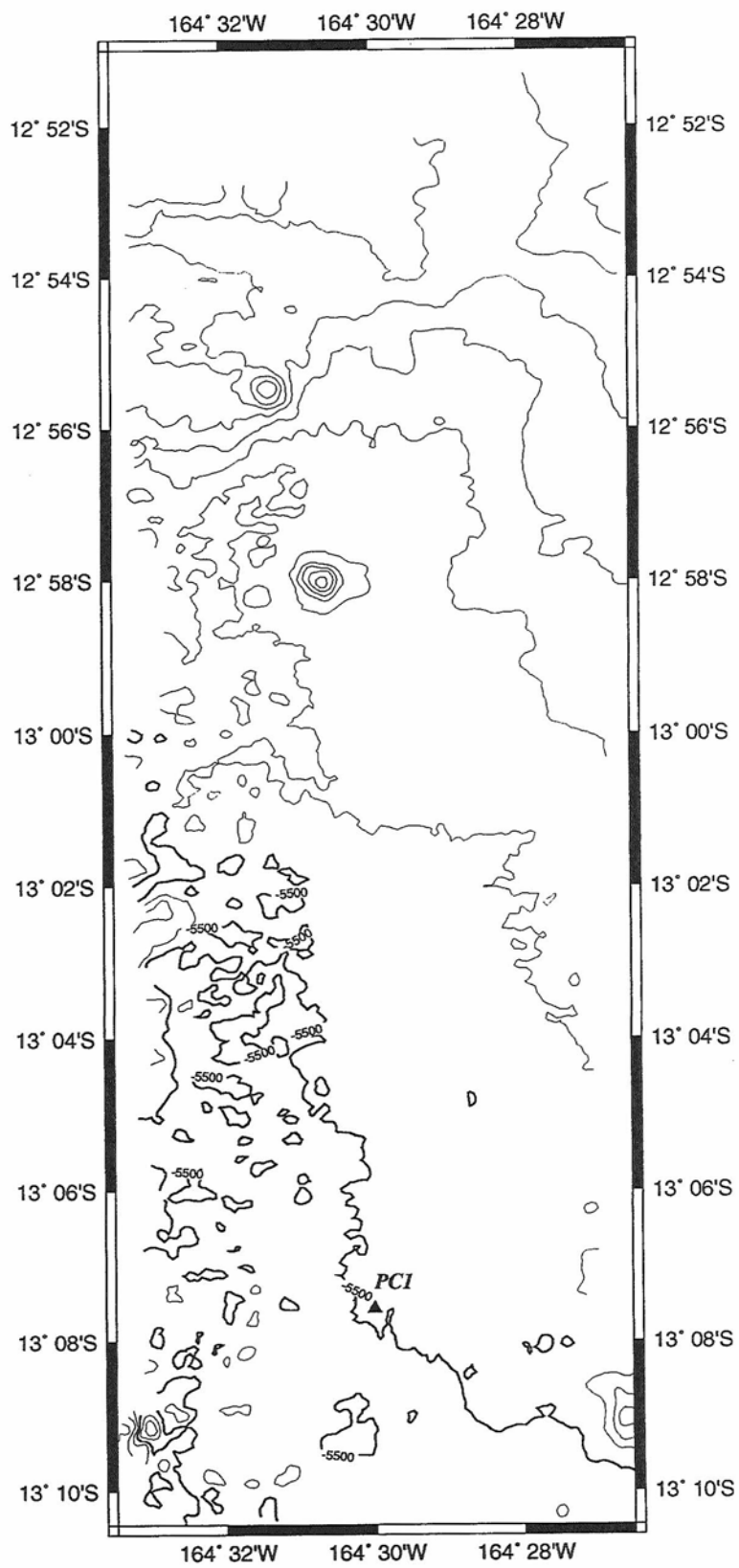
KR9912E_D11,12,13



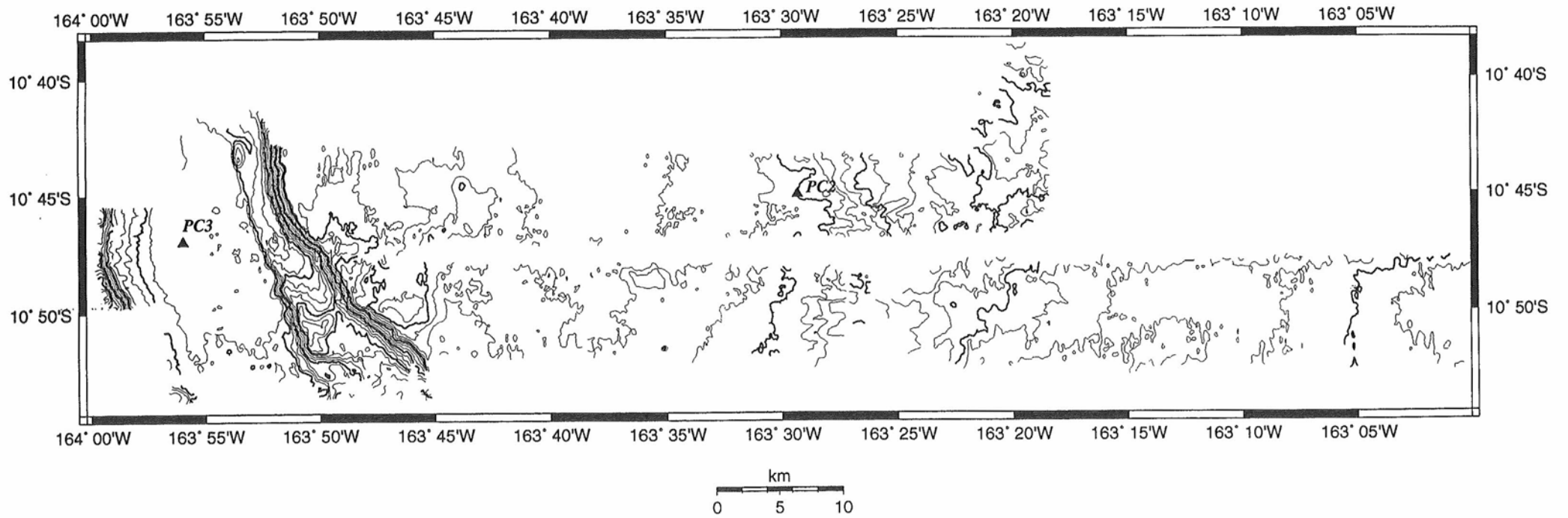
KR9912E_D14,15



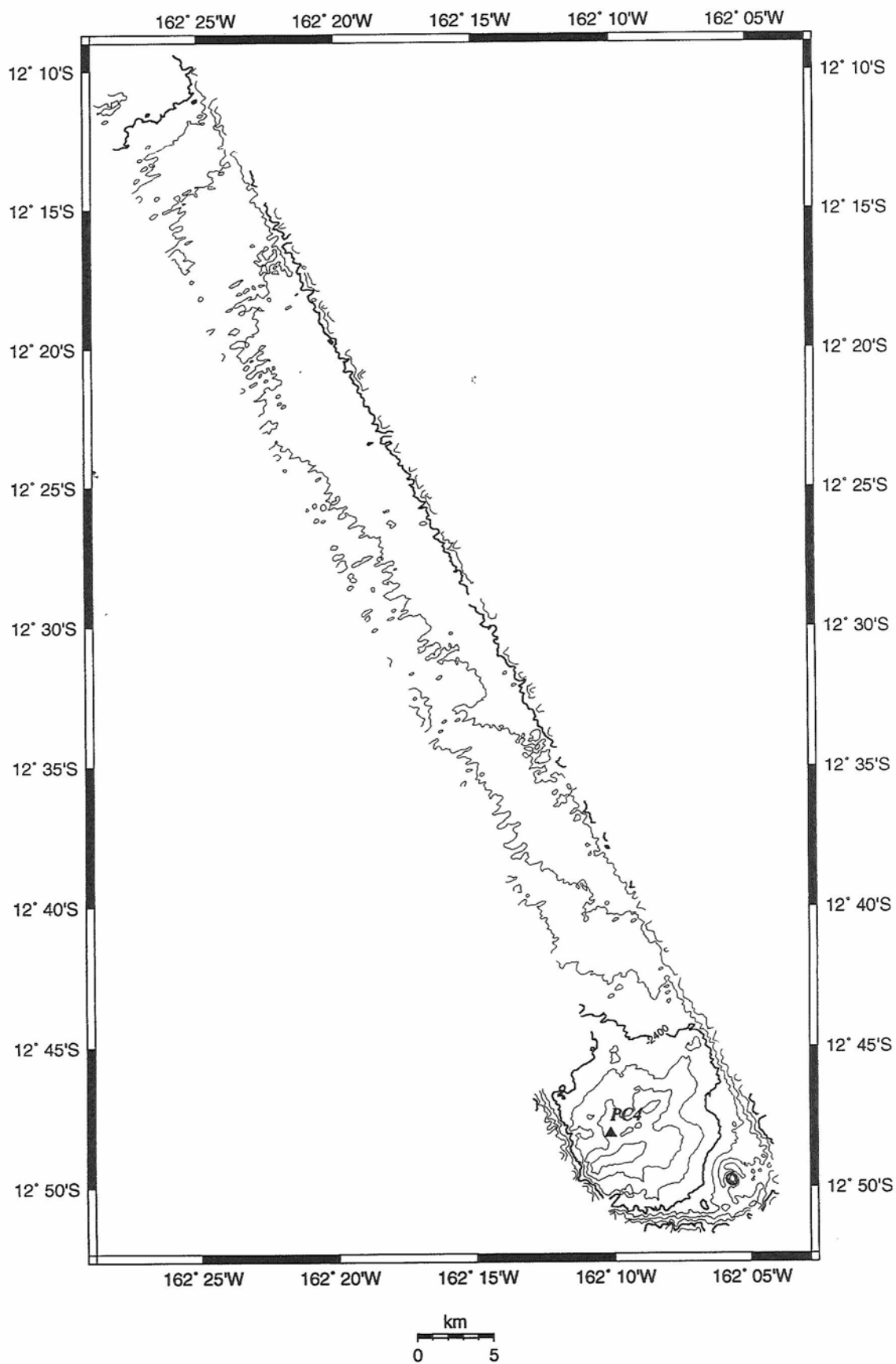
KR9912B_PC1



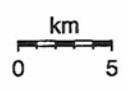
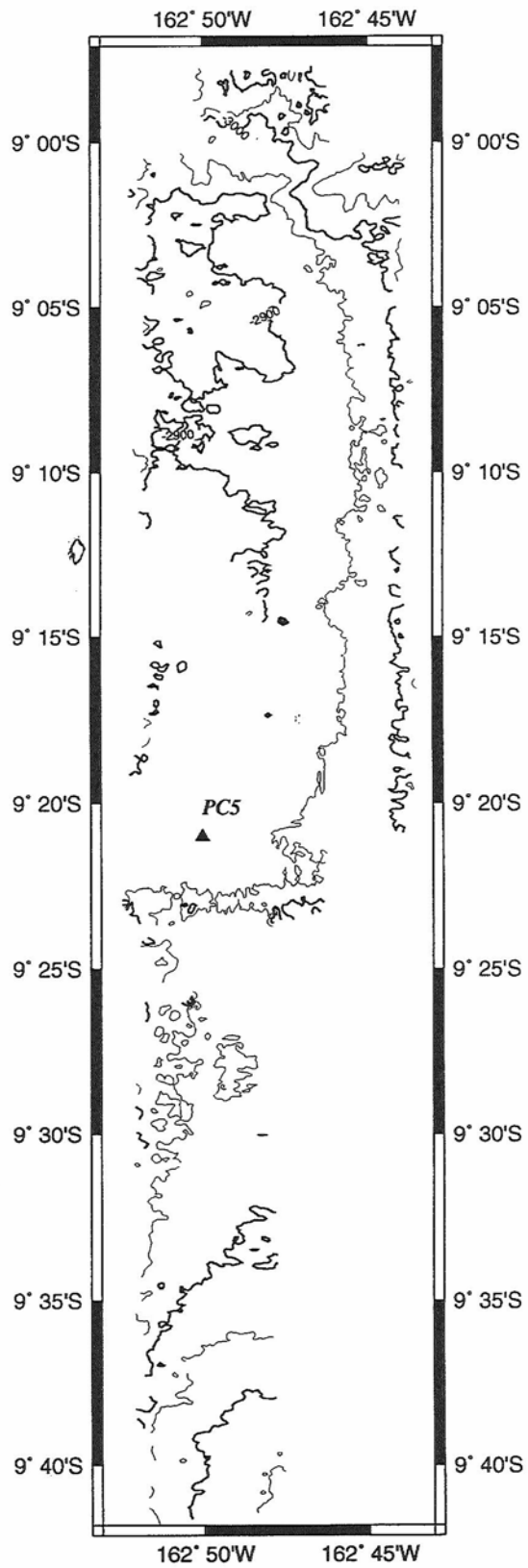
KR9912B_PC2,3



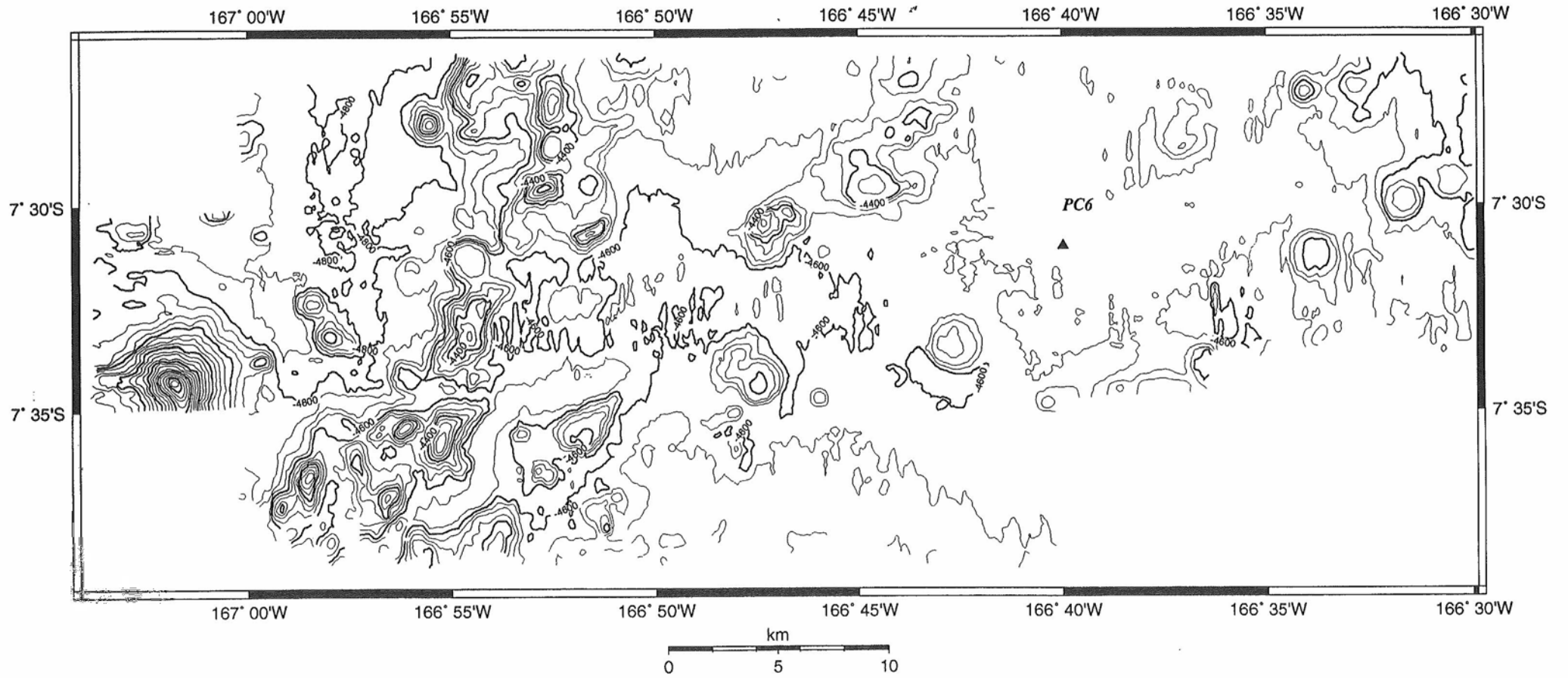
KR9912B_PC4



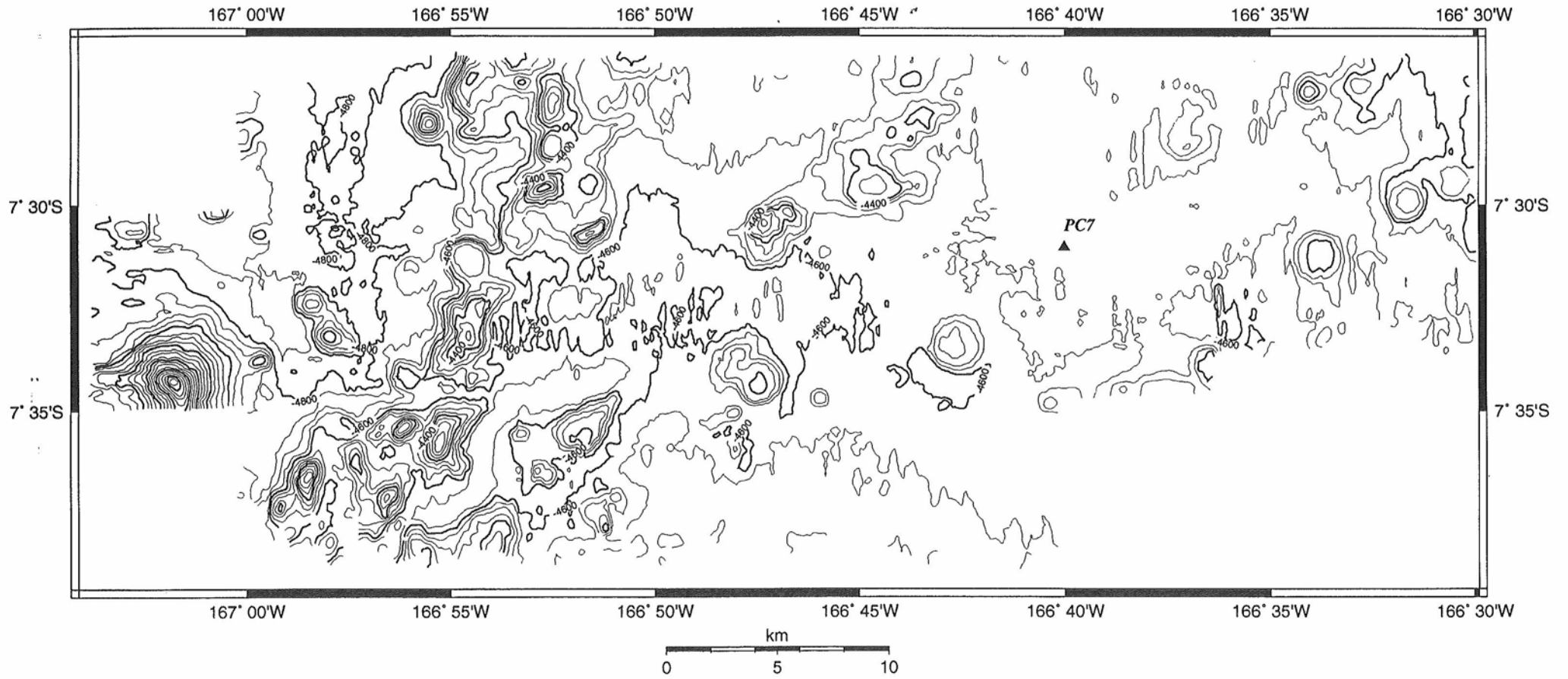
KR9912B_PC5



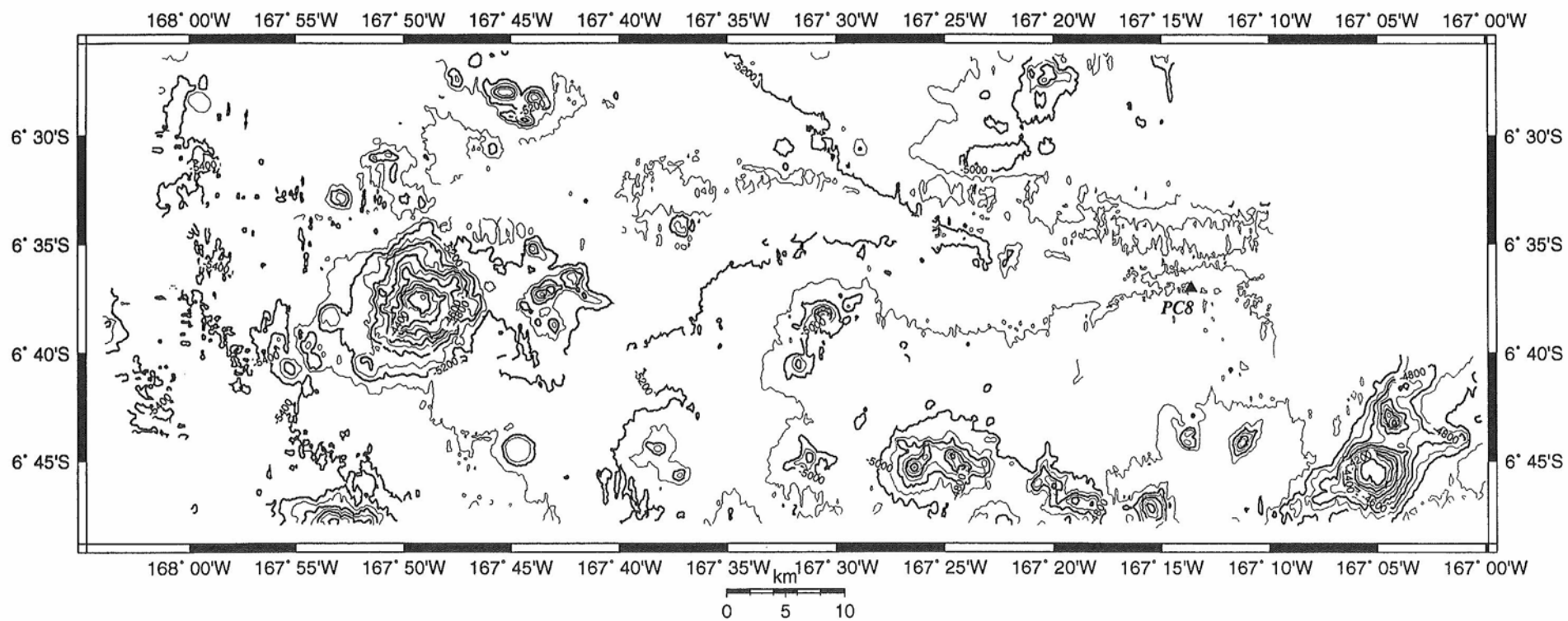
KR9912B_PC6



KR9912B_PC7



KR9912B_PC8



3. Dredge

Total 19 dredge hauls were performed on seamounts of the Cook-Austral Islands and the Gilbert Islands. Because no bathymetry was available beforehand for the seamounts, we performed site survey in the night time, made bathymetric maps, and determined two or three dredging sites on each seamounts. The sites were mainly on small ridges on the seamounts.

We presents table of summary and sample description for each site.

KR99-12 Dredge Summary (1)

Area	Dredge No.	Latitude	Longitude	Water depth (m)	Location	Number of samples	Dredge Haul with sample numbers in parentheses.
A	D-01	21°37.5516'S 21°37.0463'S	155°26.0129'W 155°26.1235'W	2671 2518	Maria W Seamount	2	Mn-oxides-coated vesiculated cpx-bearing basalt (1) and aphyric basalt (2).
A	D-02	21°34.7220'S 21°34.2950'S	155°26.9256'W 155°26.9140'W	1173 983	Maria W Seamount	>13	vesiculated olivine-bearing (1,4-6) or aphyric (2,3,5) basalt lava blocks, scoriaceous vitric tuff(7) and volcanic conglomerate (8).
A	D-03	21°34.4163'S 21°34.1227'S	155°31.9801'W 155°31.7754'W	3551 3362	Maria W Seamount	0	No sample recovered.
A	D-04	20°39.4538'S 20°39.4545'S	157°04.1801'W 157°03.5265'W	3004 2579	Mauke SE Seamount	>100	Vesiculated cpx-ol (1,3,4,8,22,28) or ol (2,5-7,10-15,23-27,29-34) basalt lava blocks. Minor amount of lapilli stone (16),volcanic conglomerate(17,20,35) and sandstone (21), and calcareous silt(18,19)
A	D-05	20°45.9147'S 20°45.8513'S	157°07.0955'W 157°06.4000'W	3077 2680	Mauke SE Seamount	16	Three large Mn-oxides crusts (14-16) and five smaller crusts (9-13). Substrate of these crusts are volcanoclastics(basalt lava fragments and volcanic sand). Eight vesiculated ol basalt lava block(1-8). Some of the lavas are very rich in olivine phenocryst (up to 20%).
A	D-06	20°09.7870'S 20°09.7163'S	158°34.7974'W 158°35.2240'W	2426 2017	Aitu SW Smt.	21	Slightly vesiculated pl-cpx-amp trachyte lava (1-10)and volcanic conglomerate (11). About 25 Mn-oxides nodules were collected by small dredger. Core of the nodules are trachyte lava fragment.
A	D-07	20°09.5727'S 20°09.0945'S	158°36.1032'W 158°39.2440'W	1633 1430	Aitu SW Smt.	0	Dredger lost.
A	D-08	20°08.9051'S 20°09.1073'S	158°39.6815'W 158°39.1946'W	1959 1480	Aitu SW Smt.	7	Calcareous conglomerate containing pl-bearing hawaiite lava fragment (1-5), and foraminiferal sandstone (6).

Positions mean "hit bottom" (upper) and "left bottom" (lower).

KR99-12 Dredge Summary (2)

Area	Dredge No.	Latitude	Longitude	Water depth (m)	Location	Number of samples	Dredge Haul with sample numbers in parentheses.
E	D-09	6° 31.0021'S	176° 49.3407' E	2893	Nanumanga SE Smt.	>19	Vesiculated pictite (1) and ol basalt (2-16) and minor amount of irregular-shaped calcareous rocks (17-19).
		6° 31.1186'S	176° 48.9775' E	2629			
E	D-10	6° 30.3742'S	176° 42.2230' E	2717	Nanumanga SE Smt.	3	Three vesiculated picritic to ol basalt block (1-3)
		6° 30.6041'S	176° 42.5058' E	2442			
E	D-11	5° 16.8986'S	176° 29.1837' E	1231	Nanumea NE Smt.	9	Recrystallized and very hard limestone (1-6). Some samples contain Mollusca Fossil. (Main dredger was lost. Small dredger collected limestone.)
		5° 16.7504'S	176° 29.3320' E	1085			
E	D-12	5° 21.6233'S	176° 28.9020' E	2684	Nanumea NE Smt.	0	No sample was recovered.
		5° 21.3227'S	176° 28.7455' E	2439			
E	D-13	5° 22.0358'S	176° 27.4987' E	2960	Nanumea NE Smt.	>6	Calcareous conglomerate (1-4) and sandstone (5,6). Conglomerate samples contain vesiculated
		5° 21.9495'S	176° 27.6004' E	2846			
E	D-14	4° 05.6091'S	175° 54.0718' E	3041	Tamana S Smt.	11	Basalt fragments embedded in calcareous sand (4,5,7,8), calcareous sandstone (9,10) and Mn-oxides crust. (1,2,3,6,11)
		4° 05.3069'S	175° 53.2701' E	2707			
E	D-15	4° 04.6312'S	175° 41.6458' E	2941	Tamana S Smt.	>15	Brown-colored lapilli tuff (2,5,6,10) and calcareous sandstone with lithics of limestone (11-13,15). were mainly collected. Lapilli tuff contain ol-cpx basalt lava block(4) and aphyric basalt lava (3). Mn-oxides crust were also collected(1,8,9,14).
		4° 04.2697'S	175° 42.3747' E	2398			

Positions mean "hit bottom" (upper) and "left bottom" (lower).

CRUISE & LEG NO.	STATION NO.	LOCALITY	DAY	MONTH	YEAR	NO.
KR99-12	D-04	Mauke SW smt.	6	Jan	2000	1

Sample No.	Size of rock sample			Weight (g)	Roundness	Mn-coating	Comment
	a (cm)	b (cm)	c (cm)				
1	14	10	10		SR	6mm	vesiculated cpx-ol basalt lava
2	16	11	9		SR	3mm	highly vesiculated ol basalt lava
3	20	16	8		SR	10mm	vesiculated cpx-ol basalt lava
4	13	11	8		SR	2mm	vesiculated cpx-ol basalt lava
5	14	14	8		SR	2mm	vesiculated ol basalt lava
6	15	12	7		SR	10mm	vesiculated ol basalt lava
7	13	8	7		SR	2mm	vesiculated ol basalt lava
8	14	11	7		SR	5mm	vesiculated cpx(?) ol basalt lava
9	11	7	6		SR	2mm	vesiculated cpx(?) ol basalt lava
10	9	6	6		SR	1mm	vesiculated ol basalt lava
11	10	7	5		SR	5mm	vesiculated ol basalt lava
12	9	7	5		SR	film	vesiculated ol basalt lava
13	10	8	4		SR	1mm	vesiculated ol basalt lava
14	6	4	4		R	film	slightly vesiculated ol basalt
15	6	5	5		R	1mm	vesiculated ol-rich basalt lava
16	17	14	4		SA	film	stratified lapilli stone. Lithic: vesiculated basalt(ϕ 1-5mm, A-SA). Matrix: pale yellow calcareous material.
17	18	15	13		SR	2mm	volcanic conglomerate. Matrix: reddish yellow calcareous silt. Conglomerate: subrounded vesiculated lava (ϕ 3-5cm)
18	33	23	13		SR		Conglomerate (calcareous silt matrix and SR to SA pebble)
19	18	16	6				calcareous siltstone (upper) and volcanic sandstone (lower).
20	20	13	5			7mm	volcanic conglomerate.
21	11	9	6			3mm	volcanic sandstone with pebbles. (ϕ 1-2cm)
22	25	20	20		SA	3mm	vesiculated cpx-bearing ol basalt
23	25	12	12		SA	3mm	vesiculated ol basalt
24	15	9	8		SA	3mm	vesiculated ol-rich basalt lava
25	14	9	8		SR	9mm	vesiculated ol-bearing aphyric basalt lava
26	18	13	7		SA	8mm	vesiculated ol-basalt lava
27	17	11	10		SA	5mm	vesiculated ol-rich basalt lava
28	11	10	8		SA	1mm	vesiculated cpx-ol basalt lava
29	11	10	8		SR	3mm	vesiculated ol-rich basalt lava
30	13	9	7		SA	2mm	vesiculated ol-rich basalt lava
31	10	8	8		SR	8mm	vesiculated ol-rich basalt lava
32	12	9	9		SR	2mm	vesiculated ol-rich basalt lava
33	11	7	7		SR	1mm	vesiculated ol basalt lava
34	7	6	6		SR	2mm	vesiculated ol-rich basalt lava
35	18	15	13		SR	4mm	volcanic conglomerate cemented by Mn-oxides and calcareous silt.

CRUISE & LEG NO.	STATION NO.	LOCALITY	DAY	MONTH	YEAR	NO.
KR99-12	D-9	Nanumanga SE Smt	18	Jan	2000	1

Sample No	Size of rock sample			Weight	Roundness	Mn-coating	Comment
	a (cm)	b (cm)	c (cm)				
1	60	56	45			50	moderately to severely altered non vesicular picrite lava, phenocryst contents change variously from more than 50 vol.% to about 20 vol.%
2	18	17	15		SR		altered vesiculated ol basalt lava
3	19	14	11		SA	4	slightly altered vesiculated ol basalt lava
4	18	14	13		SR	-	moderately to severely altered vesiculated ol basalt lava
5	15	10	10		SR	4	scoriaceous volcanic breccia., altered
6	17	13	11		SA	film	altered vesiculated ol basalt lava
7	15	11	8		SA	2	moderately altered, slightly vesiculated ol basalt lava
8	18	11	8		SA	1	altered vesiculated ol basalt lava
9	15	10	7		SR	4	altered ol basalt lava with large vesicles
10	16	12	9		SR	2	altered vesiculated ol basalt lava
11	13	10	7		SR	film	altered vesiculated ol basalt lava
12	11	8	8		SR	2	moderately altered vesiculated ol basalt lava
13	8	8	5		SR	none	altered vesiculated ol basalt lava
14	12	11	4		SR	none	altered vesiculated ol basalt lava
15	12	8	6		SR	3	altered vesiculated ol basalt lava
16	27	22	20		SR	not measured	altered vesiculated ol basalt lava, elongated pillow lava like morphology (radial joints, concentric vesicles)
17	11	7	3		SR	film	irregular shaped calcareous rock
18	14	6	6		SR	film	irregular shaped calcareous rock
19	8	4	3		SR	film	irregular shaped calcareous rock

4. Piston core

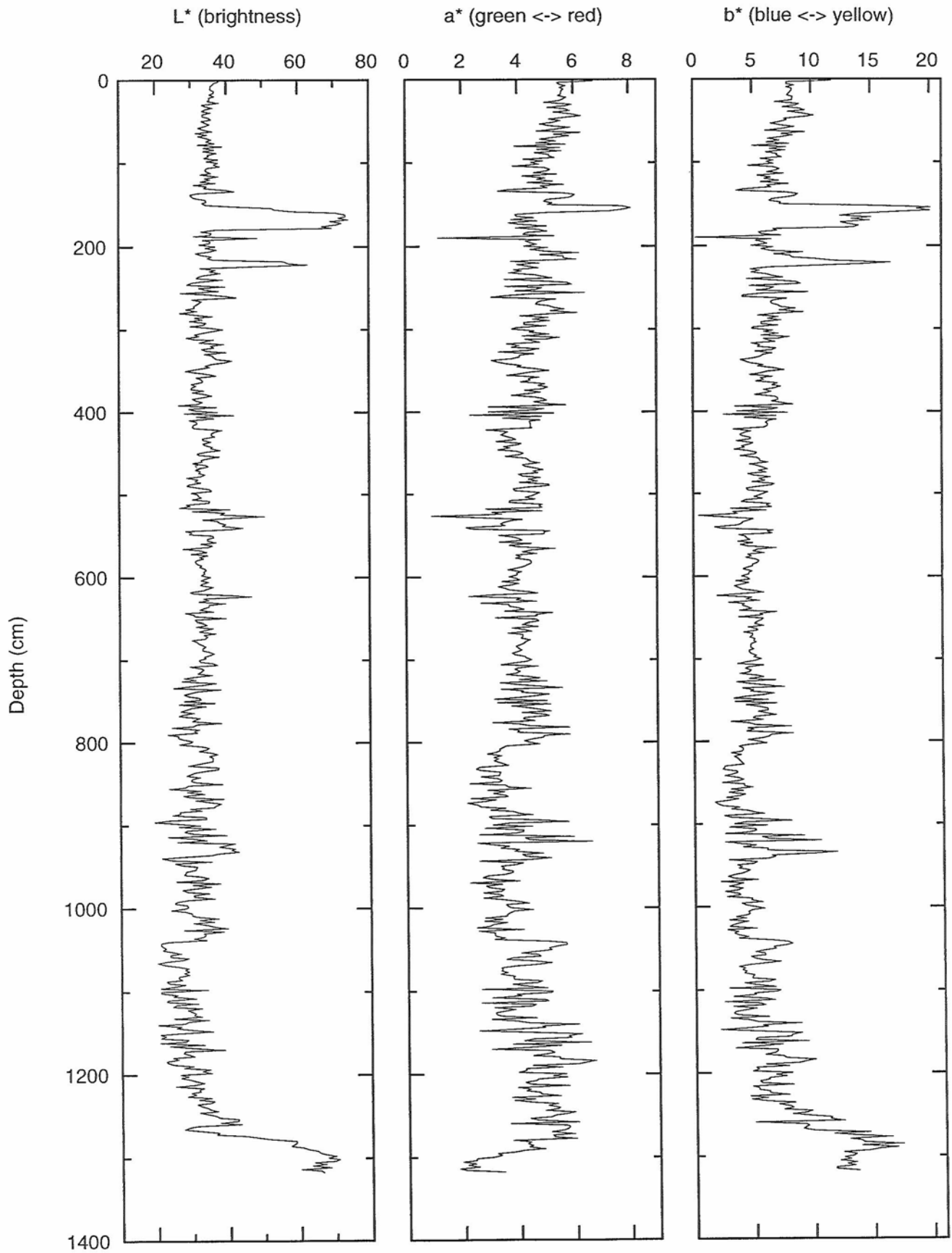
Eight piston cores were obtained from Manihiki Plateau. Water depths of the sites range from 2300 to 5500m. Piston corer of 15m or 20m in length was used, and almost full of sediments was recovered each time. After core recovery, sediment cores were cut at 1m intervals, and split into two halves lengthwise. One half was used for color reflectance measurements and paleo- and rock magnetic sampling by u-channels (PC02, PC03, PC04, PC07, and PC08) and 7cc discrete cubes (PC01 and PC05). After that, this half was stored as archive. Another half of the core was first photographed. Then visual description and sampling for micropaleontological studies and oxygen isotope analysis were performed.

We present a table of core summary, and results of color reflectance measurements in the following pages. Color reflectance was measured at 2cm intervals using a Minolta spectrophotometer CM-2002. Before obtaining measurements from each core, the spectrophotometer was calibrated by attaching a white calibration cap. The data are presented as total reflectance and the 650/450 nm red-to-blue ratios.

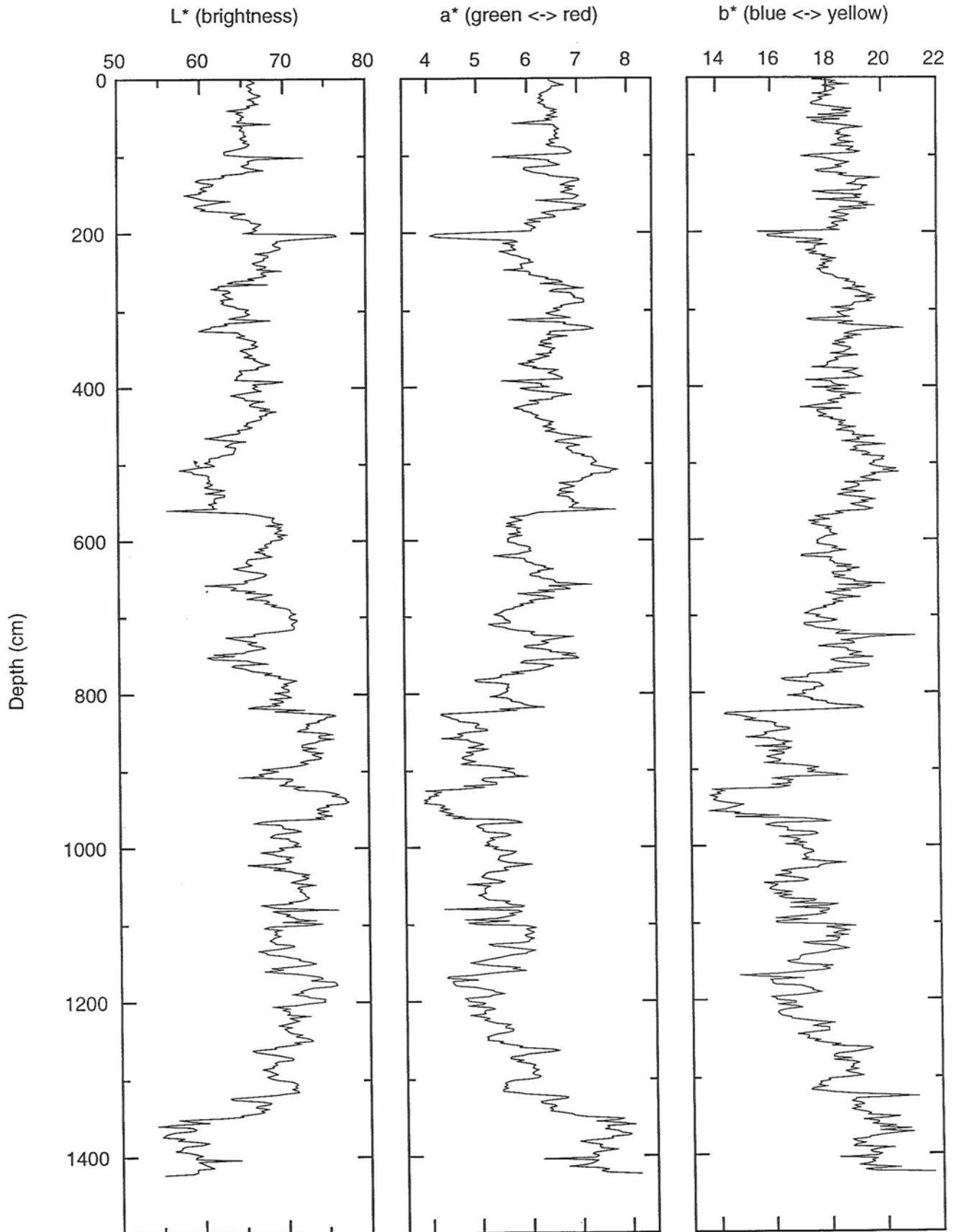
Summary of piston cores

Date	Core	Latitude (S)	Longitude (W)	Water depth (m)	Core length (cm)	Location	Description
09-Jan-2000	PC01	13-07.57	164-30.01	5496	1350	Southwestern foot of Manihiki Plateau	Mainly dark reddish brown homogeneous pelagic clay. A turbidite layer of pale yellowish white calcareous ooze is intercalated in the deeper part. Bioturbed in the deeper part. Calcareous ooze with cross laminae at the bottom.
10-Jan-2000	PC02	10-45.00	163-29.30	3383	1442	Southwestern slope of Manihiki Plateau	Yellowish brown calcareous ooze in the upper part, and homogeneous pale yellowish white calcareous turbidites with planktonic foraminifer in the middle and lower part.
10-Jan-2000	PC03	10-46.99	163-55.95	4467	1913	Southwestern slope of Manihiki Plateau	Mainly yellowish brown silty calcareous ooze. Dark reddish brown homogeneous pelagic clay with bioturbation is intercalated in the upper part. Pale yellowish white homogeneous calcareous turbidites with foraminiferal tests are in the lower part.
11-Jan-2000	PC04	12-48.08	162-10.13	2326	1416	Top of the southern Manihiki Plateau	Mainly pale yellowish white homogeneous calcareous ooze with foraminiferal tests.
12-Jan-2000	PC05	09-21.01	162-50.03	2933	1734	Top of the northern Manihiki Plateau	Mainly pale yellowish white homogeneous calcareous ooze with foraminiferal tests.
13-Jan-2000	PC06	07-31.00	166-39.96	4539	471	Northwestern slope of Manihiki Plateau	Disturbed. Malfunction of trigger of piston corer.
13-Jan-2000	PC07	07-31.02	166-40.00	4542	2015	Northwestern slope of Manihiki Plateau	Mainly dark reddish to yellowish brown pelagic clay with intense bioturbation. Pale yellowish white homogeneous turbidites with foraminiferal tests are intercalated.
14-Jan-2000	PC08	06-37.01	167-13.60	5098	1965	Northwestern foot of Manihiki Plateau	Mainly dark reddish homogeneous pelagic clay. Pale yellowish white turbidites with foraminiferal tests are intercalated in the lower part. Bioturbed in the lower part.

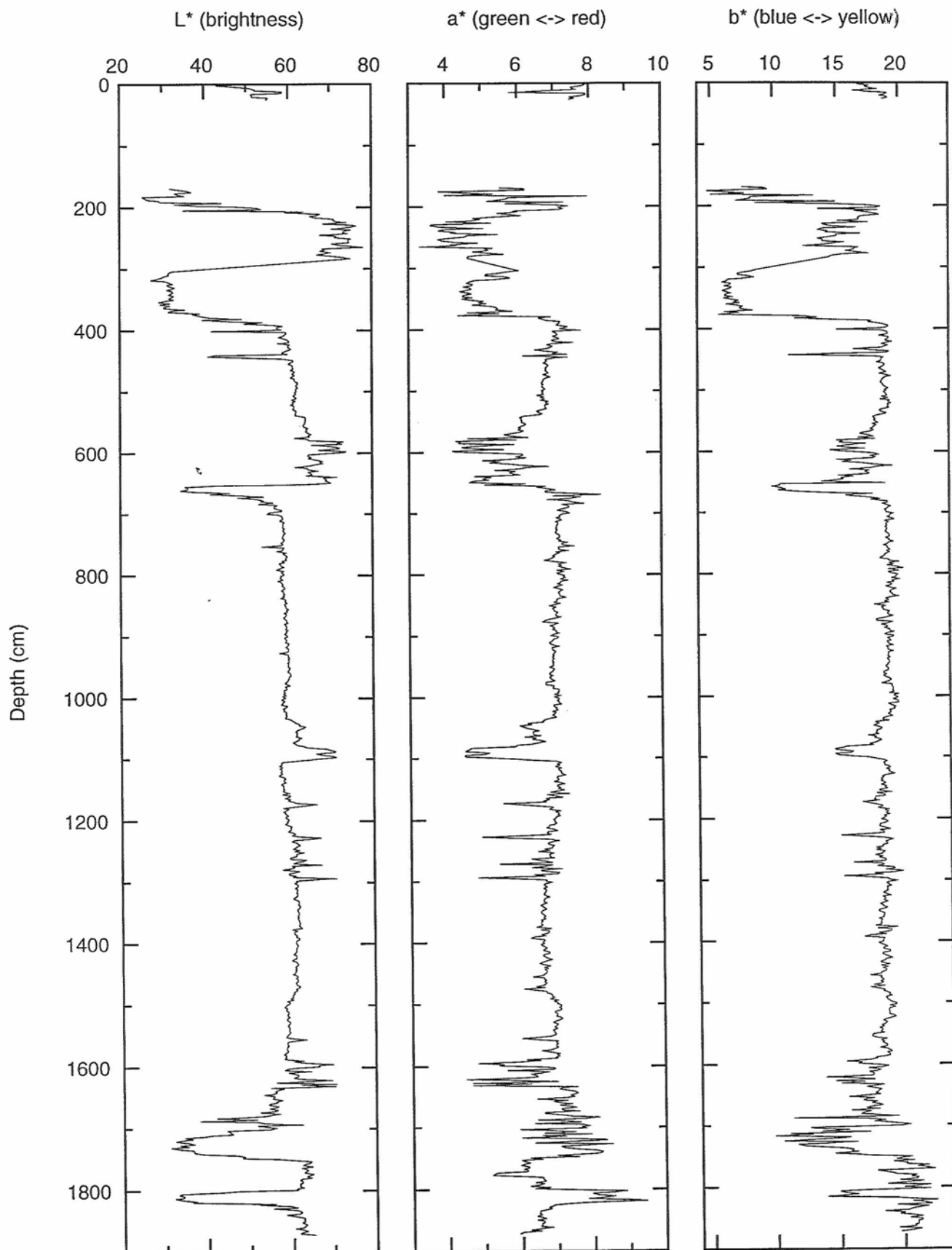
PC1: color



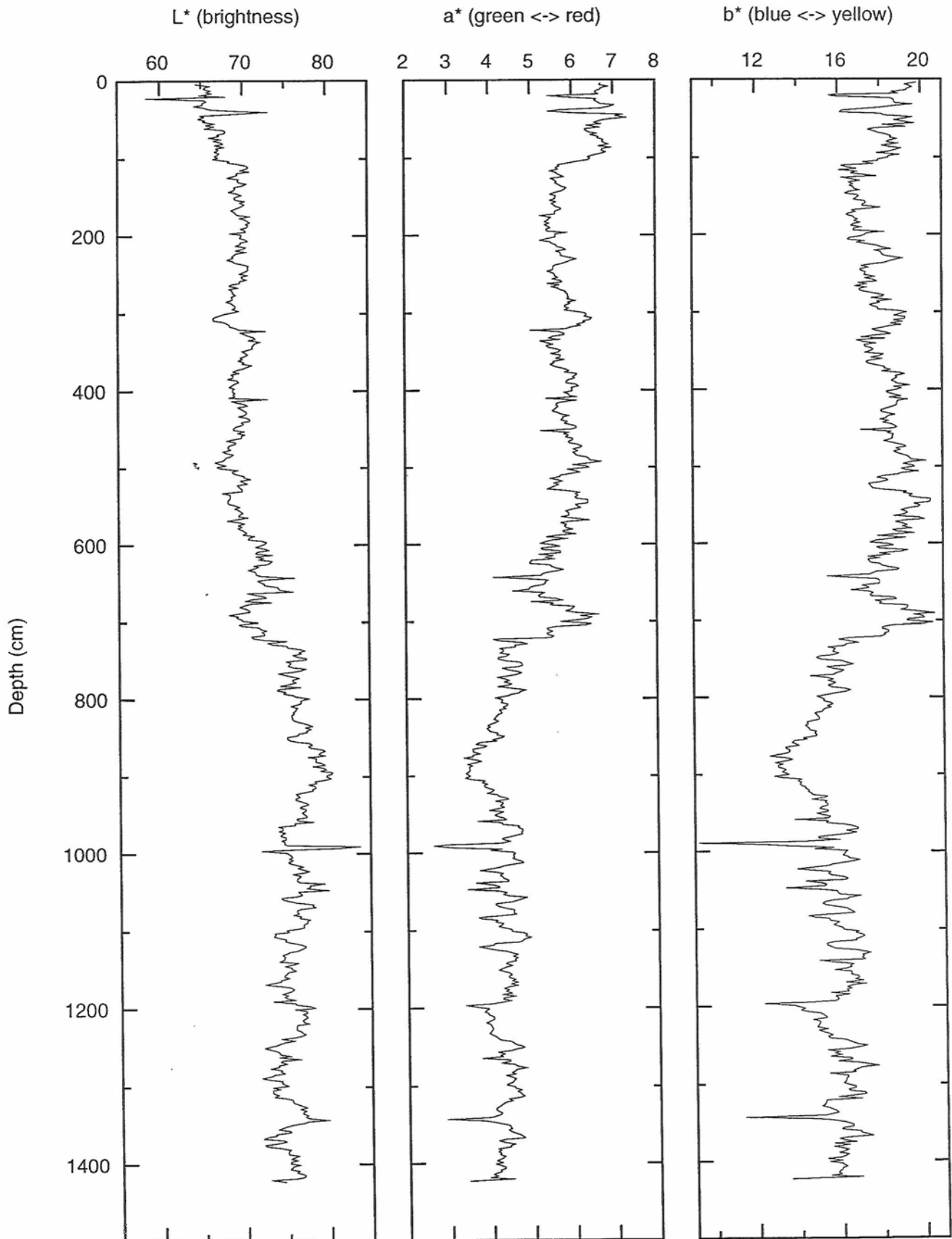
PC2: color



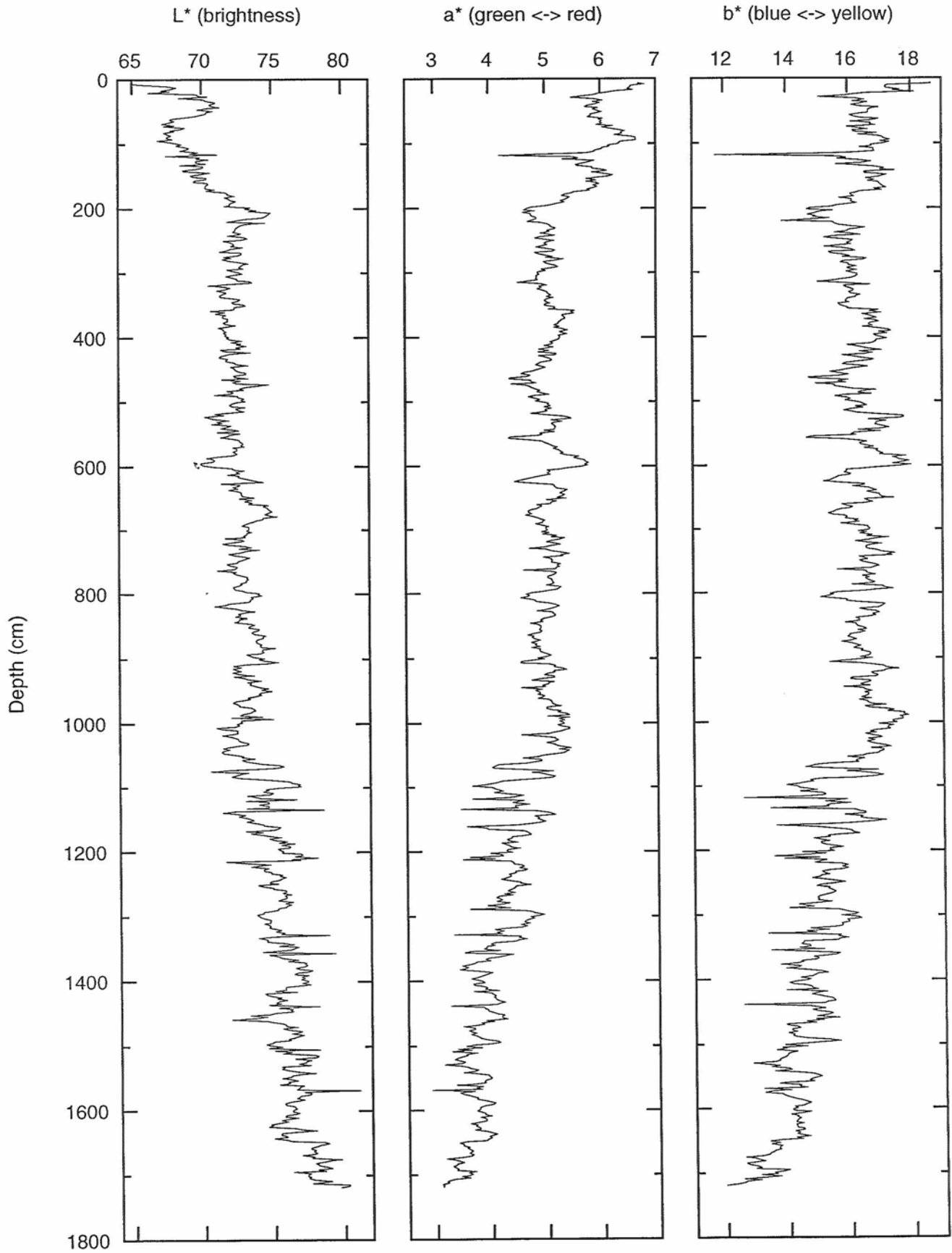
PC3: color



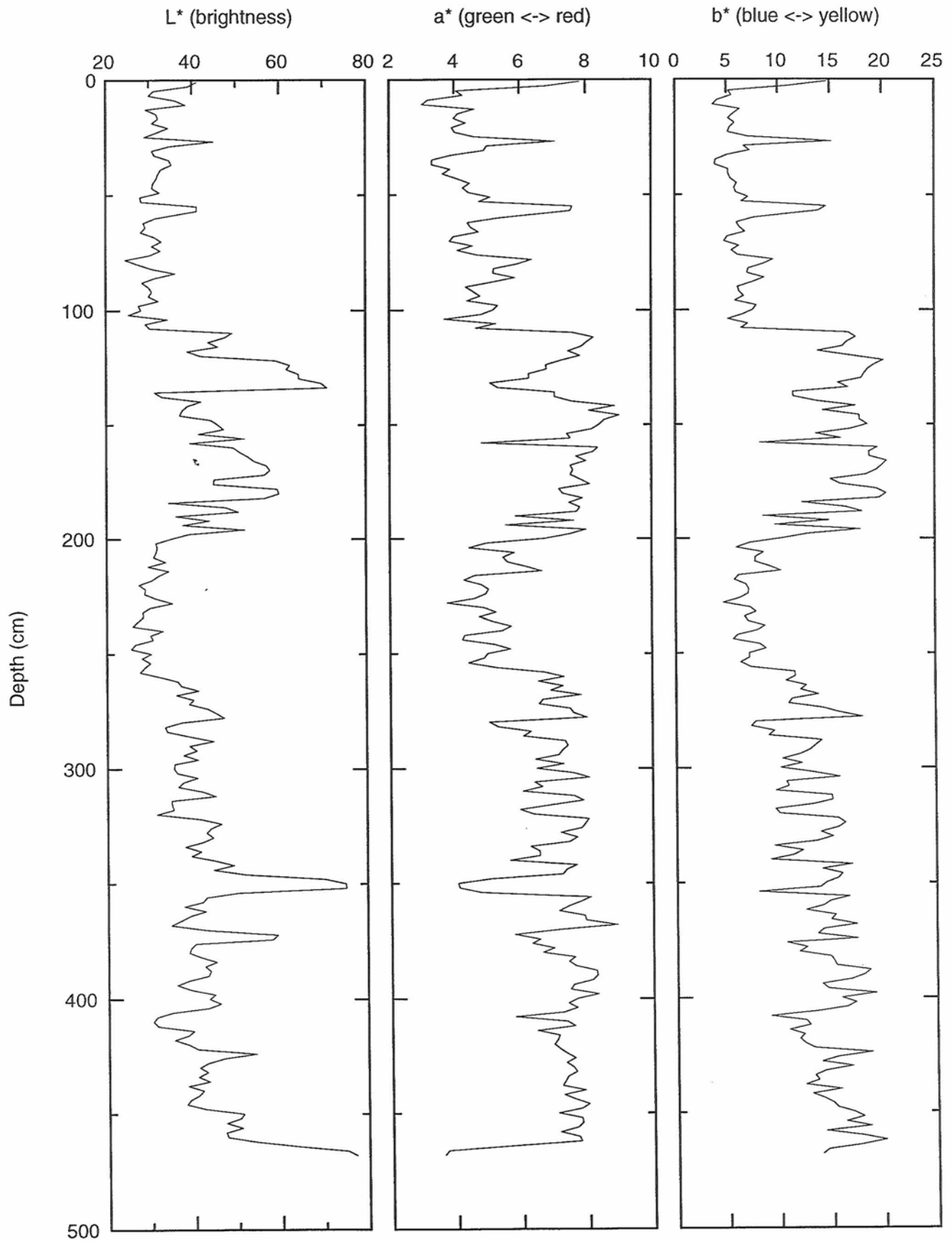
PC4: color



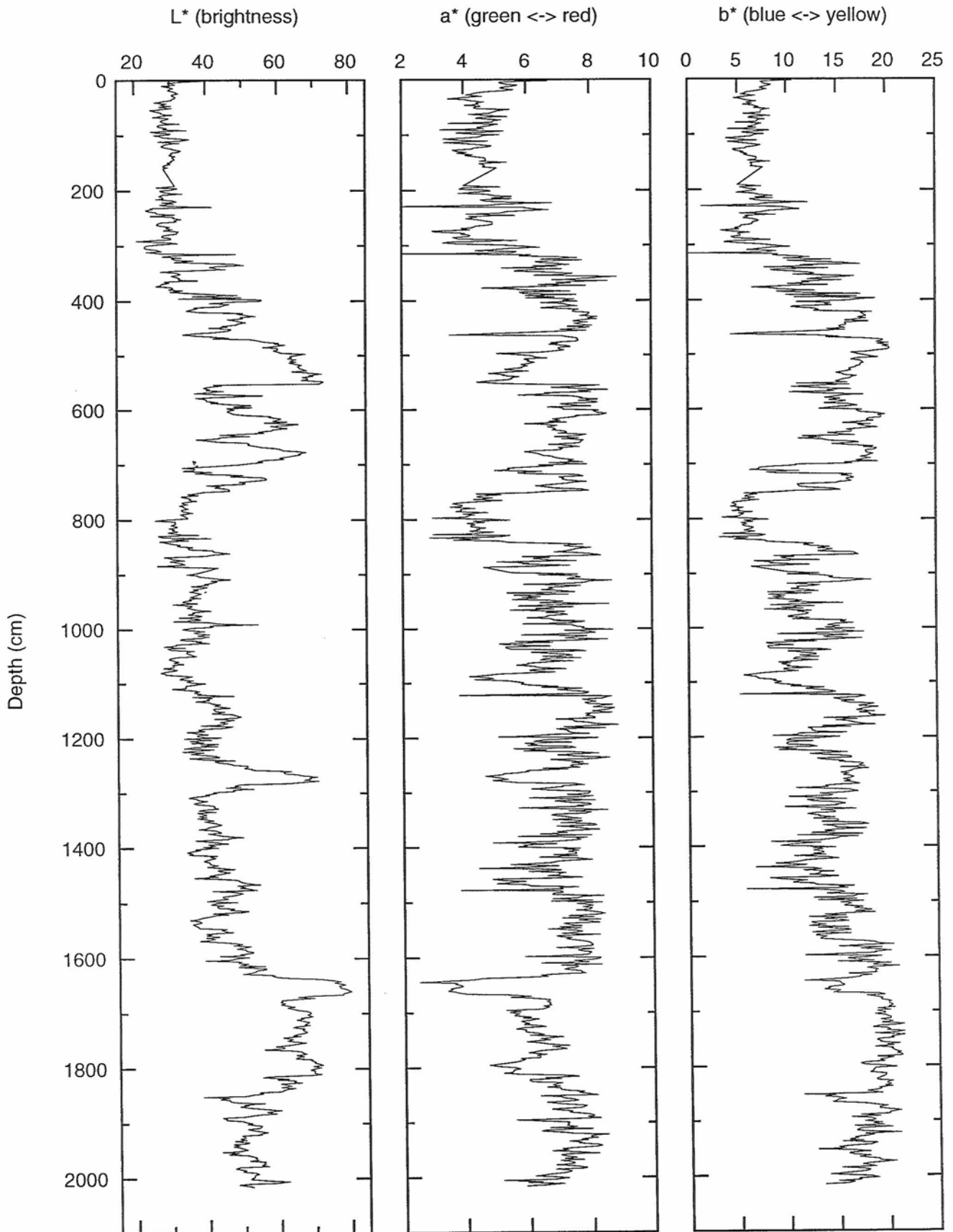
PC5: color



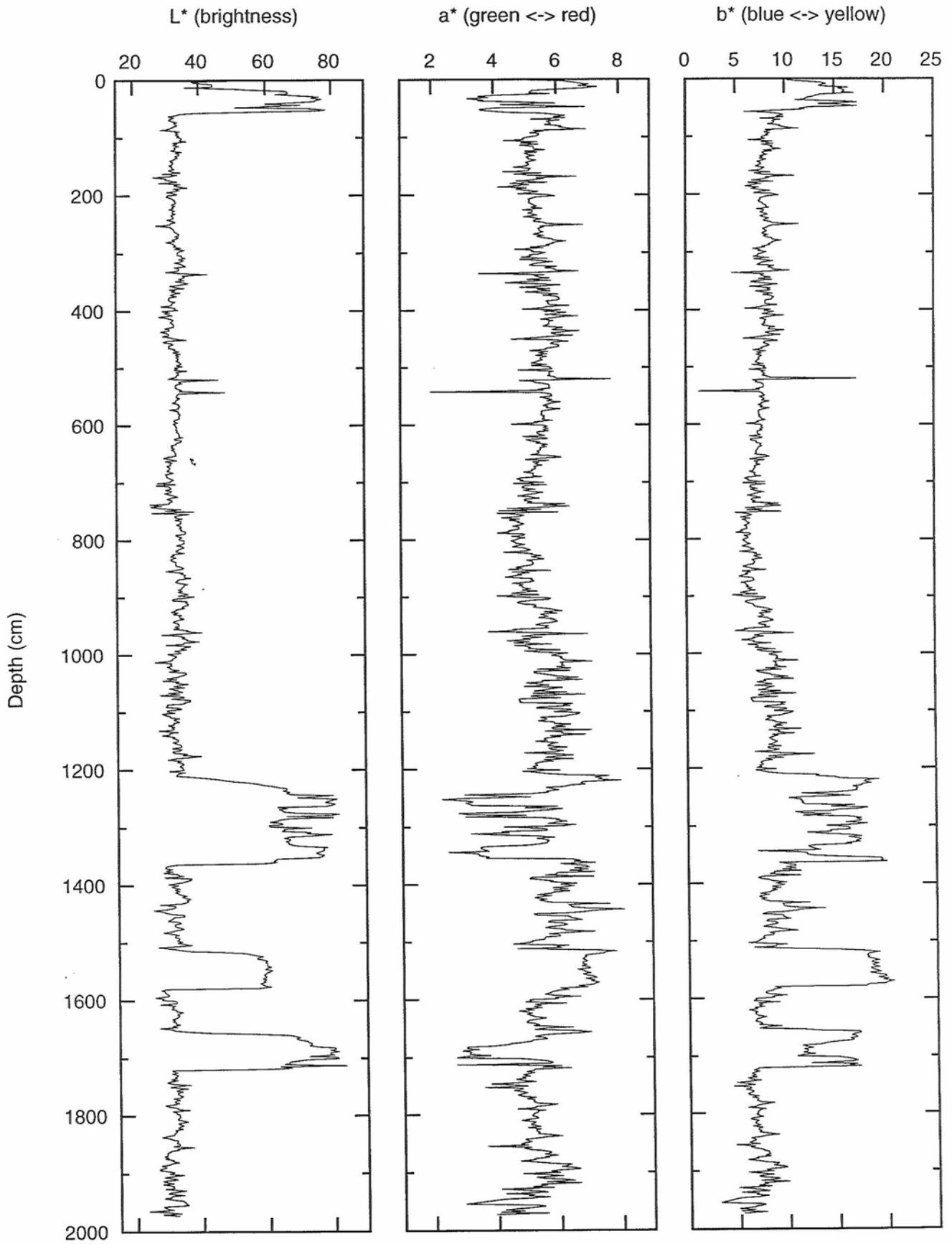
PC6: color



PC7: color

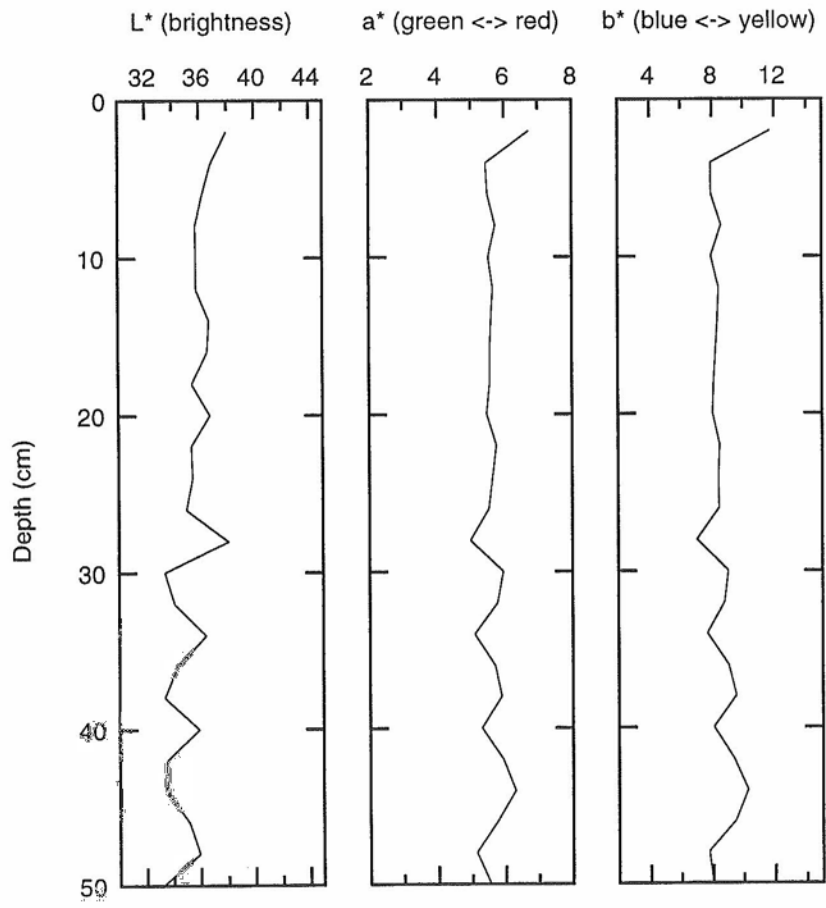


PC8: color

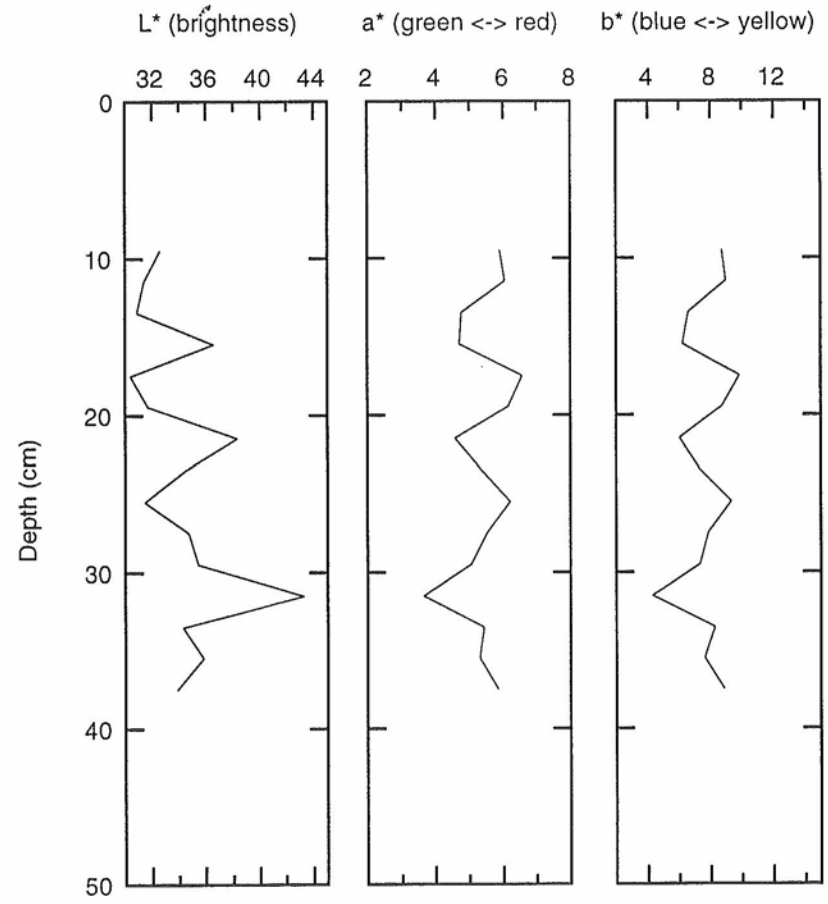


PC1: color

Piston Core

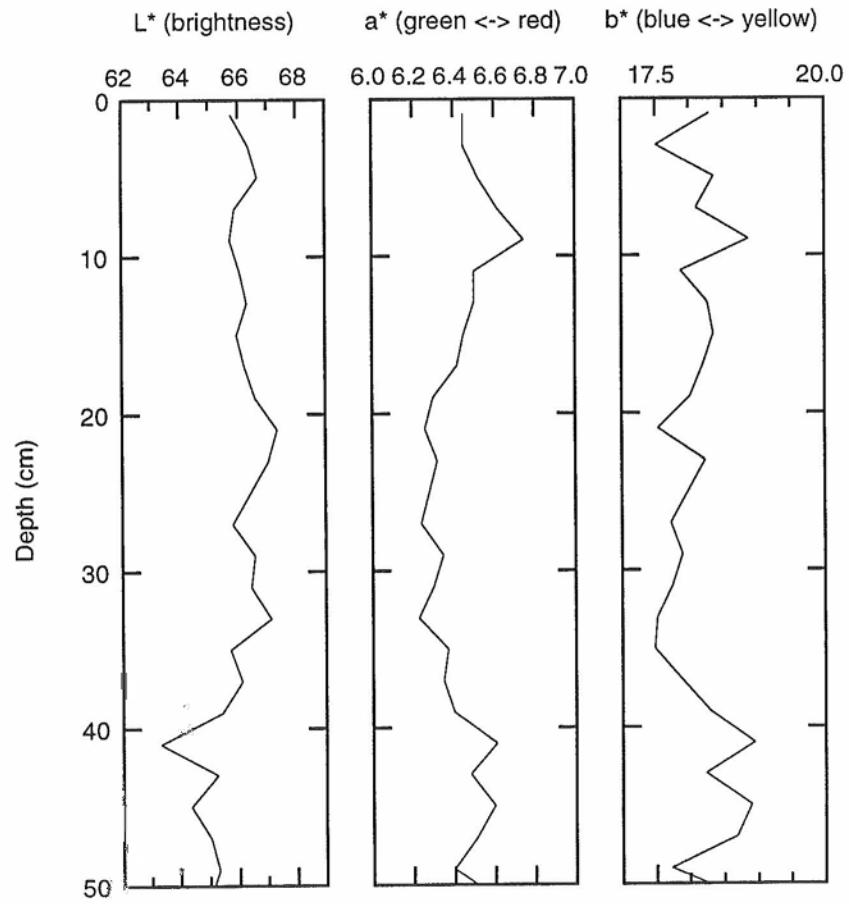


Pilot Core

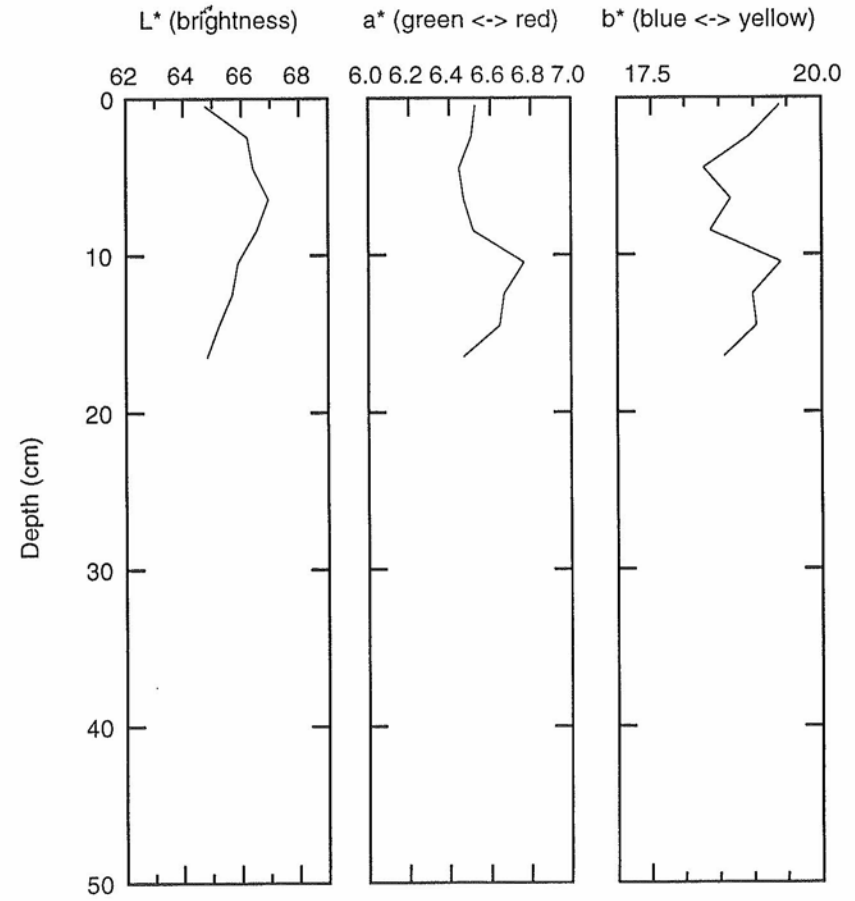


PC2: color

Piston Core

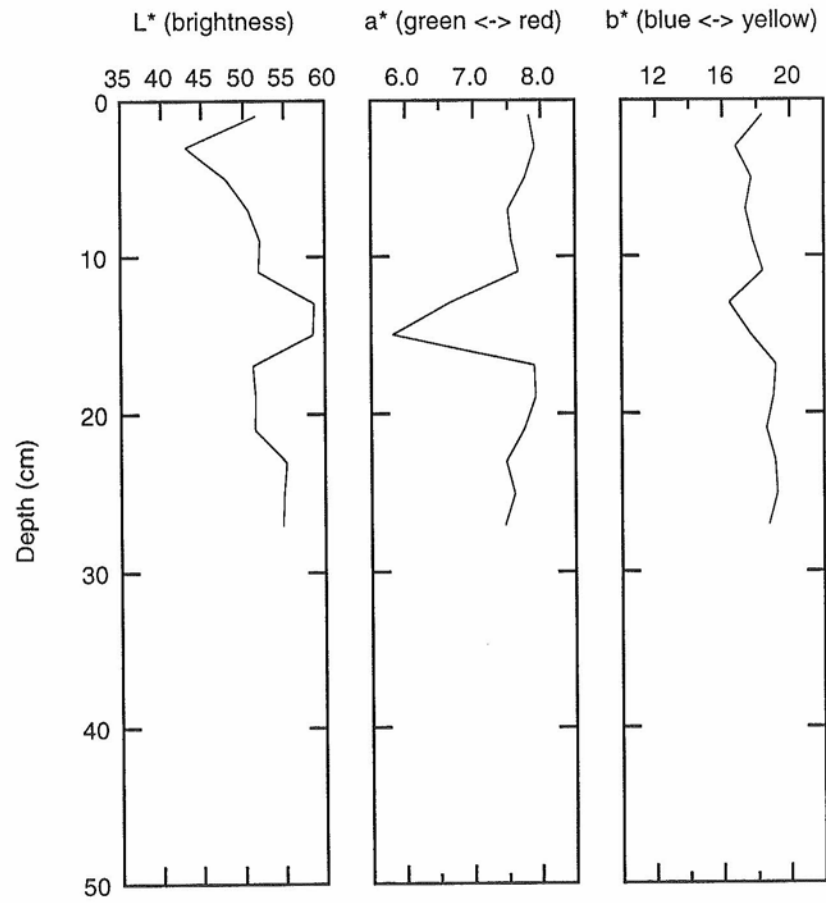


Pilot Core

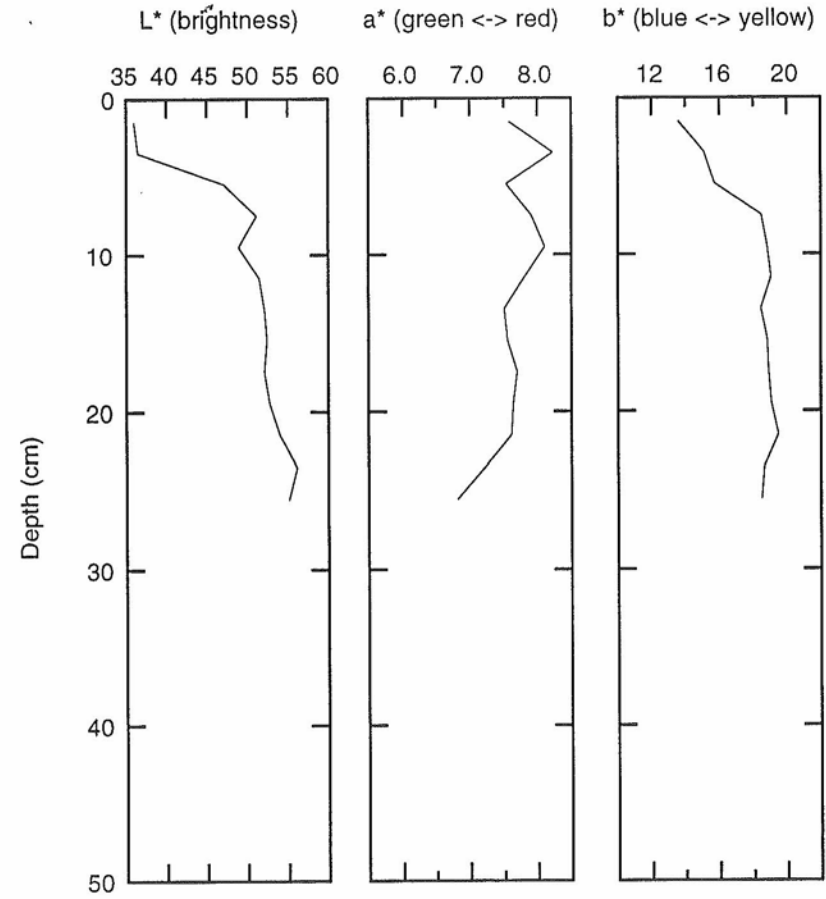


PC3: color

Piston Core

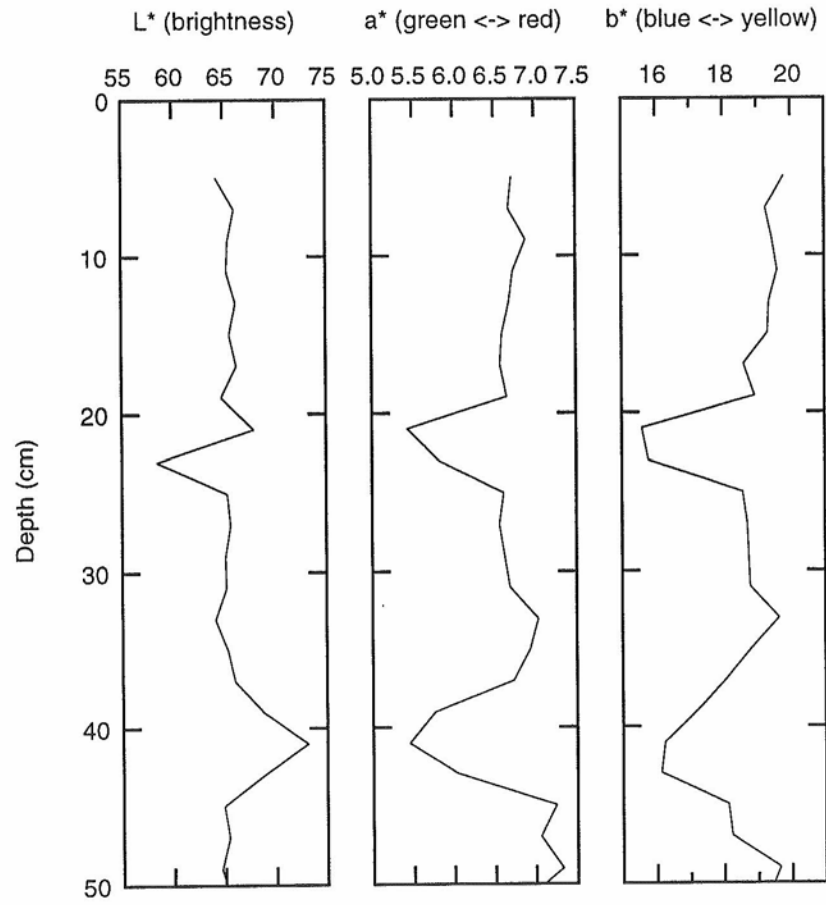


Pilot Core

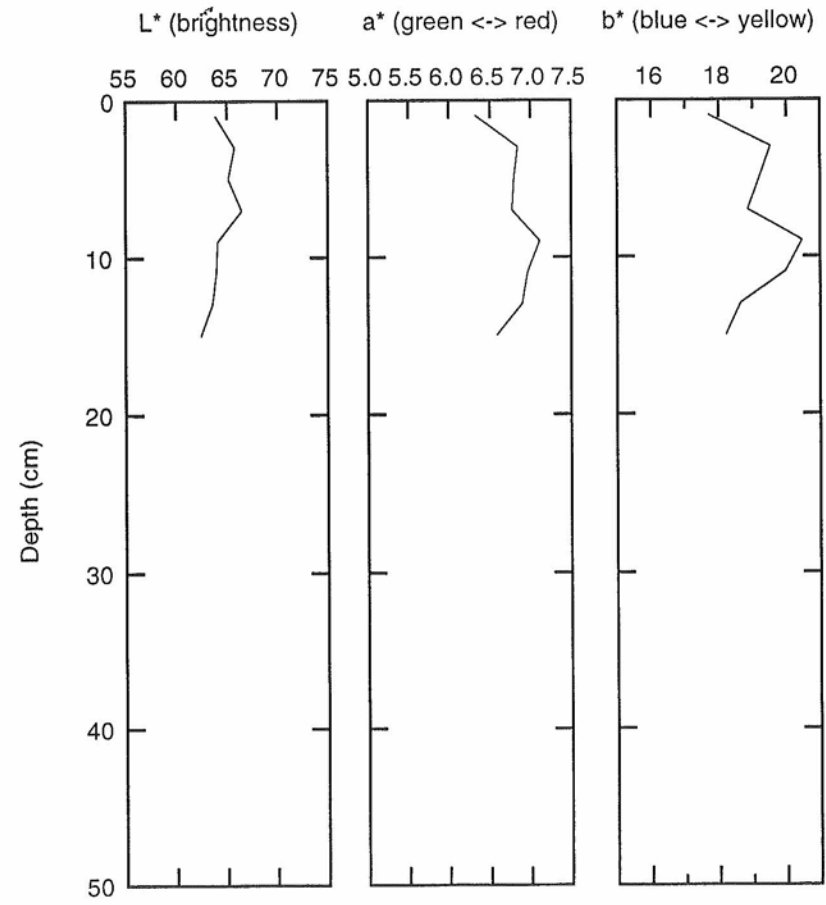


PC4: color

Piston Core

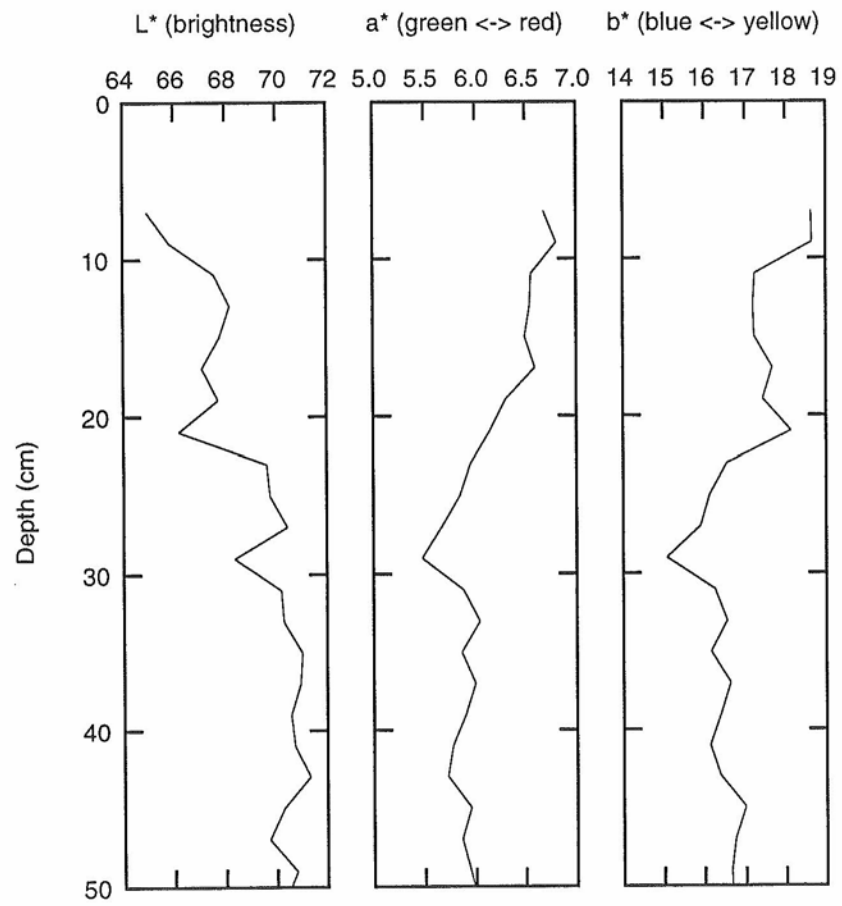


Pilot Core

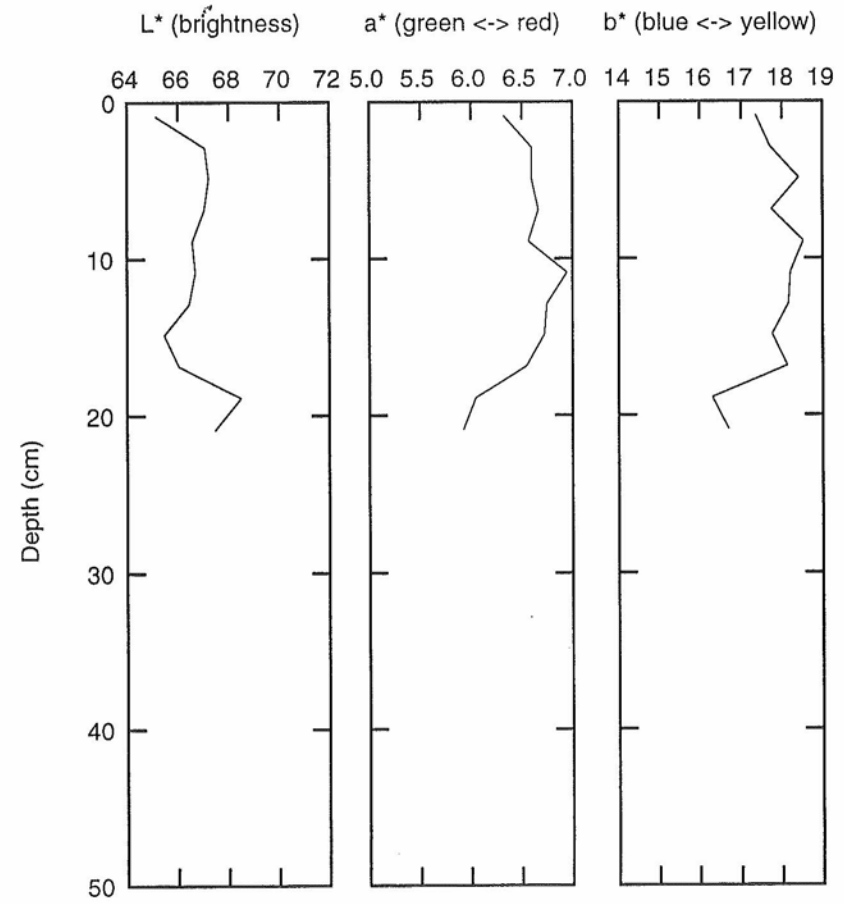


PC5: color

Piston Core

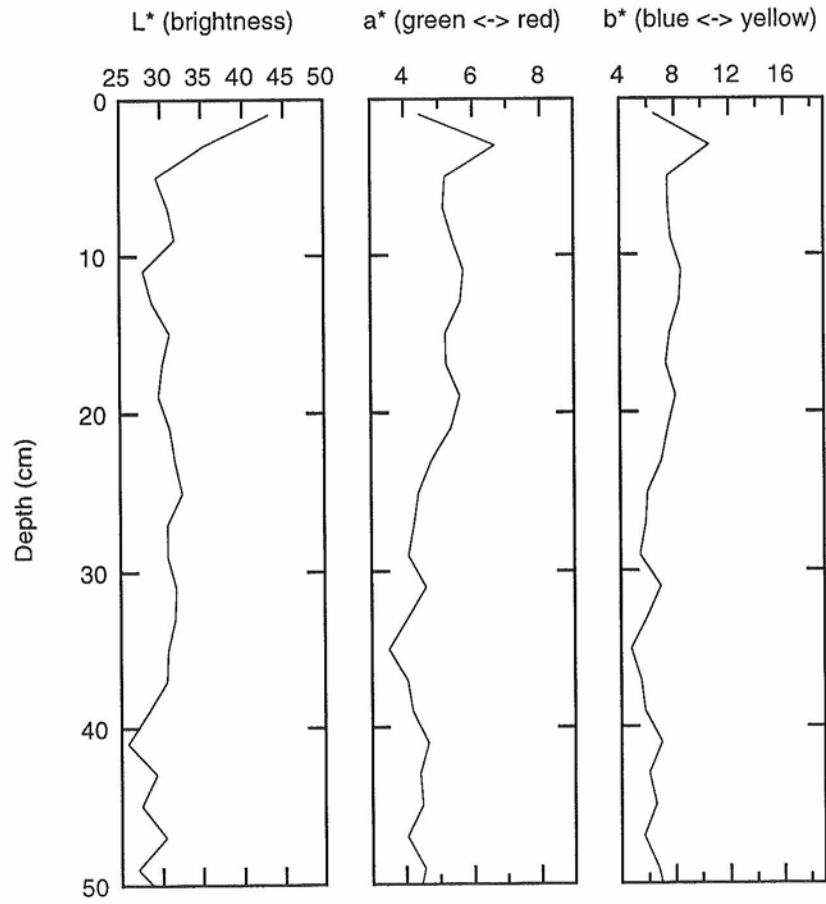


Pilot Core

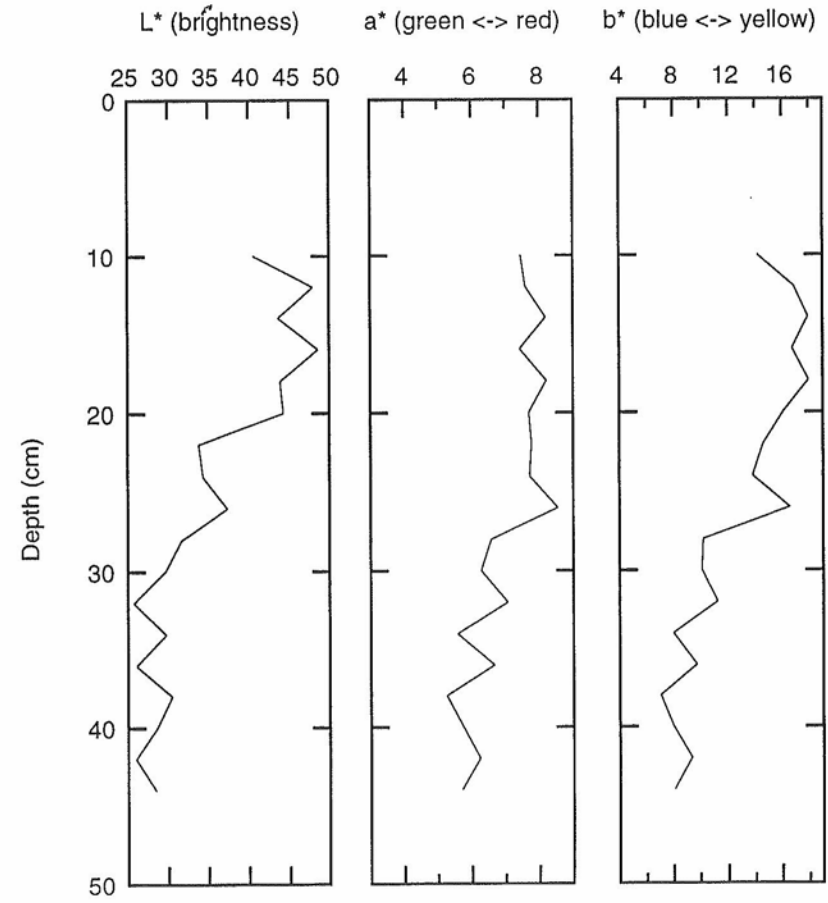


PC7: color

Piston Core

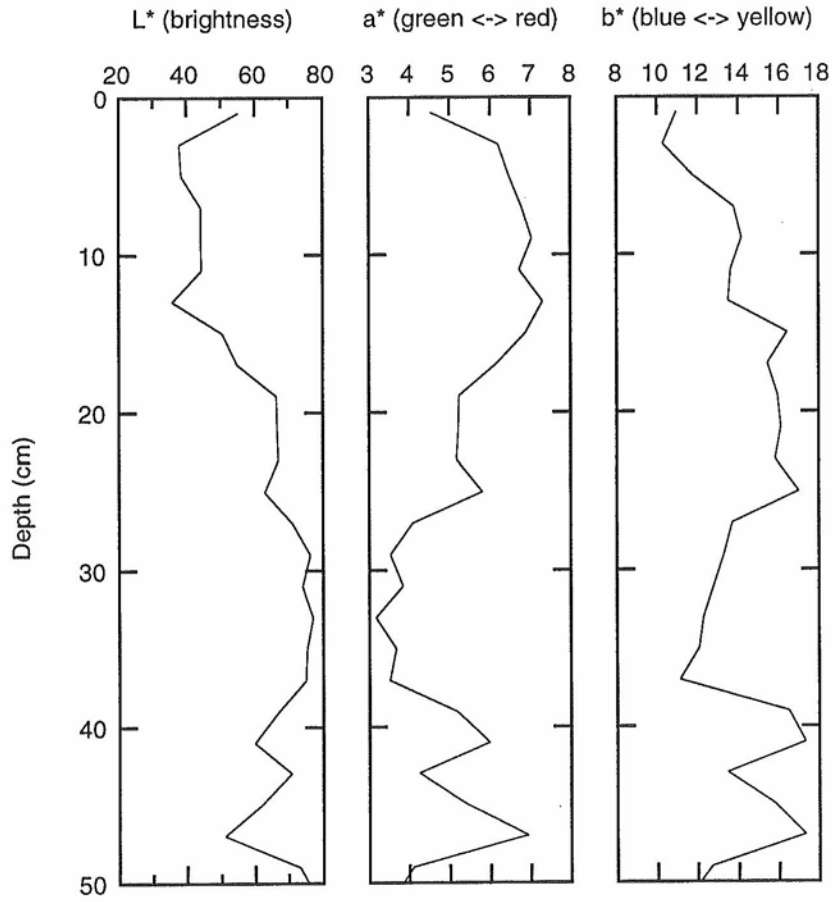


Pilot Core



PC8: color

Piston Core



Pilot Core

