USGS DREDGE OPERATIONS LOG

CRUISE KODOS 98-3 DATE ~~[illegible]~~ JD 236 LOCAL 8/24/98 15:10 = local time

STATION H4 CHIEF SCIENTIST Lee

DREDGE NO. D5, Page #1 TECH ON WATCH

DEPTH INTERVAL (m) on-off bottom 2753 – 2250 corrected 2500 – 2350

	ON STATION	DREDGE ON BOTTOM	DREDGE OFF BOTTOM	OFF STATION
GMT	06:10	07:05:38.93	10:51:53:92	11:32:58.91
latitude	08° 56.82′ N	08.56.668′ N	08° 54.381′ N	08° 53.910 N
longitude	137° 40.846′ E	137° 40.740′ E	137° 41.172′ E	137° 40.971′ E
water depth	2283.6 (m)	2757 (m)	2250m	2235m

Site Description and Target: Yap Arc Hydrothermal area – Nugulu Ridge

Operation*	GMT	Depth (m)	Wire Out (m)	Tension	HDG/SPD	Comments
begin forward	7:13:53.90	2774 (m)	~~[illegible]~~ (m) 3200	1.3	32.2/0.3	stop wire out
Sm bites	08:15:38.91	2594 (m)	3286	1.9, 1.9, 1.9	186.6/0.9	8:55.990 N/137.40.949 E
Sm bites	08:17:23.91	2594 (m)	3286	1.9	184.4/0.8	8:55.964/137:40.936 E
Sm bite	08183891	2594 (m	3286	1.9	183.3/0.8	8:55.954/137,40,932 E
Cont. sm bites	08:21.891	2489	3286	1.9	165.8/0.7	8:55:855/137:40:907 E
Series of bites	8:25:38.9	2489	3286	2.0-1.9-2.2	164.7/0.5	8:55:848/137 40.911 E
Continuous bites	8:33:53.91	2440	3286	To 2.2	169/0.5	8:55.741/137.40.968
Continuous bites	8:38:53.91	2400	3286	1.8 2.0	158.9/0.6	8:55.689/137:40.943
continuous bites	8:43:53.91	2448	3286	up to 2.2	165.1/0.6	8:55.614/137:40.986
"	8:48:53.91	2451	3286	1.8, 1.9	169.4/0.5	
"	8:53:53.90	2736	3286	1.8, 2.0	163.2/0.7	
"	8:57:38.90	2336	3286	2.3.	166.6/0.6	
Sm Bite	9:00 53.9	2320	3286	2.0	165.6/0.8	8:55:408/137:41.027 E
Sm bite	9 02:23.91	"	"	2.1-2.3	167.8/0.5	855383N/137.41.032 E

*on/off bottom, bites, etc.

Other Comments:

Ship speed varied between 0.5 knots + 1.2(?) knots

D5

USGS DREDGE OPERATIONS LOG

CRUISE KODOS 98-3 DATE 236 (JD) 8-24-98 (LOCAL) (15:10 time local)

STATION H4 CHIEF SCIENTIST Lee

DREDGE NO. 05, cont (pg2) TECH ON WATCH

DEPTH INTERVAL (m) on-off bottom: Corrected 2600-2350

	ON STATION	DREDGE ON BOTTOM	DREDGE OFF BOTTOM	OFF STATION
GMT	06:10	07:05:38.93	10:51:53:92	
latitude	08°56.82′N	08°56.668′N	08°54.381′N	
longitude	137°40.846′E	137°40.740′E	137°41.172′E	
water depth	2283.6 m	2757 m	2250 m	

Site Description and Target: Yap Arc Hydrothermal Area

Operation*	GMT	Depth (m)	Wire Out (m)	Tension	HDG/SPD	Comments
Sm bites	9:5:23.91	2303→	3286→3282	2.0, 2.1, 2.2	168.3/0.8	brought in 4m/minute
	to 9:12:38	2286	—	2.2, 2.3,	—	—
	.91/9:13:38.9	2285	3268	2.4, 2.5	171.7/0.8	8:55:219/137.41.058 E
↓	9:15:23.91	2273	3260	24, 2.5, 2.3	170.8/0.7	55.194/41.061E
*	9:17:23.93	~~2272~~	3250	2.0 - 2.5	171.5/0.8	55.164/41.063E
↓	9:19:53.90	2272	3240	"	172.3/0.7	55.127/41.059E
↓	9:24:8.93	2272	3220	2.1	165.2/0.9	55.067/41.051E
↓	9:30:8.91	"	3183	2.0	151.9/0.5	54.988/41.043E
↓	9:33:53.91	2359	3156	2.0	139.4/0.6	54.943/41.052E
Ship holding	9:36:38.91	2355	3130	~~1.9~~	134.3/0.5	54.912/41.064E
position end		↓	—	—	—	—
of line - winch	@ 9m/minute (in)		—	—	—	—
	9:39:08.91	↓	31 —	2.0	152.3/0.4	54.901/41.059E
	44:08.91	↓	3080	2.1	189.8/0.6	54.948/41.024E

*on/off bottom, bites, etc.

Other Comments:

* ~~brought line in~~ continuing bringing line in ~~to 3224~~ + getting sm bites (2.0) on the way up.

Ship speed < 1 knot

USGS DREDGE OPERATIONS LOG

	JD	LOCAL
CRUISE KODOS 98-3	DATE 236	8-24-98 (15:10 local time)
STATION H4	CHIEF SCIENTIST Lee	
DREDGE NO. 05, con't (Pg 3)	TECH ON WATCH	

on-off bottom

DEPTH INTERVAL (m)

	ON STATION	DREDGE ON BOTTOM	DREDGE OFF BOTTOM	OFF STATION
GMT	06:10	07:05:38.93	10:51:53.92	11:32:58.91
latitude	08° 56.82′ N	08°56.668′N	08°54.381′N	08°53.910′N
longitude	137°40.846′E	137°40.740′E	137°41.172′E	137°40.971′E
water depth	2283.6 m	2757 m	2250 m	2235 m

Site Description and Target: Yap Arc Hydrothermal Area

Operation*	GMT	Depth (m)	Wire Out (m)	Tension	HDG/SPD	Comments
Sm bite	48:23.91	2369	3045	2.0, 2.1	183.8/0.4	54.454/41.001E
Sm bite	57:38.91	2349	2975	2.0	169.3/0.5	54.879/40.969E
Sm bite	10:01:38.91	2352	2937	2.0	169.0/0.6	54.844/40.967E
* lg bite	10:12:8.91	2313	2849	4.8-2.6-3	166.8/0.5	broke, 4.8 *
bite	10:25:38.91	2290	2705	3.3	162.8/0.8	broke 3.3
off bottom	10:51:53.92	2250	2300		161.0/0.6	off bottom
off Station	11:33:28.91	2235		0.3	263.8/1.2	

*on/off bottom, bites, etc.

Other Comments: * ~~4.5, 4.8, broke~~ 3.3 bite = 54.629N/41.014E′

Ship speed < 1.0 knot

DREDGE LOG

	JD	LOCAL
CRUISE KODOS 98-3	DATE 236	8/24/98
STATION 44	GMT on-off bottom	LOCAL on-off bottom
DREDGE D5	TIME 07:05:38.93 – 10:51:53.92	16:05:38.91 – 19:51:53.92
DEPTH INTERVAL (m) on-off bottom 2757 – 2250	LATITUDE on-off bottom 8°56.668'N – 08°54.381'N	
DEPTH (m) CORRECTED 2600 – 2350	LONGITUDE 137°40.740'E – 137°41.172'E	

TOTAL WEIGHT: DREDGE 16.5 kg CRUST <1 kg (3.2 kg actual)

% OF ROCK COVERED BY CRUST 50%

% BROKEN FROM: OUTCROP 80 TALUS 20

THICKNESS OF CRUST: MAX ~~5 mm~~ 1 mm actual MIN <1 mm AVG 2 mm (3 mm actual)

DOMINANT SURFACE TEXTURE granular

SUBSTRATE LITHOLOGY breccia, limestone, volcanic rocks pumice, mudstone,

NODULES PRESENT None

REMARKS: golden coral

KODOS 98-3

DREDGE 5

Sample #	CC	PGE	REE	OC	CFA	PTS	Paleo	XRD
D5-2A	X			X				
D5-2B				X				X
D5-4A	X	X +Au		X		X		
D5-7A								X
D5-16A	X							X

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 80x70x42 Location: 8° 55.53' N 137° 40.96' E

Sample Id: D5-1 Weight (kg): ~0.380 Depth (m): 2757-2250

Mn Crust Description

Surface Texture: granular to microbotryoidal

Mn Crust Thickness (mm):

Min: 10 Max: 11 Ave: 10

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1	10	11	10	Black, Very porous
side 2	0	5	4	Black, V. porous
3				
4				
5				
6				

D5-1
Kodoo 98-3

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)

100% KORDI

Substrate Description

Rock Type: Breccia

Description: cemented w/ Fe-Mn oxides @ crust/subst interface (greenish-tan) clasts = pale gray, granule to pebble size; clay mineral matrix (smectite) matrix-supported; Sandstone clasts, minor felsic volcanic

Biology (?): Planktonic (few) forams & encrusting (few) forams

Described by: M Burrows

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 135x40x105 Location: 8°55.53'N 137°40.96'E

Sample Id: D5-2 Weight (kg): 0.570 Depth (m): 2757-2750

Mn Crust Description

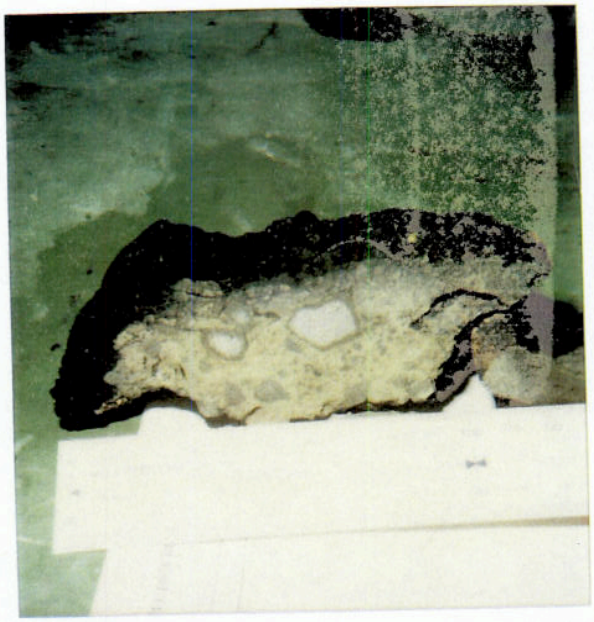
Surface Texture: granular

Mn Crust Thickness (mm):

Min: 7 Max: 11 Ave: 8

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1	7	11	8	black, porous, dendritic
2				
3				
4				
5				
6				



D5-2
Kodoo 98-3

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D5-2A	OC Bulk	0-8	7.0
D5-2B	OC Bulk XRD	substrate	11.1

CC = MER, Te, H_2O^- ; XRD
60% KORDI
40% USGS

OC = XRF-102, FeO, CO_2, H_2O^+, H_2O^-, NA-Au+3 ; XRD

D5

Substrate Description

Rock Type: Breccia

Description: Mainly gray volcaniclastic sandstone clasts up to 16mm in a yellow-green altered clay matrix upper margin cemented w/ Fe-Mn oxides

Biology (?): planktonic forams

Described by: J. Dowling

Subsampled by: Dowling + Hein

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 90x75x34 Location: 8° 55.53' N 137° 40.96' E

Sample Id: D5-3 Weight (kg): 0.200 Depth (m): 2757-2250

Mn Crust Description

Surface Texture: granular patina, patchy

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave: <1

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				
2				
3				
4				
5				
6				

KODOS 98-3

D5-3

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)

100% KORDI

Substrate Description

Rock Type: Breccia

Description: gray volcanic (and volcaniclastic) clasts up to 6 mm, breccia clasts, + hydrothermal(?) quartz clasts in yellow/green matrix of clay minerals (smectite ?) + also black ferromag. clasts(?) + quartz cement

Biology (?): NONE

Described by: Dowling

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 110x75x58 Location: 8°55.53'N 137°40.91'E

Sample Id: D5-4 Weight (kg): 0.62 Depth (m): 2757-2250

Mn Crust Description

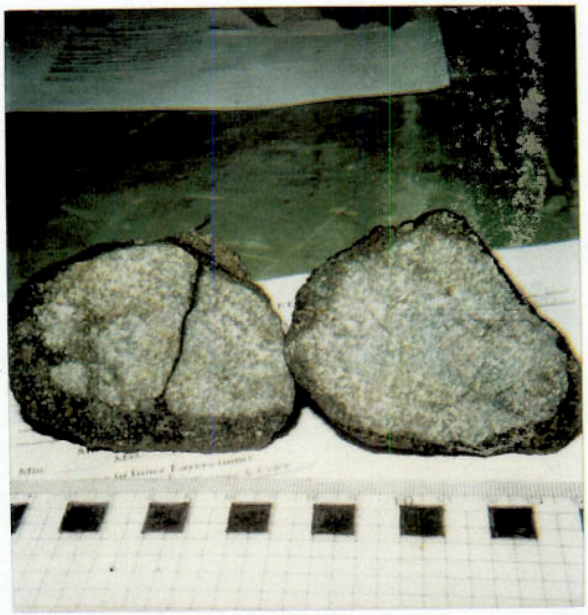
Surface Texture: micro-botryoidal to smooth

Mn Crust Thickness (mm):

Min: 0 Max: <1mm Ave: Patina

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				
2				
3				
4				
5				
6				



D5-4
Kodos 98-3

Comments and XRD Mineralogy:

serpentinite

Substrate Description

Rock Type: Hydrothermally altered ultramafic rk (?)

Description: mottled white & dark gray, blue, green + gold. Gray = porous; veined w/ quartz(?) Dense & heavy-

Biology (?): Planktonic + Encrusting Forams

Described by: M Burrows

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D5-4A	PTS	HORDI	
	PTS	USGS	
	OC	HORDDI	
	XRD, OC	USGS	23.7

OC = XRF-102, FeO, CO_2, H_2O^+, H_2O^-, NA-Au+3

85% HORDI
15% USGS

Subsampled by: Hein

D5-4
Kodos 98-3

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 45 x 35 x 45 Location: 8°55.53'N 137°40.96'E

Sample Id: D5-5 Weight (kg): 0.070 Depth (m): 2757-2250

Mn Crust Description

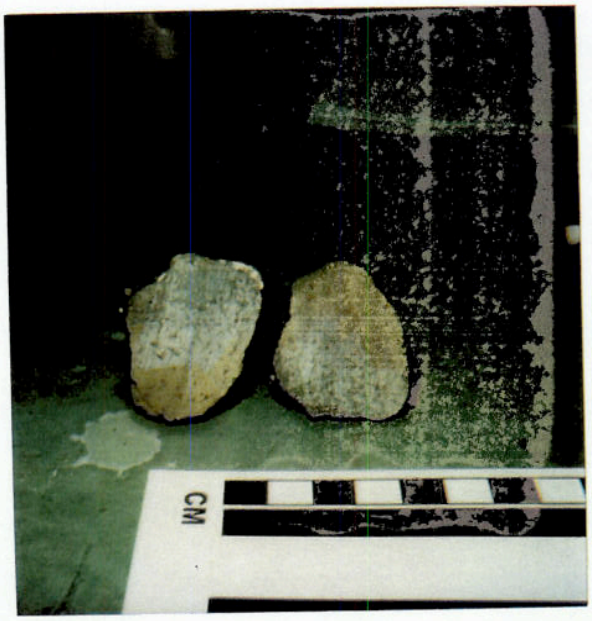
Surface Texture: granular to smooth, patchy

Mn Crust Thickness (mm):

Min: 0 Max: <1 Ave: Patina

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1	0	<1mm		Black, Patina.
2				Vuggy
3				
4				
5				
6				



D5-5
Kodos 98-3

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	100% KORD?		

Substrate Description

Rock Type: altered completely, volcanic rock(?) serpentinite

Description: pale-to-medium gray mottled w/ greenish tan. Top 25% altered to fine-grained clay + + Fe oxide - may be some sulfides; calcite on fracture surfaces

Biology (?): Planktonic + Encrusting Forams

Described by: M Burrows

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 5 Coated Pebbles 15-40 diameter Location: 8°55.53'N 137°20.96'E

Sample Id: D5-6 Weight (kg): 0.175 Depth (m): 2457-2260

Mn Crust Description

Surface Texture: smooth to micro-botryoidal to granular

Mn Crust Thickness (mm):

Min: 0 Max: 4 Ave: <1

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				Black, massive
2				
3				
4				
5				
6				

D5-6
Kodos 98-3

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	10% HORDI		

Substrate Description

Rock Type: ① laminated Sandstone ② Breccia

Description: ② fresh basalt clasts w/ alteration rinds; cement = Fe-Mn & gran-to-sand sized carbonate — hydrofracture vein breccia — ① hard, calcite-cemented(?) sandstone, gray, w/ hydrothermal alteration rind — clays +/or Mn oxides — → Some laminated

Biology (?): Planktonic + Encrusting foraminifera

Described by: M Burrows

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 9 coated pebbles 22-42 diameter Location: 8° 55.53 N 137°40.96' E

Sample Id: D5-7 Weight (kg): 0.240 Depth (m): 2757-2250

Mn Crust Description

Surface Texture: smooth & polished, Patchy

Mn Crust Thickness (mm):

Min: 0 Max: <1 Ave: <1

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				Black
2				
3				
4				
5				
6				

D5-7
Kodos 98-3

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D5-7A	XRD		

Substrate Description

Rock Type: ① hard, compact gray sandstone
② Amygduloidal Volcanic Rock
Andesite

Description: ② pale-to-medium gray; very fine-grained matrix porphyritic w/ euhedral plagioclase (≈ 1mm) + mica; ① Gray, Quartz cement(?), Quartz crystals in vugs-

Biology (?): few Planktonic (globigerinacea) to none

80% HORDI
20% USGS

Described by: M Burrows

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 13 coated pebbles 15 to 50 diameter Location: 8°55.53' N 137°40.96' E

Sample Id: D5-8 Weight (kg): 0.350 Depth (m): 2757-2250

Mn Crust Description

Surface Texture: smooth to granular

Mn Crust Thickness (mm):

Min: 0 Max: 6 Ave: 1

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				Black
2				
3				
4				
5				
6				

D5-8
Kodos 98-3

Comments and XRD Mineralogy:

Red (Fe-oxide) at bottom of largest pebble. Substrate same as D5-1, 2

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	100% KORDI		

Substrate Description

Rock Type: Breccia

Description: Volcaniclastic sandstone and Breccia clasts, some w/ Red hematite patina; Fe-Mn oxide cement near crusts; in greenish clay mineral matrix (smectite +/or chlorite)

Biology (?): Encrusting + Planktonic (few) foraminifera

Described by: M Burrows

Subsampled by:

SAMPLE DESCRIPTION

4 cut pebbles, 45x30x10

Cruise Id: KODOS 98-3 Size (mm): 45 x 40 x 30 MAX Location: 8°55.531' N 137° 40.961' E

Sample Id: D5-9 Weight (kg): 0.07 Depth (m): 2757-2250

Mn Crust Description

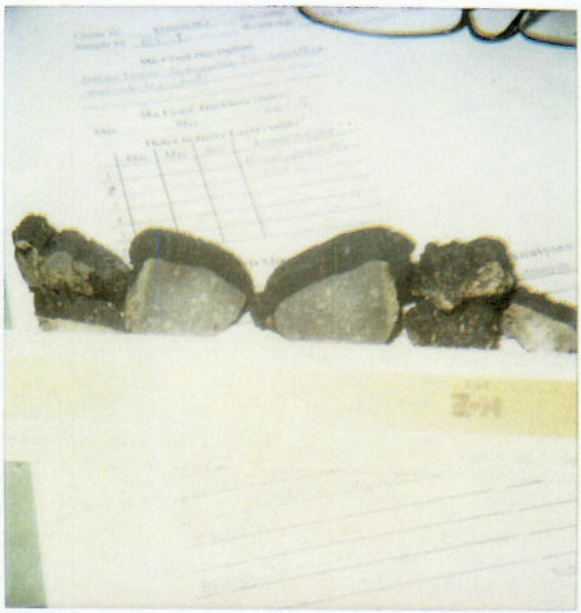
Surface Texture: Granular to smoothed microbotryoidal

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave: 5

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				Porous, massive,
2				black
3				
4				
5				
6				



KODOS 98-3
D5-9

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	100% XRDI		

Substrate Description

Rock Type: (1) Porphyretic Basalt
(2) Breccia

Description: (1) Gray Basalt w/ Plagioclase & minor olivine phenos + chill margin; (2) Volcanic rock clasts in clay mineral matrix

Biology (?):

Described by: HEIN

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 30x25x15 Location: 8°55.53'N 137°40.96'E

Sample Id: D5-10 Weight (kg): 0.015 Depth (m): 2757 - 2250

Mn Crust Description

Surface Texture:

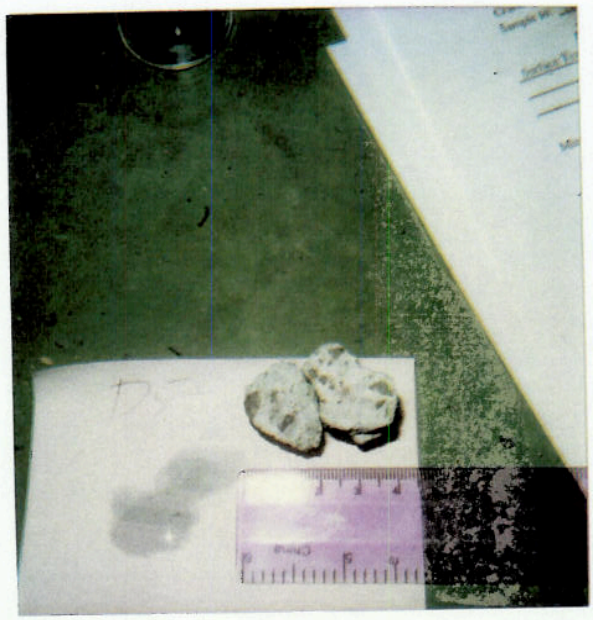
No Crust

Mn Crust Thickness (mm):

Min: Ø Max: Ø Ave: Ø

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				
2				
3				
4				
5				
6				



D5-10
Kodos 98-3

Comments and XRD Mineralogy:

slight effervescence w/ .5 M HCl when powdered

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	100% KORDI		

Substrate Description

Rock Type: Breccia

Description: Quartz - calcite cement
pale gray to white; fine-grained
Greenish to Dark gray clasts; volcanic
+ ultramafic altered clasts -
Fine, white mica in cement?

Biology (?): none

Described by: M Burrows

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 1 pebble 30x35x20 Location: 8°55.53'N 137°40.96' E

Sample Id: DS-11 Weight (kg): 0.03 Depth (m): 2757-2250

Too small for photo

Mn Crust Description

Surface Texture: No Crust

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave:_____

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				
2				
3				
4				
5				
6				

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	100% KORDI		

Substrate Description

Rock Type: Breccia

Description: Cataclastic (Fault?) breccia w/ green clasts of completely altered volcanic Rock(?) in yellow-brown - Fe-oxide matrix - clasts highly fractured; hydrothermally altered

Biology (?): Green clasts maybe Serpentinite

Described by: Hein

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 6 Crust Frags 40 x 30 x 10 - max Location: 8° 55.53' N 137° 40.96' E

Sample Id: D5-12 Weight (kg): 0.025 Depth (m): 2757-2750

Mn Crust Description

Surface Texture: microbotryoidal

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave: 10

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				massive, black
2				
3				
4				
5				
6				

KODOS 98-3
D5-12

Comments and XRD Mineralogy:

Substrate Description

Rock Type: NONE

Description:

Biology (?):

Described by: Hein

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	100% FORD F		

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 26 x 28 x 21 / 73 x 37 x 42 Location: 8°55.53'N 137°40.96'E

Sample Id: D5-13 Weight (kg): 0.145 Depth (m): 2757-2250

2 pieces

Mn Crust Description

Surface Texture: granular patina, patchy

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave: <1

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				
2				
3				
4				
5				
6				

D5-13 KODOS 98-3

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	100%	KORDI	

Substrate Description

Rock Type: ① Reef Limestone
② sandy chalk

Description: ① diagenetically altered with coral and algae

② black volcanic + Mn grains

Biology (?): planktonic foram

Described by: Hein - Dowling

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3

Sample Id: D5-14

Size (mm): MISC- Samples 35x35x10

Weight (kg): 0.060

10 small pieces

Location: 8° 55.53' N 137° 40.96' E

Depth (m): 2757-2250

Mn Crust Description

Surface Texture: lizard skin to smooth

Mn Crust Thickness (mm):

Min: 2 Max: 6 Ave: 6

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1	2	6	6	black porous
2				
3				
4				
5				
6				

D5-14 KODOS 98-3

Comments and XRD Mineralogy:

3 pieces have Mn crusts while the others have patchy Mn to NONE

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	100% KORDI		

Substrate Description

Rock Type: (1) Pumice (2) Breccia (3) Crust & volaniclastic

Description: (3) gray volcanic fclasts upto 12mm in a soft gray to yellow clay? matrix

Biology (?): planktonic encrusting forams

Described by: Dowling

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 1 Pebble 40x50x10 Location: 8°55.53' N 137°40.96' E

Sample Id: D5-15 Weight (kg): 0.02 Depth (m): 2757-2250

Mn Crust Description

Surface Texture: NONE

No Photo

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave:_____

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				
2				
3				
4				
5				
6				

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	100% KORDI		

Substrate Description

Rock Type: Pumice

Description: Gray

Biology (?):

Described by: Hein

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS 98-3 Size (mm): 45 X 50 X 15 Location: 8°55.53'N 137°40.96'E

Sample Id: D5-16 Weight (kg): 0.03 Depth (m): 2757-2250

Mn Crust Description

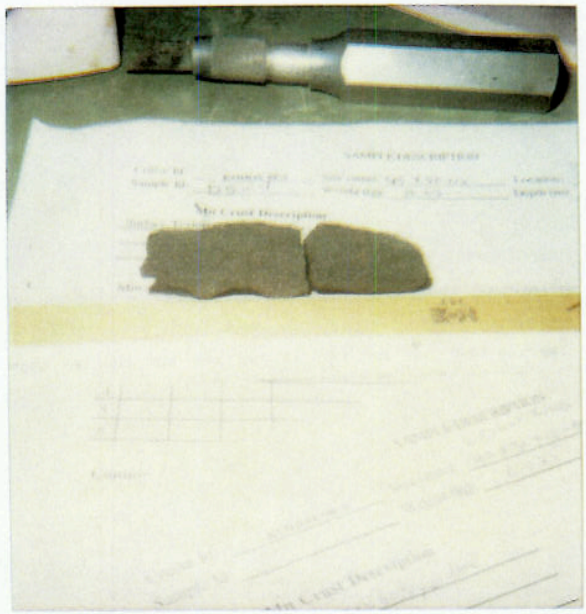
Surface Texture: No Crust

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave:_____

Outer to Inner Layers (mm)

	Min	Max	Ave	Texture & Color
1				
2				
3				
4				
5				
6				



KODOS 98-3
D5-16

Comments and XRD Mineralogy:

Substrate Description

Rock Type: Manganiferous Sandstone

Description: medium-grain volcaniclastic grains in gray to black Fe-Mn oxide cement of HydroThermal Origin

Biology (?):

Described by: HEIN

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D5-16A,	CC Bulk, XRD	~~7 gm.~~	5.6g
	CC=MER, Te, H_2O^-		
	70% HORDI		
	30% USGS		

Subsampled by: Hein