DREDGE SAMPLE LOG

			JD	LOCAL
CRUISE	KODOS97-4	DATE	245	9-2-97
STATION	20		GMT	LOCAL
DREDGE	D13	TIME	0605-0734	1805-1934
DEPTH INTERVAL(m)	2390 - 2639	LATITUDE (N,S)	11° 44.69	11° 45.40
DEPTH(m) CORRECTED	2350 - 2250	LONGITUDE (E,W)	161° 35.05	161° 35.15

TOTAL WEIGHT : DREDGE 185 CRUST 160

%OF ROCK COVEREDBY CRUST 100%

%BROKEN FROM : OUTCROP 100% TALUS

THICKNESS OF CRUST : MAX 90 MIN 20 AVG 60

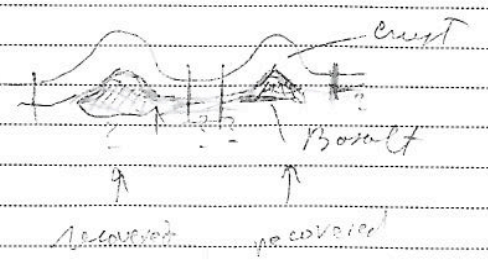
DOMINANT SURFACE TEXTURE Broken smooth modified botryoidal

SUBSTRATE LITHOLOGY basalt basalt

D13

NODULES PRESENT

REMARKS: Serveral hemispheres broken from sea floor - crust thickness is constant at crest + in lows of this topography



Third layer of this thick crusts is not the typical massive black sound elsewhere but is porous & stained

KODOS 97-4

D13

Dredge Sample Summary Sheet

KODOS 97-4 D13

Powder To KORDI

Sample ID	Bulk CC	Layer CC	Pt & Au	REE	OC	DPTS/TS	XRD	35mm Photo	Archive	Paleo
D13 1A	✓		✓				✓			
D13 1B		layer 1	✓				✓			
D13 1C		layer 2	✓				✓			
D13 1D		layer 3	✓				✓			
D13 2A	✓						✓			
D13 3A							✓			✓ (matrix)
D13 27A					✓		✓			
D13-5A	✓						✓			
D13-13A					✓ +CFA		✓			✓
D13-17A					✓ +CFA		✓			
D13-20-1A	✓						✓			

D & paleo sep. jar

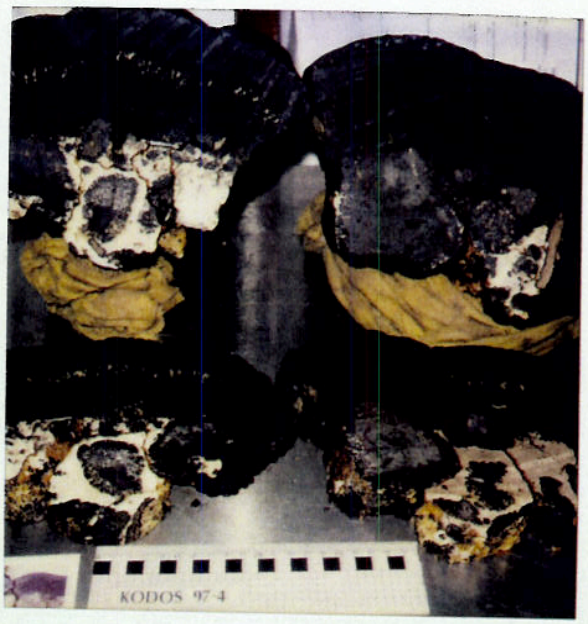
X

X

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 88 x 24 x 18.5 Location: Lomilik

Sample Id: D13-1 Weight(kg): 22.5 Depth(m): 2350-2250



KODOS 97-4 D13-1

Mn Crust Description

Surface Texture: Subdued botryoidal, smooth to microbotryoidal

Mn Crust Thickness(mm):

Min: 36 Max: 90 Ave: 75

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	19	33	28	black massive
2	22	55	10	Columnar? Vuggy w/ sed
3			40	Porous w/ Fe staining
4				
5				
6				

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D13-1A	CC, PGE	Bulk 0-25	~60g
D13-1B	CC, PGE	layer 0-28	~70g
1C	CC, PGE	layer 28-40	~45g
1D	CC, PGE	layer 40-58	~75g

½ Kordi

½ USGS

Substrate Description

RockType: Breccia

Description: Clasts 3mm to 90mm; Layer 3 Mn Crust Fragments; altered vesicular basalt - 3 Biff CFA cement; mudstone, significant Mn cement dendritic rims up to 20mm around clasts - 1 Mn nodule clast - extensive dendrites around old Mn crust clasts - Cement supported -

ology:

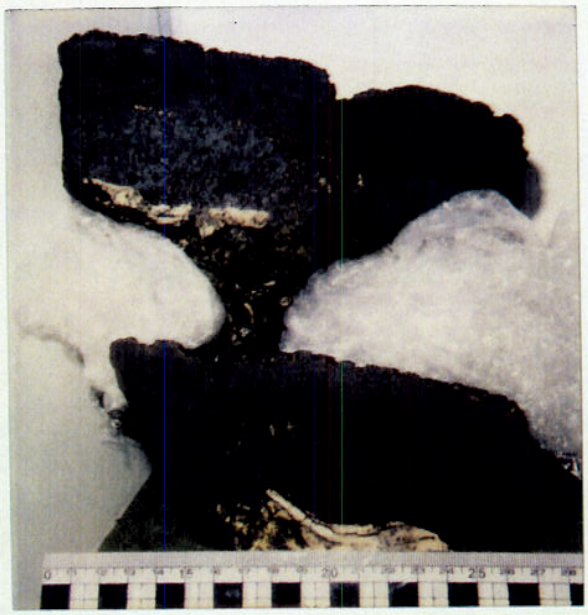
Described by: S. Zielinski

Subsampled by: S. Zielinski

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 20 x 18 x 10.5 Location: Lomilik

Sample Id: D13-2 Weight(kg): 3.8 Depth(m): 2350-2250



KODOS 97-4 D13-2

Mn Crust Description

Surface Texture: botryoidal & granular - overlain by microbotryoidal

Mn Crust Thickness(mm):

Min: 44 Max: 65 Ave: 53

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	22	30	25	massive black
2	20	34	28	massive, Fe-stained
3				
4				
5				
6				

Comments and XRD Mineralogy:

the 2 layers are separated by a thin porous section too irregular & thin to be its own layer + discontinuous

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D13-2A	CC bulk	0-50mm	~35g

10g powder to HORDI

60% USGS
40% HORDI

Substrate Description

RockType: breccia

Description: Basalt clasts in Cream CFA matrix, which is >90% of substrate - differentially phosphatized - hard, abundant Mn dendrites & concentrations

Biology:

Described by: S. Zielinski

Subsampled by: S. Zielinski

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 49x33x19½ Location: Lomilik

Sample Id: D13-3 Weight(kg): 25.6 Depth(m): 2350-2250

KODOS 97-4 D13-3

2

Mn Crust Description

Surface Texture: Lizard Skin to microbotryoidal, granular on sides

Mn Crust Thickness(mm):

Min: 10 Max: 70 Ave: 58

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	0	15	13	massive black
2	10	48	25	columnar, ruggy, porous
3			20	massive, Fe-stained
4				
5				granular on sides
6				very porous

Comments and XRD Mineralogy:

Layer 1 covers only the top surface of the sample

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D13-3A	XRD Paleo	CFA-calcite Matrix	

Substrate Description

RockType: Breccia

100% to RORDI

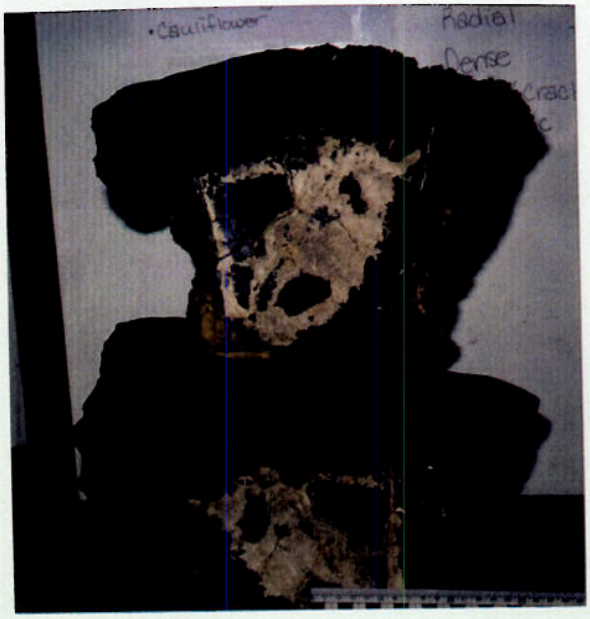
Description: 4 to 53 mm clasts of altered vesicular basalt, Phosphorite, & reworked Mn-crust (one whole side of the substrate is an old layer 3 crust w/ Phosphorite at the base) CFA cement-beige. Some dendritic Mn cement rimming clasts. Extensive dendrites. Cement supported, much softer than D13-1 & 2

Biology:

Described by: S. Zielinski

Subsampled by: Hein

*note: D13-27 is a large crust



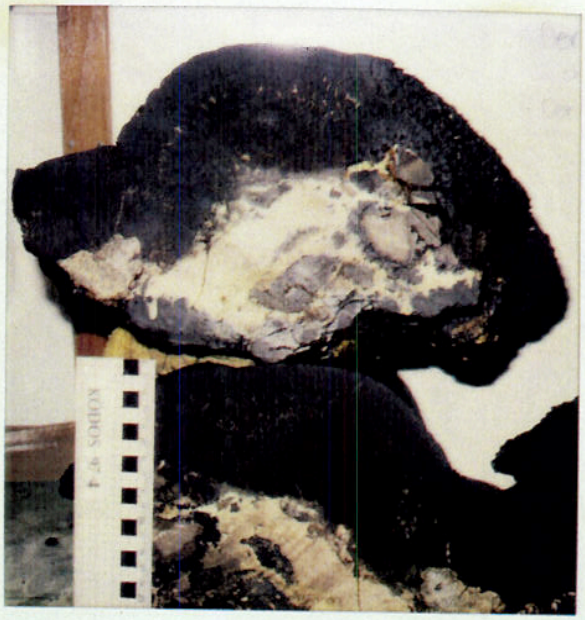
KODOS 97-4 D13-3

1

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 46 × 41 × 20 Location: Lamilik

Sample Id: D13-4 Weight(kg): 24 kg Depth(m): 2350-2250



KODOS 97-4 D13-4

Mn Crust Description

Surface Texture: lizard skin to microbotryoidal → granular on sides

Mn Crust Thickness(mm):

Min: 70 Max: 91 Ave: 80

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	18	25	21	black Columnar
2	13	30	20	black vugy, sed. infill columnar invugs
3	30	55	40	black porous some Fe oxide
4				staining, few voids have
5				sed infill, almost dendritic
6				at base

Comments and XRD Mineralogy:

sides of crust extremely porous.

Underside massive crust dense black like layer 3 replacing the CFA - dendrited boundary

Analyses

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

100% HORDI

Substrate Description

RockType: Breccia

Description: Clasts: altered basalt in a CFA matrix, Mn-oxide rinds around clasts
Breccia is matrix supported
Clasts have CFA veins in them
Mn dendrites in CFA

Biology: Encrusting forams

Described by: Leanne Roberts

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 35½ x 29 x 13½ Location: Lomilik

Sample Id: D13-5 Weight(kg): 13kg Depth(m): 2350 - 2250

Mn Crust Description

Surface Texture: lizard skin to microbotryoidal on sides

Mn Crust Thickness(mm):

Min: 65 Max: 85 Ave: 70

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	21	24	22	black massive dense
2	7	7	7	black massive, slightly porous
3	6	12	7	black vuggy vugs filled w/seeds
4	10	14	12	black massive, slightly porous
5	13	20	16	black massive
6				

KODOS 97-4 D13-5

Comments and XRD Mineralogy:

layers are not distinct

Substrate Description

RockType: Phosphorite

Description: Yellow brown phosphorite w/smaller light brown phosphorite layers w/in Mn-oxide clasts, volcanic clasts - many dendrites in OFA cement - Phosphorite clasts

Biology: Encrusting Forams

Described by: Leanne Roberts

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D13-5A	CC	Mn clast in Breccia	12g

60% USGS
90% HORDI

Subsampled by:

S. Zielinski

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 31X20X15.5 Location: Lomilik

ample Id: D13-6 Weight(kg): 9.5 Depth(m): 2350-2250

KODOS 97-4 D13-6

USGS

Mn Crust Description

Surface Texture: Lizard skin
microbotryoidal To subdued botryoidal
on back side

Mn Crust Thickness(mm):

Min: 64 Max: 79 Ave: 70

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	25	40	21	massive black
2			15 v.	Porous, Columnar
3	30	39	35	Columnar to
4				massive Fe-stained
5				porous
6				

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
50% HORDI			
50% USGS			

Substrate Description

RockType: Breccia

Description: clasts 4 - 50 mm
altered vesicular basalt + reworked
Mn crusts on basalt + Massive layer 3 Fragments,
CFA cement, minor Mn cement
substrate
Cement Supported

ology: Mn encrusted clasts

Mini-Mn Crust clasts have a Columnar
upper layer +
massive lower
layer

Described by: S. Zielinski

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 25 x 18 x 13.5 Location: Lomulik

Sample Id: D13-7 Weight(kg): 5 Depth(m): 2350-2250

KODOS97-4 D13-7

Mn Crust Description

Surface Texture: Lizard skin
silica granular

Mn Crust Thickness(mm):

Min: 60 Max: 95 Ave: 75

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	9	10	9	massive black
2	15	20	18	porous & asicular black (not filled w/ sediment)
~~3~~				
4	32	55	40	Vugs, red-black
5	4	6	4	massive black
6				

Comments and XRD Mineralogy:

- indistinct four layer
- layer 3: upper part contains more large vugs that filled w/ sediment than lower part & stained w/ Fe oxide
- layer 4 have CFA in vugs

Analyses

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

70% USGS
30% HORIZ

Substrate Description

RockType: Phosporite Breccia

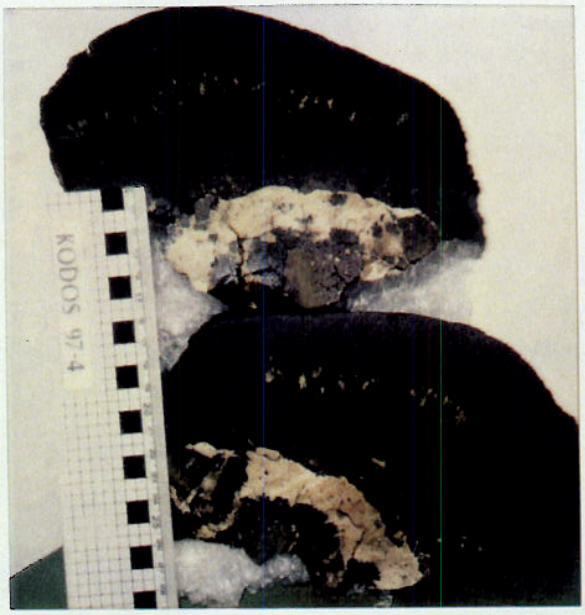
Description: clasts = Mn oxide & vesicular basalt. Some clast cemented by Mn-oxide; Mn-oxide clast growth radially & dendritic into phosporite. Phosporite is yellowish brown - hard

crust fragments

Biology: encrusting form on the surface

Described by: SH. park

Subsampled by:

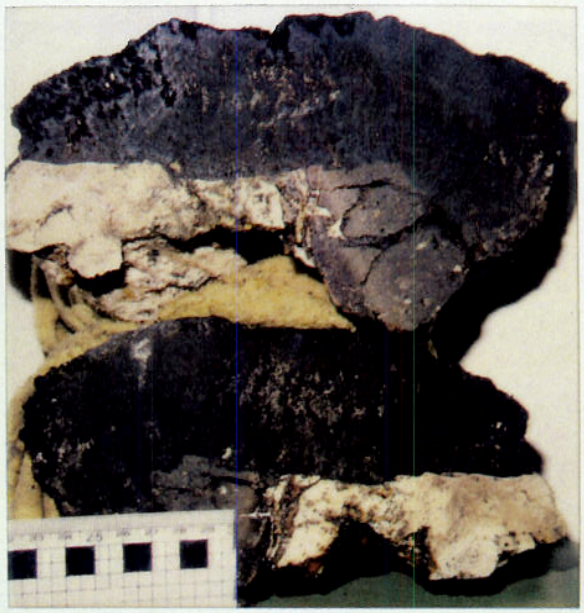


KODOS
97-4 D13-7

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 25 x 20 x 11 Location: Lomilik

Sample Id: D13-8 Weight(kg): 4.2 Depth(m): 2350 - 2250



Mn Crust Description

Surface Texture: Irregular granular

Mn Crust Thickness(mm):

Min: 23 Max: 50 Ave: 50

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	13	25	25	columnar/massive;
2				black, Fe-oxide stained colour
3				margins
4	15	25	25	Black, somewhat
5				porous
6				

Comments and XRD Mineralogy:

layer one is columner one and half of rock (13cm) then crosses sharp vertical contact to massive (8cm)

Analyses

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

100% HORDI

Substrate Description

RockType: Breccia

Description: Angular (>6x5x5cm) basalt pillow fragments with chill margins (<1cm) > angular phosphatized cobble & pebble-sized fragments in a foraminiferal phosphatized limestone matrix. Matrix grades from pale brown to pale yellow brown & contains common disseminated Fe-Mn oxide. Fe-Mn oxide is also concentrated along fractures.

Biology:

foraams on surface - probably contaminant from other samples

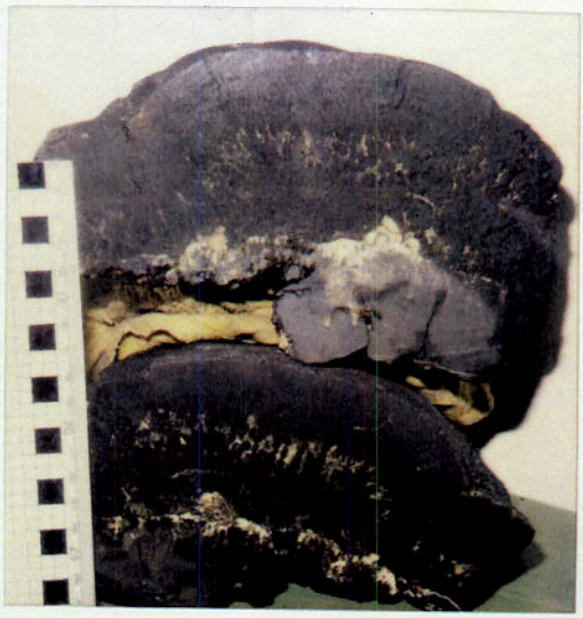
Described by: Louis B

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 30x20 x11.5 Location: Lomilik

Sample Id: D13-9 Weight(kg): 7.5 Depth(m): 2350 - 2250



KODOS 97-4 D13-9

Mn Crust Description

Surface Texture: Lizard skin - granular on modified-elongate, very subdued botryoids

Mn Crust Thickness(mm):

Min: 60 Max: 70 Ave: 60

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	8	9	9	[illegible]
2	15	25	20	[illegible]
3	40	45	15	[illegible] w/ Fe oxide
~~4~~				[illegible]
~~5~~ 4			15	massive, Fe-stained
~~6~~				

Comments and XRD Mineralogy:

layer 3 Raw large vugs in upper part that filled w/ sediments

Substrate Description

RockType: phosphorite Breccia

Description: Big clast of Mn-oxide that origin from older crust layer 3

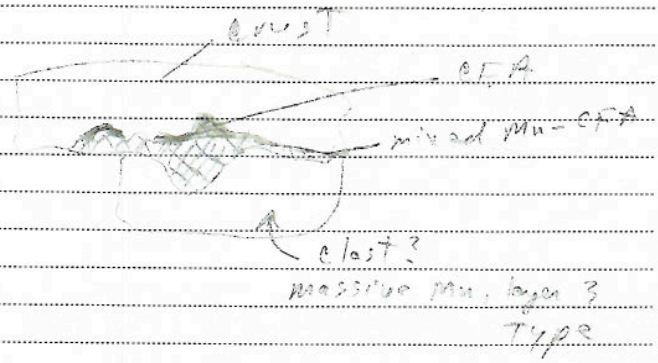
Biology: encrusting foram on the surface

Described by: SH park

Analyses

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

70% USGS
30% KORDI



Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 19 x 18 x 11 Location: Lomilik

Sample Id: D13-10 Weight(kg): 3.4 Depth(m): 2350-2250

Mn Crust Description

Surface Texture: botryoidal on top, granular on sides
Extremely porous

Mn Crust Thickness(mm):

Min: 15 Max: 35 Ave: 30

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	4	14	12	massive black
2	6	32	18	porous, Fe-stained
3				
4				
5				
6				

Comments and XRD Mineralogy:

layer 1 covers only the top of the sample

Analyses

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

Substrate Description

RockType: vesicular basalt, gray

100% HORDE

Description: slightly weathered (brown outer Cooling Rind that is 11 mm thick on upper surface
vesicles 1-5 mm

Biology: Encrusting Foram

Described by: S. Zielinski

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 28 x 23 x 10.5 Location: Lomilik

Sample Id: D13-11 Weight(kg): 6.1 Depth(m): 2350-2250

Mn Crust Description

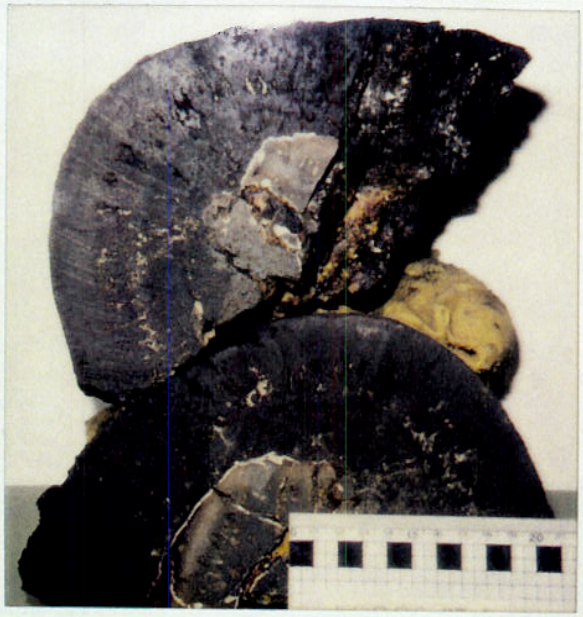
Surface Texture: Smooth on top, granular on sides

Mn Crust Thickness(mm):

Min: _____ Max: 64 Ave: 60

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	20			black, massive
2	15			Vuggy w/ sed, Fe-stained
3	28			Porous, Fe-stained, massive
4				
5				
6				



KODOS 97-4 D13-11

Comments and XRD Mineralogy:

incomplete crust, can't get a true thickness

Substrate Description

RockType: vesicular basalt

Description: vesicles 1-4 mm
CFA in fractures & some vesicles + forms a layer between basalt + crust
chill margin on basalt - brown

Biology:

Described by: S Zielinski

Analyses

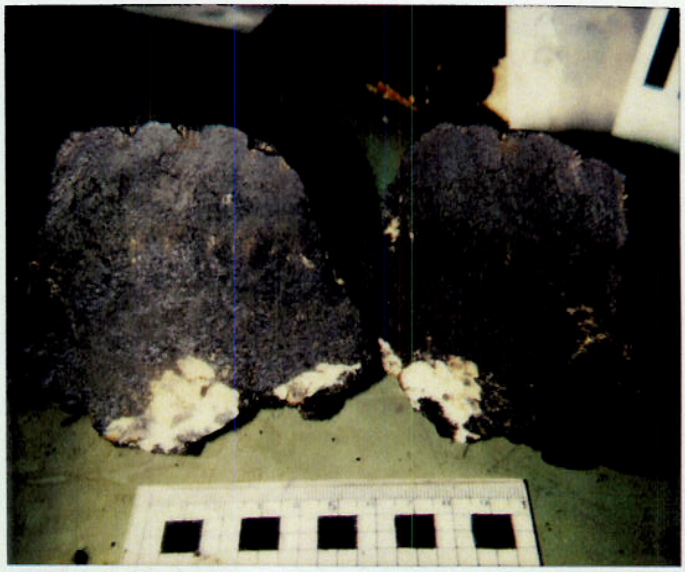
Subsample No.	Analysis	Layer Thick.	Wt.(g)

50% KORDI
50% USGS

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 12×9×8 Location: Lomilik
Sample Id: D13-12 Weight(kg): 0.96 Depth(m): 8000-8500



D13-12

Mn Crust Description

Surface Texture: Lizard Skin on subdued botryoidal

Mn Crust Thickness(mm):

Min: 64 Max: 76 Ave: 69

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	20	26	23	black botryoidal
2	48	50	49	black radial dendritic
3				
4				
5				
6				

Comments and XRD Mineralogy:

middle of crust has some vugs w/ sed infill

50% USGS
50% MARDI

Substrate Description

RockType: Breccia

Description: ~~Yellow~~ brown → light tan w/ ~~Mn oxides dotting~~ + Mn oxide cement

Biology: Encrusting Forams

Described by: Leanne Roberts

Analyses

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

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 20 x 11 x 7 Location: Lomilik
Sample Id: D13-13 Weight(kg): 1.9 Depth(m): 2350-2250

Mn Crust Description

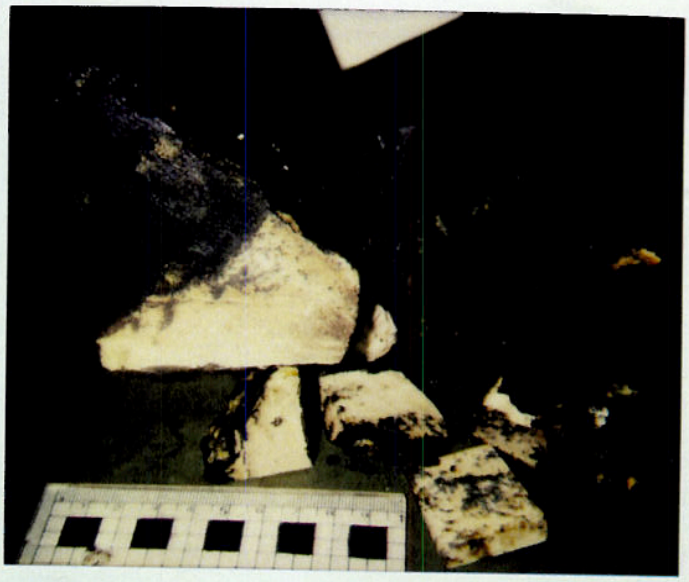
Surface Texture: Lizard Skin To granular on sides

Mn Crust Thickness(mm):

Min: 60 Max: 64 Ave: 62

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	24	26	25	Porous, black, fe-stain lower part
2			6	Porous w/sed
3			5	Asicular black
4			25	Porous, brown
5				
6				



D13-13

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D13-13A	XRD Poleo	Bulk substrate	
	OC + CFA		25g

50% USGS
50% KORDI

Substrate Description

RockType: Phosphorite

Description: Pale brown To off white hard - layered Mn dendrites,

Biology: Encrusting forams

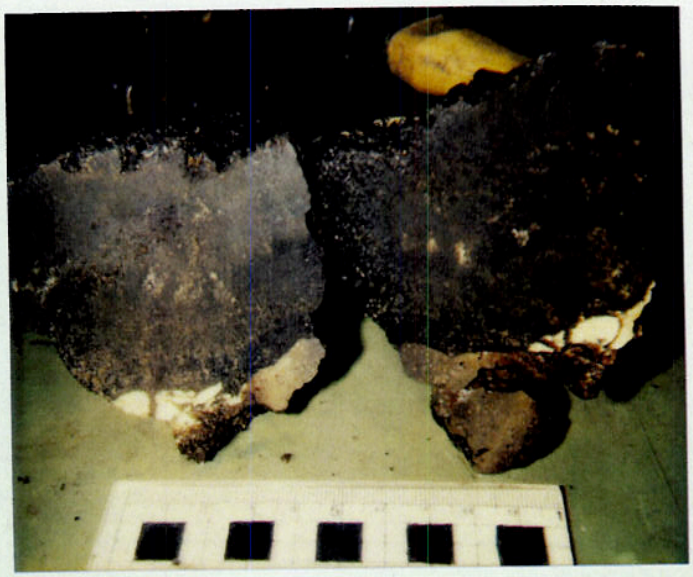
Described by: Hein

Subsampled by: Hein

SAMPLE DESCRIPTION

Cruise Id: KODOS97-4 Size(cm): 18 x 8½ x 7 Location: Lomilik

Sample Id: D13-14 Weight(kg): 0.95 kg Depth(m): 0350-2050



D13-14

Mn Crust Description

Surface Texture: Modified botryoidal - etched

Mn Crust Thickness(mm):

Min: 45 Max: 60 Ave: 55.

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	45	60	55	black massive w/
2				Fe-oxide lined vugs
3				botryoidal at top
4				slightly porous at base
5				
6				

Comments and XRD Mineralogy:

No distinct layers - Very unusual

Analyses

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

50% HORDS
50% USGS

Substrate Description

RockType: Breccia

Description: Brown basalt + CFA "clasts" in Mn oxide cement

Biology: Encrusting Forams

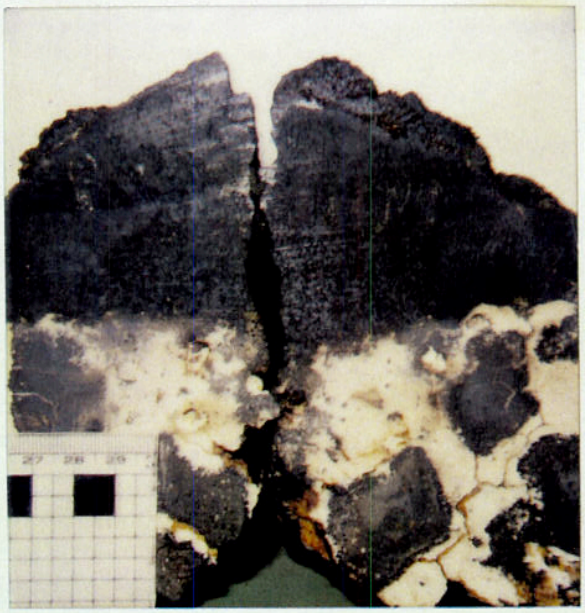
Described by: Lynne Roberts.

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 21 x 13.5 x 9 Location: Cornilik

Sample Id: D13-15 Weight(kg): 2.0 Depth(m): 2350-2250



KODOS 97-4/D13-15

Mn Crust Description

Surface Texture: granular - incomplete crust

Mn Crust Thickness(mm):

Min: 16 Max: 61 Ave: 45

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	16	61	45	massive, porous
2				black - layer 3
3				for this dredge type
4				
5				
6				

Comments and XRD Mineralogy:

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	50% HORD1		
	50% USGS		

Substrate Description

RockType: breccia

Description: clasts of vesicular basalt - gray col. Fresh 7-50 mm + Typical layer 3 Mn Crust Frags - tan CFA cement rim of Mn cement (2-3mm) around clasts

Biology:

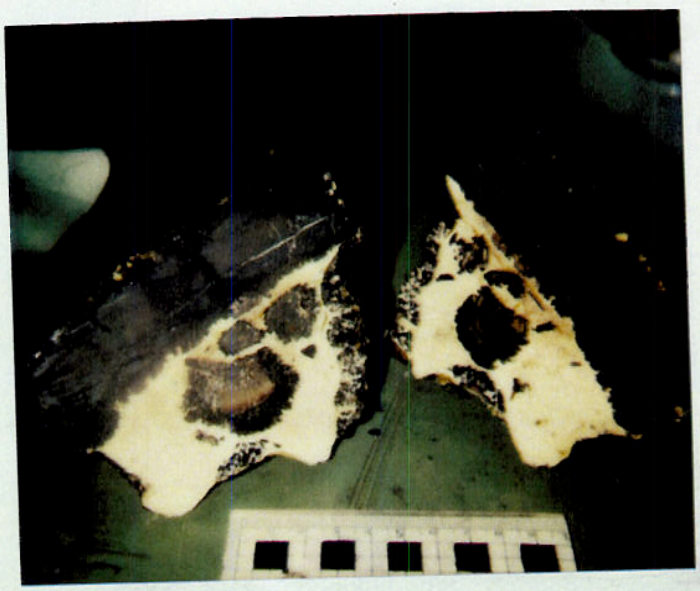
Described by: S Zielinski

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 15 x 12 x 8 cm Location: Lomilik

Sample Id: D13-16 Weight(kg): 1.75 Depth(m): 2350 - 2250



D13-16

Mn Crust Description

Surface Texture: subdued microbotryoidal

Mn Crust Thickness(mm):

Min: 30 Max: 35 Ave: 30

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	5	5	5	V. porous; Fe oxide stain
2	22	28	25	massive; black
3				
4				
5				
6				

Comments and XRD Mineralogy:

- upper porous layer contains common yellow pelagic mud with fenestral voids
- layer 2 has CFA filled horizontal partings & minor vertical partings
- at base of crust
- 4mm thick "layer" of dendritic/botryoidal Fe-Mn oxide grows down into porous CFA substrate

Analyses

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

Unusual - typical massive layer 3 w/ renewed growth - probably lg hiatus between 2 crust layers

50% USGS
50% HORIZ

Substrate Description

RockType: Breccia

Description: Phosphatized foraminiferal limestone matrix w/common matrix supported basaltic (with chill margins) intraclasts. Clasts are coated on all sides by up to 10mm of porous dendritic Fe-Mn oxide crust - Also Mn crust fragment clasts

Biology: φ

Described by: Laura B.

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 11x5.5x9 Location: Lomilik
Sample Id: D13-17 Weight(kg): 0.85 Depth(m): 2350-2250

Mn Crust Description

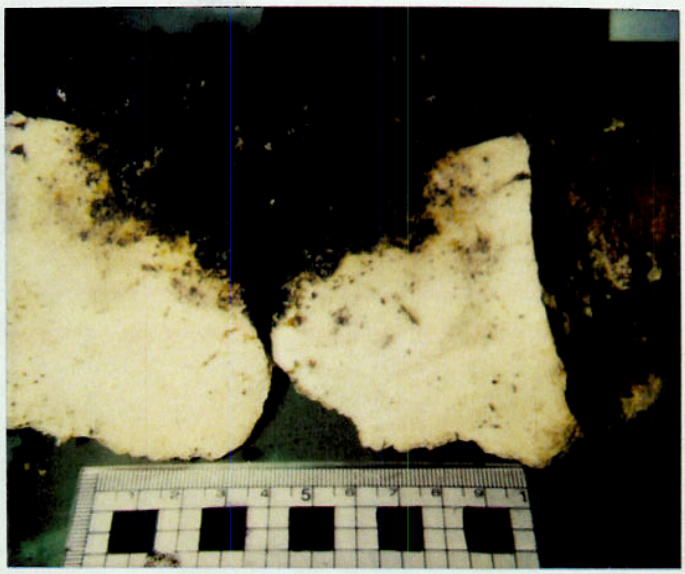
Surface Texture: granular

Mn Crust Thickness(mm):

Min: 25 Max: 31 Ave: 28

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	25	31	28	very vuggy
2				stained w/ Fe-oxide
3				vugs filled w/ sediments
4				porous
5				
6				



D13-17

Comments and XRD Mineralogy:

Substrate Description

RockType: tan phosporite
Cream, porous

Description: This phosporite has many Mn-oxide & pinkish spots near the crust

Biology: encrusting form on the surface

Described by: Park

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D13-17A	OC CFA	bulk substrate	

50% USGS
50% KORDI

Subsampled by: Hein

SAMPLE DESCRIPTION

Cruise Id: KODOS97-4 Size(cm): 9.5x7.5x7 Location: Lomilik

Sample Id: D13-18 Weight(kg): 0.75 Depth(m): 2350-2250

Mn Crust Description

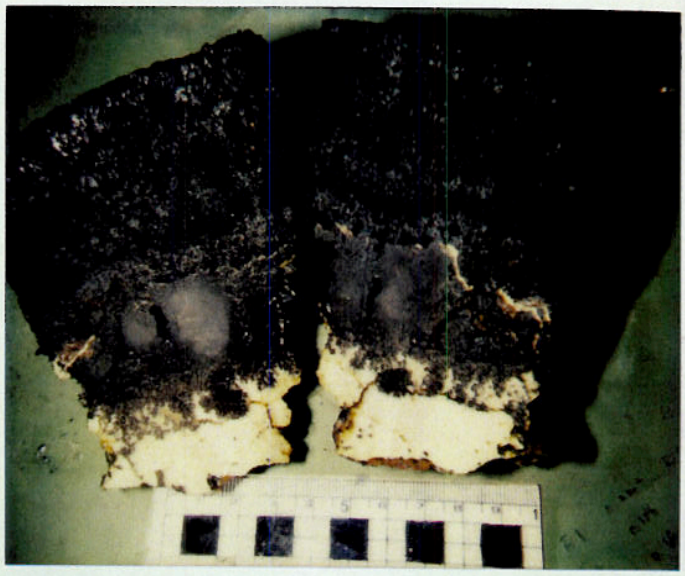
Surface Texture: granular - microbotryoidal

Mn Crust Thickness(mm):

Min: 35 Max: 45 Ave: 38

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	35	40	38	Very vuggy black
2				Ext. porous
3				
4				
5				
6				



D13-18

Comments and XRD Mineralogy:

- spottedly stained w/ Mn oxide
- lower part is more stained w/ Mn oxide

Subtle bedding into crust

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
	50% USGS 50% NORDI		

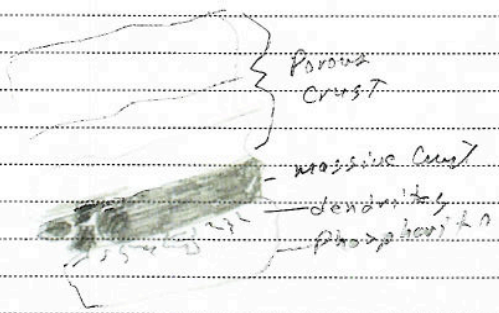
Substrate Description

RockType: phosphorite breccia

It is not clear whether the massive black (typical layer 3) Mn is a clast in breccia of regrowth on older crust

Description: Mn oxide & basalt clasts
Mn oxide crust thicker than CFA
veins on surface & inner part

Mn dendrites extend from crust into phosphorite



Biology: none

Described by: SH park

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 3 rocks 20x17x7; 16x12x7; 14x11x7 Location: Lomilik

Sample Id: D13-19 Weight(kg): 4.1 kg Depth(m): 2380-2250

KODOS 97-4 D13-19

Mn Crust Description

Surface Texture: Subdued modified (elongate) botryoidal, granular on sides

Mn Crust Thickness(mm):

Min: 50 Max: 65 Ave: 62, 54, 60 } each of 3 rocks

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	20	27	24	black, dense, massive
2	5	12	7	Porous, Fe-oxide lining &
~~3~~				Some sed infill
~~4~~ 3	21	31	25	black asicular
~~5~~				
~~6~~				

Comments and XRD Mineralogy:

3 Crusts w/out substrate

Analyses

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

Substrate Description

RockType: Basalt (very small fragment)

50% HORDI
50% UGGS

Description: Brown Basalt

Biology: Encrusting Forams

Described by: Leanne Roberts

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 14 rocks. from: 16×10½×7½, 6½×5×3½ Location: Lomilik

Sample Id: D13-20 Weight(kg): 7.8 kg Depth(m): 2350-2260

Mn Crust Description

Surface Texture: lizard skin → granular

sides + edges

Mn Crust Thickness(mm):

Min: 25 Max: 80 Ave: 50

Outer to Inner Layers(mm)

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

80% of samples

20% of samples

D13-20

Comments and XRD Mineralogy:

1 sample only is complete (w/ substrate)

Porous layers have some sed infill

all side or edge pieces

Substrate Description

RockType: Phosphorite

Description: Yellow brown w/ Mn

Biology: few encrusting forams

Described by: Leanne Roberts

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D13-20-1A	CC	0-33	~7 g
↑ V. Porous side piece			
70% HORDI 30% USGS		100 powder to HORDI	

Subsampled by: Roberts

SAMPLE DESCRIPTION

Cruise Id: KODOS97-4 Size(cm): 11.5x9x4 & 12x6.5x5 Location: Lomilik

Sample Id: D13-21 Weight(kg): 1.13 Depth(m): 2250-2250

Mn Crust Description

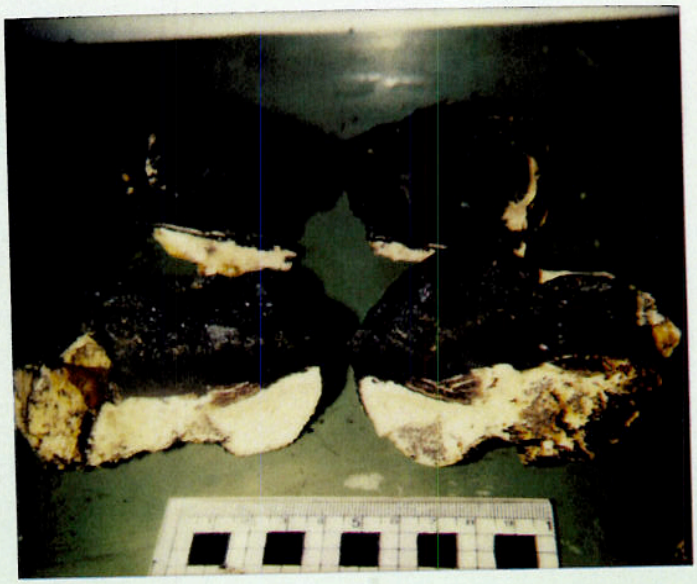
Surface Texture: botryoidal; microbotryoidal

Mn Crust Thickness(mm):

Min: 7 Max: 36 Ave: 20

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	0	4	2	porous, Fe-stained
2	7	32	18	massive, black
3				
4				
5				
6				



D13-21

Comments and XRD Mineralogy:

one sample has both crust layers
the other only has layer 2

Analyses

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

All KORDI

Substrate Description

RockType: phosphorite breccia

Description: 2 cobbles of tan phosphorite w/ Mn encrustation

Biology: encrusting forams on surface

Described by: S. Zielinski

Subsampled by:

SAMPLE DESCRIPTION

Substrate RX

Cruse Id: KODOS97-4 Size(cm): 1) 15×7×4 2) 10×6.2×3 3) 7×6.5×5.5 Location: Lamilik

Sample Id: D13-22 Weight(kg): total: 0.65 Depth(m): 2350 - 2250

Mn Crust Description

Surface Texture: modified granular

Mn Crust Thickness(mm):

Min: 15 Max: 30 Ave: 25

side crusts

Outer to Inner Layers(mm)

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

3 rocks so not applicable

D13-22

Comments and XRD Mineralogy:

one phosphatic limestone may have 2 crust layers (outer porous, inner dense & massive); other 2 samples are coated by a single porous layer.

All crusts on these rocks are from sides of crusts

Substrate Description

RockType: Phosphatized limestone

Description: 2 tan phosphatic limestones with common Fe-Mn oxide dendrites; 1 dry brown vesicular basalt w/ upper local polygonite zone & thin lens of CFA with volc. intraclasts separating basalt from overlying crust

Biology: ϕ

Described by: Laura B.

Analyses

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

100% KORDI

Subsampled by:

SAMPLE DESCRIPTION

(3 pieces)

Cruse Id: KODOS97-4 Size(cm): 7.5x7x6 to 11x12x5.5 Location: Lomelik

Sample Id: D13-23 Weight(kg): 1.8 Depth(m): 2350-2250

Mn Crust Description

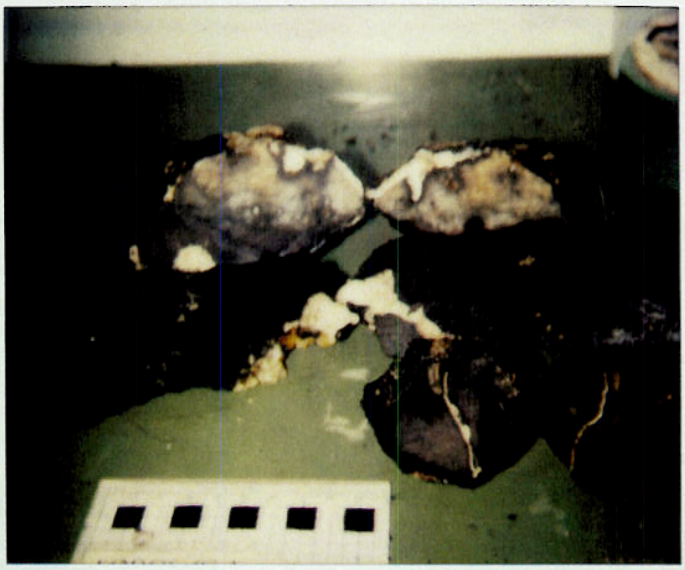
Surface Texture: Ligand stain 1 [illegible], granular sides

Mn Crust Thickness(mm):

Min: 20 Max: 60 Ave: 40

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	0	30	12	massive to porous; black
2	10	60	30	massive to porous;
3				black & Fe-stained
4				
5				
6				



D13-23

Comments and XRD Mineralogy:

(2 Rocks) are Typical Layer 3 massive Mn Crust fragments from breccia

(1) Fragment is a side crust

Substrate Description

RockType: Phosphorite Breccia

& phosphorite [illegible] w/ [illegible] (it may be [illegible] from older crust)

Description:

phosphorite [illegible]

veins & vugs filled [illegible]

Biology: [illegible] form [illegible] surface of Rock)

Described by: SH park

Analyses

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

100% HORDF

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 15 x 14 x 4 to 8 x 10 x 25 spaces Location: Lomilik

Sample Id: D13-24 Weight(kg): 2.2 Depth(m): 2350-2250

KODOS 97-4 D13-24

Mn Crust Description

Surface Texture: patina one granular

Mn Crust Thickness(mm):

Min: _____ Max: 5 Ave: _____

patina

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

RockType: Basalt

Most likely clasts from breccia

Description: vesicular basalt w/ vesicles filled w/ zeolites? or calcite? + Fe oxide + CFA - many vesicles unfilled

Chill margins on some

CFA coat some samples

Biology: none

Described by: stl park

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 8.5x9x4.5 to 4x3.5x2 Location: Lomilik

Sample Id: D13-25 Weight(kg): 0.86 Depth(m): 2350 - 2250

8 pebbles + cobbles

D13-25

Mn Crust Description

Surface Texture: patina to granular

Mn Crust Thickness(mm):

Min: patina Max: 10 Ave: 1

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	patina	10	1	massive, columnar
2				black
3				
4				
5				
6				

Comments and XRD Mineralogy:

Analyses

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

50% USGS
50% MORDI

Substrate Description

RockType: phosphorite

Description: Offwhite To Cream - pale brown tan phosphorite w/ Mn dendrites
8 pebbles & cobbles
Dense massive To porous

Biology: NONE

Described by: S. Zielinski

Subsampled by:

SAMPLE DESCRIPTION

Cruise Id: KODOS97-4 Size(cm): 100's of pebbles Location: Lomilik
Sample Id: D13-26 Weight(kg): 22 kg Depth(m): 2350-2250

Mn Crust Description

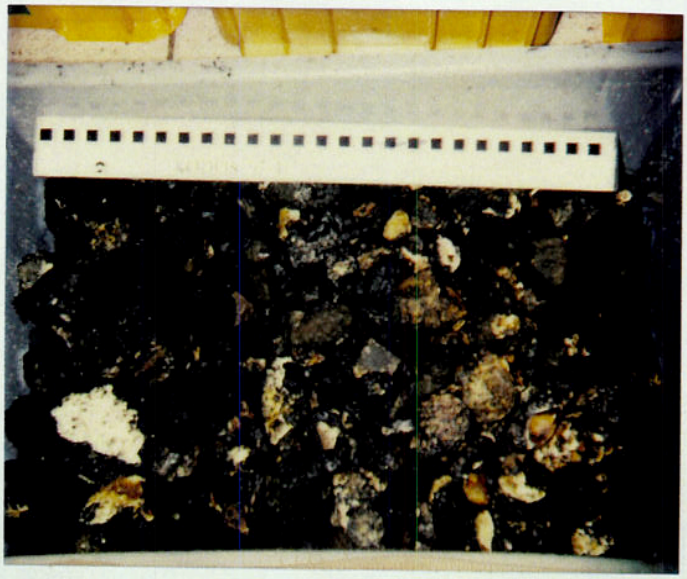
Surface Texture: Complete Range

Mn Crust Thickness(mm):

Min: petina Max: 50 Ave: 20

Outer to Inner Layers(mm)

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



KODOS 97-4
D13-26

Comments and XRD Mineralogy:

fragments of crusts, complete, inner only, outer only, lots of granular side pieces

Analyses

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

100% HORDI

Substrate Description

RockType: Breccia + Basalt

Description: Pebbles of basalt in CFA matrix + gray to brown basalt pebbles that were probably clasts in the breccia -

Biology: NONE

Described by: Hein

Subsampled by:

SAMPLE DESCRIPTION

Cruse Id: KODOS97-4 Size(cm): 27x21x15.5 Location: Lomilik

Sample Id: D13-27 Weight(kg): 6.1 Depth(m): 2350-2250

Mn Crust Description

Surface Texture: botryoidal-etched & overlain by microbotryoidal

Mn Crust Thickness(mm):

Min: 44 Max: 59 Ave: 50

Outer to Inner Layers(mm)

	Min	Max	Ave	Texture & Color
1	22	27	25	massive black
2	21	33	24	massive iron-stained
3				
4				
5				
6				

D13-27

Comments and XRD Mineralogy:

The 2 crust layers are separated by a more porous section (the irregular & discontinuous to see its own layer)

Analyses

Subsample No.	Analysis	Layer Thick.	Wt.(g)
D13-27A	OC	Bulk Substrate	~50

Substrate Description

RockType: vesicular basalt

50% USGS
50% MORB

Description: Highly altered vesicles 1mm - 3mm some filled w/ orange oxide, others w/ CFA several unfilled fractures - IT IS a very large clast (130x100mm) from breccia-phosphorite on one side

Biology:

Described by: S Zielinski

Subsampled by: Ken