USGS DREDGE LOG

SHIP/LEG FARNELLA

STATION # 1

DREDGE # D1

DEPTH INTERVAL(m) 1565-1190

DEPTH(m)corrected 1540-1250

DATE JD 257 LOCAL 258

TIME GMT 1540 to LOCAL

LATITUDE 12°06.96' TO 12°07.29' N

LONGITUDE 166°13.85' TO 166°13.37' E

TOTAL WEIGHT: DREDGE 25 kg CRUST 15 kg

PERCENTAGE OF ROCK COVERED BY CRUST 100%

PERCENT BROKEN FROM: OUTCROP 100% TALUS —

THICKNESS OF MN CRUST: MAXIMUM 70 mm MINIMUM 10 mm AVERAGE 40 mm

DOMINANT SURFACE TEXTURE Fine scale botryoidal

SUBSTRATE LITHOLOGY 1. ~~Volcanic~~ Sedimentary breccia, 2. Phosphorite cement puppor

2 large pieces, many small

NODULES PRESENT None

REMARKS: 3 distinct layers: massive, middle porous, upper botryoidal. Foram sediment between botryoids.

Small fish in bag.

Cruise Id: [illegible]-89-CP Size: 46×35×9 (cm) Location: Seamount B

Sample Id: D1-1 Weight: ~8 (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: Fine scale botryoidal crust

Mn Crust Thickness (mm):
Min: 5 Max: 55 Ave: 35

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	3	10	4	Dense Outer Botryoidal Layer Black - Vitreous
2.	4	10	4	Porous, Fe-rich, Columnar Structure is sometimes present
3.	10	35	20	dense gray-black layer phosphate in veins (sparse) and blebs
4.				
5.				
6.				

F10-89-CP
D1-1

Comments and XRD Mineralogy:

(11 gm)
(32 gm)
(27 gm)

Substrate Description

Rock Type: Phosphate cemented ~~Hyaloclastite~~ Sandstone, Poorly Sorted, angular clasts, Cream colored phosphate cement & in veins

Description:
Altered Olivine Ferric Basalt Clasts; and altered glassy(?) material. Tan colored phosphate in blebs also

Biology ?: Foraminifera between botryoids

ANALYSE

Subsample Number	Analysis	LayerThickness
D1-1B	REE, CC	Layer 1 0-7 mm (18 gm)
D1-1C	REE CC	Layer 2 7-14 mm
D1-1D	REE CC	Layer 3 14-40 mm
D1-1A	REE, CC Au, Pt	Bulb 0-40 mm
D1-1E	DPTS	Through Substrate & lower Crust
D1-1F	OC	Substrate (16 gm) sandy Part

REE
D1A (4.8 gm)
B (3.8 gm)
C (3.8 gm)
D (6.4 gm)

Described By: JS Subsampled By:

F10-89-CP

D1-1

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 39 x 28 x 12 (cm) Location: Seamount B

Sample Id: D1-2 Weight: 6 (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: Botryoidal / partly granular and subdued botryoidal mostly on sides

Mn Crust Thickness (mm):
Min: 25 Max: 70 Ave: 47

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	5	10	7	Massive & slightly porous
2.	5	20	13	Highly porous
3.	15	37	26	Massive & Dense / Black
4.				
5.				
6.				

F10-89-CP
D1-2

Comments and XRD Mineralogy:

- Layer 1: less dense than layer 2
- Layer 2: Pores with various size filled or partially filled with iron oxide and cream-colored phosphorite
- Layer 3: Some pores and voids filled with cream-colored phosphorite → some fragments of basalt in layer 3
- * Each boundary between layers is more or less gradational

ANALY

Subsample Number	Analysis	LayerThickness

SAMPLE TO KORDI

Substrate Description

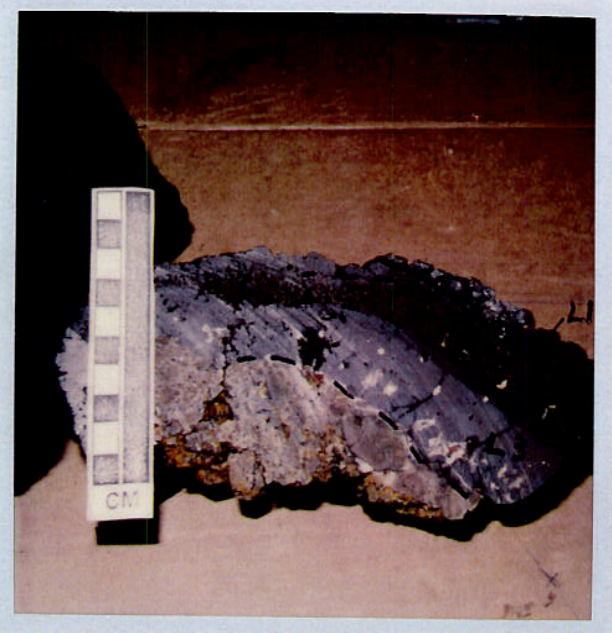
Rock Type: Breccia

Description:
Granule to pebble-size clasts in fine phosphorite matrix; altered basalt clast with olivine phenocryst dominant

Biology ?: encrusting forams in subdued part of botryoid

Described By: Yoon Subsampled By:

F10-89-CP
D1-2



F10-89-CP
D1-2

DESCRIPTION

Cruise Id: F10-89-CP Size: 14X8X9 (cm) Location: Seamount B

Sample Id: D1-3 Weight: 0.5 (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: Fine scale botryoidal crust

Mn Crust Thickness (mm):
Min: 12 Max: 22 Ave: 17

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	4	7	6	Porous w/ radially shear columns Black
2.	5	12	8	Black, porous w/ large (pole thin) holes from ?
3.				
4.				
5.				
6.				

F10-89-CP
D1-3

Comments and XRD Mineralogy:

porous, Fe-Rich crust
phosphorite veins in the substrate.

ANALY

Subsample Number	Analysis	LayerThickness
D1-3 (88.4gm)	CC-Bulk	0-20 mm
	XRD	
Rock Taken	Ar-Ar, Isotopes	Brandigel

Substrate Description

Rock Type: Basalt

Description: Altered Ferric Basalt cobble; showing phenocrysts of Hornblend, plagioclase
Cream colored phosphorite on one side of sample which permeates crust on that side

Biology ?:

substrate to M Pringle for dating

Described By: LCC/JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 9x8.5x5 (cm) Location: Seamount B

Sample Id: D1-4 Weight: <1kg (kg) Depth: 1540-1250 (m)

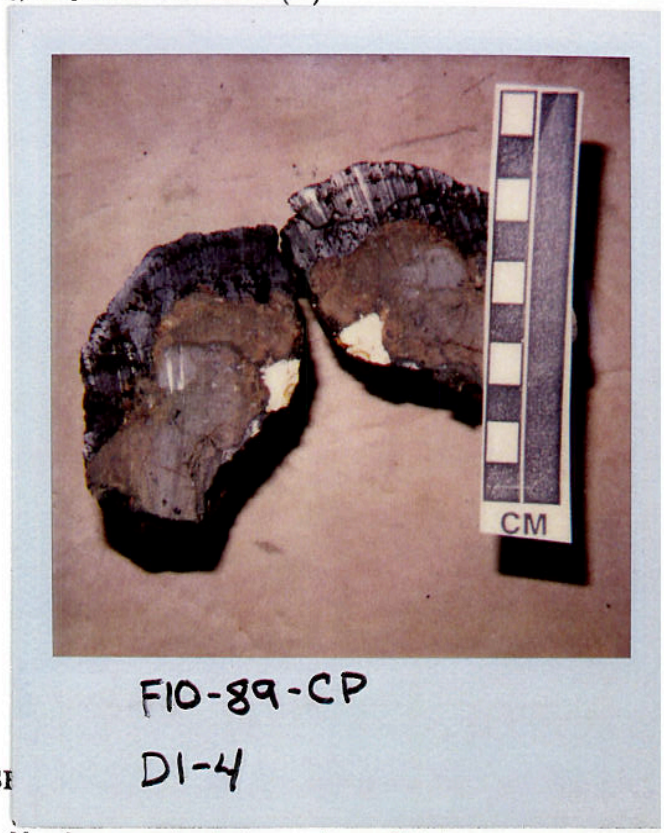
Mn Crust Description

Surface Texture: Porous and granular botryoidal texture

Mn Crust Thickness (mm):
Min: 8 Max: 20 Ave: 13

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	1	5	3	Porous & granular, black
2.	7	16	12	Black, dense w/areas of porosity
3.				
4.				
5.				
6.				



Comments and XRD Mineralogy:
The area between layers is Fe-stained and granular (staining is like Fe blebs)

ANALYSES

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Porphyritic Basalt, hornblende phenocrysts same lithology as D1-3

Description:
Altered glassy (?) edges on basalt cobble cream colored phosphorite on bottom of sample.

Biology ?:

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 5 x 4 x 3 (cm) Location: Seamount B

Sample Id: D1-5 Weight: <1 (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: patina Only

Mn Crust Thickness (mm): NONE

Min:_____ Max:_____ Ave:_____

Layers (Outer to Inner)(mm):

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

Comments and XRD Mineralogy:

ANALYSES

Subsample Number Analysis LayerThickness

Sample given to Malcolm Pringle

Rock Taken AC-Ac, Tsunper Standigel

Substrate Description

Rock Type: Porphyritic Basalt w/ hornblende phenocrysts, matrix is moderately altered

Description: phosphorite on outside of pebble

Biology ?:

Described By: JS Subsampled By:

Cruise Id: FIO-89-CP Size: 14 X 13 X 2 (cm) Location: Seamount B

Sample Id: D1-6 Weight: 1.5 (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: Granular Botryoids, somewhat abraded; gives the feeling of having been around awhile

Mn Crust Thickness (mm):

Top Min: 13 Max: 27 Ave: 20

Bottom 7 21 8

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
Primary Crust	1. 2	10	8	SL. ERODED BOTRYOIDAL GRANULAR, POROUS
	2. 12	17	15	MASSIVE, BLACK, PHOSPORITE DENDRITES, FRACTURED ⊥ BEDDING PLANE
	3.			
Secondary Crust	4. 7	21	8	GRANULAR EXTERIOR, POROUS IRON STAINING
	5.			
	6.			

Comments and XRD Mineralogy:

BOULDER FLIPPED OVER - PRIMARY LAYER WAS PERMEATED WITH PHOSPORITE (CREME COLORED, POROUS, IRON STAINING, FOSSIL EMBEDDED IN PHOSPORITE)

ANALYSES

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Volcaniclastic Breccia w/ Phosphate cement & matrix of altered glassy (?) kinds

Description: Moderately Sorted, angular to subrounded clasts; clast are all highly altered Porphyritic basalts. Some Mn in the matrix

Se Won Chang took subsample 10/95

Biology ?: ~~OSTRACOD? EMBEDDED IN PHOSPHORITE * POSSIBLY DATABLE *~~ inclusion not a fossil

Described By: JS/RO Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 10 X 7 X 7 (cm) Location: Seamount B

Sample Id: D1-7 Weight: 0.3 (kg) Depth: 1540-1550 (m)

Mn Crust Description

Surface Texture: Botryoidal to granular

Mn Crust Thickness (mm):
Min: 8 Max: 19 Ave: 14

Layers (Outer to Inner)(mm):

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

F10-89-CP
D1-7

Comments and XRD Mineralogy:

Dense and partially porous; Some pores filled with yellowish iron oxide

ANALYS

Subsample Number	Analysis	Layer Thickness

Substrate Description

Rock Type: Breccia

Description: Angular altered basaltic clasts in the matrix of fine-grained sediment or dense phosphorite; phosphorite veinlets

Biology ?: forams

Described By: Yoon Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 18 x 18 x 5.2 (cm) Location: Seamount B

Sample Id: D1-8 Weight: <1 (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: POROUS to granular botryoidal
looks like a side or bottom crust

Mn Crust Thickness (mm):
Min: 10 Max: 25 Ave: 20

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	4	9	7	Porous, Black w/Fe Stain at base
2.	10	15	12	Mass of Black w/ porosity increasing near the base
3.				
4.				
5.				
6.				

Comments and XRD Mineralogy:

ANALYSE

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Volcaniclastic Breccia w/phosphorite (cream colored) and altered glass matrix

Description: Clasts are basaltic altered porphyritic basalts. Some Mn staining in matrix

Biology ?:

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 8 x 6 x 4.5 (cm) Location: Seamount B

Sample Id: D1-9 Weight: 0.8 (kg) Depth: 1250-1440 (m)

Mn Crust Description

Surface Texture: Botryoidal

Mn Crust Thickness (mm):
Min: 33 Max: 42 Ave: 37

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	7	10	8	Slightly porous
2.	6	10	8	Highly porous
3.	17	25	21	Massive & dense
4.				
5.				
6.				

F10-89-CP
D1-9

Comments and XRD Mineralogy:

Layer 2: pores filled with iron oxide; lower boundary distinct but upper one gradational and irregular

Layer 3: thin phosphorite veinlets and small altered basalt fragments in lower part

ANALYSES

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Breccia (minor substrate rock)

Description:
Altered basalt clasts cemented by phosphorite

Biology ?: encrusting forams

Described By: Yoon Subsampled By:

F10-89-CP
D1-9

SAMPLE DESCRIPTION

Cruise Id: F10 89-CP Size: 9.5 X 7 X 2.1 (cm) Location: SEAMOUNT B

Sample Id: D1-10 Weight: .3 (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: Botryoidal w/ petina of most recent granular

Underside CRUST: SMOOTHED BOTRYOIDAL, SL. GRANULAR

Mn Crust Thickness (mm):

Min: <1 Max: 2 Ave: 1 Top

Min <1 Max 3 Ave 1 underside

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
Top 1.	<1	2	1	BLACK, BOTYROIDAL, GRANULAR SL POROUS
underside 2.	<1	3	1	BLACK, SMOOTHED OR ERODED BOTYROID, OVERLIEING SOME PHOSPORITE
3.				
4.				
5.				
6.				

F10-89-CP
D1-10

Comments and XRD Mineralogy:

ANALY

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: SEDIMENTARY BRECCIA

Description:

CLASTS ARE MADE UP OF ALTERED BASALT FRAGMENTS (SUB-ANGULAR) WITH IRON STAINING - PHOSPORITE AND Fe-Mn cement.

Clasts + cement?

Biology ?: —

Described By: R.O.

Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 16 x 9 x 6 (cm) Location: Seamount B

Sample Id: D1-12 Weight: 0.7 (kg) Depth: 1250-1540 (m)

Mn Crust Description

Surface Texture: Botryoidal (3~10mm in diameter)

Mn Crust Thickness (mm):
Min: 36 Max: 50 Ave: 43

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	8	13	11	Massive (slightly porous)
2.	7	17	12	porous
3.	15	25	20	Massive and dense
4.				
5.				
6.				

F10-89-CP
D1-12

Comments and XRD Mineralogy:

Layer 2: highly porous; tiny pores filled with iron oxide; lower boundary sharp but upper one gradational
Layer 3: Massive and dense; very thin phosphorite veinlets in lower part

ANALY

Subsample Number Analysis LayerThickness

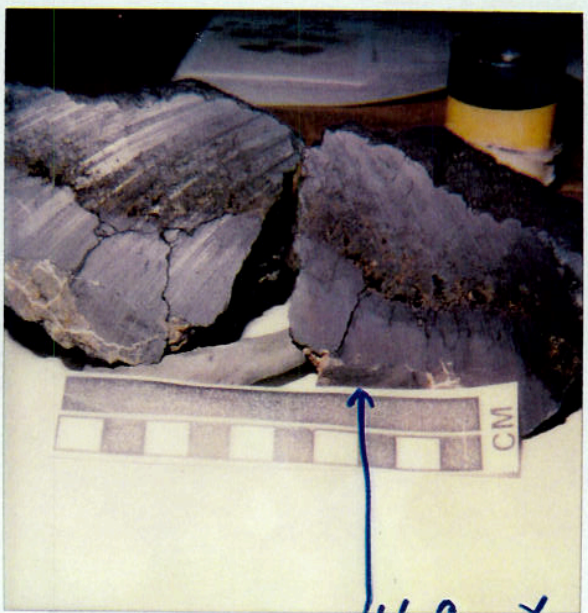
Substrate Description

Rock Type: Breccia

Description:
highly-altered basalts and older Mn crusts as clasts; cemented by phosphorite
V. little substrate

Biology ?: encrusting forams

* SAMPLE TO KORDI *



D1-12

Described By: Yoon Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 12 x 6 x 6 (cm) Location: Seamount 3

Sample Id: D1-13 Weight: 0.1 (kg) Depth: 1540 - 1240 (m)

Mn Crust Description

Surface Texture: Botryoidal

Mn Crust Thickness (mm):
Min: 33 Max: 55 Ave: 39

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	5	9	7	Massive & partially porous
2.	8	14	11	Highly porous
3.	13	33	23	Massive & dense
4.				
5.				
6.				

F10-89-CP
D1-13

Comments and XRD Mineralogy:

Layer2: small pores filled with iron oxide but larger pores empty; upper boundary more irregular than lower one
Layer3: large (1-3mm) pores in upper part; some pores filled with cream-colored phosphorite; tiny phosphorite veinlets in lower part

Substrate Description

Rock Type: Breccia

Description:
altered basaltic clasts cemented by dense phosphorite (?)

Biology ?: encrusting forams

ANALYSES

Subsample Number	Analysis	LayerThickness

Described By: Yoon

Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 5x3.5x6 (cm) Location: Seamount 3

Sample Id: D1-14 Weight: 0.08 (kg) Depth: 1250 - 1740 (m)

Mn Crust Description

Surface Texture: Granular / younger layer is probably removed

Mn Crust Thickness (mm):
Min: 45 Max: 50 Ave: 48

Layers (Outer to Inner)(mm):

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

F10-89-CP
D1-14

Comments and XRD Mineralogy:

- Massive and dense texture; large pores filled with phosphorite in upper part; phosphorite-filled veinlets and micro-pores in lower part

ANALY

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Breccia

Description:
altered basalt clasts cemented mainly by phosphorite

Biology ?:

Described By: Yoon Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: Sm-Lrg Pebble (cm) Location: SEAMOUNT 13

Sample Id: D1-15 Weight: .5 (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: ERODED CRUST FRAGMENTS, BLACK VITREOUS APPEARANCE

Inner dense part of Crusts

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave:_____

Layers (Outer to Inner)(mm):

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

F10-89-CP
D1-15

Comments and XRD Mineralogy:

FRAGMENTS OF DENSE INNER LAYERS WITH PHOSPHORITE FILLED VEINS AND VUGS

ANALY

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: PHOSPHORITE AND SED. BRECCIA little present

Description:

PHOSPHORITE - RUSTY-CREME COLOURED BRECCIA - COARSE GRAINED. ALTERED BASALT ANGULAR TO SUBANGULAR; PHOSPHORITE AND drusy CALCITE CEMENT

Biology ?: SESSILE FORAMINIFERA

Described By: R.D.

Subsampled By:

Cruise Id: F10-89-CP Size: Various (cm) Location: B Seamount

Sample Id: D1-16 Weight: 1.5 total (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: Mostly Botryoidal Some granular

Mn Crust Thickness (mm):
Min: 10 Max: 35 Ave: 20

Layers (Outer to Inner)(mm):

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

F10-89-CP

D1-16

Comments and XRD Mineralogy:

Group of Crust Fragments, little or no substrate

Massive lower layer mostly missing

ANALY

Subsample Number	Analysis	Layer Thickness

Substrate Description

Rock Type: Basalt, phosphorite, breccia

Description:

Biology ?: Encrusting Foram's

Described By: HEIN

Subsampled By:

SAMPLE DESCRIPTION

Cruise Id. F10-89-CP Size: various sm. pieces (cm) Location: B Seamount

Sample Id: D1-17 Weight: 1 kg (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: Botryoidal to granular

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave:_____

Layers (Outer to Inner)(mm):

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

D1-17
F10-89-CP

Comments and XRD Mineralogy:

ANALY

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Various Small pieces of crust & substrates.

Description: Volcaniclastics are cemented by phosphorite and calcite

Biology ?:

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 21.5 x 10 x 8.5 (cm) Location: Seamount B

Sample Id: D1-18 Weight: ~2 kg (kg) Depth: 1540-1250 (m)

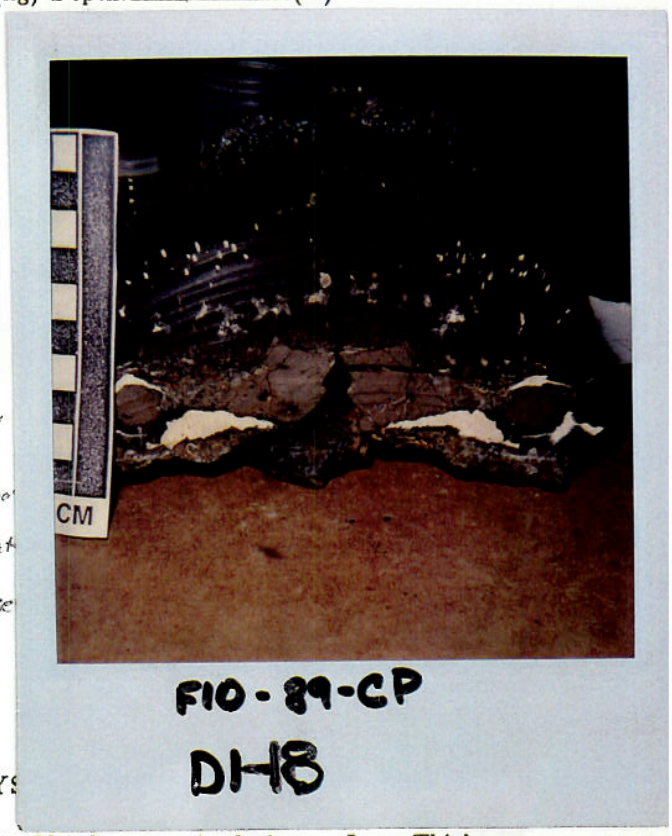
Mn Crust Description

Surface Texture: botryoidal, and eroded

Mn Crust Thickness (mm):
Min: 15 Max: 70 Ave: 50

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	5	12	7	Dense ultrafine botryoidal w/ Festain
2.	10	17	15	layer of coalescing botryoidals: very porous, w/ Festaining blebs
3.	25	45	40	Dense layer (base is 10 mm thick) vugs, some w/ cream colored phosphate. The middle of the dense layer has clasts and areas of phosphate dessimination between botryoid outlines lower portion of dense layer is Fe Rich
4.				
5.				
6.				



Comments and XRD Mineralogy:

ANALYS

Subsample Number	Analysis	LayerThickness
D1-18	Bulk	0 - 50 mm

sample has phosphate and clasts which were part of the crust

Substrate Description

Rock Type: Volcaniclastic Breccia, Cream colored phosphoric cement and fracture fill. Larger areas of phosphate probably altered calcareous

Description: sediment, outlines of centers. Also has a calcareous cement, and altered matrix Clasts of Altered porphyritic basalt

Biology ?: Encrusting foram and foram sediment on outer layer

Described By: JS Subsampled By:

Cruise Id: F10 89-CP Size: 4.5 x 3.3 x 2 / 2.8 x 2.7 x 1.6 (cm) Location: Seamount B

Sample Id: D1-20 Weight: 0.4 (kg) Depth: 1540-1250 (m)

Mn Crust Description

Surface Texture: Mn has smooth eroded only petina

Mn Crust Thickness (mm): NONE.

Min: Max: Ave:

Layers (Outer to Inner)(mm):

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

F10-89-CP

D1-20

Comments and XRD Mineralogy:

probably dense, altered basalt

ANALYS

Subsample Number	Analysis	Layer Thickness
D1-20	OC	1 Fragment (159
		Sawed outer
		Mn petina
		off

Substrate Description

Rock Type: Highly altered basalt ferrobasalt

Description: some Mn coated, Brown, iron stain, rare phosphorite veinlet, pebble size calcite vein on one sample

Biology ?: —

Described By: Lee Subsampled By: HEIN

MPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 15 x 11 x 4 (cm) 9 x 6 x 3 } 2 cobbles Location: B Seamount

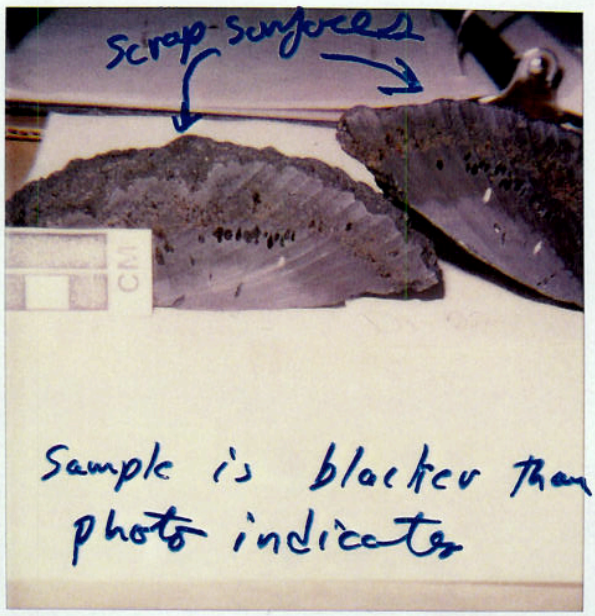
Sample Id: D1-21 Weight: 0.5 / 0.2 (kg) Depth: 1540-1250 (m)

Mn Crust Description
Surface Texture: Botryoidal

Mn Crust Thickness (mm):
Min: 20 Max: 40 Ave: 34

Layers (Outer to Inner)(mm): 30

Min	Max	Ave	Texture & Color
1.		(10) 5	Porous, brown
2.		(10) 10	V. Porous brown
3.		(12) 20	dense, massive,
4.			black
5.			
6.			



F10-89-CP
D1-~~22~~ 21

Comments and XRD Mineralogy:
Crust Frag. (2, cut)

ANALYS

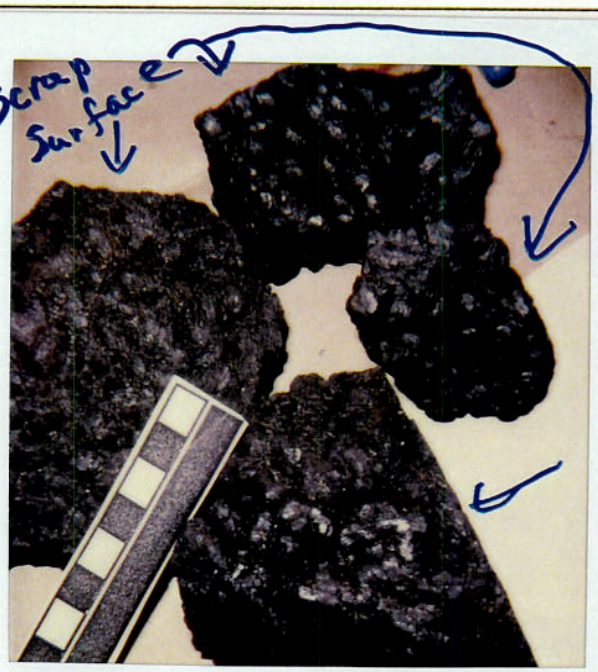
Subsample Number	Analysis	Layer Thickness
D1-21	CC	≤ 0-0.5mm (5.5gm) scrape surface

No XRD

Substrate Description
Rock Type: NONE

Description:

Biology ?: Encrusting Forams



F10-89-CP
D1-21

Described By: HEIN

Subsampled By: HEIN