Dredge 9

USGS DREDGE LOG

SHIP/LEG FARNELLA

STATION # 12

DREDGE # D9

DATE JD 262 LOCAL 19 September

TIME GMT 1002 LOCAL

DEPTH INTERVAL(m) 2495-2530

LATITUDE 11°45.1' TO 11°45.4'

DEPTH(m)corrected 2530-2525

LONGITUDE 161°33.6' TO 161°33.6

TOTAL WEIGHT: DREDGE 250 kg CRUST 15 kg

PERCENTAGE OF ROCK COVERED BY CRUST 50%

PERCENT BROKEN FROM: OUTCROP 90% TALUS 10%

THICKNESS OF MN CRUST: MAXIMUM 80 MINIMUM 0 AVERAGE 10

DOMINANT SURFACE TEXTURE granular, rare botryoidal, smooth

SUBSTRATE LITHOLOGY ≈ 45% limestone, ≈ 45% volcaniclastic sandstone
yellow-green (altered glass); 10% (phosphorite-) crust breccias, phosphorite - pale
brown dense

NODULES PRESENT 2 Nodules

REMARKS: borings present on surface of limestone blocks
fracture surfaces coated w/ Mn
Crust breccia w/ Limestone matrix +/or phosphorite cement
Lms w/ only potina of Mn, SS w/ more + breccia
w/ most -

Threw out 60 kg of small stuff ~ ½ SS + ½ Lms
+ 15-20 kg of D9-11

Cruise Id: F10-89-CP Size: 59x45x22 (cm) Location: Seamount

Sample Id: D9-1 Weight: 24 (kg) Depth: 2495-2530 (m)

Mn Crust Description

Surface Texture: large 10-12 cm bulbous areas, covered w/ modified botryoids are separated by "rills" or ditches that are smoothed as if by water currents. The botryoids are polished on one side microbotryoidal or [illegible], almost dune-like

Mn Crust Thickness (mm):
Min: 40 Max: 70 Ave: 45

1 2 5 4

Layers (Outer to Inner)(mm): thin, dense layer easily separated from

	Min	Max	Ave	Texture & Color
2	8	15	12	porous fe-stained w/ radial column structures
3	20	25	22	more dense than above, rare vertical cracks
4	6	30	15	primary crusts on substrate clasts;
4.				dense w/ fine dendritic veinlets filled with fe-stained clay
5.				
6.				

F10-89-CP
D9-1

D9-1F ~~Cement~~ fossil crust clast

Comments and XRD Mineralogy:

Substrate Description ⇒ Phosphatized to smectite

Rock Type: Breccia; cobble to pebble sized; clasts of Altered (greenish sandstones and siltstones

Description:
Many of the clasts have crusts of their own up to 1.5 mm thick. These are cemented by a white/cream colored phosphate and in some places tan mud.

Biology ?:

ANALYS

Subsample Number	Analysis	Layer Thickness
D9-1A	XRD, BULK CC, Pt, Au REE (5.3g)	70 mm (22
D9-1B	XRD, CC	3mm (5
2 D9-1C	XRD CC	15 mm (
3 D9-1D	XRD CC	20 mm (
4 D9-1E	XRD, CC	30 mm (
D9-1F	XRD, CC fossil crust ~~Cement~~	17 mm (6
D9-1G	OC, XRD (substrate)	(20.4g)

35 mm of crust texture

crust from substrate

Described By: J.S. Subsampled By: [illegible]

Secondary crust with imbedded nodule

Manganese encrusted breccia with primary crust of manganese

F10-89-CP
D9-1

SAMP ESCRIPTION

Cruise Id: F10-89-CP Size: 53 x 21 x 35 (cm) Location: D Seamount

Sample Id: D9-2 Weight: 24.5 (kg) Depth: 2495-2530 (m)

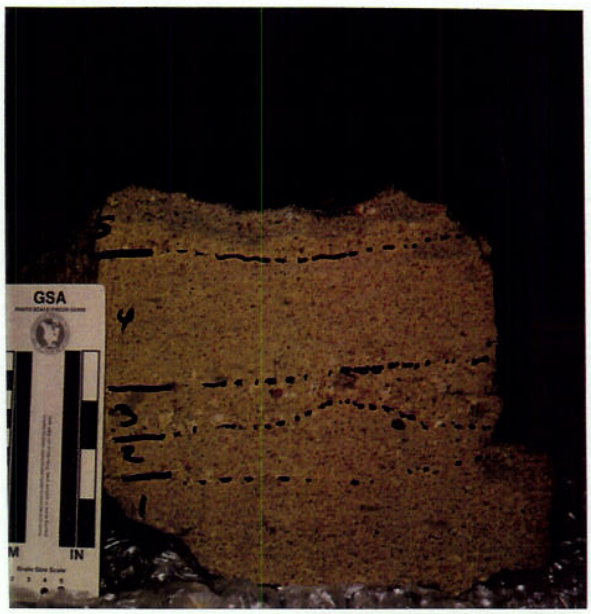
Mn Crust Description

Surface Texture: Modified Botryoidal w/ polished areas; and down current is microbotryoidal. Definately seems to be current influence on crust texture.

Mn Crust Thickness (mm):
Min: <1 Max: 2 Ave: 1

Layers (Outer to Inner)(mm):

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



D9-2 F10-89-CP

Comments and XRD Mineralogy:

Substrate Description

Rock Type: Altered volcaniclastic sandstone, yellow-green in color. Manganese blebs throughout, friable. Approximately 2cm of top substrate

Description: stained with manganese. Substrate has 5 layers of coarse grains fining upwards. Layer 3 is irregular and contains altered pumice-like pebbles

Biology ?: encrusting Forams

ANALY

Subsample Number	Analysis	LayerThickness

THICKNESSES

Layer 1

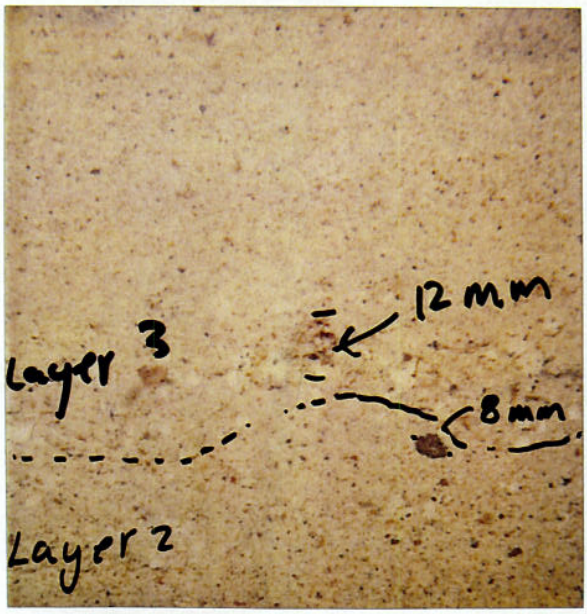
Layer 3 - [illegible] 2.5 cm

Layer 4 - [illegible] 5.0 cm

Layer 5 - [illegible] 2.5 cm

Described By: JS Subsampled By:

D9-2 F10-89-CP



D9-2 F10-89-CP

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 5.1/4 x 2 x 8.5 (cm) Location: D Seamount

Sample Id: D9-3 Weight: 1 (kg) Depth: 2530-2525 (m)

Mn Crust Description

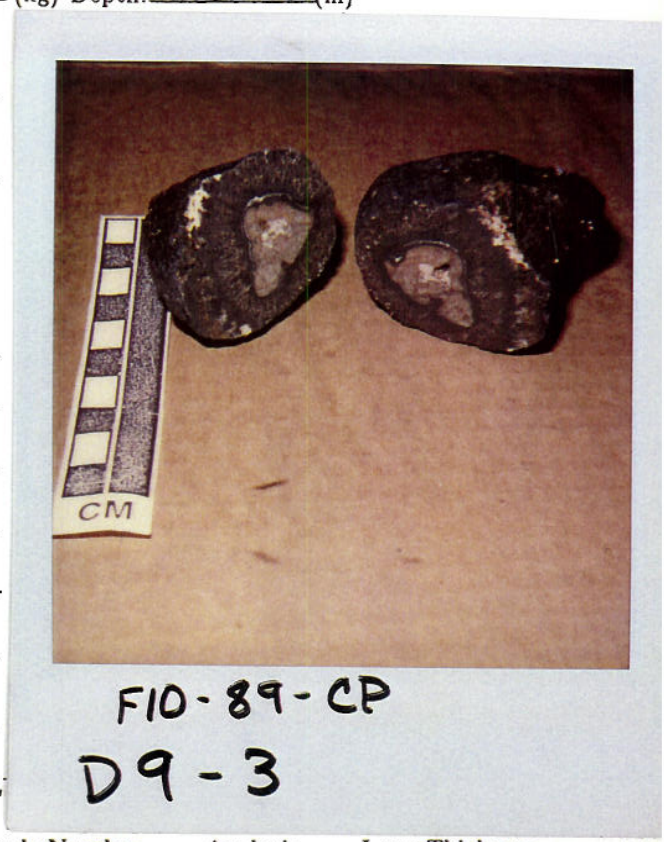
Surface Texture: Smooth, patchy, porous granules.

Mn Crust Thickness (mm):

Min: 6 Max: 22 Ave: 10

Layers (Outer to Inner)(mm):

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



Comments and XRD Mineralogy:

Nodule

ANAL

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Altered Basalt cobble w/ infilled zeolite

Description:

Biology ?:

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 13.5 x 11 x 4 (cm) Location: D Seamount

Sample Id: D9-4 Weight: 1 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Current influenced smooth botryoids, aligned almost aligned like ripples

F10-89-CP
D9-4

Mn Crust Thickness (mm):
Min: 32 Max: 40 Ave: 35

Layers (Outer to Inner)(mm):

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

Comments and XRD Mineralogy:
Crust is black dense w/ Fe staining between botryoidal growth columns

ANAL

Subsample Number	Analysis	LayerThickness
Sample to KORDI		
35mm		

Substrate Description

Rock Type: None

Description:

Biology ?:

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Id: F10-89-CP Size: 16 x 9.5 x 7.5 (cm) Location: D Seamount

Sample Id: D9-5 Weight: 2 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: smooth to microbotryoidal

Mn Crust Thickness (mm):

Min: 1 Max: 7 Ave: 2

Layers (Outer to Inner)(mm):

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

F10-89-CP
D9-5

Comments and XRD Mineralogy:

crust growing on sandstone was interrupted by debris flow(?). This broke up the crust; all that remains are some laminae of inner crust. Subsequently this debris cemented by phosphorite.

This cobble has 1mm patina on bottom.

ANALY

Subsample Number	Analysis	Layer Thickness

Substrate Description

Rock Type: Altered Green-yellow volcaniclastic sandstone

Description: Graded volcaniclastic sandstone largest basalt clasts on top up to 7mm. Subangular to sub rounded clasts

Biology ?:

Described By: JORIE Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: FIO-89-CP Size: 12 x 9 x 7.5 (cm) Location: D Seamount A

Sample Id: D9-6 Weight: 1 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: smooth and microbotryoidal

Mn Crust Thickness (mm):

Min: 10 Max: 20 Ave: 15

Layers (Outer to Inner)(mm):

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

FIO-89-CP

D9-6

Comments and XRD Mineralogy:

Crust is very broken up, maybe

ANAL

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Breccia of Altered Volcaniclastic cobbles, cemented by phosphate

Description: Many of the clasts in the breccia have crusts of their own, also Mn clasts

Biology ?:

Described By: JS Subsampled By:

Cruise Id: F10-89-CP Size: 22 x 13 x 9 (cm) Locat.: D Seamount

Sample Id: D9-7 Weight: 5 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Botryoidal; botryoids appear to be aligned, perhaps current affected

Mn Crust Thickness (mm):
Min: 60 Max: 87 Ave: 75

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	10	17	13	massive Mn w/ Fe staining between large botryoidal columns
2.	15	20	18	area of porous quasi-laminae
3.	5	10	8	Dense Mn w/ pockets of more porous Fe Rich Mn
4.	10	17	15	Porous Fe-stained w/ radial column structure
5.	8	15	10	Dense Botryoidal columns separated by pockets of sediment & phosphate
6.				

SEE BACK

F10-89-CP
D9-7

TO O'NIONS

Comments and XRD Mineralogy:

ANAL

See Diagram

Subsample Number	Analysis	LayerThickness
D9-7A	XRD; BULK CC, PE, Au (128.4g); REE (32.7g)	75
D9-7B	XRD; CC (31.4g); REE (6.4 gm)	15 m
D9-7C	XRD; CC (49 gm); REE (9 gm)	16 m
D9-7D	XRD; CC (16.4 gm); REE (4.5 gm)	12 m
D9-7E	XRD; CC (68 gm); REE (17.2 g)	24 m
D9-7F	XRD; CC (14 gm); REE (3.3 gm)	8 m

35 mm Photos taken. DPTS

Bulk of botryoidal surface sent to O'Nions for U + other isotopes
½ 50% of Sample

Substrate Description

Rock Type: Volcaniclastic Sandstone.

Description:
Not much substrate; what is here looks Mn cemented. Probably diffusion of Mn into upper layer of sediment

Biology ?: encrusting Forams

Described By: JS Subsampled By:

RO

1 (D7-B)
moderate change
2 (D7-C)
STRONG CHANGE
3 (D7-D)
STRONG CHANGE
4 (D7-E)
This Contact very diffuse, not definite
5 (D7-F)
SUBSTRATE

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size 11 x 9 x 7 (cm) Location: D Seamount

Sample Id: D9-8 Weight: 1.5 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Smooth w/ micro botryoids

Mn Crust Thickness (mm):
Min: 4.5 Max: 50 Ave: 47

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	20	20	--	Dense above - lower 1/3 has more porous areas between botryoids
2.	10	15	12	Porous Fe-Stained w/ Radial microcolumns
3.	10	15	13	Dense w/ upper 1/3 being botryoidal columns.
4.				
5.				
6.				

Inner layer

No inner layer

F10-89-CP

D9-8

Sample D9-1: layer 1 [illegible] 1,2&3 of D9-7, layer 2 here is 4 of 9-7, layer 3 = layer 5 of 9-7

Comments and XRD Mineralogy:

Substrate Description

Rock Type: Breccia of Volcaniclastic Cobbles in a phosphorite cement

Description: large Cobble has inner layer the rest of the crust has brown [illegible] other side of sample does not have the inner crust

Biology ?:

ANAL

Subsample Number	Analysis	LayerThickness

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89 CP Size: 15 x 10.5 x 6.2 (cm) Location: D Seamount

Sample Id: D9-9 Weight: 4 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: patina and staining

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

D9-9

Comments and XRD Mineralogy:

phosphorite (replaced foram sand)

Substrate Description ⇒ Phosphorite (XRD)

Rock Type: ~~Micrite~~ w/ dispersed glass CF altered volcanics medium-brown in color; with med. [illegible] to fine grained

Description: altered [illegible] clastic ~~[illegible]~~ ← all glassy grains - hyaloclastite repl. + cemented by phosphorite

Mudgrains are [illegible] by green colored phosphorite. [illegible] of sandstone are also filled w/ phosphorite

Biology ?:

ANAL

Subsample Number	Analysis	LayerThickness
D9-9	Thin Section	
D9-9A	phosphorite ~~Limestone~~ OC	⇒ xrd phosphorite
D9-9B	Sandstone OC	

Part of Sample to KORDI

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 30 x 23 x 13 (cm) Location: D

Sample Id: D9-10 Weight: 5 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Smooth w/ granular polished by wave influence

Mn Crust Thickness (mm):

Min: < 1 Max: 2 Ave: 1

Layers (Outer to Inner)(mm):

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

D9-10
F10-89-CP

Comments and XRD Mineralogy:

ANALYS

Subsample Number	Analysis	LayerThickness

All sample taken by KORDI

Substrate Description

Rock Type: fine grained sandstone of volcanic clasts

Description: Mn disseminated irregulary in layer. yellow to pale green in wet. poorly consolidated and altered

Biology ?: encrusted foraams

Described By: KADG Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 45 X 36 X 19 (cm) Location: D

Sample Id: D9-11 Weight: 30 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Granular, Petina

Mn Crust Thickness (mm):

Min: 0 Max: 2 Ave: 1

Layers (Outer to Inner)(mm):

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

D9-11

Comments and XRD Mineralogy:

Mn dendrite along cracks (up to 10mm in depth)

ANALY

Subsample Number	Analysis	LayerThickness
	XRD	
2/3	Thrown overboard	

Substrate Description

Rock Type: Limestone (Calcite + Apatite)

Description:

· fine-sand-size calcareous grains

· crudely laminated

Biology ?: Boring and worm tracks

good prospect Study

Send for paleo -

Described By: [illegible] Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 36 x 24 x 16 (cm) Location: D Seamount

Sample Id: D9-12 Weight: 15 (kg) Depth: 2530-2525 (m)

Mn Crust Description

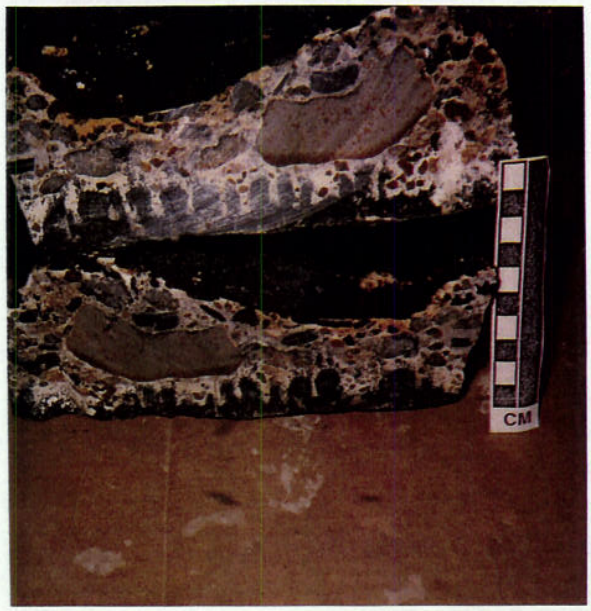
Surface Texture: porous to granular texture; smooth in places

Mn Crust Thickness (mm):

Min: patina Max: 2 Ave: 1

Layers (Outer to Inner)(mm):

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



D9-12

F10-89-CP

Comments and XRD Mineralogy:

Old generation, botryoidal crust now incorporated into phosphate breccia, possibly debris flow covered old surface and subsequently cemented by phosphate

Substrate Description

Rock Type: Phosphate cemented breccia

Description:

Clasts of: altered basalts, volcaniclastic [illegible] and old crust clasts

Biology ?:

ANAL

Subsample Number	Analysis	LayerThickness
DPTS - D9 - 12		

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 19x10.5x5 (cm) Location: D Seamount

Sample Id: D9-13 Weight: 2 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Mn surface mostly broken, where the texture remains seems smooth, microbotryoid

Mn Crust Thickness (mm):
Min: 17 Max: 20 Ave: 17

Layers (Outer to Inner)(mm):

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

F10-89-CP

D9-13

Comments and XRD Mineralogy:
Crust is porous with Fe staining

ANALY

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Breccia cemented by phosphate

Description: large volcaniclastic sandstone cobble dominates the substrate area of this sample, cobble has own crust prior to cementation in breccia

Biology ?:

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 9x8x3.5 (cm) Location:

Sample Id: D9-14 Weight: 0.2 (kg) Depth: 2530-2535 (m)

Mn Crust Description

Surface Texture: Botryoidal w/ granular

Mn Crust Thickness (mm):

Min: 4 Max: 8 Ave: 6

Layers (Outer to Inner)(mm):

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

F10-89-CP
D9-14

Comments and XRD Mineralogy:

ANALY

Subsample Number Analysis LayerThickness

All sample taken by KORDI

Substrate Description

Rock Type: Coarse grained volcanic clasts sandstone

Description: yellow, brown, pale-green colored volcanic clasts are cemented by Mn, carbonate and phosphorite. on bottom, 5mm thick $CaCO_3$ layer

Biology ?: contains crusts grains

Described By: Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 18.5 x 15.5 x 9 (cm) Location: D Seamount

Sample Id: D9-15 Weight: 2 (kg) Depth: 2530-2535 (m)

Mn Crust Description

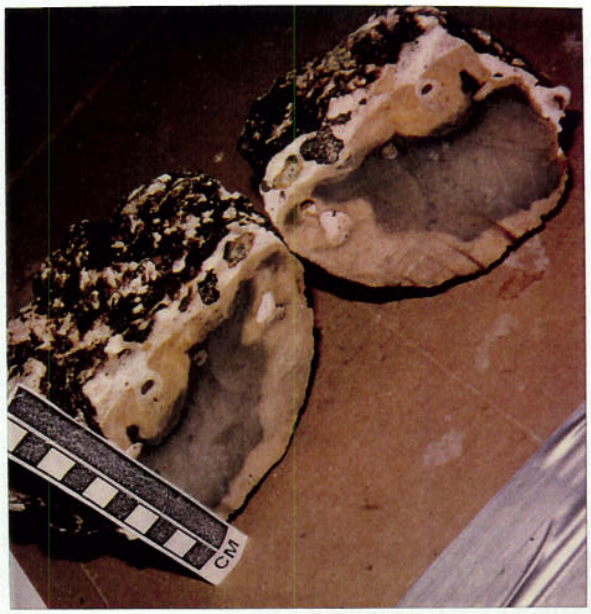
Surface Texture: Patina of Mn

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
D9-15

Comments and XRD Mineralogy:

XRD shows phosphorite

Substrate Description

Rock Type: ~~Limestone~~ Phosphorite cobble, with Mn stained centre.

Description: Edges of the cobble have pebbles cemented together by phosphorite.

Biology ?:

ANAL

Subsample Number	Analysis	LayerThickness
	Thin Section	
	XRD	
	½ To Kandy	

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 14.5×1.5×7 (cm) Location: D Seamount

Sample Id: D9-16 Weight: 2 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: smooth patina of Mn on whole rock.

Mn Crust Thickness (mm):
Min: patina Max: 1mm Ave:

Layers (Outer to Inner)(mm):

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

F10-89-CP
D9-16

Comments and XRD Mineralogy:

XRD - smectite

Substrate Description

Rock Type: Alternating layer (yellow-green sandstone and siltstone.

Description: The sandstone appears to be ripple cross-bedded with Mn blebs, the fine grained siltstone has parallel laminae

Biology ?:

ANAL

Subsample Number	Analysis	LayerThickness
D9-16	OC	
	Thin Section	

hyaloclastite PBW
reworked ash - } all glass → smectite

w/ lenses w/ Mn void fill

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 10 x 7 x 3 (cm) Location: D Seamount

Sample Id: D9-17 Weight: <1 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: botryoidal to small botryoids. current influenced texture

Mn Crust Thickness (mm):
Min: 2 Max: 4 Ave: 3 ← secondary crust

Layers (Outer to Inner)(mm):

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

F10-89-CP
D9-17

Comments and XRD Mineralogy:

Thin Mn crust on a broken piece of Mn crust, as if primary crust was flipped over

Primary crust is porous with Fe staining [5mm Min, 20mm Max, 17mm avg]

Substrate Description

Rock Type: Volcaniclastic Sandstone: altered green-yellow, Mn staining

Description: Probably edge piece, broken in dredging

Biology ?: encrusting forams

ANAL

Subsample Number	Analysis	LayerThickness

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: Pebbles to cobbles (cm) Location: D Seamount

Sample Id: D9-18 Weight: 5 kg (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: (1) smooth Patina
(2) granular to microbotryoidal

Mn Crust Thickness (mm):
Min: <1 Max: 4 Ave: <1

Layers (Outer to Inner)(mm):

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

F10-89-CP
D9-18

Comments and XRD Mineralogy:

ANALYS

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Volcaniclastic sandstone
IBW mudstone

Description:
yellow-green altered glassy volcanic grains in finer-grained matrix of same alternating w/ mudstone (matrix material of the SS) - laminae + lenses of Mn grains (detrital).

½ to KORDI

Biology ?:

Described By: HEIN

Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: Pebbles + Cobbles (cm) Location: D Seamount

Sample Id: D9-19 Weight: 1 kg (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Polished, fluted to granular

Mn Crust Thickness (mm):
Min: 2 Max: 7 Ave: 5

Layers (Outer to Inner)(mm):

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

F10-89-CP
D9-19

Comments and XRD Mineralogy:

Crust - SS Fragments

Substrate Description

Rock Type: Volcaniclastic SS

Description: yellow-green volcaniclastic Sandstone as in others

Biology ?:

ANAL

Subsample Number	Analysis	Layer Thickness
D9-19	CC surface	(4 grams)

Described By: HEIN

Subsampled By: RO

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 21 x 13.5 x 9 (cm) Location: D seamount

Sample Id: D9-20 Weight: 2.5 (kg) Depth: 2430-2125 (m)

Mn Crust Description

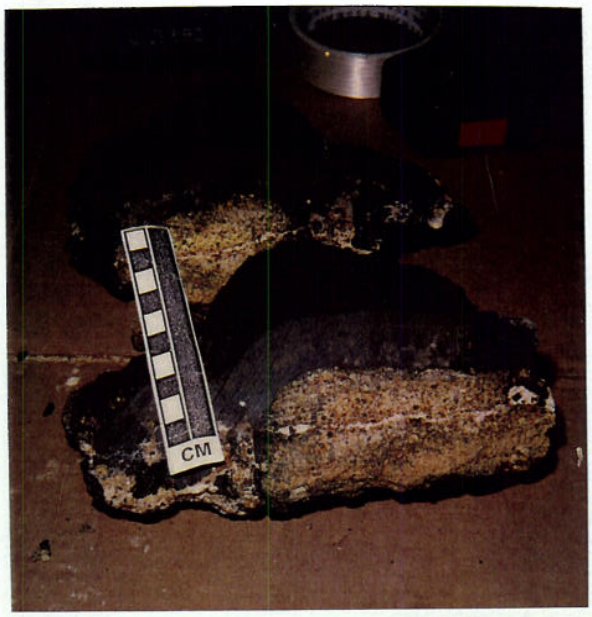
Surface Texture: smooth w/ granular

Mn Crust Thickness (mm):

Min: 41 Max: 55 Ave: 45

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	21	24	22	relatively massive and vertical fissures filled by Fe oxides
2.				
3.	20	34	28	2~3 mm thick layers distinguished by intercalation of phosphorite
4.				
5.				
6.				



F10-89-CP
D9-20

Comments and XRD Mineralogy:

ANALYS

Subsample Number Analysis LayerThickness

all sample taken by KORDI

Substrate Description

Rock Type: medium grained volcanic clasts sandstone

Description: yellow, brown and pale green colored grains cemented by carbonate. volcanic clasts are altered substance of glass.

Biology ?:

Described By: KANG Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: Pebbles to cobbles (cm) Location: D Seamount

Sample Id: D9-21 Weight: 2.5 kg (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Smooth to granular Petina

internal Crust layers to 10mm

Mn Crust Thickness (mm):

Min: <1 Max: 4 Ave: 1

crust Fragments in Breccia 2 12 10

Layers (Outer to Inner)(mm):

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

F10-89-CP

D9-21

Comments and XRD Mineralogy:

Probably Fragments from D9-51

Crust Fragments in Breccia still have botryoidal Surface

Substrate Description

Rock Type: Volcaniclastic Sandstone and phosphorite, Crust-phosphorite-Sandstone Breccia in phosphorite cement

Description:

also mudstone clasts, most pebble size

Biology ?:

ANALYSI

Subsample Number	Analysis	LayerThickness

½ To KORDI

Described By: HEIN

Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: FIC 89-CP Size: 8.5 x 6 x 4.5 (cm) Location: D Seamount

Sample Id: D9-22 Weight: < 1 (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Stain

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave:_____

Layers (Outer to Inner)(mm):

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

FIO-89-CP
D9-22

Comments and XRD Mineralogy:

ANAL

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Phosphate Cemented Breccia

Description: Clasts of altered basalts, Mn Clasts and volcaniclastic sandstones in cream colored phosphate; Mn staining in phosphate.

Biology ?:

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: FIO-89-CP Size: 9x7x4.5 (cm) Location: D Seamount A

Sample Id: D9-23 Weight: 41 (kg) Depth: 2530-2545 (m)

Mn Crust Description

Surface Texture: current influenced micro botryoidal

Mn Crust Thickness (mm):

Min: 1 Max: 2 Ave: 2

Layers (Outer to Inner)(mm):

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

F10-89-CP

D9-23

Comments and XRD Mineralogy:

ANAL

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Volcaniclastic Sandstone Cobble w/ phosphate breccia

Description: Cobble had older generation crust (thickness) incorporated in the phosphorite breccia

Similar to D1-5

Biology ?:

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

ıse Id: F10-89-CP Size: 8 x 5 x 3.5 (cm) Location: D Seamount

Sample Id: D9-24 Weight: < 1 kg (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Current polished, nucleobotryoidal & botryoidal

Mn Crust Thickness (mm):

Min:_____ Max:_____ Ave:_____

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
TOP 1.	10	15	2	Dense, laminated
Bottom 2.	5	5	5	Dense, laminated
3.				
4.				
5.				
6.				

F10-89-CP
D9-24

Comments and XRD Mineralogy:

phosphorite laminae in Crusts

Substrate Description

Rock Type: Mn Crust on both sides of Altered Volcaniclastic sandstone. Phosphate Cemented Breccia on the side.

Description: The Mn layers have phosphate between the sandstone is well cemented by Mn, some perhaps replaced by Mn.

Biology ?:

ANAL

Subsample Number	Analysis	LayerThickness

Described By: JS Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: Cobbles (cm) Location: D Seamount

Sample Id: D9-25 Weight: 7 kg Total (kg) Depth 2530-2525 (m)

Mn Crust Description

Surface Texture: smooth, polished + fluted by current action, patina, granular in places

Mn Crust Thickness (mm):
Min: <1 Max: 4 Ave: 1

Layers (Outer to Inner)(mm):

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

F10-89-CP

D9-25

Comments and XRD Mineralogy:

XRD- Calcite cemented sandstone

Substrate Description

Rock Type: Pebbly Coarse-grained volcaniclastic Sandstone w/ Some layers of mudstone

Description: Reddish-brown pebbles of altered volcanic rock fragments in yellowish-green volcaniclastic Sandstone w/ minor Calcite Cement - also Calcite veins

Biology ?:

ANALYS

Subsample Number	Analysis	LayerThickness
D9-25-1	OC	bulk
	½ TO HORDI	

Described By: HEIN

Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: Pebbles & Cobbles (cm) Location: D Seamount

Sample Id: D9-26 Weight: 20 kg (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Smooth, polished + fluted by current action

Patina

Mn Crust Thickness (mm):

Min: <1 Max: 2 Ave: 1

Layers (Outer to Inner)(mm):

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

F10-89-CP

D9-26

Comments and XRD Mineralogy:

XRD: 63% - Phillipsite, 37% Smectite

Substrate Description

Rock Type: ~~Volcaniclastic Sandstone~~ Phillip. Cemented hyaloclastite

Description: medium Sand Sized yellow-green altered Volcanic glassy grains in minor fine-grained altered matrix bedded - poorly consolidated

Mn clusts scattered through rock, some in laminae + lenses -

½ to HORDI

Biology ?:

ANALYS

Subsample Number	Analysis	LayerThickness
D9-26-1	OC	bulk
D9-26-2	TS	

Described By: HEIN

Subsampled By: HEIN

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: Cobble (cm) Location: D Seamount

Sample Id: D9-27 Weight: 6 kg (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Smooth, polished + fluted by current action, patina - granular in places to microbotryoidal

Mn Crust Thickness (mm):
Min: <1 Max: 4 Ave: 2

Layers (Outer to Inner)(mm):

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

F10-89-CP

D9-27

Comments and XRD Mineralogy:

ANALYS

Subsample Number Analysis LayerThickness

½ TO ITORDI

Substrate Description

Rock Type: Sandstone to granule stone - pebbly sandstone - all volcaniclastic

Description: small pebble, granule, to coarse-sand sized yellow-green altered glassy volcanic grains in minor matrix or cement. poorly consolidated

Biology ?:

Described By: HEIN

Subsampled By: "

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 20x20x12 (cm) Location: D Seamount

Sample Id: D9-28 Weight: 2.5 (kg) Depth: 2530-2525 (m)

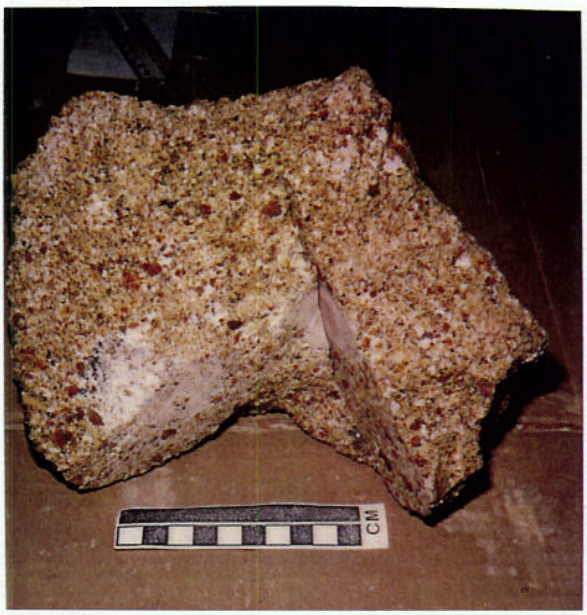
Mn Crust Description

Surface Texture: Granular (Irregular) / patina

Mn Crust Thickness (mm):
Min: 0 Max: 1 Ave: 0.5

Layers (Outer to Inner)(mm):

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



F10-89-CP
D9-28

Comments and XRD Mineralogy:

ANALYS

Subsample Number	Analysis	LayerThickness

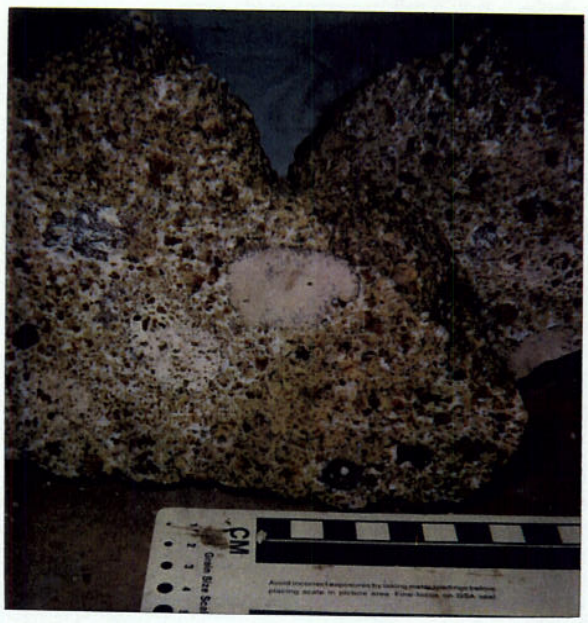
Substrate Description

Rock Type: Sandstone (pebble to medium sand) (brownish yellow)

Description:
Vesicular volcanic clasts. limestone fragments are cemented by calcite large ~~phosphorite~~ limestone nodules
Same as D9-25 except for well cemented-lms clasts

Biology ?: forams

Described By: Joon Subsampled By:



D9-28 F10-89-CP

D9-28 F10-89-CP

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: Cobbles to boulder (cm) Location: D Seamount

Sample Id: D9-29 Weight: 60 kg Total (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: granular to smooth patina

Mn Crust Thickness (mm):
Min: 0 Max: 2 Ave: <1

Layers (Outer to Inner)(mm):

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

F10-89-CP

D9-29

Comments and XRD Mineralogy:

blocks of limestone

XRD: Phosphatized limestone (85% Calcite 15% apatite)

Substrate Description

Rock Type: Limestone

Description: bedded to Massive
Thin layer of pebbly sandstone
on some pieces w/ CO_3'' + volcanic
clasts; Some admixed Mn

Biology ?: borings -

ANALY

Subsample Number	Analysis	LayerThickness
D9-29-1	OC	bulk (27 gm)

3 pieces to Schlanger ≈ 5 kg
4 " " HORDI ≈ 15 kg

Described By: HEIN

Subsampled By: HEIN

F10-89-CP

D9-29

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: Pebbles + cobbles (cm) Location: D Seamount

Sample Id: D9-30 Weight: 1.5 kg (kg) Depth: 2530-2525 (m)

Mn Crust Description

Surface Texture: Crust Fragments, Natural surface = botryoidal to smooth, polished + fluted. alla granular

Mn Crust Thickness (mm):
Min: 3 Max: 30 Ave: 20

Layers (Outer to Inner)(mm):

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

F10-89-CP

D9-30

Comments and XRD Mineralogy:

phosphorite veins + layer at base of some crusts

ANALYS

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Volcaniclastic Sandstone w/ some fragments

Description:

Biology ?:

Described By: HEIN Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 8x5x5.6x4x3 (cm) Location: D seamount

Sample Id: D9-31 Weight: 0.2 (kg) Depth: 2520-2525 (m)

Mn Crust Description

Surface Texture: fine botryoidal / smooth

Mn Crust Thickness (mm):

Min: 0 Max: 4 Ave: 2

Layers (Outer to Inner)(mm):

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

F10-89-CP
D9-31

Comments and XRD Mineralogy:

Massive but slightly porous; pores filled with iron oxides

ANALYS

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Breccia / sandstone

Description: altered volcanic grains & Mn phosphorites cemented by calcite, and manganese, + phosphate

Biology ?: encrusting forams

Described By: Yoon Subsampled By: