DREDGE 21

JSGS DREDGE LOG

SHIP/LEG FARNELLA

STATION # 35

DREDGE # D 21

DEPTH INTERVAL(m) 1850 – 1965 2nd 2100 – 2300 1st

DEPTH(m)corrected 2100–1850

DATE JD 270 LOCAL 27 Sept. 1989

TIME GMT 0210 LOCAL 1410

LATITUDE 10°30.21' TO 10°30.14' N

LONGITUDE 160°51.1' TO 160°51.47' E

TOTAL WEIGHT: DREDGE 225 CRUST 10

PERCENTAGE OF ROCK COVERED BY CRUST 70% most is just patina

PERCENT BROKEN FROM: OUTCROP 70–100 TALUS 0–30

THICKNESS OF MN CRUST: MAXIMUM ~65 MINIMUM 0 AVERAGE 10

DOMINANT SURFACE TEXTURE Granular, rare botryoidal & smooth

SUBSTRATE LITHOLOGY 1) breccia, 2) basalt (came from breccia; at least 30% of basalt from outcrop rest from breccia)

1 breccia with small pieces w calcareous or phosphorite cement
2 breccia larger angular pebble size - more calcite? phosphorite.

NODULES PRESENT ∅

REMARKS: Well-hung dredge - threw 30 kg of pebble-sized fragments overboard

* Dredge came on and off bottom twice.

% broken from outcrop depends on if cobbles are part of disaggregated breccia

Much of the crust removed in dredging – Also much of it is fossil crusts buried by pebbly Lms debris flow –
Hydrothermal Ironstone + Mn oxide

Dredge S ple Summary Sheet

Sample ID	Bulk CC	Layer CC	Pt & Au	REE	OC	DPTS/TS	XRD	35mm Ph	Archive	Paleo
D21-1	1/2 TO	KORDI				✓				
D21-2					✓	✓				
D21-3						✓	✓			
D21-4	✓	1/2 TO KORDI					✓			
D21-5	END PIECE TO KORDI					✓	✓ (substrate)			
D21-6	✓	(1/2 TO KORDI)				✓	✓			
D21-7	1/2 TO	KORDI				✓				
D21-8					✓	✓				
D21-9					✓	✓				
~~# of grams?~~ * D21-10	✓	✓					✓			
D21-11	surface ✓	(1/3 TO KORDI, 1/3 TO M. PRINGLE)								
D21-12	1/2 TO	KORDI			✓					
D21-13										
D21-14	1/2 TO	KORDI								
D21-15	TO KORDI									
D21-16	1/4 TO SY SCHLANGER			1/4 TO KORDI						
D21-17	TO KORDI									
D21-18										
D21-19	1/2 TO KORDI				✓	✓				
D21-20	1/2 TO	KORDI								
D21-21	1/2 TO	KORDI								
D21-22										
D21-23										
D21-24	(24 PIECES TO KORDI, 4 TO M. PRINGLE)						✓			

* WEIGH WHEN WE GET HOME

USGS DREDGE LOG

Depth Interval 2100-2300 / 1850 - 1965

Julian Date 269/270

Cruise I.D. F10-89-CP

Local Date (m/d/y) 9/27/89

Station No. 35

Chief Scientist Hein/Kang

Dredge No. 21

Tech on Watch Kevin O'Toole

	On Station	Dredge on Btm	Dredge off btm	Off Station
GMT	21:57.27	0051 22:56.42	0210 0005	0246
LATITUDE	10 30.22N	10° 30.21N 10 30.18 N	10° 30.14'N 10 30.4	10 30.1
LONGITUDE	160 52.26E	160 51.1E 160 51.82 E	160° 51.47'E 160 51.8	160 51.3
WATER DEPTH	2650 m	1850 2100	1965 2300	

Site Description and Target : Rocks probably from 2100 - 1850

OPERATION*	GMT	DEPTH (m)	WIRE OUT (m)	TENSION	HDG/SPD	COMMENTS
On bottom	2256	2100	2640			on bottom
wire out	2258	2100	2750			more wire out
bite	2319	1895m	"	2.3 T	290/1.2	bite
bite	2325	1870	"	5.1 T	346/1.2	"
"	2326	1870	"	4.2 T	188/1.6	"
"	2327	1865	"	2.4	306/0.9	"
hung up	2332	1860	"	6.0T.	346/1.1	hung up
off	0005	2300	2490	4.1		broke free Going to try again
Dropping dredge	0045	1850	~~2450~~ 2000			hope it will land down slope behind us
On bottom	0051	1850	2280			putting out scope
scope is out	0057	1830	2400			taking up slack
Wire is tightening	~~0104~~	1820	2400			should start to dredge soon
Bite	0106	1820	"	2.7		
Bite	0107	1815	"	4.8		
Hung	0114	1810	"	0.0		
Broke off	0116	1805	"	4.0		
Bite	0118	1805	" 2.9	4.6, 3.0	2.7	
Bite	0118	1800	" 2.9	~~3.0~~ 5.0	2.7	

*on/off bottom, bites, etc.

OTHER COMMENTS:

Bite 120 1795 " 2.8, 3.3

USGS DREDGE LOG

Depth Interval _____ Julian Date 269/270

Cruise I.D. F10-89-CP Local Date (m/d/y) 9/27/89

Station No. 35 continued Chief Scientist Hsin/Kang

Dredge No. 21 Tech on Watch O'Toole

	On Station	Dredge on Btm	Dredge off btm	Off Station
GMT			279/0210	
LATITUDE				
LONGITUDE				
WATER DEPTH			1965	

Site Description and Target : _____

OPERATION*	GMT	DEPTH (m)	WIRE OUT (m)	TENSION	HDG/SPD	COMMENTS
Well Hung	0122	1790	2500	6.5		
Broke	0124	1785	2500	3.3		
Hung	0124	1785	"	6.0		
Broke	0125	1785	"	5.2, 2.7		
Hung	0133	1780	2550	6.4		
Broke	0147	~~1845~~ 1780	2190	4.0		
Hung	0147	1845	2190	40, ~~38~~		
Broke	0148	1845	2190	3.8		
Hung	0148	1845	2190	5.2		Broke at 0148
~~Hung~~	0149	1845	2190	4.1		Broke at 0148
Hung	0149	1845	"	6.5		vertick wire angle
off Bottom Fell off ~~Broke~~	0210	1965	2025			OFF BoHom

*on/off bottom, bites, etc.

OTHER COMMENTS:

SAMPLE DESCRIPTION

5 crust fragments

Cruise Id: F10-89-CP Size: small cobble sized (cm) Location: SEAMOUNT F

Sample Id: D21-1 Weight: 1.5 (kg) Depth: 2100-1850 (m)

Mn Crust Description

Surface Texture: granular; botryoidal

Mn Crust Thickness (mm):
Min: 19 Max: ~65 Ave: 30

Layers (Outer to Inner)(mm):

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

NO Photo

Comments and XRD Mineralogy:

No complete crusts - 3 basic types of crust 1) Granular, very porous, iron stained, 2) More dense, iron staining and ~~yellow mud~~, 3) dense black, metallic lower crusts

ANALYSES

Subsample Number	Analysis	LayerThickness

Substrate Description

Rock Type: Breccia

Description: Composed of volcanic clasts; grey; aphanitic; clasts have vesicles; sub-angular; grain supported; pink/sk-brown phosphorite(?) cement

Biology ?: encrusting forams

½ TO HORDI

Described By: RO Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 16 x 18 x 7 (cm) Location: F Seamount Complex

Sample Id: D21-2 Weight: 2.5 (kg) Depth: 2105-1850 (m)

Mn Crust Description

Surface Texture: Smooth - some of outer crust removed

Mn Crust Thickness (mm):
Min: 1 Max: 25 Ave: 10

Layers (Outer to Inner)(mm):

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

Comments and XRD Mineralogy:
6-8 phosphorite laminae in crust
Separate crust from substrate
Thin lower crust ≤ 5 mm incl phosphorite laminae

ANALY

Subsample Number	Analysis	Layer Thickness
D21-2	OC	46 g
	TS	

Substrate Description

Rock Type: Goethite replaced Breccia
~~Volcanic Rx~~ - Ironstone (C)

Description:
Dense brown hydrothermally altered (?) Volcanic Breccia (C) unreplaced fragments & patches + partially replaced fragments (A) (B)

Biology ?:

Described By: HEIP

Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 13×8×4 (cm) Location: F Seamount Complex

Sample Id: D21-3 Weight: 0.5 (kg) Depth: 2100-1850 (m)

Mn Crust Description

Surface Texture: Top modified botryoidal, bottom granular

Mn Crust Thickness (mm):
Min: 6 Max: 13 Ave: 10

Layers (Outer to Inner)(mm): mixed w/ abundant phosphorite + volcanic clasts, + some partly replaced limestone

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

Comments and XRD Mineralogy:
lower granular Crust ≤ 3 mm

(A) in photo Crust mixed w/ limestone - phosphorite (1), phosphorite (2) and volcanic Rx fragment (3)

ANALYS D21-3; F10-89-CP

Subsample Number	Analysis	Layer Thickness
DPTS	D21-3	
Layer A	D21-3A	XRD
Layer B	D21-3B	XRD
Layer C	D21-3C	XRD

Substrate Description

Rock Type: Exhalite

Description: metallic gray hydrothermal Mn (B in photo) and brown hydrothermal Goethite replaced Volcanic Rx (C);

Biology ?: abundant Encrusting Forams

Described By: HEIN Subsampled By: Schulz

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 18 X 10 + 5 (cm) Location: F Seamount Complex

Sample Id: D21-4 Weight: 1.5 (kg) Depth: 2100-1850 (m)

Mn Crust Description

Surface Texture: Smooth to granular and buried beneath a white cemented pebbly limestone (A fossil Crust)

Mn Crust Thickness (mm):
Min: 6 Max: 23 Ave: 20

no photo
Crust same as in D21-2

Layers (Outer to Inner)(mm):

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

Comments and XRD Mineralogy:
Younger crust generation removed by debris flow

dense, w/ phosph. laminae & fracture laminated in upper 3–5 mm

ANALYSES

Subsample Number	Analysis	LayerThickness
D21-4	CC, phosphate cement between layers	Bulk

Substrate Description
Rock Type: ~~B~~ Breccia

Description: Grey subrounded vesicular volcanic rock clasts in a predominantly phosph cement – some calcite + Mn grain supported

½ TO HORDI

Biology ?:

Described By: HEIN

Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 15X11 x 9 (cm) Location: F Seamount Complex

Sample Id: D21-5 Weight: 2.5 (kg) Depth: 2100-1950 (m)

Mn Crust Description

Surface Texture: Modified Botryoidal (upper Surface)

Mn Crust Thickness (mm):
Min:_____ Max:_____ Ave: 3

Layers (Outer to Inner)(mm):

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

D21-5 Crust

Comments and XRD Mineralogy:
massive block crust 3cm completely surrounds RK.

Substrate Description

Rock Type: Breccia

Description: Clasts of volcaniclastic SS and phosphorite cemented by Fe-Mn oxides & phosphorite - Phosph. vug fill; pebble Lms overlying (?)

Biology ?: Rock ?

ANALYS D25-5 F10-89-CP

Subsample Number	Analysis	Layer Thickness
D21-5	XRD of substrate	
DDTS		

End Piece to HORDI

Described By: Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 5 pieces Large pebble sized (cm) Location: SEAMOUNT F

Sample Id: D21-6 Weight: 1.5 (kg) Depth: 2100-1850 (m)

Mn Crust Description

Surface Texture: granular to botryoidal; smooth

Mn Crust Thickness (mm):
Min: 1 Max: 10 Ave: 7

Layers (Outer to Inner)(mm):

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

no photo

Comments and XRD Mineralogy:
MOST FRAGMENTS have BEEN FLIPPED OVER DURING THEIR HISTORY, EXCEPT ONE WHICH WAS FRACTURED FROM THE SUBSTRATE THAT HAS A GRANULAR SIDE CRUST. 3 FRAGMENTS HAVE THIN CRUSTS. THE REMAINING HAS A PORTION OF DENSE LOWER CRUST ATTACHED TO SUBSTRATE.

Substrate Description

Rock Type: Breccia

Description:
composed of altered volcanic clasts; manganese fragments; phosphorite clasts angular to sub-rounded; pebble to sand sized; grain supported; Biology: phosphorite cement, calcareous in places. Phosphorite is dense grey, pale brown, cream encrusting forams

ANALYSES

Subsample Number	Analysis	LayerThickness
D21-6	CC of "hydrothermal" layer	
	DPTS of pieces of "hydrothermal" layer.	
	½ TO HORD	
	1 sample separate of a hydrothermal Mn layer	

- To me this looks like it could be old crust, covered by sediment & then phosphatized. J. Schulz

Described By: RO Subsampled By: Schulz

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 3 pieces Lrg pebble sized (cm) Location: SEAMOUNT F

Sample Id: D21-7 Weight: 1 (kg) Depth: 2100-1850 (m)

Mn Crust Description
Surface Texture: granular

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

NO PHOTO

Layers (Outer to Inner)(mm):

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

Comments and XRD Mineralogy:
Thin crusts on breccia fragments
Manganese diffusing into carbonate mud in one sample

ANALYSES

Subsample Number	Analysis	LayerThickness
D21-7	OC	(47.5g)
	TS	
	½ TO HORD	

Substrate Description
Rock Type: Breccia

Description:
composed of altered volcanic clasts + phosphorite clasts angular to sub-rounded, small pebble to sand sized, poorly sorted, grain to cement supported, phosphorite + phill, p.

Biology ?: cement (one fragment is resting in carbonate mud with floating volcanic clasts)

Described By: RD Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 16 x 10 x 10 (cm) Location: F Seamount

Sample Id: D21-8 Weight: ~1.5 kg (kg) Depth: 2100 - 1850 (m)

Mn Crust Description

Surface Texture: granular

Mn Crust Thickness (mm):
Min: 0 Max: 7 Ave: 4

NO PHOTO

Layers (Outer to Inner)(mm):

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

Comments and XRD Mineralogy:
- Highly porous texture
- Pores filled with iron oxide

ANALYSES

Subsample Number	Analysis	LayerThickness
D21-8	OC	Fe cemented layer
T.S. of Fe-cemented layer		

Substrate Description

Rock Type: Breccia (two generation of breccia, older and younger ones sharply distinguished.

Description:
Old breccia has altered basalt and basalt-including phosphorite cemented by (hydrothermal iron oxide) + phosphorite
Younger breccia: basalt clasts cemented by phosphorite - pearl-gray

Biology ?: ↳ Forams

Described By: Yoon Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 30 x 21 x 15 (cm) Location: Fi Seamount

Sample Id: D21-9 Weight: ~7 kg (kg) Depth: 2140 - 1240 (m)

Mn Crust Description

Surface Texture: Granular to subdued botryoidal

minor polished + fluted areas

Mn Crust Thickness (mm):

upper crust? Min: 4 Max: 24 Ave: 14

lower crust 3 10 5

Layers (Outer to Inner)(mm):

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

Comments and XRD Mineralogy:

- Massive and dense
- horizontal phosphorite laminae abundant
- One side of sample covered by lime-mud-cemented breccia and covered Mn crust shows dendrite of manganese

same crust as in D21-2 + 4

ANALYS D21-9 F10-89-CP

Subsample Number	Analysis	Layer Thickness
D21-9A	OC	Layer "B" above (55g)
D21-9B	OC	Layer "A" above (44g)
D21-9C	OC	Layer "B1" above (54g)
DPTS - through all 3 layers		

Substrate Description

Rock Type: Altered breccia

Description:

(B) altered lava? clasts cemented by phosphorite; (A) hydrothermally replaced by iron oxide; forming bands (1~15 cm thick); Phosphorite veins in B1 only

Biology ?: Encrusting forams

(C) pebble Lms

Described By: Yoon Subsampled By:

SAMPLE DESCRIPTION

Cruise Id: F10-89-CP Size: 32 x 29 x 10 (cm) Location: F Seamount

Sample Id: D21-10 Weight: 7 kg (kg) Depth: 2100-1850 (m)

Mn Crust Description

Surface Texture: Botryoidal to granular

Mn Crust Thickness (mm):

upper crust Min: 3 Max: 19 Ave: 11

Layers (Outer to Inner)(mm):

	Min	Max	Ave	Texture & Color
1.	3	5	4	slightly porous
2.	0	13	8	Massive and dense
3.				
4.				
5.				
6.				

Comments and XRD Mineralogy:

- Layer 2: surrounding whole substrate rock
- Layer 1: only on one side of Rock + phosphorite veinlets horizontal or vertical
- crust partially covered by lime-mud
- covered crust show Mn dendrite

Substrate Description

Rock Type: Breccia

Description:

altered basalt clasts cemented by brown to cream → phosphorite and rare calcite + in fine-grained volcaniclastic debris

- Basalt clast show weathered rims

Biology ?: Encrusting forams

ANALYS D21-10; F10-89-CP

Subsample Number	Analysis	Layer Thickness
D21-10A	CC	Bulk (36g) 0-18 mm
D21-10B	CC	Layer 1 (46g) 0-4 mm
D21-10C	CC	Layer 2 (44g) 4-18 mm

Note D21-10B: layer 1 has a phosphorite layer incorporated into the crust, was not removed

Described By: Yoon Subsampled By: [illegible]