S. Johnston Is.
Ridge

AMPLE ID	Mn CHEM	Pt & Au	REE	Si Chem	DP.Sect.	35mm Pho	Archive	Paleo					
CD2-1													
CD2-2													
CD2-3	Layers			V.Breccia	✓								
CD2-4													
CD2-5													
CD2-6													
CD2-7													
CD2-8	Layers	Layers	Layers	V. Breccia	2 Sects.								
CD2-9													
CD2-10	Layers								Slab to Majs				
CD2-11													
CD2-12	Bulk												
CD2-13													
CD2-14													
CD2-15	Layers												
CD2-16													
CD2-17													
CD2-18									2/3 to Halbacks				
CD2-19	Bulk								XRD - Mud from cracks & Sand in Hollow				
CD2-20													
CD2-21	Bulk												
CD2-22													
CD2-23	Layers				2 Sects				1/2 to Bureau of Mines				

AMPLE ID	Mn CHEM	Pt & Au	REE	Si Chem	DP Sect.	35mm Pho	Archive	Paleo					
CD2-24									1/2 to Bureau of Mines				
CD2-25													
CD2-26									1/2 to Bureau of Mines				
CD2-27													
CD2-28	Layers												
CD2-29					Thin Section								
CD2-30					Thin Section			✓					
CD2-31													
CD2-32													
CD2-33													
CD2-34													
CD2-35													
CD2-36													
CD2-37	Layers			V. Breccia	✓								
CD238	Layers		layers	V. Conglomer.	✓				XRD OF MUD IN LAYER #7				
CD2-A2	—								nice rock for phosphorite studies				
CD2-A3													

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 14x12x7

Sample I.D: Sta: 03 CD2-1

Location: S. Johnston Is Ridge

Size: _____ **Weight:** 0.6 kg

Mn crust thickness:

Total: min: 2.1 max: 3.0 ave: 2.7

Inner crust: min: — max: — ave: —

Outer crust: min: — max: — ave: —

Surface texture: Elongate Botryoidal

Internal structure:

layered:
laminated:
massive: + dense
porous: inner part more porous
dendritic:
other:

CD2-1

F7-86-HW
Karin Ridge
Johnston Is

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Breccia

Description: Cemented w/ zeolites +/or phosphorite; v. Altered Basalt Clasts, some coated w/ Mn.

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 13X15X7

Sample I.D: Sta: 03 CD 2-2

Location: S. Johnston I Ridge

Size: _____ Weight: 0.5 kg

Mn crust thickness:

Total: min: 4.5 max: 5.0 ave: 4.75

Inner crust: min: _____ max: _____ ave: _____

layered, but older + younger generations not clear

Outer crust: min: _____ max: _____ ave: _____

Surface texture: Extreme elongate Botryoidal Linear wavy bands

Internal structure:

layered: At least 3

laminated:

massive: outer most + innermost

porous: middle layer

dendritic:

other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: hyaloclastic -

Description: yellow-brown fine grained highly altered volcanic debris -

Mineralogy (XRD):

CD2-2

F7-86-HW
Karin Ridge
Johnston IS

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 30x19x9

Sample I.D: Sta: 03 CD 2 - 3

Location: S Johnston Ridge

Size: _____ **Weight:** 2.5 kg

Mn crust thickness:

Total: min: 20mm max: 30 mm ave: 25 mm

Inner crust: min: 12 mm max: 15 mm ave: 13 mm

Outer crust: min: 7mm max: 12 mm ave: 10 mm

Surface texture: Botryoidal + slightly elongate botryoidal; smoothest in places w/ microbotryoids

Internal structure:

layered: 2
laminated:
massive: outer
porous: inner
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Breccia

Description: Altered basalt clasts to 6 cm - in a zeolite + Ian phosphorite matrix - clasts coated w/ Mn + Mn in matrix. Matrix supported Breccia

Note: Inner Mn layer porous with "clay/mud" along pores

Mineralogy (XRD):

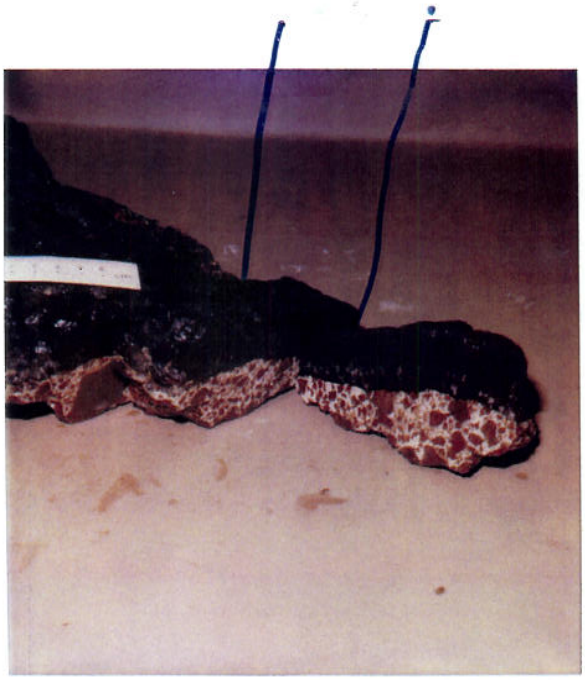
CD2-3

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:
Mn Crust Chemistry	
CD2-3A outer layer 17 gm sample 0-10 mm	
CD2-3B inner Mn layer 14 gm sample 10-25 mm	
CD2-3C Bulk Mn layer + Pt & Au 47 gm sample	
Silicate Chem	
CD2-3D substrate 15 gm sample	
D. Polished Section	

Chem



CD2-3

F7-86-HW
Karin Ridge
Johnston Is

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 8.5 x 10 x 6

Sample I.D: Sta: 03 CD 2-4

Location: S. Johnston Ridge

Size: _____ **Weight:** 0.1 kg

Mn crust thickness:

Total: min: ____ max: ____ ave: ____

Inner crust: min: 0.2 max: 1.0 ave: 0.8 Top / 0.3 Bottom

Outer crust: min: — max: — ave: —

Surface texture: Separated Botryoids - Top; Fused Botryoids - Bottom; Smooth - Sides

Internal structure:

layered:
laminated:
massive: X
porous:
dendritic:
other:

CD2-4

F7-86-HW
Karin Ridge
Johnston Is

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Fine-grained Volc. Breccia

Description: yellow & reddish-brown altered volcanic debris sandwiched in between 2 layers of crust

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:

Cruise I.D: F7-86-HW Karin Ridge Johnston Is

Sample Description

Sample I.D: Sta: 03 CD2-5

Location: S. Johnston Ridge

Size: 13x8x6 Weight: 0.2 kg.

Mn crust thickness:

Total: min: 2.0mm max: 5.0mm ave: 3.5mm

Inner crust: min: — max: — ave: —

Outer crust: min: max: ave:

Surface texture: Smooth to Granular — irregular

Internal structure:

layered:
laminated:
massive: X
porous:
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Basalt Cobble, fairly fresh

Description: Mn crust on all sides, small vesicles, veins of phosphorite?

Mineralogy (XRD):

CD2-5

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D:

Sample I.D: Sta: 03 CD2-6

Location: S. Johnston Ridge

Size: 13x10x5.5 **Weight:** 0.2 kg

Mn crust thickness:

Total: min: 3.0 max: 5.0 ave: 4.0

Inner crust: min: 2.0 max: 3.0 ave: 2.8

Outer crust: min: 0.2 max: 2.5 ave: 1.2

Surface texture: Smooth

Internal structure:

layered: 2 or 3
laminated:
massive: outer (+ immediately adjacent to subst?)
porous: inner
dendritic:
other:

F7-86-HW
Karin Ridge
Johnston Is

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Breccia

Description: V. Thin layer of Volc. breccia w/ phosphorite cement –

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 13-9

Sample I.D: Sta:03 CD2 - 7

Location: S. Johnston I Ridge

Size: 17 x 8 x 6.5 **Weight:** 0-3 kg

Mn crust thickness:

Total: min: 2.5 max: 3.0 ave: 2.8

Inner crust: min: — max: — ave: —

Outer crust: min: max: ave:

Surface texture: Partly fused botryoidal w/ microbotryoids

Internal structure:

layered: X large
laminated:
massive:
porous:
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Breccia

Description: Altered Basalt clasts in zeolite & iron phosphate cement; fine to medium grained

Mineralogy(XRD):

CD2-7

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 25Y21X10

Sample I.D: Sta: 03 CD2-8

Location: S. Johnston Ridge

Size: _____ **Weight:** 5 kg

Mn crust thickness:

Total: min: 7.5 max: 10.00 ave: 8.5

Inner crust: min: _____ max: _____ ave: 4.0
middle 1.0

Outer crust: min: _____ max: _____ ave: 3.5

Surface texture: Perfectly smooth

Internal structure:

layered: At least Five (see back)
laminated:
massive: inner 3 + outer 2
porous: middle
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Breccia

Description: V. little Loft - Yellowish highly altered Volcanic debris

When sampling substrate for Chem, very hard to avoid Mn because substrate so sparse

Mineralogy (XRD):

F7-86-HW
~~Karin Ridge~~
Johnston Is

CD2-8

Analyses and subsamples:

analysis:	analyst:
All Chem on Mn - Pt/Au - REE & General	
CD2-8-A Layer 1 48 gm	0 - 12.5 mm
CD2-8B Layer 2 40 gm	12.5 - 32.5 mm
CD2-8C Layer 3 51 gm	32.5 - 52.5 mm
CD2-8D Layer 4 46 gm	52.5 - 72.5 mm
CD2-8E Layer 5 54 gm	72.5 - 92.5 mm
CD2-8F Bulk 50 gm	
CD2-8G Substrate - Silicate Chem	
2 D. Polished Sections F + H	
H is one parallel to Layers through botryoidal laminae	
F is bulk, thru all layers	
XRD on all samples	

CD2-8

F7-86-HW
Karin Ridge
Johnston Is

1) Layer #1 Outer layer - Dense & massive "worn" smo
w/just faint hints of botryoids.
10 to 15mm thick - popped off layer 2
when sampled

2) Layer #2 Porous layer w/large "vesicles"
at bottom of the layer. These "vesicles" are fille
with mud. The mud actually filled in space
between botryoids of layer 3.
18 to 24mm

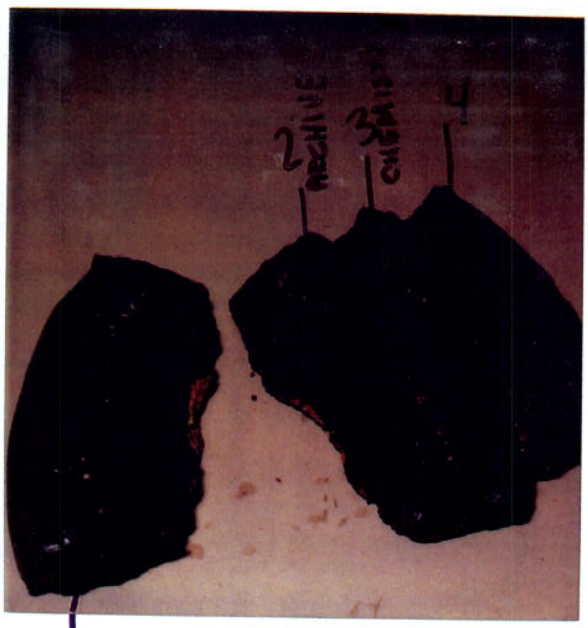
3) Layer #3 - Thick set of botryoidal
laminae
17 to 22mm

4) Layer #4 - laminanated layer more
porous than Layer #3. In the center of
this layer is a porous iron stained
sublayer. 15 to 23mm thick

5) Layer #5 - Bottom layer, contact w/ substrate
is uneven. Layer 5 is dense like layer #1
layering is visible, but layers appear
thicker. This layer broke easily away from
layer 4; the top of layer that pulled away
was very vitreous, almost like obsidian
12 to 20mm

CD2-8

F7-86-HW
Karin Ridge
Johnston Is



CD2-8

F7-86-HW
~~Karin Ridg~~
Johnston I

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 19X17X8 **Sample I.D:** Sta: 03CD2-9 **Location:** S. Johnston I. Ridge

Size: _____ **Weight:** 1.0 kg

Mn crust thickness:

Total: min: 0.1 max: 3.0 ave: 1.0

Inner crust: min: _____ max: _____ ave: _____

Outer crust: min: _____ max: _____ ave: _____

Surface texture: irregular - granular to smooth

Internal structure:

layered:
laminated:
massive: X
porous:
dendritic:
other:

Mineralogy (XRD):

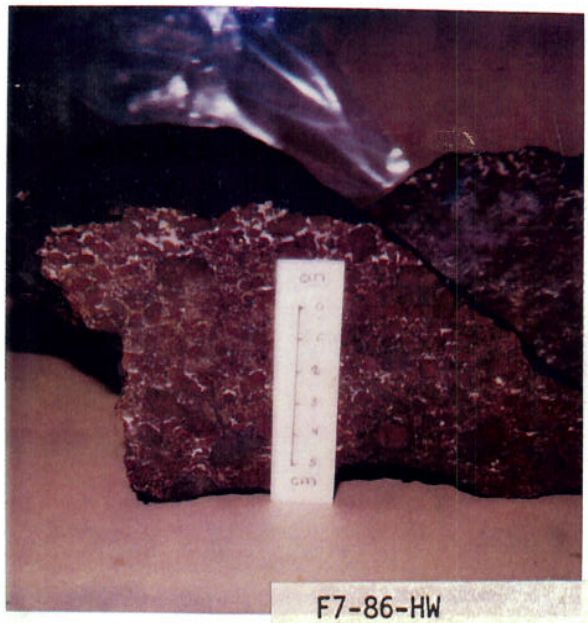
Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Breccia

Description: brown altered Volc. debris w/ phosphorite cement - Sandwich coated w/ Mn - Substr. layered by [illegible] -

Mineralogy (XRD):



F7-86-HW
~~Karin Ridge~~
Johnston Is
CD2-9

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 30x17x12

Sample I.D: Sta: 03 CD2-10

Location: S. Johnston Ridge

Size: _____ **Weight:** 4 kg

Mn crust thickness:

Total: min: 1.0 max: 7.0 ave: 3.8

Inner crust: min: — max: — ave: —

Outer crust: min: — max: — ave: —

Surface texture: perfectly smooth

Internal structure:

layered:
laminated:
massive: X
porous: Randomly distributed porous areas -
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: hyaloclastite or volcanic breccia

Description: only small amount exposed in center of large Roll of Mn -

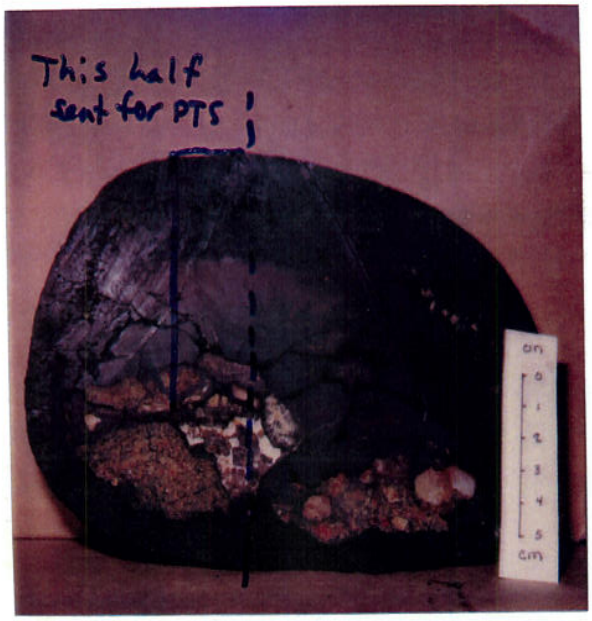
Mineralogy (XRD):

CD2-10

F7-86-HW
Karin Ridge
Johnston Is

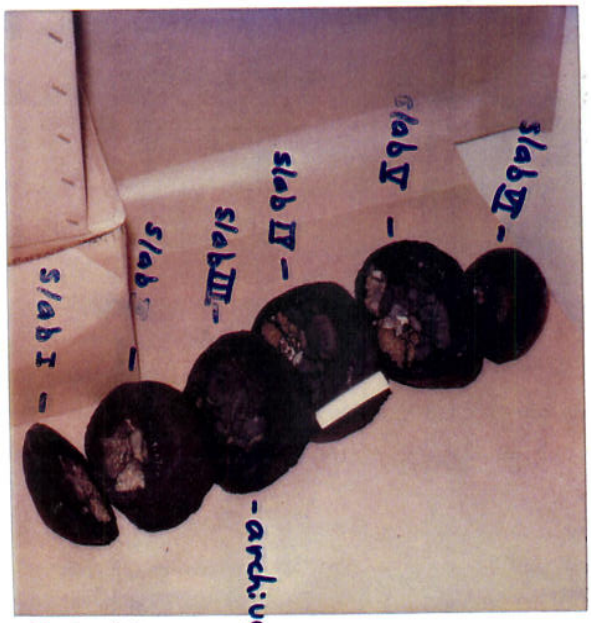
Analyses and subsamples;

analysis:	analyst:
Chemistry: "manheim" pkg	Lisa Gein
A (top layer) see back	
B (middle)	
C (inner)	
D (built)	
XRD	Lisa Gein
A (top layer)	
B (middle)	
C (inner)	
D (built)	
slab	Given to Maya



CD2-10
slab IV

F7-86-HW
Karin Ridge
Johnston Is



CD2-10

F7-86-HW
Karin Ridge
Johnston Is

Slab IV Description 3 layers:

(A): 32-40 mm on pictured side. [illegible] mm on flip side. Coal black, [illegible] layered. [illegible] layers are wavy. Actually [illegible] [illegible] by another layer [illegible] [illegible] layers are wavy. [illegible] for chem: 33 mm ("Manheim pkg") sent 66.6 gms

(B) [illegible] mm (pinched out) on pictured side. 0-25 mm on flip side. [illegible] pure [illegible] in this layer. Thickness of crust [illegible] sent for chem: 14-23 mm ("Manheim pkg") sent 47.7 gms

(C) 7-44 mm (ave. 15 mm) on pictured side. The [illegible] strata extends way up into crust on pictured side which [illegible] 7 mm [illegible]. Flip side is 20-42 mm. This layer is very massive dense [illegible] more of a [illegible] black. Has been cracked in places w/ sedimentary material infilling these cracks. Thickness of crust sent for chem: 6-4[illegible] mm ("Manheim pkg") sent 53.5 g

(D) Bulk crust: 65-96 mm on pictured side. Flip side 71-91 mm. Thickness of sample sent for chem 76-89 mm. ("Manheim pkg"). wt. sent 60.2 gms

SLAB II to Maja

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D:

Sample I.D: Sta:03 CD2-11

Location: S. Johnston Ridge

Size: 21.7 6.5 x 9.5 Weight: 1.0 kg

Mn crust thickness:

Total: min: 5.5 max: 6.5 ave: 6.0

Inner crust: min: max: ave: 2.2

middle 2.0

Outer crust: min: max: ave: 1-8

Surface texture: Perfectly smooth to finely granular

Internal structure: innermost Coaly

layered: 3 To 5

laminated:

massive: inner most + outer 2

porous: middle

dendritic:

other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: NONE

Description:

Mineralogy(XRD):

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: F7-86-HW Karin Ridge Johnston Is

Sample I.D: Sta: 03 CD 2-12

Location: S. Johnston Ridge

Size: _____ **Weight:** _____

Needs To be Cut

Mn crust thickness:

Total: min: <1mm max: 24mm ave: 13mm

Inner crust: min: <1mm max: 5mm ave: 2.5 mm

Outer crust: min: 15mm max: 20mm ave: 17mm
COVERS ONLY 1/3 of COBBLE

Surface texture: granular, small botryoids

Internal structure:

layered: ✓
laminated:
massive:
porous: ✓
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Vesicular Basalt Cobble

Description:

Rock coated with Mn on all sides. The thicker crust looks as if it may have been more extensive but has broken off while cobble being pounded?

Basalt has altered outer rind; phosphorite fill some vesicles & veins.
Phosphorite between layers of Mn

Mineralogy (XRD):

CD2-12

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:
Mn1-Crust-Chemistry	
CD2-12 Bulk Sample 12gm	20mm
XRD Bulk	

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 18x16x9

Sample I.D: Sta: 03CD2-13

Location: S. Johnston Ridge

Size: _____ **Weight:** 1.5 kg

Mn crust thickness:

Total: min: 5.5 max: 9.0 ave: 8.0

Inner crust: min: _____ max: _____ ave: 1.0

middle inner 1.3

Outer crust: middle outer 3.0

min: _____ max: _____ ave: 2.7

Surface texture: Perfectly smooth

Internal structure:

layered: X

laminated: X outer middle - dense

massive: inner - outer (w/ cracks)

porous: middle inner w/ brown (cracks)

dendritic:

other: outer 2 layers separated by thin layer w/ pits or vugs -

Mineralogy (XRD):

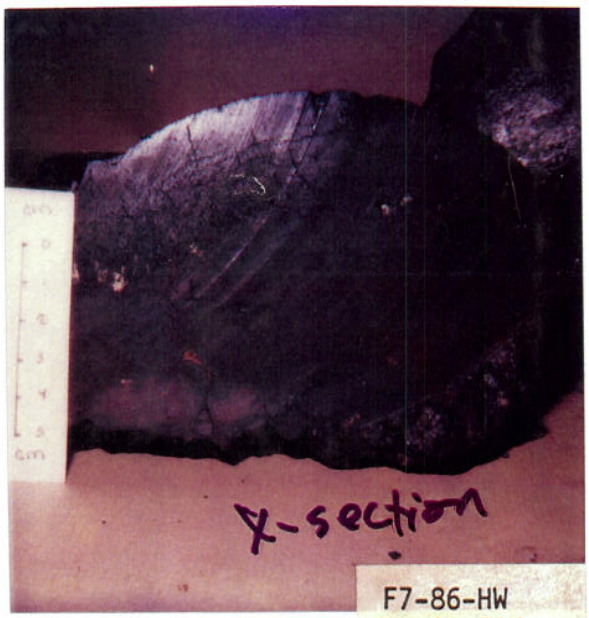
Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: NONE

Description:

Mineralogy (XRD):



F7-86-HW
~~Karin Ridge~~
Johnston Is
D2-13

Analy

a

Smooth Top Surface

F7-86-HW
~~Karin Ridge~~
Johnston Is
D2-13

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 11x14x8

Sample I.D: Sta: 03 CD2-14

Location: S Johnston I Ridge

Size: _____ **Weight:** 0.8 kg

Mn crust thickness:

5 **Total:** min: 8.0 max: 11.0 ave: 9.5

4 2.5

3 **Inner crust:** min: _____ max: _____ ave: 2.5

2 2.0

1 **Outer crust:** min: _____ max: _____ ave: 1.2

Surface texture: Smooth

Internal structure:

layered: 5 or more
laminated:
massive: inner 2 + outer most
porous: middle
dendritic:
other:

F7-86-HW
~~Karin Ridge~~
Johnston Is
CD2-14

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Trace of hyaloclastite or Volc. Breccia

Description: Yellowish brown - altered

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:
1	massive w/ fractures
2	⊥ crystallites
3	Botryoidal laminae
4	porous yellow brown
5	crack massive & dense
phosphate veins	

KarinRidge
Johnston Is

Sample Description

D2-15 and 16 actually dissolved tube top & bottom of Sanic sample.

Cruise I.D:

Sample I.D: Sta: 03-CD2-15 **Location:** S. Johnston Is

Size: _____ **Weight:** 9.5 kg

crust thickness:

Total: min: 65mm **max:** 85m **ave:** 77.7mm

Inner crust: min: SEE BACK **max:** _____ **ave:** _____

Outer crust: min: _____ **max:** _____ **ave:** _____ SEE BACK

Surface texture: Botryoidal, somewhat worn

Internal structure:

layered: ✓
laminated: ✓
massive: ✓
porous: ✓
dendritic:
other:

CD2-15,16

Mineralogy (XRD):

sociated alteration, phosphorite, or drothermal deposits:

Substratum:

Rock type: Volcaniclastic Breccia w/ phosphatic cement

Description:

Breccia appears to be sitting on another dense Mn layer. Some Mn Clasts are in the Breccia Clast are highly altered.

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:
Mn Crust Chem + XRD	
CD2-15A Layer 1 15gm.	0-13, 13mm
CD2-15B Layer 2 10gm	13-27 14mm
CD2-15C Layer 3 10gm	27-40 13mm
CD2-15D Layer 4 23gm	40-65, 25mm
CD2-15E Bulk 15gm	

Layer 1 - 11mm min to 18mm max
Dense massive outer layer, faint laminae visible

Layer 2 - 12mm min to 20mm Max
Porous layer, at the bottom of the layer voids filled with mud

Layer 3 - 12mm min to 14mm Max
More massive layer, laminae visible, more porous towards the bottom

Layer 4 - (unable to accurately measure thickness because it broke off substrate)
thickest spot to measure 25mm
Very dense vitrious layer, top of layer has iron staining, laminae visible
This layer is cracking apart

CD2-15,16

F7-86-HW
Karin Ridge
Johnston Is

Cruise I.D.:

Sample Description

Sample I.D: Sta: 03 CD2-17

Location: S. Johnston Ridge

Size: 20 x 14 x 9 Weight: 1-5 kg

Mn crust thickness:

Total: min: 6.0 max: 9.0 ave: 8.0

Inner crust: min: max: ave:

Outer crust: min: max: ave:

see below right

Surface texture: Perfectly smooth

Internal structure:

layered: 7
laminated:
massive: inner, outer, middle
porous: 3 middle
dendritic:
other: innermost glossy black; layer of vugs

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: NONE

Description: highly vesicular

Mineralogy (XRD):

Analyses and subsamples:

mm	analysis:	analyst:
12		massive dense
5		porous
10		vugs
20		massive dense
10		porous, some vugs
7		porous yellow brown massive

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 13X10X8

Sample I.D: Sta:03 CD2-18

Location: S. Johnston Ridge

Size: _____ **Weight:** 1.2 kg

Mn crust thickness:

Total: min: 0.5 max: 2.2 ave: 1.5

Inner crust: min: — max: — ave: —

Outer crust: min: _____ max: _____ ave: _____

Surface texture: botryoidal to granular - irregular

Internal structure:

layered:
laminated:
massive: X
porous:
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Breccia

Description: Altered Volc. Rock Frgs. in phosphorite + 100 zeolite cement - brown - ~~[illegible]~~ Cobble completely coated w/ Mn

Mineralogy (XRD):

CD2-18

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:
2/3 of cobble given to Haibach	

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 21 x 15 x 10

Sample I.D: Sta: 03 CD 2 - 19

Location: S. Johnston I Ridge

Size: _____ **Weight:** 3.0 kg

Mn crust thickness:

Total: min: 1-2 max: 3.5 ave: 2.0 cm

Inner crust: min: — max: — ave: —

Outer crust: min: ____ max: ____ ave: ____

Surface texture: smoothed - large-scale botryoids on top; granular on bottom & sides

Internal structure:

layered:
laminated:
massive: X
porous: in places
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Basalt & Phosphorite Breccia

Description: 1 large (4.5 x 4.5 cm) Basalt ~~pe~~ pebble - relatively fresh on one side & area of fractured phosphorite on other side of interior of large cobble-sized Mn-coated Rock -

In slabbing Rock came upon a hollow in Rock filled with [illegible] sediment

Mineralogy (XRD):

CD2-19

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:
Mn Crust Chem & XRD	
CD2-19A Bulk ≈ 18 gm composite 30mm	
XRD	
CD2-19B - Foram? Sand from Hollow	
CD2-19C - Mud from crack where slab broke	
↳ XRD: remade slide & re-xrd'd it (#2)	
↳ It is dolomite mud	
CD2-19D XRD, O C (phosphorite pebble)	

Send Dolomite for O + C isotopes & for (re-XRD'd 19C-C before any other action)

~~O C Chem~~
CD2-38M also

Fragmented Sediment

CD2-19

F7-86-HW
Karin Ridge
Johnston Is

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 23X17X9

Sample I.D: Sta: 03 CD 2-20

Location: S. Johnston Ridge

Size: _____ Weight: 3 kg

Mn crust thickness:

Total: min: 6.5 max: 8.5 ave: 8.0

Inner crust: min: _____ max: middle ave: 4.5

Outer crust: min: _____ max: _____ ave: 2.0 1.5

Surface texture: Perfectly smooth

Internal structure:

layered: At Least 3
laminated:
massive: inner + outer
porous: middle
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: NONE

Description:

Mineralogy (XRD):

CD2-20

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 2 to 5 cm diameter

Sample I.D: Sta: 03 CD 2-21

Location: S. Johnston I Ridge

Size: _____ **Weight:** 10-30 gms each

Small Nodules

Mn crust thickness:

Total: min: 0.2 max: 0.8 ave: 0.6

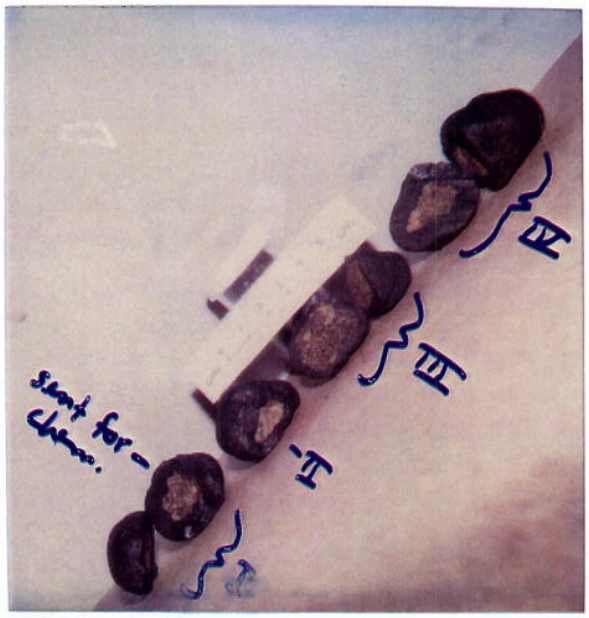
Inner crust: min: ____ max: ____ ave: ____

Outer crust: min: ____ max: ____ ave: ____

Surface texture: Smooth

Internal structure:

layered:
laminated:
massive: X
porous:
dendritic:
other:



CD2-21

F7-86-HW
Karin Ridge
Johnston Is

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: hyaloclastite or V. Fine-grained Volcanic Breccia

Description: yellowish altered Volc. debris as the nuclei of small nodules

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:
CD2-21-I	
chemistry: Manheim pkg	Lisa Bein 3-8 m
XRD: of crust	" "

OVER →

nodule [illegible]: nodule are single layered.

nodule [illegible]: 3-8 mm thick [illegible] Hollowed out hallard

[illegible] Top

[illegible] 2.0×2.5×~3.0cm

nodule [illegible] 3.1×3.0×2.5 cm

nodule [illegible] 1-3 mm thick [illegible]

2.2cm×3.0cm×3.6cm

nodule IV: 5-7 mm thick [illegible]

2.6×3.2×5.0 cm

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 11X7X7

Sample I.D: Sta: 03 CD2-22

Location: S. Johnston Ridge

Size: _____ Weight: 0-2 kg

Mn crust thickness:

Total: min: 1.3 max: 4.0 ave: 3.0

Inner crust: min: — max: — ave: —

Outer crust: min: ____ max: ____ ave: ____

Surface texture: irregular

Internal structure:

layered:
laminated:
massive: X
porous:
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Phosphorite veins in crust ⊥ to growth - 1 layer, //

Substratum:

Rock type: Hyaloclastite

Description: yellowish - fine grained altered volc. tuffs -

Mineralogy (XRD):

CD2-22

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
KarinRidge
Johnston Is

Sample Description

Cruise I.D: 28x14x11

Sample I.D: Sta:03 CD2 - 23

Location: S. Johnston I Ridge

Size: _____ **Weight:** 5 kg

Mn crust thickness:

Total: min: 3.4 max: 6.0 ave: 4.8

Inner crust: min: 1.2 max: 2.0 ave: 1.6

Outer crust: min: 3.0 max: 3.4 ave: 3.2

Surface texture: Smooth; granular on side

Internal structure:

layered:
laminated:
massive: X
porous: in places
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Hyaloclastite

Description: Yellowish to greenish, highly altered rock. Lobes w/ phosphorite "veins" or infillings

Crust Texture on Side of sample very porous and granular. 2 polished sections to look at texture differences

Mineralogy (XRD):

OUTER LAYER More Porous
INNER LAYER - Denser

CD2-23

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:
1/2 Taken by Bu. Mines	
Mn Crust Chem + XRD	
CD2-23A Bulk Sample 64 gm	
CD2-23B outer 63 gm	0-16, 16 gm
CD2-23C inner 61 gm	16-~~24~~ 32 gm
CD2-23A Resubmitted for Hg Chemistry	
CD2-23B	
CD2-23C	
D. Polished Sections	
CD2-23A - Top Texture	
CD2-23B - Side Texture	

F7-86-HW
Karin Ridge
Johnston Is

Cruise I.D:

Sample Description

Sample I.D: Sta: 03 CD2-24

Location: S. Johnston Ridge I

Size: 15 x 11 x 8.5 Weight: 1.5 kg

Mn crust thickness:

Total: min: 0.5 max: 2.5 ave: 1.8

Inner crust: min: — max: — ave: —

Outer crust: min: max: ave:

Surface texture: Smooth; granular on sides & bottom

Internal structure:

layered:
laminated:
massive: X
porous: in places
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Breccia

Description: Mod. Fresh to highly altered Volc. Rx Frags floating in phosphorite Cement - lower 1/2 is closer-packed than upper 1/2 -
Cobble Coated all round

Mineralogy (XRD):

CD2-24

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:
1/2 of sample taken by Ber-Mines -	

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 16 X 14 X 7.5 **Sample I.D:** Sta: 03CD2-25 **Location:** S Johnston I Ridge

Size: _____ **Weight:** 1.2 kg

Mn crust thickness:

Total: min: 0.8 max: 2.5 ave: 2.0

Inner crust: min: — max: — ave: —

Outer crust: min: _____ max: _____ ave: _____

Surface texture: Subdued botryoidal to granular

Internal structure:

layered:
laminated:
massive: X
porous: in places
dendritic:
other: older Crust Fragment as part of nucleus —

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic breccia & older Crust Fragment

Description: Altered Volc. Rx Clasts Cemented by & partly replaced by phosphorite —
A more dense & metallic older Crust Frag.

Mineralogy (XRD):

CD2-25

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 20X12X9

Sample I.D: Sta:03 CD2-26

Location: S. Johnston I. Ridge

Size: _____ **Weight:** 3 kg

Mn crust thickness:

Total: min: 1.4 max: 2.0 ave: 1.8

Inner crust: min: ≥1.4 max: ≥2.0 ave: ≥1.8

Outer crust: min: missing max: _____ ave: _____

Surface texture: blocky

Internal structure: only massive inner layer present - rest has been stripped off

layered:
laminated:
massive: X
porous:
dendritic:
other:

Phos Study

CD2-26

F7-86-HW
Karin Ridge
Johnston Is

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Breccia

Description: below Crust is 2 1/2 cm layer of phosphorite w/ Volc-Rx Clasts w/ Thick Concentric Rinds of Mn + Mn Nodules w/ NSO Nodel; below is Volc. Clasts in milk-chocolate brown phosphorite (?) - only some clasts have Mn rinds -

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:
1/2 Taken by Ru Mines	
35mm	G Smith

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D. 16x12x6

Sample I.D: Sta: 03CD2-27

Location: S. Johnston I Ridge

Size: _____ **Weight:** 1-2 kg

Needs Cut

Mn crust thickness:

Total: min: 1.0 max: 2.0 ave: 1.8

Inner crust: min: ≥1.0 max: ≥2.0 ave: ≥1.8

Outer crust: min: _____ max: _____ ave: _____ missing

Surface texture: Blocky

Internal structure: mud lacunt to well

layered: _____
laminated: _____
massive: x
porous: _____
dendritic: _____
other: _____

CD2-27
rock may be upside down in photo.

F7-86-HW
Karin Ridge
Johnston Is

Mineralogy (XRD): _____

Associated alteration, phosphorite, or hydrothermal deposits: _____

Substratum:

Rock type: Hyaloclastite

Description: (Sandwiched between mn — outer Layer missing —

Mineralogy (XRD): _____

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 13 X 9 X 6

Sample I.D: Sta: 03 CD2-28

Location: S. Johnston Ridge

Size: _____ **Weight:** 0-5 kg

Mn crust thickness:

Total: min: 2.0 max: 4.5 ave: 3, 5

Inner crust: min: [illegible] max: [illegible] ave: 16 mm

Outer crust: min: [illegible] mm max: [illegible] ave: [illegible]

Surface texture: V. highly granular - unique [illegible]

Internal structure: 2 layers

layered:
laminated:
massive: X inner layer, interpreted [illegible]
porous: X outer layer
dendritic:
other:

CD2-28

F7-86-HW
Karin Ridge
Johnston Is

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

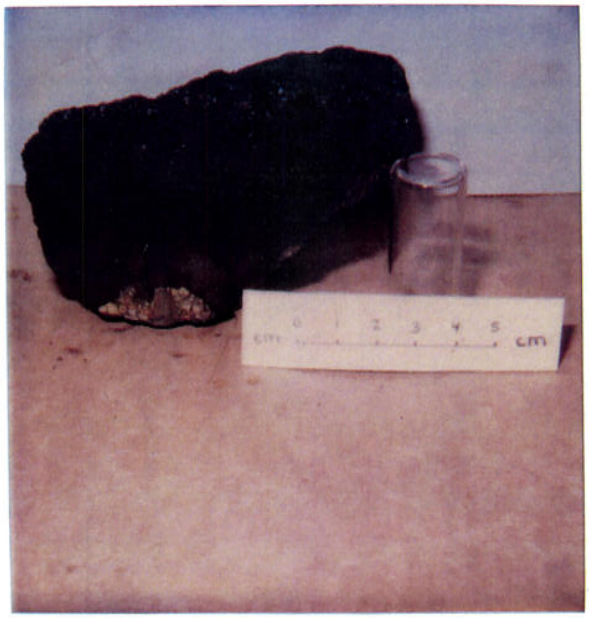
Rock type: Hyaloclastite

Description: Yellowish to greenish highly altered Volcanic Debris -

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:
chemistry: "Manheim plug"	Lisa Gein
A = outer layer [illegible]	0-35, 35 mm
B = [illegible] back	35-50, 15 mm
C = bulk	
XRD: [illegible] back	Lisa Gein
A = outer layer	
B = inner	
C = bulk	



CD 2-28

F7-86-HW
Karin Ridge
Johnston Is

CD 2-28A = outer
Thickness of crust sent: [illegible] mm. 14.00 gms [illegible]
for "Manheim phg"
This layer has [illegible] material
mixed in.

CD 2-28B = inner
[illegible] sent 11.67 gm
for "Manheim phg.

CD 2-28C = bulk crust. Sent [illegible] gm for
"Manheim phg". Thickness of crust
sent: 4.5 cm

Cruise I.D: F7-86-HW Karin Ridge Johnston Is

Sample Description

ample I.D: Sta: 03 CD2-29

Location: S. Johnston Ridge

Size: — Weight: <1

Mn crust thickness: No Crust

Total: min: max: ave:

Inner crust: min: max: ave:

Outer crust: min: max: ave:

Surface texture:

Internal structure:

layered:
laminated:
massive:
porous:
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcaniclastic SS or hyaloclastite

Description: yellowish-green, medium to coarse-sand sized, altered vole. grains - some Mn-grains + veins, lt brown Phosphorite veins + brown phosph. patches + veins

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:
XRD	Jack
TS	Dean

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: **Sample I.D:** Sta: 03 CD2 - 30 **Location:** S. Johnston Ridge

Size: — **Weight:** <1

Mn crust thickness: - No Crust

Total: min: max: — ave:

Inner crust: min: max: ave:

Outer crust: min: max: ave:

Surface texture:

Internal structure:

layered:
laminated:
massive:
porous:
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Limestone - Massive Dense

Description: white Lms - Massive & bored w/ holes lined w/ mn - several red-brown Volc. Rx. Frags. (?) altered to clays - some vugs filled w/ massive mn oxide. -

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:
XRD	Jorie
Paleo	Quinterno
TS	Mann

F7-86-HW
KarinRidge
Johnston Is

Sample Description

Cruise I.D: 18 x 12 x 11 **Sample I.D:** Sta: 030 CD2-31 **Location:** S. Johnston Ridge

Size: _____ **Weight:** 2 kg

Mn crust thickness:

Total: min: 5.0 cm max: 10.0 ave: 8.0 cm

Inner crust: min: ____ max: ____ ave: ____

Outer crust: min: ____ max: ____ ave: ____

Surface texture: Perfectly Smooth

Internal structure:

layered: At least 3
laminated:
massive: X
porous: X
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Hyaloclastite or volcaniclastic SS.

Description: Thin layer left - yellowish - altered volc. debris

Mineralogy (XRD):

CD2-31

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:
Layer 1 - Massive 5 to 10 mm	
Layer 2 - Porous with voids at bottom of layer 25 mm	
Layer 3 - botryoidal laminae w/ porous texture along laminae	
Layer 4 - Very Porous w/ iron staining & mud in voids	
Layer 5 - Massive anthracite like sheen	

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 17x12x7 **Sample I.D:** Sta:03 CD2-32 **Location:** S. Johnston Ridge

Size: _____ **Weight:** 1 kg

Mn crust thickness:

Total: min: 5-5 max: 7.0 ave: 6.0

Inner crust: min: _____ max: _____ ave: 3.0

Outer crust: min: middle max: _____ ave: 2.0 / 1.0

Surface texture: Elongate Botryoidal to smooth granulous sides —

Internal structure:

layered: At least 3 layers
laminated:
massive: inner + outer
porous: middle
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

CD2-32

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:

Substratum:

Rock type: NONE

Description:

Crust layers similar to all thick crusts in this dredge. Outer #1 Dense 10cm
#2 Porous 15 to 20cm
#3 Botryoidal layers 10 to 15cm
#4 Porous 7 to 10cm
#5 Dense & thin layers
Layer 5 broken on this sample

Mineralogy (XRD):

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 3.0 X 24 X 18

Sample I.D: Sta: 03 CD 2 - 33

Location: S. Johnston Ridge

Size: _____ **Weight:** 15 Kg

Cut RX - not cut as missing outer layers.

Mn crust thickness:

Total: min: 1.5 max: 3.0 ave: 2.0

Inner crust: min: ≥1.5 max: ≥3.0 ave: ≥2.0

Outer crust: min: _____ max: _____ ave: _____

Surface texture: Blocky

Internal structure: Only inner layers present

layered: outer layers stripped off.
laminated:
massive:
porous:
dendritic:
other:

CD2-33

F7-86-HW
Karin Ridge
Johnston Is

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Conglomerate

Description: Rounded to subrounded altered Volcanic pebbles in phosphorite + altered tuff cement - Clasts are Coated w/ Mn -
Substrate maybe bedded?

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 16x12x8 **Sample I.D:** Sta: 03 CD2-34 **Location:** S. Johnston I Ridge

Size: _____ **Weight:** 1.3 kg

Mn crust thickness:

Total: min: 7.5 max: 8.5 ave: 8.0

Inner crust: min: ____ max: ____ ave: 4.0

middle 2.0

Outer crust: min: ____ max: ____ ave: 2.0

Surface texture: Perfectly Smooth

Internal structure:

layered: at Least 3 layers
laminated:
massive: inner + outer
porous: middle
dendritic:
other:

CD2-34

F7-86-HW
Karin Ridge
Johnston Is

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Hyaloclastite

Description: yellowish green highly altered volc. debris Only small piece

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 21x18x10

Sample I.D: Sta: 03 CD2-35

Location: S. Johnston I Ridge

Size: _____ Weight: 3-5 kg

Mn crust thickness:

Total: min: 7.0 max: 9.0 ave: 8.0

Inner crust: min: _____ max: _____ ave: 5.0

Outer crust: min: middle max: _____ ave: 1.5

Surface texture: Perfectly smooth; granular on sides

Internal structure: at least 5 layers

layered: _____
laminated: _____
massive: 2 inner & 2 outer
porous: middle
dendritic: _____
other: _____

Mineralogy (XRD): _____

Associated alteration, phosphorite, or hydrothermal deposits: _____

Substratum:

Rock type: Hyaloclastite Trace

Description: Yellowish-green

Mineralogy (XRD): _____

CD2-35

F7-86-HW
KarinRidge
Johnston Is

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 22x22x6

Sample I.D: Sta: 03 CD2-36

Location: S. Johnston Ridge

Size: _____ **Weight:** 3 Kg

Excellent Surface Texture

Mn crust thickness:

Total: min: 4.0 max: 7.0 ave: 6.0

Inner crust: min: ____ max: ____ ave: 2.5

Outer crust: min: ____ max: ____ ave: 2.0

middle 1.5

Surface texture: V. Elongate + interconnected botryoidal

Internal structure:

layered: At least 3 layers
laminated:
massive: inner + outer
porous: middle
dendritic:
other:

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: NONE

Description:

Mineralogy (XRD):

CD2-36

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D:

Sample I.D: Sta: 03 CD2 - 37

Location: S. Johnston Ridge

Size: 32x20x9 **Weight:** 6.0 kg

Excellent Surface Texture

Mn crust thickness:

Total: min: 30mm max: 40 ave: 35

Upper ~~Inner~~ **crust:** min: 30m max: 40 ave: 35

Lower ~~Outer~~ **crust:** min: 7mm max: 12 ave: 10

Surface texture: Botryoidal + granular on side encrusting foraminifera

Internal structure:

layered:
laminated:
massive: X
porous: X
dendritic:
other:

Mineralogy (XRD):

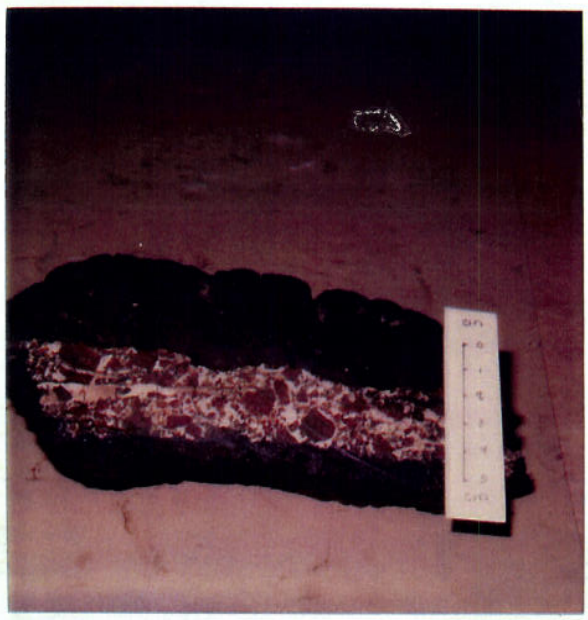
ssociated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanoclastic Breccia w/ Phosphorite matrix.

Description: Clasts are matrix supported. Clasts are vesicular basalt. Substrate may have been shelf or flat to have crusts forming on both sides like this

Mineralogy (XRD):

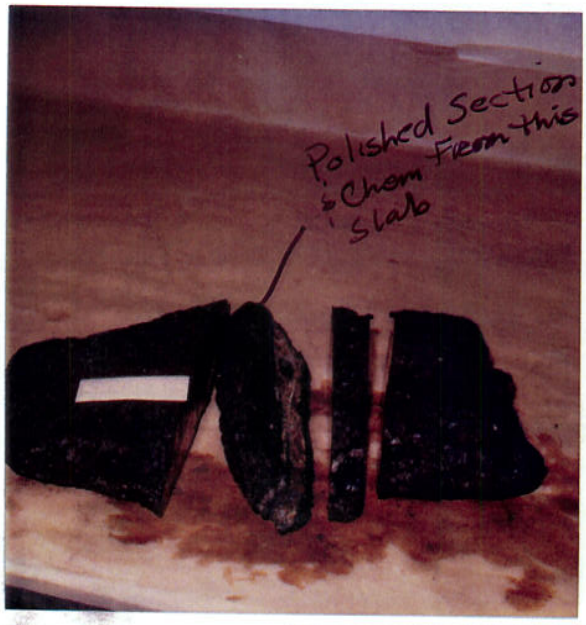


CD2-37

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst:
Mn Crust Chem & XRD	
CD2-37A Upper Bulk	142gm
CD2-37B Lower Bulk	288gm
Silicate Chem & XRD	
CD2-37C Substrate	38gm
D. Polished thin sections	



CD2-37

F7-86-HW
Karin Ridge
Johnston Is

F7-86-HW
Karin Ridge
Johnston Is

Sample Description

Cruise I.D: 42x26x22

Sample I.D: Sta: 03 CD 2 - 38

Location: S. Johnston I Ridge

Size: _____ **Weight:** 20 kg

Excellent Paleoceanography Sample would be good for phosphate study

Mn crust thickness:

Total: min: 6.5 max: 9.0 ave: 7.5

Inner crust: min: ____ max: ____ ave: 4.5

Outer crust: min: ____ max: ____ ave: 3.0

Surface texture: microbotryoidal Smooth; was botryoidal at least on spot; granular on side

Internal structure:

layered: 6 To 10 Layers (sampled for chem as 5 layers.)
laminated:
massive: most Seeback
porous: / ? For Descriptions
dendritic:
other:

CD2-38

F7-86-HW
Karin Ri
Johnston

Pnos study

Mineralogy (XRD):

Associated alteration, phosphorite, or hydrothermal deposits:

Substratum:

Rock type: Volcanic Conglomerate + Hyaloclastite

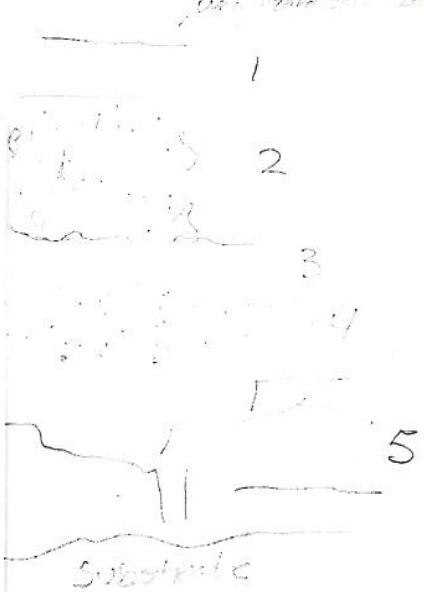
Description: thick layer of Rounded Volc- Pebbles close-packed in altered ashy (?) matrix, underlain by a layer of yellowish-green hyaloclastic - completely altered -
Clasts have Mn crusts up to 4mm thick
Conglomerate is separated from Hyaloclastite by a layer of laminated crust

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:
Mn Crust Chem & XRD	
CD2-38A Layer 1 - 46gm	0-10, 10mm
CD2-38B Layer 2 - 59gm	10-35, 25mm
CD2-38C Layer 3 - 59gm	35-50, 15mm
CD2-38D Layer 4 - 57gm	50-65, 15mm
CD2-38E Layer 5 - 73gm	65-90, 25mm
CD2-38F Thin Layer - 11gm	5mm
Nodule Bulk	
CD2-38H Bulk 46gm	0 -
Substrate Sample - Silicate Chem	
CD2-38-G 19gm	-XRD
XRD CD2-38-M Mud Layer 2	
Dissections - through Slab	Marin
35 mm	G. Smith

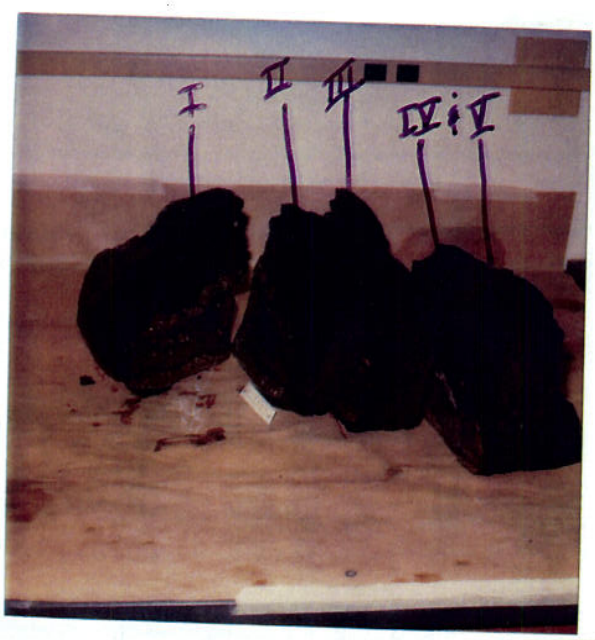
Layer #1 - 7mm to 10mm thick
Dense layer faintly laminated



Substrate has phosphate cement, making it very hard

CD2-38 35mm!

F7-86-HW
Karin Ridge
Johnston Is



CD2-38

F7-86-HW
Karin Ridge
Johnston Is

Chem. Polished sections

Slab IV

CD2-38

F7-86-HW
Karin Ridge
Johnston Is

77-86-HW
KarinRidge
Johnston Is

Sample Description

Cruise I.D:

Sample I.D: Sta: CD2-A2

Location:

Size: Weight:

crust thickness:

Total: min: <.4cm max: 1.5cm ave:

Inner crust: min: max: ave:

Outer crust: min: max: ave:

Surface texture:

Internal structure: Large & Small Botryoids

layered: Patches of granular

laminated:

massive: ✓

porous: ✓

dendritic:

other:

Mineralogy (XRD):

ociated alteration, phosphorite, or drothermal deposits:

Substratum:

Rock type: Basalt w/patches of Volcanic Breccia

Description:

Mineralogy (XRD):

CD2-A2

Analyses and subsamples:

analysis:	analyst:
Alice Davis to look at Basalts	
Nice rock for phosphate study	
Stabbed several times for book needs in B156	

KarinRidge
Johnston Is

Cruise I.D:

Sample Description

Sample I.D: Sta: CD2-A3

Location:

Size: Weight:

crust thickness:

Total: min: <.2cm max: 1cm ave:

Inner crust: min: max: ave:

Outer crust: min: max: ave:

Surface texture: Botryoidal to Granular

Internal structure:

layered:
laminated:
massive: ✓
porous: ✓
dendritic:
other:

Mineralogy (XRD):

sociated alteration, phosphorite, or drothermal deposits:

Substratum:

Rock type: Basalt w/ Patches of Volcanic Breccia Mound 18

Description:

Mineralogy (XRD):

CD2-A3

F7-86-HW
Karin Ridge
Johnston Is

Analyses and subsamples:

analysis:	analyst: