DATE: 1 August
CRUISE ID: SO 33
LOC: I
AREA: A

SAMPLE: 6DK Box dredge

	time (GMT)	LAT (N)	LON (W)	water depth (m)	wire out
(uncorrected) ON BOTTOM =	1420	18°40.9784	158°18.8480	1047	1260
(uncorrected) OFF BOTTOM =	1530	18°41.1942	158°18.0048	486	~520
mean dredge data (corrected):		18° 40' 59"	158° 18' 46"	870 (476 fm)	

RECOVERY WEIGHT = Total 300 kg Crust 20 kg?

CRUST THICKNESS = Veneer to 5 cm
Avg.: 1.5 cm
2 generations

SUBSTRATE = Basalt w/ altered olivine, hyaloclastite with smectite. Much rounded rubble w/ Mn veneer
Trachyte

COMMENTS: Strange rough surface - Halbach says maybe due to O_2 minimum causing dissolution.
Lots of coral, brittle stars, sharks teeth

* 1 microbio sample
* 2 bio samples (plastic boxes)
* 1 bio sample (plastic bag)

6DK

6 DK

Gesamtmenge: 300 kg

Hauptsächlich Basaltbruchstücke faustgroß mit dünner Mn-Umkrustung

5 größere Stücke 60 × 40 cm groß mit 2-8 cm mächtiger Mn-Kruste an Oberseite und Seite, Unterseite as dünne Mn-Haut. Substrat Hyaloklastit mehr oder weniger altenert, durchzogen mit Phosphorit, teilweise lagenweise – d auf Klüften Phosphorit. Mn-Kruste → 2 Krustengenerationen, junge Krust mit feinknotiger Oberfläche, teilweise angelöst (korrodiert), teilweise Smektitbruchstücke (0,5 cm) eingelagert; alte Kruste phosphoritimprägniert, durchzogen mit Apatit- o adem, muscheligem Bruch, die scharfe Grenze zwischen Krust und Substrat

6 DK 1 25×10 cm groß, Mn-Kruste (1 cm) oben, unte hauch dünn Oberfläche knotig (Phole), basalt. Substrat

6 DK 2 40×50 cm Stück, 5 cm Mn-Kruste, 2 Generationen, Apa imprägniert, Kruste korrodiert, knotige Oberfläche Unterseite dünne Mn-Haut, alte Kruste durchzogen mi Klüften gefüllt mit Phosphorit.
Substrat - stark alterierter Hyaloklastit, olivgrün, fast nur noch Smektit, Breccien größe 0,5-2 cm

6 DK 3 40×40 cm Stück, Substrat wie 6 DK 2 mit eingelagerten Basaltbruchstücken, überzogen mit Mn-Kru 1-4 cm mächtig, 2 Generation, junge Kruste eingela gerte Smektit Bruchstücke ~0,5 cm knotige Ober fläche, alte Kruste ist durch 2 mm Phosphoritlage ge trennt, Apatitimprägniert, differierende Mächtigkeit in beiden Generationen

6 DK 4 Substrat wie 6 DK 2 Mn-Kruste 7-8 cm mächtig Oberseite, unte dünne Mn-Haut, 2 Generationen jg. 3-5 cm, ältere 2-3 cm, durchzogen mit 2-3 mm Phosphoritlage, Krustenoberfläche feinknotig

6 DK 5 Substrat: teilweise alterierter Hyaloklastit (rote Lapilli stark durchzogen mit Phosphorit, eingelagerte Basalt bruchstücke (blasig), Mn-Kruste 0,8-3 cm mächtig 2 Generationen, getrennt durch dünne Phosphoritlage Unterseite dünne Mn-Haut

6 DK 6 Phosphorit mit Mn-Dendriten, 2 mm mächtige Mn-Umkrustung

6 DK 7 Basaltbruchstück ohne Kruste

ca 20 kg Krust

AKal A ~50 kg Mn-Kruste

Sample Description

Cruise I.D: SO 33

Sample I.D: Sta: DK 6

Location: (Cross Sunt
158° 18' 46"
18° 40' 39"
(-) 870 m.

Size: _____ Weight: _____

Mn crust thickness:

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: _____

Description: _____

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:

6DK1

basalt hyaloclastite/breccia

6DK2

	Basalt (AOB?) submarine pillowed? trap?	Clastite / Breccia
Color:	Dark Gray (N 3) ~~to~~ ~~Dark yellowish brown (10YR 4/2)~~	Light brown (5YR/6) to yellowish-gray (5Y 7/2)
Texture:	Aphanitic – subaphyric hyalopilitic / pilotaxitic / subtrachytic to diktytaxitic trachytic	Aphanitic hyalopilitic / pilotaxitic / subtrachytic – trachytic flow structure;
Phenocrysts:	very rare Olivine – <1% ~1mm Pyroxene(?) <<1% 0.75mm plagioclase <1–16% ~1mm	not observed
Groundmass:	tabular feldspar (plagioclase?) (~65%, <0.5mm) glass ~30% Opaques ~5%	glass 95–99+% (?)
Vesicles:	large flat, lensoid size: 5–10 cm filling: empty shape	dense to scoriaceous <1mm – ±3m empty round to elongate
Clasts:		
Shape:		subangular – angular
Size:		<1mm — 50+mm ~1 cm avge
Remarks:	angular – subangular clasts of aphanitic – subaphyric AOB(?) fresh to very altered basalt. ~~possibly erupted subaerially in part~~. Texture is highly directed, pilotaxitic ⊥ to top of flow, micaceous ∥ to top of flow more vesicular toward top; phenocrysts rare, but locally abundant in rare pieces, oriented ∥ to direction of flow; alteration is localized, fresh material often immediately adjacent to very altered zones (alteration aureoles along fractures?); coated generally w/ thin ≤ mm (~0.5cm) crust often overlying localized grayish orange (10YR 7/4) phosphorite layer frequently deposited in low surface features	highly to completely altered basaltic hyaloclastite mwh alteration is in part to nontronite(?) (pale greenish-yellow) & zeolites(?) and in part to brown iron oxide; frequently deposit directly on top of larger basalt clasts; sometimes these are incorporated in the hyaloclastite itself flow structure can easily be observed, hyaloclastite cobbles, pebbles usually covered with ±1 cm-thick layer of ≤ mm cemented w/ pale brown (5YR 5/4) to grayish orange pink (5YR 7/2) phosphorite and lighter colored chalk

Sample Description

Cruise I.D: S033

Sample I.D: Sta: 6DK

Location: Cross Smt
158° 18' 46"
18° 40' 59"
(-) 870 m.

Size: _____ Weight: _____

Mn crust thickness:

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: _____

Description: _____

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:

6DK3	6DK4	6DK5	6DK6
Rock Type: Trachyte(?) Hyaloclastite/Breccia	Trachy AOB Hyaloclastite	Basalt, AOB(?) Subaerially erupted?	Phosphorite/ Phosphorite Volcanogenic Br
Color: moderate greenish-yellow to pale olive (10Y 7/4) (10Y 6/2)	→ Light brown (5YR 5/6) to Pale greenish-yellow (10Y 8/2)	→ Dark Gray (N3)	→ Pale brown (5YR 5
Texture: Pyroclastic (holohyaline)	→ -do-	≠ Texture: intersertal	Clastic/Pyroclastic, granular
Matrix: Trachyte fragments, ±55% pumice	→ -do-, ± 40%, AOB gracia ± 20%	≠ Phenos: Plagioclase ±5%, ±3mm Olivine <1%, ±2mm	≠ (Matrix) Basalt(?)/trachyt altered aphanitic c hyaloclastite
Cement: Phosphorite, (pe. bru 5YR 5/2) ±45%	→ -do-, ± 40%	≠ Groundmass: Olivine, Plagioclase } not detec	≠ (Cement) Phosphorite (originally chalk
Avge. Grain Size: ± 3mm (gravel size) ≠	±	≠ Vesicles: ± 40% of total rx round-oval shape ± 0.25 mm dia. calcite, zeolites, smectite filling, ± 20% of total vesicles	(Avg. gz) ±.01 mm (grain shape) sub rounded
Avge. Grain Shape: angular-subangular	→ -do-		
Sorting: Very poorly-sorted ≠	poorly-sorted		→ extremely poorly-s
Porosity: ± 75%	→ ± -do-	≠ Alteration: Superficial(?) (zeolitization?) (iddingsitization of olivine)	→ complete (smectit. zeolitization, hydrati of hyaloclastite, phosphorization of or chalk cement.
Permeability: ± 75%	→ ± -do-		
Alteration: complete? (Smectitization (nontronite?) zeolitization (phillipsite?), hydration (matrix); phosphorization (cement)	} -do-, oxidation	≠ Remarks: large cobble-size rounded-to-subrounded clasts encrusted to ± 5mm with chalk/phosphorite coated generally with thin veneer of L-MnO_2 concentric development of vesicles, crystals in X-section of cobbles (originally volcanic bombs erupted subaerially?); Olivine glomerophyric with itself, plagioclase generally single crystals, often displaying resorption.	→ subangular to subrounded large pebbles & cobbles of (probably) slope talus (often coate with veneer-to-seve cm-thick deposits o L-MnO_2(?) & todoro birnessite(?) [dendrit growth patterns most frequent]; probably de loped as foraminif ooze on terraces which received "rain volcaniclastic mate subsequently phosph (volcaniclastic mate often coated with 1 thick layers of shin dark-brown, glassy phosphorite (phosph nodules?); hyaloc fragments are com altered to smectites zeolites; as terraces collapsed or otherwise disturbed, clasts of phosphorite rolled to slope.
Remarks: holohyaline angular fragments of totally(?) altered trachytic(?) pumice (crystals of any kind usually rare, acicular (feldspar only) very rare shiny black, flat, hexagonal crystals (biotite, amphibole?), usually holohyaline, very gassy; individual fragments often show flow structure, directed texture, "accordion structure, like expanded vermiculite; dredge recovered many subrounded clasts (cobble-boulder-size) some bearing thin (±5mm) discontinuous deposits of phosphorite volcanogenic breccia and chalk/volcanogenic breccia (Lithologies 6, 8), coated generally with veneer-thickness-to 5-cm-thick deposits of L-MnO_2, often with 2 generations of crust (dendritic to laminar) separated by thin (± 2mm thick) layer of yellowish phosphorite	→ -do- Similar to Lithologn ±3, & ±2 but with included (usually larger than trachyte frags) AOB gracia(?); some appears to have minute iddingsite rhombs included, otherwise very like the trachyte (less directed texture, no "accordion" structure). Some clasts have ± 0.5 mm-thick deposits of L-MnO_2(?) coating them (incorporated into the trachyte hyaloclastite/breccia later?); pebble-to-cobble-size rounded to subrounded to subangular clasts coated with veneer of L-MnO_2, some penetration to 2-3cm with dendritic MnO_2 (remobilized from veneer coating)		

Sample Description

Cruise I.D: S033

Sample I.D: Sta: 60K

Location: Cross Sm
158°19'46" W
18°40'59" N
-870 m.

Size: _____ Weight: _____

Mn crust thickness:

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: _____

Description: _____

Mineralogy (XRD):

Analyses and subsamples:

analysis:	analyst:

6DK7 | 6DK8 | 6DK9

Rock Type: Trachyte, Chalk, Ferromanganese, Nodular

Color: Pale brown (5YR5/2) → Grayish-orange (10YR 7/4) to very pale orange (10YR8/2) → Brownish-black 5YR2/1

Texture: Aphanitic, subtrachytic (micaceous on surfaces ∥ to top of flow) → granular, arenaceous → dendritic, warty, caspate (internal), (external)

≠ (Matrix): Globigerina(?) calcareous foraminiferal tests, ±0.25 mm ≠ ±95%

Phenocrysts: absent

Groundmass: Sanidine ±0.10 mm ≠ ≠ (Cement): calcite, phosphorite(?) ± 5% ≠
Titanomagnetite(?) ±2% ±0.05 mm

Vesicles: absent — 35-40% elongate ovoid (Scoriaceous variety) ≠ (Avge G2): ± 0.25 mm
≠ (" G Shape): rounded

Alteration: moderate-extensive ≠ (Sorting): well-sorted
(smectitization, zeolitization, hydration [feldspar]; oxidation [opaques]) ≠ (Porosity): ± 80%
≠ (Permeability): ± 80%
(Alteration): incipient/superficial (phosphorization) recrystallization of calcite

Remarks. Rare subangular pebble-to-cobble-size clasts set in volcaniclastic, volcanogenic conglomerate; some varieties are dense, some are vesicular, all aphanitic (rare [illegible] micro phenocrysts [illegible] titanomagnetite micro-phenocrysts; brown color (oxydation) probably due to alteration of fine grained titanomagnetite(?)

→ apparently foraminiferal ooze that has been lithified, is in form of pebble-size angular clasts forming the capping layer of other detrital rocks. incipient phosphorization (heaviest near contact with fragmented tuff(?)). Stained variously in shades of pale orange by remobilized $Fe(OH)_3$(?); various fractures dusted or lined with dendritic todorokite(?)

Microlaminae of todorokite(?)/birnessite(?) developed in arborescent growths around central nucleii (usually angular - subangular fragments of volcaniclastic material (tuff, hyaloclastite, volcanogenic breccia); thickness varies from ±1 cm - ±7 cm, usually with two generations separated by thin (±1 mm) phosphorite layer. Surface texture warty to caspate; high porosity; fragile; probably terrace nodules developed around volcaniclasts