

## Appendix 1-1

## APPENDIX 1: Dredge Station Locations and Sample Descriptions

## Abbreviations:

DR -

Kettensack dredge

Chain-bag dredge

MS -

Multisonde

CTD + water sampler

Station no., type and place	Date, time (UTC), depth and coordinates: on bottom stuck (if applicable) off bottom	Description
01 MS	16.05.1999 on bottom: 08:18 h 5774 m 31°48.415 N 168°54.972 E off bottom: not noted	
04 DR Yuryaku	17.05.1999 on bottom: 07:15 h 2602 m 32°46.23 N 172°22.16 E off bottom: 09:15 h 2058 m 32°45.12 N 172°22.11 E	-1: Weathered pumice boulder, 5 cm in diameter. 5% fractured plagioclase, traces of hornblende. Black (Fe, Mn) stained interior, yellow exterior. -2: Weathered pumice boulder, 10 cm in diameter. 5% plagioclase and trace hornblende. Fresh glass shards in pale grey core, minor black staining near surface, yellow surface. -3: Weathered pumice boulder, 5 cm in diameter. 5% plagioclase and trace hornblende. Spheroidal weathering with pale grey core. Black (Fe, Mn) horizon 1 cm from surface, and yellow surface. -4: Light brown foram ooze caught in sediment tubes of dredge.
05 DR Yuryaku	17.05.1999 on bottom: 13:20 h 3022 m 32°33.61 N 172°11.31 E off bottom: 16:29 h 2251 m 32°34.55 N 172°12.03 E	-1: 20 cm diameter vesicular weakly weathered aphyric basalt. Vesicles partly filled by pale green mineral (zeolite?). MnOx coating 1 mm wide. -2: 8 cm diameter basalt boulder as above. Altered along thin (<1 mm wide) fractures. -3: 9 cm diameter weakly weathered aphyric basalt. MnOx coating <1 mm wide. Altered along thin (<1 mm wide) fractures. -4: 12 cm diameter weathered basalt. Pyroxene and plagioclase in groundmass. MnOx coating 1 mm wide. -5: 7 cm diameter weathered plagioclase (5%) basalt. MnOx staining on surface. -6: 9 cm diameter basalt as for 5, with alteration along thin (<1 mm wide) fractures. -7: 7 cm diameter basalt as for 5, with alteration along thin (<1 mm wide) fractures. -8: 12 cm diameter basalt as for 5, with alteration along thin (<1 mm wide) fractures. MnOx coating up to 1,5 cm wide.

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		<p>Contains weathered gabbroic xenolith.</p> <p>-9: 15 x 3 cm diameter weathered vesicular aphyric basalt. MnOx coating &lt;3 mm wide. Groundmass altered.</p> <p>-10: 19 cm diameter fine grained weathered basalt. Spheroidal weathering, MnOx coating &lt;1 mm wide. A few large (0.5 cm) vesicles filled with pale blue silica.</p> <p>-11: 12 cm diameter weathered plagioclase (5%) basalt. Carbonate replacing plagioclase. Altered 1 mm wide fractures, MnOx coating &lt;1 mm wide.</p> <p>-12: 10 cm diameter basalt as for 11, but all plagioclase replaced by carbonate.</p> <p>-13: 6 cm diameter basalt as for 11.</p> <p>-14: 12 cm diameter basalt as for 12, with some large vesicles filled by pale blue silica.</p> <p>-15: 9 cm diameter basalt as for 12.</p> <p>-16: 9 cm diameter basalt as for 14.</p> <p>-17: 7 cm diameter weathered basalt, carbonate replacing plagioclase and Fe-Mg minerals, more intense along 1 mm wide fractures. MnOx coating 1-2 mm wide.</p> <p>-18: 13 cm diameter basalt as for 17.</p> <p>-19: 11 cm diameter basalt as for 17, but groundmass weathering produces "spotted" appearance.</p> <p>-20: 12 cm diameter weathered basalt with 10% olivine +/- pyroxene phenocrysts pseudomorphed by iddingsite. MnOx coating 1-2 mm wide.</p> <p>-21: 9 cm diameter very weathered basalt. Iddingsite replaces olivine phenocrysts. MnOx coating 1 mm wide.</p> <p>-22: 4 cm diameter vesicular weathered basalt, carbonate in vesicles. MnOx coating 1-2 mm wide.</p> <p>-23: 9 cm diameter very weathered basalt, groundmass olivine replaced by iddingsite, silica in large vesicles. MnOx coating 1 mm wide.</p> <p>-24: 8 cm diameter weakly weathered basalt. Olivine phenocrysts replaced by iddingsite but groundmass plagioclase appears fresh. MnOx coating 1-2 mm wide.</p> <p>-25: 7 cm diameter very weathered basalt. Groundmass olivine replaced by iddingsite. MnOx coating &lt;1 mm wide.</p> <p>-26: 8 cm diameter plagioclase (~20%) basalt. Pink (hematite?) alteration of some groundmass areas, but elsewhere fresh. MnOx coating &lt;1 mm wide.</p> <p>-27: 10 cm diameter breccia of weathered basalt clasts in carbonate/MnOx matrix. MnOx coating 4 mm wide.</p> <p>-28: 30 cm diameter breccia of weakly weathered plagioclase basalt. Altered along fractures &lt;1 mm wide. Plagioclase appears fresh. MnOx coating is up to 1 cm wide.</p> <p>-29: 15 cm diameter breccia of pink (hematite?) weakly altered plagioclase basalt. Plagioclase appears mostly fresh. MnOx coating up to 1 cm wide.</p> <p>-30: 25 cm diameter extremely weathered lava. MnOx coating up to 5 mm wide covering pale brown gritty clay interior.</p> <p>-31: 20 cm diameter extremely weathered lava. Botryoidal MnOx up to 2 cm wide covering pale brown gritty clay.</p>
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		<p>-32: Pale brown soft sediment composed of silica, rock fragments, forams, and magnetite trapped in sediment tubes on dredge.</p> <p>** 70% of recovered material in 05 DR was the same as samples 30 and 31, and was discarded.</p>
<p><b>06 DR</b> <b>Daikakuji</b></p>	<p>17.05.1999 on bottom: 23:01 h 3780 m 32°04.48 N 172°10.32 E off bottom: 02:30 h 2170 m 32°05.33 N 172°12.82 E</p>	<p>-1: 6 cm diameter weakly weathered basalt. Plagioclase in groundmass appears fresh, rarer olivine partly altered to iddingsite. Altered along thin &lt;1 mm wide fractures. MnOx stained surface.</p> <p>-2: 7 cm diameter basalt, as for 1.</p> <p>-3: 6 cm diameter basalt, as for 1.</p> <p>-4: 6 cm diameter weathered basalt, with equal amounts of plagioclase and olivine in groundmass. Plagioclase appears fresh, olivine is mostly altered to iddingsite. Alteration more intense along fractures.</p> <p>-5: 7 cm diameter basalt, as for 4, but slightly more weathered.</p> <p>-6: 6 cm diameter weathered aphyric basalt. Groundmass partly altered to clay (chlorite/smectite?).</p> <p>-7: 24 x 13 cm diameter weakly weathered olivine (10%) basalt. Olivine phenocrysts partly altered to iddingsite, groundmass plagioclase appears fresh. Manganese coating on 2 sides of sheet flow - in situ sample?</p> <p>-8: 11 cm diameter basalt, similar to 7 but olivine phenocrysts are larger (2-5 mm) and pseudomorphed by iddingsite. Alteration along fractures &lt; 1mm wide. Manganese coating on top side of sample - in situ?</p> <p>-9: 5 cm diameter basalt, as for 7 but more weathered.</p> <p>-10: 9 cm diameter weathered olivine (20%) basalt. Iddingsite +/- carbonate pseudomorphs all olivine. Stronger alteration along fractures &lt; 1mm wide.</p> <p>-11: 6 cm diameter basalt, as for 10.</p> <p>-12: 5 cm diameter basalt, as for 10.</p> <p>-13: 5 cm diameter basalt, as for 10.</p> <p>-14: 4 cm diameter basalt, as for 10.</p> <p>-15: 5 cm diameter basalt, as for 10 but with MnOx coating up to 1 cm wide.</p> <p>-16: 6 cm diameter basalt, as for 10 but more weathered and with MnOx coating up to 1 cm wide.</p> <p>-17: 7 cm diameter basalt, as for 10 but more weathered and with MnOx coating up to 1 cm wide.</p> <p>-18: 9 x 4 cm diameter breccia of weakly weathered aphyric basalt clasts. Clay (smectite/chlorite?) along clast boundaries.</p> <p>-19: 18 cm diameter breccia of weathered vesicular basalt clasts. Most are vesicular, deeply weathered, and 1 cm in diameter. Rarely they are fresh. MnOx coating 1 cm wide.</p> <p>-20: 8 cm diameter breccia, as for 19 but without MnOx. Includes 4 cm clast of reddish altered lava.</p> <p>-21: 8 cm diameter breccia, as for 19 but without MnOx.</p> <p>-22: 7 cm diameter breccia, as for 19 but only minor MnOx.</p> <p>-23: 5 cm diameter breccia, as for 19 but without MnOx. Includes 2.5 cm clast of basalt with fresh plagioclase in groundmass and iddingsite after olivine.</p>

## Appendix 1-4

		<p>-24:5 cm diameter breccia, as for 19.</p> <p>-25:7 cm diameter breccia, as for 19 but only minor MnOx.</p> <p>-26:5 cm diameter breccia, as for 19 but only minor MnOx.</p> <p>-27:5 cm diameter breccia, as for 19.</p> <p>-28:5 cm diameter breccia, as for 19 but only minor MnOx.</p> <p>-29:7 cm diameter breccia, as for 19 but without MnOx. Includes 3 cm clast of basalt with fresh plagioclase in the groundmass and iddingsite after olivine.</p> <p>-30:Pale brown foram ooze caught in sediment tubes in dredge.</p>
<b>07 DR East Daikakuji</b>	<p>18.05.1999 on bottom: 09:14 h 2903 m 32°06.06 N 172°30.68 E off bottom: 10:48 h 2541 m 32°06.36 N 172°30.08 E</p>	<p>-1: 20 cm diameter strongly weathered vesicular olivine basalt. All olivine phenocrysts (20%) pseudomorphed by iddingsite, rare pyroxene phenocrysts are fresh. Groundmass pervasively weathered. Zeolite in some vesicles. MnOx coating 1 cm wide.</p> <p>-2: 11 cm diameter basalt, as for 1 but with 1.5 cm wedge of pale yellow carbonate.</p> <p>-3: 9 cm diameter basalt, as for 1 but with 5 mm wide ribbon of pale yellow carbonate and no MnOx coating.</p> <p>-4: 7 cm diameter basalt, as for 1 but with 2 cm wedge of pale yellow carbonate.</p> <p>-5: Pale brown foram ooze collected in tubes in dredge.</p>
<b>08 DR East Daikakuji</b>	<p>18.05.1999 on bottom: 13:21 h 3160 m 32°05.90 N 172°31.10 E stuck: 14:05 h 2864 m 32°06.10 N 172°30.68 E off bottom: not noted</p>	<p>-1: 26 cm diameter vesicular olivine (20%) basalt. Olivine phenocrysts pseudomorphed by iddingsite. Groundmass plagioclase mostly appears fresh-some may be zeolitised. MnOx coating up to 2 cm wide. Represents a pillow lobe. Silica lining in vesicles near surface.</p> <p>-2: 23 cm diameter basalt, as for 1. Up to 2 cm of pale yellow carbonate often separates MnOx coating from weathered rock. Minor glass preserved below this layer.</p> <p>-3: 15 cm diameter basalt, as for 1.</p> <p>-4: 14 cm diameter basalt, as for 1. Represents half of small pillow.</p> <p>-5: 13 cm diameter basalt, as for 1. Includes glass patches below MnOx/carbonate layer.</p> <p>-6: 10 cm diameter basalt, as for 1.</p> <p>-7: 50 cm diameter basalt, as for 1. Large pillow- photo taken. Well preserved glass below MnOx/carbonate layer.</p>
<b>09 DR North Kammu</b>	<p>18.05.1999 on bottom: 18:52 h 2876 m 32°16.86 N 172°37.11 E stuck: 20:40 h 2408 m 32°16.69 N 172°38.31 E off bottom: 22:09 h 2802 m 32°16.76 N 172°37.37 E</p>	<p>-1: 14 x 16 cm diameter weakly weathered vesicular trachyte. Feldspar phenocrysts (25%) are flow aligned and up 1 cm long. Minor MnOx (&lt;1 mm) on surface. A few vesicles near surface and surface pits filled by soft white pelagic clay.</p> <p>-2: 7 cm diameter trachyte, as for 1 but no MnOx.</p> <p>-3: 7 cm diameter trachyte, as for 1.</p> <p>-4: 6 cm diameter trachyte, as for 1 but no MnOx.</p> <p>-5: 9 x 2 cm diameter trachyte, as for 1 but more weathered in outer 1 cm.</p> <p>-6: 5 cm diameter trachyte, as for 1 but outer 1.5 cm strongly weathered. Includes large central vesicle 1 cm long filled with soft white pelagic clay.</p> <p>-7: 5 cm diameter trachyte, as for 1 but outer 1 cm strongly weathered and no MnOx.</p>

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		<p>-8: 4 cm diameter trachyte, as for 1 but outer 1 cm strongly weathered and no MnOx.</p> <p>-9: 4 cm diameter trachyte, as for 1 but strongly weathered, 50% of vesicles filled by clay, and no MnOx.</p> <p>-10: 10 cm diameter trachyte, as for 1 but strongly weathered and most vesicles filled by white zeolite.</p> <p>-11: 7 x 1 cm diameter trachyte, as for 1 but strongly weathered and most vesicles filled by either soft clay or zeolite.</p> <p>-12: 15 cm diameter weathered scoriaceous plagioclase (10%) basalt. Plagioclase phenocrysts to 3 mm long. MnOx coating 4 mm wide. Interior contains much pale yellow sediment.</p> <p>-13: 7 cm diameter weakly weathered very vesicular trachyte. Feldspar phenocrysts (10%) to 1 cm long. Half vesicles filled by soft pale brown clay containing basaltic grit.</p> <p>-14: 15 x 4 cm diameter weathered basalt. Olivine in groundmass replaced by iddingsite, but plagioclase appears fresh. Large vesicles at center filled by zeolite. MnOx stained surface with soft clay.</p> <p>-15: 8 x 1 cm diameter weathered dolerite (or basalt). Groundmass contains abundant olivine (iddingsite) and plagioclase. MnOx stained surface with soft clay.</p> <p>-16: 10 x 3 cm diameter weakly weathered basalt. Plagioclase phenocrysts (10%) to 5 mm long and minor olivine (1%) altered to iddingsite. MnOx coating 1 mm wide on surface.</p> <p>-17: 5 cm diameter basalt, as for 16.</p> <p>-18: 7 cm diameter basalt, as for 16 but groundmass strongly weathered.</p> <p>-19: 5 cm diameter basalt, as for 16 but groundmass strongly weathered and no MnOx.</p> <p>-20: 5 cm diameter basalt, as for 16 but groundmass strongly weathered with 5 cm wide outer clay zone.</p> <p>-21: 4 cm diameter strongly weathered basalt. Plagioclase phenocrysts (15%) appear fresh. Olivine (10%) altered to iddingsite. MnOx coating 1 mm wide, and zeolite filled fractures near surface.</p> <p>-22: 5 cm diameter basalt, as for 21.</p> <p>-23: 5 cm diameter basalt, as for 21.</p> <p>-24: 12 cm diameter weathered basalt. Traces of plagioclase and olivine (iddingsite) phenocrysts. More weathered along &lt;1 mm wide fractures. MnOx staining.</p> <p>-25: 4 cm diameter weakly weathered vesicular basalt. Groundmass plagioclase appears fresh, minor groundmass olivine replaced by iddingsite. Most vesicles filled by pale brown clay.</p> <p>-26: 9 cm diameter weakly weathered vesicular basalt. Groundmass plagioclase appears fresh. Most vesicles filled by pale brown or green clay. MnOx coating 1mm wide.</p> <p>-27: 5 cm diameter basalt, as for 26 but no MnOx.</p> <p>-28: 5 cm diameter basalt, as for 26 but no clay in vesicles and no MnOx.</p> <p>-29: 4 cm diameter basalt, as for 26 but most vesicles partly filled</p>
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Appendix 1-6

		<p>by pale green clay/zeolite and no MnOx.</p> <p>-30:5 cm diameter weakly weathered vesicular aphyric basalt. Some vesicles partly filled by pale brown clay.</p> <p>-31:6 cm diameter weakly weathered vesicular olivine basalt. Olivine (20%) pseudomorphed by iddingsite. Minor clay and pale green zeolite in a few vesicles. MnOx staining and soft white clay on surface.</p> <p>-32:6 cm diameter basalt, as for 31.</p> <p>-33:4 cm diameter basalt, as for 31 but less (10%) olivine and less vesicular.</p> <p>-34:7 cm diameter basalt, as for 31 but less (10%) olivine and less vesicular.</p> <p>-35:5 cm diameter basalt, as for 31.</p> <p>-36:4 cm diameter basalt, as for 31.</p> <p>-37:11 cm diameter basalt, as for 31.</p> <p>-38:4 cm diameter basalt, as for 31.</p> <p>-39:4 cm diameter basalt, as for 31 but less olivine (10%) and less vesicular.</p> <p>-40:4 cm diameter basalt, as for 31 but more vesicular with white zeolite lining vesicles and less olivine (10%).</p> <p>-41:11 x 3 cm diameter weathered vesicular olivine basalt. Olivine (25%) pseudomorphed by iddingsite. Many vesicles filled by white zeolite. Soft white clay on surface and in some vesicles.</p> <p>-42:10 x 2 cm diameter basalt, as for 41.</p> <p>-43:5 cm diameter basalt, as for 41 but less olivine (10%).</p> <p>-44:4 cm diameter basalt, as for 41 but with MnOx staining.</p> <p>-45:6 cm diameter basalt, as for 41 but with MnOx staining.</p> <p>-46:9 x 2 cm diameter basalt, as for 41 but encrusted with carbonate on one side.</p> <p>-47:9 x 2 cm diameter basalt, as for 41 but encrusted with carbonate in places.</p> <p>-48:12 cm diameter basalt, as for 41 but MnOx staining and annelids (worms) on surface.</p> <p>-49:5 cm diameter basalt, as for 41.</p> <p>-50:7 cm diameter basalt, as for 41 but encrusted with carbonate in places.</p> <p>-51:18 x 3 cm diameter basalt, as for 41 but with minor MnOx staining.</p> <p>-52:6 cm diameter basalt, as for 41 but MnOx stained.</p> <p>-53:5 cm diameter basalt, as for 41 but encrusted with carbonate on some surfaces and strongly weathered.</p> <p>-54:6 cm diameter basalt, as for 41 but encrusted with carbonate and volcanoclastic sediment (sandstone) on some surfaces.</p> <p>-55:7 cm diameter basalt, as for 41 but encrusted with carbonate (oyster shell?) on some surfaces and MnOx stained.</p> <p>-56:11 x 3 cm diameter basalt, as for 41.</p> <p>-57:8 cm diameter basalt, as for 41 but all vesicles are filled with white zeolite.</p> <p>-58:6 x 1 cm strongly weathered breccia of silicified goethite-stained basalt clasts 2-3 mm in diameter. MnOx stained surface.</p>
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Appendix 1-7

		<p>-59:6 x 2 cm diameter breccia of strongly weathered basalt clasts. MnOx coating to 1 cm wide.</p> <p>-60:5 cm diameter breccia of strongly weathered trachyte clasts with feldspar 5 mm long. Carbonate encrusted on some surfaces.</p> <p>-61:6 x 1 cm in diameter breccia of pale brown carbonate clasts.</p> <p>-62:7 x 1 cm diameter fine grained well-bedded volcanoclastic conglomerate. All clasts strongly weathered.</p> <p>-63:15 x 3 cm diameter fine grained volcanoclastic conglomerate with sand beds. All clasts strongly weathered.</p> <p>-64:4 cm diameter pale grey pumice with flow aligned vesicles. Glass shards appear fresh. Trace hornblende? MnOx coating 1 mm wide.</p> <p>-65:6 cm diameter pumice, as for 64 but with 5% plagioclase and definite traces of hornblende.</p> <p>-66:5 cm diameter pumice, as for 64 but more weathered.</p> <p>-67:7 cm diameter very weathered lava, now consisting of MnOx 5 mm wide on pale brown clay.</p> <p>-68:6 cm diameter very weathered lava, as for 67.</p> <p>-69:15 x 4 cm diameter limestone. Numerous corals and bivalves, but mostly algal(?).</p> <p>-70:15 x 7 cm diameter limestone breccia. Includes clasts of weathered trachyte.</p> <p>-71:15 x 4 cm diameter limestone. Numerous small algal(?) structures.</p> <p>-72: Bulk sample of 22 limestone boulders in 2 bags.</p> <p>-73:40 x 4-6 cm diameter tapering bone, with joint at one end. Prominent grooves along length, and 4 symmetric holes in interior. From whale? MnOx stained.</p> <p>-74: Pale brown foram ooze from sediment tubes in dredge.</p>
<b>10 DR South Kammu</b>	<p>19.05.1999 on bottom: 03:23 h 2785 m 31°57.74 N 173°16.19 E off bottom: 06:32 h 2287 m 31°58.19N 173°14.80 E</p>	<p>-1: 50 x 20 cm diameter limestone. Weathered and soft. Contains numerous bivalve shells of one species, 1-2 cm in diameter.</p> <p>-2: 3 cm diameter pale grey pumice with traces of black mineral (hornblende?). Glass shards are weathered. MnOx stained.</p> <p>-3: Pale brown foram ooze from sediment tubes in dredge.</p>
<b>11 DR Abbott</b>	<p>19.05.1999 on bottom: 20:15 h 3271 m 31°45.76 N 174°17.76 E off bottom: 22:42 h 2440 m 31°46.60 N 174°17.53 E</p>	<p>-1: 40 cm diameter weathered vesicular olivine basalt. Olivine phenocrysts (20%) pseudomorphed by iddingsite, trace pyroxene (fresh). Small vesicles partly filled by zeolite near surface, but empty in interior. Groundmass appears fresh. MnOx coating 5 mm wide, then 1 cm wide zone of carbonate-altered rock, rarely with preserved glass. Photos taken. Interpreted as an in situ pillow lava.</p> <p>-2: Pale brown foram ooze from sediment tubes in dredge.</p>
<b>12 DR Abbott</b>	<p>20.05.1999 on bottom: 01:23 h 3593 m 31°48.650 N</p>	<p>-1: 26 cm diameter weakly weathered vesicular olivine basalt. Olivine phenocrysts (15%) pseudomorphed by iddingsite, trace fresh pyroxene. Most vesicles are empty but some are partly filled by zeolite. MnOx coating usually 3 mm wide;</p>

Appendix 1-8

	<p>174°15.050 E stuck: 03:51 h 2605 m 31°48.68 N 174°16.64 E off bottom: 05:00 h 3180 m 31°48.66 N 174°15.75 E</p>	<p>where 1 cm wide there is also a carbonate layer and fresher basalt layer (not glassy where seen).</p> <p>-2: 22 x 12 cm diameter weakly weathered vesicular basalt. Sparse large olivine phenocrysts (8 mm) replaced by iddingsite. Groundmass appears fresh. Vesicles half filled by zeolite. MnOx stained surface- usual MnOx rind was probably stripped away.</p> <p>-3: 18 x 9 cm diameter basalt. As for 1, but MnOx coating only 1 mm wide.</p> <p>-4: 7 x 3 cm diameter weakly weathered vesicular fine grained basalt. 5% olivine (&lt;1 mm diameter) pseudomorphed by iddingsite, 20% plagioclase (&lt;1 mm long) appears fresh. Vesicles are empty. MnOx stained surface.</p> <p>-5: 10 x 2 cm diameter weakly weathered vesicular basalt. Groundmass plagioclase appears fresh. Minor olivine replaced by iddingsite. Vesicles are empty. MnOx stained surface.</p> <p>-6: 7 x 2 cm diameter strongly weathered breccia including clasts of olivine (iddingsite) basalt and a dunite nodule with serpentine after olivine. Both are ~1 cm in diameter, and set in a pink carbonate-rich matrix. MnOx coating 3 mm wide.</p> <p>-7: 5 cm diameter weakly weathered dense aphyric basalt. Several small vesicles, most of which are partly filled by zeolite. Groundmass appears fresh. MnOx stained surface.</p> <p>-8: Pale brown foram ooze caught in sediment tubes in dredge.</p>
<p><b>13 DR Colahan</b></p>	<p>20.05.1999 on bottom: 16:52 h 3038 m 30°57.82 N 175°58.65 E off bottom: 18:44 h 2699 m 30°58.30 N 175°57.75 E</p>	<p>-1: 9 cm diameter dense weathered basalt. Rare olivine phenocrysts replaced by iddingsite. Groundmass plagioclase appears fresh, olivine replaced by iddingsite. Altered along &lt;1 mm wide fractures. Pull apart structures in evident lava. No MnOx coating- boulder not in situ, from higher on volcano?</p> <p>-2: 8 cm diameter weathered vesicular olivine basalt. Olivine phenocrysts (30%) pseudomorphed by iddingsite. Most vesicles filled by soft clay, some by zeolite. MnOx coating 5 mm wide.</p> <p>-3: 5 cm diameter weathered vesicular olivine basalt. Olivine phenocrysts (10%) pseudomorphed by iddingsite. Vesicles are empty. MnOx coating 3 mm wide with small carbonate layer developed in one area.</p> <p>-4: 6 cm diameter weathered basalt, as for 3 but soft carbonate/clay infills many vesicles.</p> <p>-5: 7 x 3 cm diameter weathered basalt, as for 3 but soft carbonate/clay infills many vesicles and coats much of the surface.</p> <p>-6: 7 cm diameter weathered vesicular olivine basalt from conglomerate. Olivine phenocrysts (20%) pseudomorphed by iddingsite. Vesicles mostly filled by zeolite. Strongly weathered basalt grit and carbonate from conglomerate encloses the clast.</p> <p>-7: 6 cm diameter weathered basalt in conglomerate. As for 6, but fewer olivine phenocrysts (10%) and only some vesicles infilled by zeolite.</p>



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		<p>-8: 7 x 2 cm diameter weathered basalt in conglomerate. As for 6.</p> <p>-9: 5 cm diameter weathered conglomerate. Small pebbles (1-2 mm) of carbonate and strongly weathered basalt in one layer, olivine (iddingsite) in zeolite-clay matrix in second sand layer.</p> <p>-10: 8 cm diameter coarse grained sandstone composed of iddingsite (after olivine), pyroxene, minor carbonate and clay.</p> <p>-11: 13 cm diameter weathered volcanoclastic sediment, composed of 1-3 mm olivine (iddingsite) basalt clasts in clay matrix. Poorly sorted and not bedded. MnOx coating 5 mm wide.</p> <p>-12: 10 cm diameter strongly weathered volcanoclastic sediment. As for 11, but all clasts are much more weathered, and much more carbonate.</p> <p>-13: 8 cm diameter weakly weathered pale grey pumice. Traces of hornblende, and fresh glass shards in interior. Surface stained yellow with minor MnOx.</p> <p>-14: 6 cm diameter pumice, as for 13.</p> <p>-15: 6 cm diameter nearly fresh pale grey pumice. Traces of very fine grained black mineral- pyroxene? Fresh glass shards. Surface slightly yellow stained.</p> <p>-16: 6 cm diameter pumice, as for 15.</p> <p>-17: Pale brown foram ooze caught in sediment tubes in dredge.</p>
<b>14 DR Colahan</b>	<p>20.05.1999 on bottom: 21:47 h 2813 m 30°57.062 N 175°52.401 E stuck: 22:15 h 2530 m 30°57.441 N 175°52.540 E off bottom: 00:43 h 3048 m 30°56.857 N 175°52.341 E</p>	<p>-1: 7 cm diameter weathered vesicular olivine basalt. Olivine phenocrysts (10%) pseudomorphed by iddingsite, vesicles mostly filled by soft clay and minor zeolite. MnOx stained surface.</p> <p>-2: 4 cm diameter weathered olivine basalt. As for 1, but no zeolite.</p> <p>-3: 3 cm diameter weakly weathered aphyric basalt. Thin (&lt;1 mm) MnOx coating on one side, thin carbonate layer, then nearly fresh groundmass of basalt. Good for laser ablator/microprobe. Surface part of pillow lava.</p> <p>-4: 11 cm diameter very weathered rock. Pale yellow clay (nontronite, possibly minor talc?) with dendrites of MnOx along fractures. Relic vesicles still apparent. MnOx stained surface. Interpreted as very weathered basalt.</p> <p>-5: 6 x 1 cm diameter very weathered rock, as for 4.</p> <p>-6: 4 x 1 cm diameter very weathered rock. As for 4, but with veinlet of white clay (illite?).</p> <p>-7: 5 cm diameter very weathered rock. Core of pale yellow clay (nontronite?) surrounded by orange harder clay with MnOx specks. MnOx coating 1 mm wide. Unclear whether originally basalt or pumice.</p> <p>-8: Pale brown foram ooze caught in sediment tubes in dredge.</p>
<b>15 DR Colahan</b>	<p>21.05.1999 on bottom: 02:49 h 2159 m 30°57.923 N 175°52.707 E off bottom: 03:44 h</p>	<p>-1: 30 x 8 cm diameter weathered breccia. Large clasts 2-6 cm in diameter of vesicular olivine basalt set in a yellow clay-carbonate matrix. Olivine phenocrysts (10%) replaced by iddingsite. Large range in degree of vesicularity of clasts. Groundmass freshest near contact to 1 cm wide MnOx coating. Vesicles mostly filled by zeolite and soft clay, but</p>

Appendix 1-10

	<p>1860 m 30°58.28 N 175°52.77 E</p>	<p>empty near the MnOx coating. -2: 13 x 5 cm diameter breccia, as for 1. -3: 15 cm diameter breccia. Clast supported with pale brown soft clay in holes. 2-6 cm in diameter clasts of weathered vesicular olivine basalt, in which olivine (10%) is replaced by iddingsite; much goethite. Many vesicles filled by zeolite or clay. Some clasts of very weathered rock. MnOx coating 1 cm wide. -4: 6 cm diameter weathered vesicular olivine basalt. Olivine phenocrysts (10%) replaced by iddingsite. Vesicles mostly filled by soft clay. Often goethite-stained. MnOx coating 1 cm wide. -5: 7 cm diameter basalt, as for 4. -6: 5 cm diameter breccia (basalt), as for 3 but mostly one clast. -7: 10 x 3 cm diameter breccia (basalt), as for 3 but mostly one clast. -8: 7 cm diameter breccia (basalt), as for 3 but mostly one clast. -9: 11 x 3 cm diameter breccia, as for 3 but only MnOx staining on the surface. -10: 6 cm diameter breccia (basalt), as for 3 but mostly one clast with large numerous clay-filled vesicles. Surface only MnOx stained. -11: 7 x 2 cm diameter breccia (basalt), as for 1 but mostly one clast. Very goethite-stained. Surface only MnOx stained. -12: 20 x 4 cm diameter weathered well-bedded sandstone. Bedding reflects changes in proportion of basalt to carbonate to yellow clay. MnOx spots throughout. -13: 15 cm diameter sandstone, as for 12. -14: 6 x 2 cm diameter sandstone, as for 12. -15: Pale brown clay from large cavity in 3.</p>
<p><b>16 DR</b> <b>De Veuster</b></p>	<p>21.05.1999 on bottom: 15:29 h 2810 m 30°24.67 N 177°28.08 E stuck: 16:34 h 2636 m 30°24.37 N 177°28.60 E off bottom: 17:05 h 2849 m 30°24.62 N 177°28.34 E</p>	<p>-1: 17 cm diameter weakly weathered vesicular olivine basalt. Olivine phenocrysts (20%) replaced by iddingsite near surface, but nearly fresh (leached to white) in interior. Vesicles filled by zeolite near surface, but empty in interior. MnOx coating 1 cm wide. -2: 13 cm diameter breccia, mostly composed of one large clast as for 1. Pale yellow clay-carbonate forms matrix to breccia. -3: 11 cm diameter breccia, as for 2. -4: 9 cm diameter breccia, as for 2. -5: Pink starfish with ~10 cm long arms found on surface of 1.</p>
<p><b>17 DR</b> <b>De Veuster</b></p>	<p>21.05.1999 on bottom: 19:10 h 2613 m 30°24.40 N 177°28.61 E off bottom: 20:09 h 2451 m 30°24.16 N 177°29.03 E</p>	<p>-1: 40 cm diameter weakly weathered vesicular aphyric basalt. Plagioclase in groundmass appears fresh, olivine pseudomorphed by iddingsite. Vesicles partly filled by zeolite near surface, but empty in interior. Well-developed MnOx coating 3 cm wide with various biota living on it (see 2), underlain by 5 mm carbonate-goethite, then occasional patches of black glass, then the pillow interior. Yellow and orange clays developed along fractures, and locally silica. Interpreted as complete pillow lobe.</p>

## Appendix 1-11

		<p>-2: Pink soft-bodied tube-like creatures up to 1 cm long and white and pink coral-like branches attached to surface of 1. Also a large white sponge.</p> <p>-3: Yellow clay from inside of 1.</p>
<b>18 DR Hancock</b>	<p>22.05.1999  on bottom: 07:05 h  3001 m  30°20.40 N  178°36.62 E  stuck: 08:03 h  2768 m  30°19.97 N  178°37.19 E  off bottom: 10:10 h  2951 m  30°20.34 N  178°36.77 E</p>	No rocks or sediment in dredge.
<b>19 DR Hancock</b>	<p>22.05.1999  on bottom: 12:28 h  2622 m  30°19.03 N  178°37.99 E  stuck: 13:37 h  2352 m  30°18.77 N  178°38.41 E  off bottom: 13:50 h  2379 m  30°18.77 N  178°38.38 E</p>	No rocks or sediment in dredge.
<b>20 DR Hancock</b>	<p>22.05.1999  on bottom: 15:23 h  2380 m  30°18.68 N  178°38.43 E  off bottom: 17:35 h  1848 m  30°18.63 N  178°39.08 E</p>	<p>-1: 27 x 11 cm diameter interlocking pillow lobes containing large (12 cm diameter) clasts of weakly weathered vesicular olivine-pyroxene basalt. Phenocrysts of olivine (5%) pseudomorphed by iddingsite and pyroxene (5%) in an apparently fresh groundmass. Zeolite in 20% of vesicles. MnOx coating 3 cm thick with 5 mm carbonate, then 5 mm goethite-stained layer with underlying rare glass.</p> <p>-2: 16 x 10 cm diameter pillow lobes. As for 1, but largest clast lacks carbonate or glass layers.</p> <p>-3: 11 x 2 cm diameter basalt. As for 1, but only part of one clast, inferred to be broken from the pillow, is present.</p> <p>-4: 5 cm diameter weathered vesicular olivine basalt. Small olivine phenocrysts (5%) pseudomorphed by iddingsite. Most vesicles infilled by zeolite. Surface MnOx stained.</p> <p>-5: 9 x 3 cm diameter basalt. As for 4, but most vesicles empty with soft clay in some. However, groundmass is more weathered.</p> <p>-6: 9 x 2 cm breccia of weathered goethite-stained highly vesicular olivine (iddingsite) basalt clasts. Most clasts 1 cm across. MnOx stained surface.</p> <p>-7: 12 x 4 cm diameter weathered clay-rich sandstone, composed of poorly bedded silty carbonate-rich layers and sandy</p>

Appendix 1-12

		<p>layers with basaltic grit. Goethite-stained.</p> <p>-8: Small amount of pale brown foram ooze caught in the sediment tubes of the dredge.</p>
<p><b>21 DR</b> <b>Townsend</b> <b>Cromwell</b></p>	<p>22.05.1999 on bottom: 23:25 h 2122 m 29°46.16 N 179°07.94 E off bottom: 00:20 h 1958 m 29°46.29 N 179°07.48 E</p>	<p>-1: 18 x 9 cm diameter interlocking pillows, composed of weathered vesicular aphyric basalt. The few olivine phenocrysts and ~15% groundmass olivine are replaced by iddingsite. Vesicles in zones concentric with pillow surface, mostly empty but soft clay and zeolite lining in some. MnOx coating 1 cm wide, no development of carbonate or glass.</p> <p>-2: Pink and orange branches with bulbs on them. Coral-like. Growing on surface of 1.</p>
<p><b>22 DR</b> <b>Townsend</b> <b>Cromwell</b></p>	<p>23.05.1999 on bottom: 04:07 h 2702 m 29°36.29 N 179°22.80 E stuck: 06:26 h 2288 m 29°36.88 N 175°22.87 E off bottom: 06:26 h 2291 m 29°36.88 N 179°22.87 E</p>	<p>-1: Pale brown foram ooze caught in sediment tubes of dredge.</p>
<p><b>23 DR</b> <b>Helsley</b></p>	<p>23.05.1999 on bottom: 15:29 h 3015 m 28°56.33 N 179°42.27 W off bottom: 18:46 h 2297 m 28°55.81 N 179°40.81 W</p>	<p>-1: 50 x 25 cm diameter interlocking pillows. Clasts of olivine-pyroxene basalt. Olivine phenocrysts (5%) pseudomorphed by iddingsite. Pyroxene phenocrysts (5%) are fresh. MnOx coating 1 cm wide, with thin goethite-carbonate layer, then well-developed glass layer up to 1 cm wide. White clay-carbonate fills thin fractures.</p> <p>-2: 27 cm diameter vesicular olivine basalt. Olivine phenocrysts (60%) pseudomorphed by iddingsite set in a fresh cryptocrystalline groundmass. Vesicles (5 %) are empty. MnOx 1 cm wide, rarely to 4 cm. Poorly developed thin patches of glass immediately below goethite layer under MnOx crust.</p> <p>-3: 20 x 15 cm diameter interlocking pillows. As for 1, but maybe more olivine and pyroxene phenocrysts (closer to 10%), and fewer fractures.</p> <p>-4: 27 x 10 cm diameter basalt. As for 2, but MnOx partly stripped and no glass.</p> <p>-5: 26 x 8 cm diameter basalt. As for 2, but MnOx partly stripped and no glass.</p> <p>-6: 23 cm diameter basalt. As for 2, but soft clay in some vesicles and no glass.</p> <p>-7: 25 cm diameter basalt. As for 2, but no glass.</p> <p>-8: 12 cm diameter basalt. As for 2, but no glass.</p> <p>-9: 11 cm diameter basalt. As for 2, but no glass.</p> <p>-10: 7 cm diameter basalt. As for 2, but soft clay in many vesicles and no glass.</p> <p>-11: 30 x 11 cm diameter basalt. As for 2, but soft clay in many</p>

Appendix 1-13

		<p>vesicles and no glass. 2 cm zone at rim of breccia composed of 2-3 cm olivine basalt clasts (as for above) in clay-carbonate matrix.</p> <p>-12: 16 cm diameter basalt. As for 2, but no glass and 2 cm zone at rim of breccia composed of 1 cm deeply weathered basalt (mostly clay).</p> <p>-13: 23 x 6 cm diameter basalt, as for 12.</p> <p>-14: 12 x 4 cm diameter basalt. As for 2, but no glass.</p> <p>-15: 12 x 4 cm diameter conglomerate. Strongly weathered &lt;2 mm across basalt clasts in sandy clay matrix, poorly bedded. MnOx coating 1-2 cm wide.</p> <p>-16: 10 cm diameter conglomerate. As for 15, but clasts less weathered and recognisable as olivine basalt (as for 2).</p> <p>-17: 8 x 3 cm diameter conglomerate. Composed of 1 cm across weathered olivine basalt as for 2, most clasts goethite stained. MnOx coating 1 cm wide.</p> <p>-18: 7 cm diameter conglomerate. As for 17.</p> <p>-19: 15 x 5 cm diameter conglomerate. As for 15, but with 5 cm of layered MnOx comprising most of clast.</p> <p>-20: 8 x 4 cm diameter MnOx. Poorly bedded, with orange clay in open spaces.</p> <p>-21: 11 x 3 cm diameter MnOx. As for 20.</p> <p>-22: 7 cm diameter MnOx. As for 20.</p> <p>-23: 7 x 3 cm diameter MnOx. As for 20.</p> <p>-24: 8 x 3 cm diameter MnOx. As for 20.</p> <p>-25: 5 cm diameter MnOx. As for 20.</p> <p>-26: 16 x 4 cm diameter MnOx. As for 20.</p> <p>-27: 5 cm diameter MnOx. As for 20.</p> <p>-28: 11 x 3 cm diameter MnOx. As for 20.</p> <p>-29: 8 x 3 cm diameter MnOx. As for 20.</p> <p>-30: 9 x 3 cm diameter MnOx. As for 20.</p> <p>-31: 5 x 2 cm diameter MnOx. As for 20.</p> <p>-32: 20 x 4 cm diameter MnOx. As for 20, but little orange clay. Has coral-like creatures growing on one surface.</p> <p>-33: 17 x 4 cm diameter MnOx. As for 20, but little orange clay.</p> <p>-34: 14 x 4 cm diameter MnOx. As for 20, but little orange clay.</p> <p>-35: 9 x 4 cm diameter MnOx. As for 20, but little orange clay.</p> <p>-36: 5 cm diameter MnOx. As for 20, but little orange clay.</p> <p>-37: Thin green and gold branches with pores and bulbs on them. Coral-like. Found growing on surface of 1, 3 and 32.</p>
<p><b>24 DR</b> <b>Seamount</b> <b>63</b></p>	<p>24.05.1999 on bottom: 03:00 h 2916 m 28°52.36 N 178°29.32 W stuck: 05:00 h 2180 m 28°52.65 N 178°30.15 W off bottom: 05:20 h 2175 m 28°52.65 N</p>	<p>No rocks or sediment in dredge.</p>

## Appendix 1-14

	178°30.16 W	
<b>25 DR Seamount 63</b>	24.05.1999 on bottom: 07:14 h 2533 m 28°52.40 N 178°29.71 W off bottom: 09:45 h 2093 m 28°52.73 N 178°30.34 W	-1: 30 x 15 cm diameter group of interlocking pillows. Individual lobes up to 12 cm diameter and composed of dense aphyric basalt with traces of pyroxene phenocrysts (<1%). Well-developed pull apart structures, with cavities filled by white to pale blue zeolite. Groundmass very fresh away from cavities, fractures and surface. MnOx coating 5 mm wide, with stalks growing on it. -2: 15 cm diameter basalt. As for 1, but mostly one clast. -3: 12 cm diameter basalt. As for 1. Pale brown clay separates pillow lobes, 5 mm green chlorite weathering rind on basalt lobes. -4: 11 x 4 cm diameter basalt. As for 1, but mostly one clast.
<b>26 DR Kure</b>	24.05.1999 on bottom: 15:50 h 2888 m 28°14.82 N 178°29.43 W off bottom: 18:25 h 2215 m 28°15.89 N 178°28.48 W	-1: 10 cm diameter weathered vesicular basalt. Traces of olivine and pyroxene phenocrysts (both <1%), with olivine pseudomorphed by iddingsite and pyroxene fresh. Groundmass olivine also pseudomorphed by iddingsite, and cryptocrystalline groundmass somewhat weathered. Vesicles in bands, 50% empty, 50% filled by soft clay. MnOx coating 2-3cm wide with annelids and stalks growing on it. -2: 15 x 6 cm diameter conglomerate. Pale brown clay (weathered basalt) overlain by conglomerate of strongly weathered goethite-stained basalt clasts, most 2 mm across (max. 1 cm). MnOx coating 1 cm wide, with stalks growing on it. -3: 17 x 4 cm diameter conglomerate. As for 2, but lacks clay. -4: 12 cm diameter pale grey pumice. Large vesicles filled by soft white clay. No phenocrysts. Glass shards are fresh. Slight MnOx staining on surface, and a few pink soft-bodied tube-like creatures growing on it. -5: White to pale brown foram ooze, composed of foraminifera (>90%, many different species), sponge spicules, and other empty shells. No sand, silt or clay derived from the volcano or its limestone cap. Caught in sediment tubes of dredge.
<b>27 DR Nero</b>	24.05.1999 on bottom: 23:53 h 2851 m 28°00.06 N 178°05.01 W stuck: 01:42 h 2415 m 28°00.62 N 178°03.89 W off bottom: 03:31 h 2469 m 28°00.37 N 178°04.26 W	-1: White to pale brown foram ooze, composed of foraminifera (>90%, many different species), sponge spicules, and other empty shells. No sand, silt or clay derived from the volcano or its limestone cap. Caught in sediment tubes of dredge.
<b>28 DR Nero</b>	25.05.1999 on bottom: 07:20 h 2520 m 28°05.03 N	-1: 8 x 1 cm diameter vesicular olivine basalt. Olivine phenocrysts (5%) and much groundmass olivine pseudomorphed by iddingsite. Vesicles mostly empty but some are partly zeolite filled. Large area of black glass

Appendix 1-15

	<p>177°54.21 W off bottom: 12:08 h 2142 m 28°04.01 N 177°54.30 W</p>	<p>below goethite-carbonate layer under 5 mm MnOx coating. Represents top part of a pillow stripped from rest of lobe.</p> <p>-2: 14 x 7 cm diameter vesicular olivine basalt. Olivine phenocrysts (20%) and groundmass olivine pseudomorphed by iddingsite. Vesicles mostly empty, but near rim some have zeolite lining. MnOx coating on one side only, and is layered and 5 cm wide.</p> <p>-3: 5 x 2 cm diameter basalt. As for 1, but strongly weathered and has breccia of goethite-stained basalt clasts under 5 mm MnOx coating.</p> <p>-4: 10 x 4 cm diameter MnOx. Layered, with sliver of goethite-stained basalt (as for 2) on one side. Represents MnOx coating stripped from pillow.</p> <p>-5: 10 x 3 cm diameter MnOx, as for 4.</p> <p>-6: 13 x 4 cm diameter MnOx. Layered, with goethite-stained clay on one side representing contact to pillow.</p> <p>-7: 10 x 3 cm diameter MnOx, as for 6.</p> <p>-8: 7 x 3 cm diameter MnOx, as for 6.</p> <p>-9: 8 x 2 cm diameter MnOx, as for 6.</p> <p>-10: 4 x 2 cm diameter MnOx, as for 6.</p> <p>-11: 4 x 1 cm diameter MnOx, as for 6.</p> <p>-12: 3 cm diameter MnOx, as for 6.</p> <p>-13: 4 x 2 cm diameter MnOx, as for 6.</p>
<p><b>29 DR</b> <b>Midway</b></p>	<p>25.05.1999 on bottom: 17:26 h 2938 m 28°01.47 N 177°31.21 W off bottom: 00:09 h 1589 m 28°05.63 N 177°30.13 W</p>	<p>-1: 30 cm diameter pillow of vesicular aphyric basalt. Sparse olivine phenocrysts. Groundmass contains plagioclase, pyroxene, and minor olivine. All olivine pseudomorphed by iddingsite. Vesicles almost all empty. MnOx coating 5 cm wide, with poorly developed glass patches beneath the goethite-carbonate layer under the MnOx crust. Often more weathered in core zone.</p> <p>-2: 20 x 12 cm diameter pillow of vesicular aphyric basalt. Sparse olivine phenocrysts, but abundant groundmass olivine. Phenocryst and most groundmass olivine pseudomorphed by iddingsite, but some is colourless to pale green. Vesicles mostly empty, but some are lined with zeolite. MnOx coating 3 cm wide with thin glass layer beneath the goethite-carbonate layer under the MnOx crust.</p> <p>-3: 12 cm diameter basalt. As for 1, but no glass and minor breccia of goethite-stained clasts on one side.</p> <p>-4: 12 cm diameter basalt. As for 1, but no glass.</p> <p>-5: 14 x 7 cm diameter basalt, as for 3.</p> <p>-6: 18 x 7 cm diameter basalt, as for 3.</p> <p>-7: 18 cm diameter basalt. As for 1, but no glass.</p> <p>-8: 18 cm diameter basalt. As for 1, but no glass and brecciated into numerous mostly 1-2 cm across clasts in goethite-stained finer matrix. Largest is 8 cm.</p> <p>-9: 11 cm diameter basalt, as for 3.</p> <p>-10: 12 x 6 cm diameter basalt. As for 3, but surface only MnOx stained.</p> <p>-11: 9 cm diameter basalt. As for 3, but surface only MnOx stained and many vesicles filled by zeolite.</p> <p>-12: 12 x 5 cm diameter basalt. As for 1, but surface MnOx</p>

Appendix 1-16

		<p>stained and no glass.</p> <p>-13:10 x 3 cm diameter basalt. As for 1, but no glass.</p> <p>-14:8 x 4 cm diameter basalt. As for 3, but surface MnOx stained.</p> <p>-15:6 x 4 cm diameter basalt, as for 3.</p> <p>-16:6 cm diameter basalt. As for 3, but surface MnOx stained.</p> <p>-17:6 cm diameter dense olivine basalt. Olivine phenocrysts (10%) pseudomorphed by iddingsite, and sparse pyroxene phenocrysts. Breccia of smaller clasts of same unit on one side. MnOx coating 3 cm wide.</p> <p>-18:5 x 3 cm diameter basalt. Similar to 17, but has fine grained olivine (iddingsite) and pyroxene in the groundmass and MnOx stained surface.</p> <p>-19:14 x 4 cm diameter basalt. As for 2, but lacks glass or fresh olivine. Zeolite in many vesicles, and three 4 x 0.5 cm gouges in surface with zeolite crystals in them.</p> <p>-20:16 x 7 cm diameter vesicular olivine basalt. Olivine phenocrysts (10%) and much groundmass olivine. Most olivine is pseudomorphed by iddingsite, but some is colourless to pale green. Vesicles are empty. MnOx coating 1 cm wide.</p> <p>-21:20 cm diameter basalt. As for 20, but much is a breccia of 3-4 cm clasts.</p> <p>-22:14 x 6 cm diameter basalt. As for 20, but all olivine altered.</p> <p>-23:8 cm diameter basalt, as for 20.</p> <p>-24:7 x 3 cm diameter basalt. As for 20, but all olivine altered.</p> <p>-25:4 cm diameter basalt, as for 20.</p> <p>-26:7 x 3 cm diameter basalt. As for 20, but all olivine altered and breccia of small clasts along one side.</p> <p>-27:5 cm diameter vesicular olivine basalt. Olivine phenocrysts (30%) pseudomorphed by iddingsite. Vesicles are mostly empty, but zeolite in some. Breccia of smaller clasts along one side. MnOx coating to 1 cm wide.</p> <p>-28:10 x 4 cm diameter basalt, as for 27.</p> <p>-29:6 x 1 cm diameter basalt, as for 27.</p> <p>-30:11 x 5 cm diameter basalt. As for 27, but MnOx is layered and 3 cm wide</p> <p>-31:18 x 6 cm diameter breccia of aphyric basalt (as for 3). Clasts mostly 2 cm across and part of pillow. Layered MnOx coating to 4 cm wide.</p> <p>-32:16 x 5 cm diameter breccia, as for 31.</p> <p>-33:14 x 5 cm diameter breccia, as for 31.</p> <p>-34:10 x 3 cm diameter breccia of weathered basalt clasts &lt;1 cm across and part of pillow. Layered MnOx coating to 4 cm wide.</p> <p>-35:13 x 4 cm diameter breccia, as for 34.</p> <p>-36:8 x 5 cm diameter breccia, as for 34.</p> <p>-37:9 x 3 cm diameter breccia, as for 34.</p> <p>-38:9 x 4 cm diameter breccia, as for 34.</p> <p>-39:6 cm diameter breccia, as for 34.</p> <p>-40:9 cm diameter breccia, as for 34.</p> <p>-41:7 x 4 cm diameter breccia, as for 34.</p> <p>-42:8 x 2 cm diameter MnOx crust from top of pillow.</p>
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Appendix 1-17

		<p>Minor goethite-stained clay in open pores. Top surface has botryoidal morphology.</p> <p>-43:8 x 3 cm diameter MnOx crust, as for 42.</p> <p>-44:5 x 2 cm diameter MnOx crust, as for 42.</p> <p>-45:15 x 3 cm diameter MnOx crust, as for 42.</p> <p>-46:6 cm diameter MnOx crust, as for 42.</p> <p>-47:9 cm diameter MnOx crust, as for 42.</p> <p>-48:8 x 3 cm diameter MnOx crust, as for 42.</p> <p>-49:8 x 2 cm diameter MnOx crust, as for 42.</p> <p>-50:4 cm diameter MnOx crust, as for 42.</p> <p>-51:9 x 3 cm diameter MnOx crust, as for 42.</p> <p>-52:7 x 3 cm diameter MnOx crust, as for 42.</p> <p>-53:7 cm diameter MnOx crust, as for 42.</p> <p>-54:6 x 2 cm diameter MnOx crust, as for 42.</p> <p>-55:7 x 2 cm diameter MnOx crust, as for 42.</p> <p>-56:Pale brown foram ooze from dredge tubes, consisting of forams and sponge spicules. No sand or clay.</p>
<p><b>30 DR</b> <b>Ladd</b></p>	<p>26.05.1999 on bottom: 07:13 h 3061 m 28°35.35 N 176°50.95 W stuck: 09:57 h 2305 m 28°34.76 N 176°49.25 W off bottom: 11:08 h 2441 m 28°34.88 N 176°49.48 W</p>	<p>-1: 25 cm diameter pillow of vesicular olivine basalt. Olivine phenocrysts (20%) pseudomorphed by iddingsite. Most vesicles are empty, but some are zeolite lined near the surface. MnOx coating 1 cm wide. Goethite staining on fractures, and local development of green chlorite zones giving a glassy appearance.</p> <p>-2: 25 cm diameter basalt. As for 1, but no chlorite zones.</p> <p>-3: 15 cm diameter basalt. As for 1, but no chlorite zones.</p> <p>-4: 30 x 12 cm diameter section from a pillow of vesicular olivine basalt. Olivine phenocrysts (20%) mostly pseudomorphed by iddingsite, but some near core are colourless or pale green. Vesicles empty except for zeolite near surface. MnOx coating 1 cm wide.</p> <p>-5: 24 x 6 cm diameter section from a pillow basalt, as for 4.</p> <p>-6: 20 x 8 cm diameter section from a pillow basalt, as for 4.</p> <p>-7: 18 x 7 cm diameter section from a pillow basalt, as for 4.</p> <p>-8: 15 x 11 cm diameter section from a pillow basalt, as for 4.</p> <p>-9: 16 x 10 cm diameter section from a pillow basalt. As for 4, but MnOx crust 5 cm wide.</p> <p>-10:20 x 11 cm diameter section from a pillow basalt. As for 4, but all olivine pseudomorphed by iddingsite and MnOx coating 5 cm wide.</p> <p>-11:25 x 9 cm diameter breccia of goethite-stained strongly weathered vesicular olivine basalt clasts 0.5 to 1 cm across in clay-carbonate matrix. MnOx coating 1 cm wide.</p> <p>-12:16 x 8 cm diameter yellow claystone. Colour banded, with small fragment of vesicular olivine basalt on one side. MnOx coating 2 cm wide.</p> <p>** Several samples of MnOx-encrusted 30 x 10 cm diameter breccia of strongly weathered olivine basalt (as for 11) were also recovered, but later discarded.</p>
<p><b>31 DR</b> <b>Pearl and</b> <b>Hermes</b></p>	<p>26.05.1999 on bottom: 18:41 h 3052 m</p>	<p>-1: 30 x 9 cm diameter brown claystone. Surface has tubes up to 6 cm long and 6 mm in diameter, overlain by botryoidal MnOx to 5 mm wide.</p>

## Appendix 1-18

	<p>27°54.37 N 176°07.50 W off bottom: 23:06 h 2201 m 27°54.46 N 176°04.89 W</p>	<p>-2: 20 x 10 cm diameter claystone. As for 1, but thicker for clay sampling.</p> <p>-3: 28 x 8 cm diameter claystone. As for 1, but surface tubes very well preserved in MnOx crust.</p> <p>-4: 23 x 4 cm diameter claystone. As for 1, but most of sample is 3 cm wide MnOx.</p> <p>-5: Two 6 cm diameter fragments of sugary calcite (halite?), in which tube structures are also preserved.</p> <p>-6: White to pale brown foram ooze caught in sediment tubes of dredge.</p> <p>** About 80 pieces of claystone identical to samples 1-4 were recovered by 31 DR, and were discarded.</p>
<b>32 DR Pearl and Hermes</b>	<p>27.05.1999 on bottom: 05:33 h 3381 m 27°32.38 N 175°30.27 W stuck: 06:52 h 2936 m 27°33.13 N 175°30.20 W off bottom: 09:36 h 3218 m 27°32.55 N 175°30.23 W</p>	<p>-1: 15 x 10 cm diameter brown claystone. Features include conchoidal fracture, weak colour banding, MnOx specks, and 1 cm diameter holes filled with soft white clay. MnOx stained surface. Interpreted as extremely weathered basalt.</p>
<b>33 DR Pearl and Hermes</b>	<p>27.05.1999 on bottom: 15:51 h 2750 m 27°45.65 N 176°09.40 W stuck: 16:51 h 2359 m 27°46.01 176°08.85 W off bottom: 17:59 h 2605 m 27°45.79 N 176°09.16 W</p>	<p>-1: 20 x 6 cm diameter breccia. Consists of angular clasts of goethite-stained strongly weathered vesicular olivine basalt up to 1 cm across. Olivine pseudomorphed by iddingsite. MnOx crust 4 cm wide.</p> <p>-2: 12 x 3 cm diameter breccia, as for 1.</p>
<b>34 DR Pearl and Hermes</b>	<p>27.05.1999 on bottom: 20:12 h 2610 m 27°45.79 N 176°09.14 W off bottom: 23:27 h 1918 m 27°46.50 N 176°07.54 W</p>	<p>-1: 18 cm diameter vesicular aphyric basalt. Groundmass is cryptocrystalline. Most vesicles are empty, but some are infilled by pale brown zeolite. MnOx stained surface.</p> <p>-2: 15 x 3 cm diameter vesicular aphyric basalt. Groundmass includes olivine (iddingsite) and considerable plagioclase. Vesicles large but few and empty. MnOx coating to 5 mm wide.</p> <p>-3: 8 x 4 cm diameter basalt. As for 1, but nearly all vesicles filled with zeolite.</p> <p>-4: 23 cm diameter breccia of 1. Most clasts 1 cm across and goethite-stained (largest is 4 cm), in zeolite-clay-carbonate matrix. MnOx coating 2 cm wide.</p> <p>-5: 11 cm diameter breccia, as for 4. Largest clast is 5 cm across,</p>

Appendix 1-19

		<p>and most MnOx is stripped off.</p> <p>-6: 14 x 8 cm diameter breccia. As for 4, but most clasts are of 2 and few of 1. Very goethite-stained.</p> <p>-7: 7 cm diameter breccia. As for 6, with largest clast 3 cm across and surface only MnOx stained.</p> <p>-8: 11 x 4 cm diameter breccia. As for 6, but surface only MnOx stained.</p> <p>-9: 7 cm diameter breccia. As for 6, but surface only MnOx stained.</p> <p>-10: 11 x 6 cm diameter breccia. As for 6, but surface only MnOx stained.</p> <p>-11: 11 x 3 cm diameter sandstone. Composed of goethite-stained rock fragments, MnOx, iddingsite (olivine), and clay-carbonate. MnOx stained surface.</p> <p>-12: 15 x 3 cm diameter sandstone. As for 11, but well-bedded.</p> <p>-13: 18 x 4 cm diameter sandstone. As for 11, but MnOx coating 2 cm wide.</p> <p>-14: 13 x 3 cm diameter sandstone, as for 11.</p> <p>-15: 32 x 5 cm diameter sandstone. As for 11, but somewhat finer grained.</p> <p>-16: 8 x 3 cm diameter sandstone, as for 11.</p> <p>-17: 15 x 11 cm diameter breccia. Mostly composed of goethite-stained clasts of 1 and 2 (50:50) with interbedded sandstone (as for 11) and yellow claystone. Largest clasts of both 1 and 2 to 7 cm across and relatively fresh. MnOx coating up to 2 cm wide.</p>
<b>35 DR Seamount 72-74</b>	<p>28.05.1999 on bottom: 06:41 h 2975 m 27°09.82 N 175°33.59 W off bottom: 12:11 h 2269 m 27°08.11 N 175°34.37 W</p>	<p>-1: 12 x 2 cm diameter breccia of strongly weathered goethite-stained basalt clasts, up to 1 cm across. MnOx coating 1 cm wide.</p> <p>-2: 9 x 2 cm diameter yellow claystone. Colour banded, with MnOx specks throughout. Surface MnOx stained in places.</p> <p>-3: Green coral-like stalk with bulbs and spikes on it. Presumably growing on MnOx crusts.</p>
<b>36 DR Seamount 72-74</b>	<p>28.05.1999 on bottom: 14:26 h 2797 m 27°10.29 N 175°34.61 W off bottom: 16:17 h 2228 m 27°10.30 N 175°34.61 W</p>	No rocks or sediment in dredge.
<b>37 DR Seamount 72-74</b>	<p>28.05.1999 on bottom: 21:37 h 2979 m 26°52.29 N 175°33.82 W off bottom: 00:06 h 2135 m 26°52.31 N</p>	<p>-1: 31 x 15 cm diameter vesicular olivine basalt. Olivine phenocrysts (5%) pseudomorphed by iddingsite. Vesicles mostly empty. MnOx stained surface.</p> <p>-2: 70 x 11 cm diameter breccia. Very weathered goethite-stained clasts of vesicular olivine basalt with 5% olivine phenocrysts pseudomorphed by iddingsite, clasts mostly 0.5 cm across but some to 6 cm, set in a clay-carbonate matrix. MnOx coating 2 cm wide. 1 stone taken (stone A), similar</p>

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	<p>175°35.09 W</p>	<p>to -1, however, more vesicular.</p> <p>-3: 15 x 8 cm diameter breccia. Clasts as for 2, but half of boulder is yellow claystone. MnOx stained surface.</p> <p>-4: 21 x 5 cm diameter breccia. As for 2, but clasts much finer grained (1 mm maximum diameter). Transitional to sandstone. MnOx coating 5 mm wide.</p> <p>-5: 25 x 5 cm diameter pale grey to yellow claystone. MnOx stained surface.</p> <p>-6: Pale brown foram ooze from sediment tubes of dredge.</p>
<p><b>38 DR Salmon</b></p>	<p>29.05.1999 on bottom: 05:23 h 2639 m 27°12.72 N 176°08.50 W off bottom: 06:39 h 2280 m 27°12.35 N 176°09.04 W</p>	<p>Sample processing was undertaken shortly after the start of SO 142. Most (95%) appear to be strongly weathered basalt breccia. Also, pale brown foram ooze caught in sediment tubes of dredge.</p> <p>-1: Aphyric, partially altered volcanic rock. Dark grey angular fragment coated with thick (1.8 cm) MnOx. A portion (1/4) of the sample is brecciated with light green angular fragments of the same volcanic (degraded surface). The main piece shows parallel oriented vesicles (empty), flow oriented texture.</p> <p>-2: Similar as #1 with lack of light green hydrothermal alteration.</p> <p>-3: Similar as #1, smaller fragment (6 cm Ø). Subrounded fragment with light green alteration product.</p> <p>-4: Volcanic with hydrothermal brecciated material (about 10 cm Ø). Aphyric sample, angular coated with (2 cm thick) MnOx.</p> <p>-5: Predominantly altered light brown rock (ca. 5 cm Ø) with contorted reinlets of darker brown product. Few cavities filled with tan colored sediment. MnOx coating.</p> <p>-6: Volcanic breccia (ca. 10 cm Ø) with vein of inducted pelagic sediment. One fragment appears highly vesicular with cavities filled by secondary clay-like (yellowish – light green) and reddish (Fe-oxyhydroxide) product. MnOx coating.</p> <p>-7: Four pieces of subrounded MnOx coated material.</p> <p>Note: Samples -2 to -6 were taken as individual pieces from the MnOx coated weathered breccia</p>