Chapter 7 Discussions and Recommendations

7 - 1 Formation, Development of Seamounts and Occurrence of Cobalt-rich Crusts

(1) Formation and development of seamounts

The four areas surveyed this year are; two marine areas to the east of the Caroline Islands and two marine areas to the northwest of the Caroline Islands, and these two groups of areas are far apart. The seamounts in each area has different morphology, and they were formed and developed under individually diverse environment. The diverse morphology and development history are reflected in the mode of occurrence of cobalt-rich crusts of each area. The outline of the history of formation and development of the seamounts in each area is as follows.

The seamounts of the MC11 and MS13 areas located to the east of the Carolines were formed as oceanic islands by alkali basalt volcanism during Mesozoic to early Paleogene. Cessation of the volcanism and erosion, and further subsidence sank the island below the sea surface and they became seamounts. The subsidence is considered, from the investigation of other seamounts in the vicinity, to have started in Miocene time. They are both guyots, but MC11 seamount summit is covered by unconsolidated sediments with common dome structure, while MS13 seamount summit is rugged with many pinnacles.

The seamount in MC12 area located to the northwest of the Carolines was formed as oceanic islands by alkali basalt volcanism during Mesozoic. After the cessation of volcanism and erosion, it gradually subsided developing reef on the summit, then in Paleogene it subsided rapidly and became a seamount. Controlled by the geologic structural changes caused by the movement of the seafloor, it is presently an oceanic ridge-type seamount with east-west trending axis.

The seamount in MC13 area located to the northwest of the Carolines was formed before Early Cretaceous of Mesozoic. It is believed to have been formed by alkali basalt volcanism as in the case of MC12 seamount, but evidences for this were not obtained by the present survey. After he cessation of the volcanism it subsided slowly, then rapidly subsiding in Paleogene and became a seamount. It moved to the present location accompanying the seafloor movement and during this process a new volcanism occurred in Late Cretaceous, and the steep cliff of the northern slope is considered to have formed at the time.

The western sea off the Carolines, areas MC02~Mc10 were surveyed in 1997, and the seamounts of these areas were divided into four groups by their age. The seamounts in MC11 and MC13 were grouped with those of areas MC08 and MC10 to seamounts formed before middle Paleogene, these four seamounts are

distributed in the east-west direction north of the Caroline Ridge. the scamounts in MC11 and MS13 areas to the east of the Carolines continue to the scamount chain in the EEZ of the neighboring Marshall Islands. The composition and genesis of the basalt inferred from the results of the chemical analysis carried out this year are similar to those of the scamount chain of the western sea off the Marshall Islands.

(2) Occurrence of cobalt-rich crusts

In the MC11 area to the east of the Carolines, occurrence of thick cobalt-rich crusts was confirmed. Generally cobalt-rich crusts are thickly developed at water depth of 1,000 to 2,500m, but it was confirmed that in this area the seamounts with summit deeper than 2,500m had thick developed cobalt-rich crusts on the summit. Also generally the Co, Ni, Mn and other metal grade of the cobalt-rich crusts decreases with water depth, but in the seamount of MC11 area, the grade of the samples collected on the slope is somewhat lower, than those from the summit of seamounts in waters shallower than 2,000m, but the difference is small.

In the seamount of MS13 area, the samples containing thick crusts were concentrated near the pinnacles which occur sporadically on the summit. But, since MS13 seamount is considered to have been formed before Paleogene, there is a possibility of thick crust distribution under the unconsolidated sediment cover on the summit.

The seamounts in MC12 and MC13 areas were formed and subsided before Paleogene, and thick crusts reflecting the seamount age were collected. But the distribution of the thick crusts are limited and samples with mere coatings of manganese oxides occur widely. The topography of the seamounts in these two areas strongly reflect the geologic structure. Also there are evidences of repeated volcanism after submergence are found in the seamount of MC13 area. These factors and the localization of thick crusts do not appear to be directly related, but the distribution of crusts is considered to be affected directly or indirectly by the above factors.

7 - 2 Hydrothermal Activities

During the 1997 survey, pyrite-disseminated rocks were collected from the northern steep slope of the seamount in MC02. This indicated the possibility of hydrothermal sulfide deposit occurrence in the area. This year, survey was conducted in the MC02 area with the specific purpose of clarifying the state of hydrothermal activity of the area. The survey was centered around the foot of the northern steep slope of the seamount and the small depression on the northern side of the steep slope of the seamount. The area around

the small depression was selected because hydrothermal activities were inferred from the geologic structure. The results did not show direct geological and biological evidence of the existence of hydrothermal activity, but it was confirmed that spring water flow associated with hydrothermal activity occurred in the small depression in after Pleistocene. Also mounds were found to exist under unconsolidated sediments in the small depression. Thus the possibility of the existence of hydrothermal sulfide deposits in the small depression was indicated aside from the steep northern slope of the seamount where pyrite disseminated rocks were sampled.

7-3 Future Work

Thick crusts and cobble crusts were confirmed in the scamounts of MC12 and MC13 areas, but the distribution is uneven. This is believed to be caused by the history of the scamount development and the geologic structure of the Western Sea of the Carolines, but the number of samples acquired is insufficient to thoroughly consider the problem. In the seas north to northwest of the Caroline Islands, the possibility of occurrence of thick crust ores is high and it is necessary to further conduct survey on the occurrence of the cobalt-rich crusts together with acquisition of data on geology and geologic structure of the area.

Cobalt-rich crusts are not well developed in waters below water depth of 2,500m, and the content of metal such as cobalt tend to decrease in further deep zones. But the summit of the seamount in MC11 area is deeper than 2,500m, and thick crusts were confirmed and the metal grade is not very different from those collected from other seamounts. Survey on occurrences and metal grades of cobalt-rich crust on deeper seamounts is rare, and future surveys are desired.

In MC02 area, the existence of hydrothermal deposits under unconsolidated sediments was indicated. Also in MS13 area seamount, thick crusts possibly occur under sediments. At the present state of survey methods, it is not possible to clarify material below the sediments. Thus survey methods for such purpose including seafloor drilling need to be established.

-134-

Chapter 8 Summary

This is the fourth year of the third phase of the five-year SOPAC Program. This year, following the results of the survey in the exclusive economic zone of the Republic of the Marshall Islands in 1996, and that of the Federated States of Micronesia in 1997, topographic surveys and sampling for cobalt-rich crust deposits were carried out in the marine areas of both countries which were not studied in the previous surveys.

The duration of the survey cruise was 49 days, of which that in the waters of the Federated States of Micronesia was 22 days. This paper reports the results obtained in the EEZ of Micronesia.

There are many occanic islands, atolls and seamounts in the waters of Micronesia. The survey was carried out in two areas; namely the eastern sea area to the south of Anewetak Atoll adjacent to the Marshall Islands, and the western sea area in the vicinity of Yap Province of Micronesia. The western sea area is located north of the 1997 survey area.

The survey was composed mainly of MBES topographic survey for preparing detailed topographic maps of the seamounts, and of sampling by chain bag dredge (CB), arm dredge (AD), and large corer (LC). Also seafloor observation by FDC, study of depositional conditions of unconsolidated sediments by SBP, and microtopographic survey by SSS. Important samples were studied in laboratories on land by various methods including ore assay and thin section microscopy of rocks. These together with the results of onboard analysis provided the basis for integrated analysis of the resource.

Generalization of results of survey in 1997 and this year is shown in Table 8-1(1),(2).

(Topographic survey)

The survey area consisted of the exclusive economic zones of the Marshall Islands and of Micronesia. It was divided into the eastern sea area centered around the oceanic plateau with Anewetak Atoll, and the western sea area in the vicinity of Yap Province of Micronesia. Five areas were selected for cobalt-rich crust survey in the eastern sea, and two in the western sea (excluding the MC02 area which will be mentioned in this report for hydrothermal activity only). Of these, two in the eastern sea area and two in the western sea area area located in the EEZ of Micronesia. These seamounts were selected after considering the water depth, size, and the survey itinerary. In addition to the above, survey for hydrothermal activities was carried out in the MC02 area where indications for hydrothermal activity was discovered in the 1997 survey.

The areal extent of the topographic survey differ by the size of the individual seamount, but it was generally 25 X 30 miles, which was an area sufficient for understanding the shape and the topographic characteristics of the seamounts. For all seamounts, the survey provided detailed topography and formed the basis for sampling and other subsequent studies.

In the four survey areas, two seamounts in eastern sea are guyots, one with dome-type summit, one with undulating rugged summit. The two seamounts in the western sea are oceanic ridge-type seamount and oceanic plateau-type seamount.

Table 8-1-1(1) Summary of Survey in Micronesia Federation Waters

													ſ
Area	MC02	MC03	MC04	MC05	MC06	MC07	MC08	MC09	MC10	MC11	MC12	MC13	MS 13
	9° 04' N	6° 18′ N	(E)6°12'N (W)5°15'N	5°31′N	4° 23' N	6° 05' N	(N)10°20'N (S)10°16'N	(N)8° 21' N (S)8° 06' N	(N) 10° 10' N (S) 9° 45' N	7° 30′ N	9° 20' N	10° 20' N	8° 15' N
Location"	141°28'E	141° 37' E	(E)144° 45′ E (W)144° 22′ E	149°13'E	147°58'E	157° 26' E	(N)156° 41' E (S)156° 27' E	(N)155°26'E (S)154°58'E	(N)148° 16′ E (S)148° 20′ E	161° 18' E	146° 05' E	145°00'E	160°40′E
Duration of survey	5 days	7 days	8 days	5 days	2 days	6 days	8 days	7 days	9 days	3 days	5days	6 days	7 days
Topographic survey	529.6nm	831.4mm	914.9nm	613.4nm	252.5mm	592.5nm	649.1nm	861.2nm	1,042.2nm	310.6nm	827.0nm	701.1nm	845.0nm
-SSS survey. track line	2	-		-			-						-
Total length of track line	10.0nm	4.0nm					4.Ôrm					4.7nm	5.4nm
- Sampling													
AD Number of	•	4				4				5	13	=	12
CB Number of	2	œ	18	œ	80	9	16	12	17				
LC Number of samples	4	4	ę			5	3	-	e.	-	1	e	m
Amount of cn (incl. Cobbi	12.3kg	290.3kg	100.8kg		140.6kg	16.0kg	417.0kg	167.6kg	121.5kg	6.0kg	578.0kg	496.0kg	609kg
Amount of nodules		38.5kg	19.9kg		16.2kg	11.7kg	96.4kg	0.8kg	52.7kg		19.0kg	290.0kg	24kg
Amount of rocks	167.4kg	77.5kg	203.2kg	113.8kg	123.1kg	42.1kg	68.1kg	60.5kg	40.8kg	16.0kg	364.0kg	208.0kg	191kg
• FDC observation Number of track line		-	2			1	1	-	-	-	-	-	2
Total length of track line	-	5.7nm	8.8nm			6.3nm	4.5nm	2.3nm	4.8nm	2.1nm	2.4nm	2.2nm	3.9nm
Number of photographs		251	407	•		265	222	125	176	111	182	182	192
Video tapes		4 reels	5 reels			4 reels	4 reels	2reels	3 reels	2 reels	1 reeis	1 reeis	4 reeis
Surveyed water depth zone													
Topographic-SBP survey	1,080~3.700m	510~5,200m	100~3,800m	190~4,100m	740~4,500m	1,423~3,700m	1,583~5,600m		1,09€~5,200m 1,442~4,800m 1,777~4,800m 1,141~4,100m 1,656~3,900m 1,387~5,100m	1,777~4,800m	1,141~4,100m	1,656~3,900m	1,387~5,100m
Sampling	1,268~3,335m	1,268~3,335m 1,079~3,508m	301~3,876m	1,204~4,060m	· •	,421~2,636m 1,446~3,079m	1,682~5,208m		1,122~4,758m 1,593~4,366m	1,966~2,785m	1.150~3.798m	1,669~3,441m	1.801~4,069m
F D C		980~3,870m	178~3,636m			1,569~2.940m	1,969~2,284m	1,569~2,940m 1,969~2,284m 1,202~2,734m 1,948~3,525m 1,829~3,036m 1,179~2,514m 1.551~3,187m 1.458~3,287m	1,948~3,525m	1.829~3.036m	1,179~2,514m	1.651~3,187m	1,458~3,287m
*1: Center of seamount summits.	mmits.								-				

*1: Center of seamount summits.
*2: 1998 survey is excluded because it was hydrothermal survey.
*3: Include coatings and stains.

-136-

Waters
Federation
 Micronesia Fed
 y cf Survey in Microl
Summary
Table 8-1-1(2)

6

Type Type Scal (trm) Scal (trm) Scal (trm) Scal (trm) Score area (trm) Score area (trm) Score area (trm) Score area (trm) Score Score Score Mode & occurrence Mode & occurrence Mode & occurrence Mode & occurrence Mode & occurrence Mode & occurrence Mode & occurrence Score Mode & occurrence Mode & occurrence	MCO2 Pleteau-figured 1,080~3.500m 1,080~3.500m 7° /6° 7° /6° 2.972 1,134 2.972 1,134 2.972 1,134 6 Generally bastl, forminifier bastl, forminifier bastl, former on upper shore on upper shore on upper shore of all hill. 26 26 27 29 20 20 20 20 20 20 20 20 20 20 20 20 20	MC03 Ridge 80 x 20km 510~3,800m 510~3,800m 537 15km 16 ² 1/14 ² /5 ² 1031 825 7051 825 7051 825 7051 825 7051 6000 8100 81000 81000 81000 81000 81000 81000 81000 81000 81000 81000 812000 81200 81000 81000 81000 81000 81000 8100000 8100000000	MCOA MCOA (E)Part of ridge (S)Part of ridge (S)Part of ridge (S)Part of ridge (E)12 (N)100-3806m (W)100-3806m (W)2542 (E)12 (N)100-3806m (E)12 (N)2542 (E)12 (N)2542 (E)12 (N)2542 (E)12 (N)2542 (E)12 (N)2542 (E)2379 (N)2542 (E)2379 (N)2542 (E)24 (N)2542 (E)24 (N)2542 (E)24 (N)2542 (E)24 (N)2542 (E)24 (N)2542 (D)24 (N)242 <	MCOS Shorel 60 x 30 km 190 ~ 4,000m 40 × 19 km 14° / 11° / 15° 734 504 4,730 Reefal litmestone, 4,730 Reefal litmestone, 10° 110° 110° 110° 110° 110° 110° 110°	MC06 Rugerd eurort 740~3500m 16" /16" /10" 240 240 240 1.486 Resett: hystocatette preconstrants Paster hystocatette Baster hystocatette imestone. bit imestone. bit imesto	MCO7 SSD x 20km SSD x 14km SSD x 14km Marky basit havio (Lister Prevention (Second on Some SSD x 14km Marky basit havio (Lister Marky basit havio (Lister Marky basit havio (Lister Marky basit havio (Lister Marky basit havio (Lister Marky basit havio (Lister havio (Lister havi	MC08 MC08 (N)Guyet (S)Guyet (S)J134 x15m (S)1134 x15m (S)113 x15m (S)1135 - 5500m (S)1135 - 5500m (S)113 - 5500m (S)113 - 5500m (S)113 - 5500m (S)113 - 5500m (S)113 - 5500m (N)13 - 550	MC09 MC09 (N)Rugard Serrout (N)S x1 3hum (N)S x1 3hum (N)S x1 3hum (N)S x1 3hum (S)S x8 3hum (N)S x1 3hum (S)S x1 3hum (N)S x1 3hum (S)S x 13hum (N)S x1 3hum (S)S x 13hum (N)S x1 3hum (S)S x 2hum (N)S x2 x 2hum (N)S x 2hum (N)S x1 2hum (N)S x 2hum (N)S x2 x 2hum (N)S x 2hum (N)S x 2hum (N)S x 2hum (N)S x 2hum (N)S x 2hum (N)S x 2hum (S)S x 2hum (N)S	MG10 MG11 MG10 MG11 (N33 x 4)bm 13 x 23m (N33 x 4)bm 13 x 23m (N33 x 4)bm 13 x 23m (N32 05 x 2)bm 13 x 23m (N32 05 x 2)bm 13 x 13m (N31 442 - 4 80m 177 - 4 80m (N32 05 x 2)bm 23 x 13m (N32 05 x 2)bm 23 x 13m (N32 05 x 3)bm 285 (N32 05 x 3)bm 344 (N31 442 - 4)bm 13 7 5 (N31 442 - 4)bm 2814 (N1 3 406 adore of S 94 (N1 3 406 adore of S 94 (N1 442 - 4)bm 11 1 1 1 (N1 442 - 4)bm 11 1 1 (N1 442 - 4)bm		MC12 Rdge-figured 45 x 20km 1,141~3,300m 18 x 2km 18 x 2km 18 x 2km 18 x 2km 18 x 2km 18 x 10 x 2km 12 x 10 x	Anurus Platesu-rigured 40 x 35km 1656-33.800m 355 x 35km 355 x 35km 355 x 35km 355 x 35km 355 x 35km 100° /7' /5' 11.808 Basalt, mudstone, Luff, foramiofrend Luff, f	Mista Mista Aussed gives 23 × 50 1,337 ~ 5,000m 55 × 50 50 × 25km 51 × 1,17 / 45 1,47 1,17 / 45 1,47 1,12 2 1,41 1,132 1,41 1,132 1,41 1,132 1,41 1,132 1,41 1,132 1,41 1,132 1,41 1,132 1,41 1,132 1,41 1,132 1,41 1,132 1,41 1,41 1,41 1,41 1,41 1,41 1,41 1,41 1,41 1,41 1,41 1,41 1,41 1,41 1,5 1,5 1,5 1,5 1,5 1,5 1,5 1,5 1,1 1,1 1,1 1,1 1,1 1,1
R (3)	19.67	24.21 15.95	27.13 27.13		24.88 16.25	26.15 26.15	23.67	25.57	4,07 22.67	23.50	17.70	17.51 19.73	20.75
Mn (%) Fe (%) Number of samples assayed ⁴ Mode of bedrock (crust) axposure	19.67 17.44 Etosures on N Etosoures on R Steep sloes, rear pinnecies on E side. Crust distribution	P	tures tures teres	Exposures widely occur from upper to middle clope and parts of lower slope. young seamount and	5 # 0	26.15 15.16 15.16 7 Exposures at unmit binnecies.	23.67 15.96 15.96 22 Exposures from upper slope of N and S seamounts. Exposures seen mear Exposures seen mear	25.57 15.62 15.62 16.00 Exposures observed on summit pratrusion of N semount Exposures widely Coccur from summit		1 1 1	17.70 19.70 19.70 11 Summit generally excost across throughout stope except valleys. Oc., Mi are a fittle tow	17.71 19.73 19.73 12 Exposures observed on rågre on euramit N side and continuing N siope. continuing N siope. Co.M. are a little low	Exposur dishibut summit Co.Ni.ar
Assessment	limited, but relatively crusts limited, but thick. and exposure ratio		crust exposure ratio thus crusts good, but thin.	thus crusts undeveloped.	÷peu	not collected, but existence of such.	ewhet t thick.	rugged topography. crusts relatively thin. But Comparing thin.	many crusts thick. exposure ratio high.		high but very thick crust distributing	high but very thick ervet distributing.	

44: For 1996 survey areas (MS01 ~ 09), the velues indicate "long axis x short axis" of the water-depth contour of the base. For 1398 survey areas (MS10~13), the values indicate the "long axis x short axis" of the 3.000m water-depth contour 45: For 1996 survey wates (MS01 ~ 09), the average of assaved samples. For 1938 survey areas (MS10~13), the average value of the average of all collected samples. *7: Maximum value of all collected samples, avcluing nodules in (MS10~13). 43: Sampling sites where crusts, cobbie crusts, and nodules without of assaved samples. For 1938 survey areas (MS10~13), the average value of the average of all collected samples. *7: Maximum value of all collected samples, avcluing nodules in (MS10~13).

-137-

The water depth of the shallowest seamount summits ranges from 1,141m to 1,777m, the relative height from the base ranges from 2,140m to 3,610m and that of the MS10 area is the smallest with seamount area of 13 X 23km, and summit of the seamount in MC12 is the smallest with 35km2 of area; and the largest seamount is MC13 occupying an area of 40 X 35km. The largest summit area is that of MC13 with 1,382km2.

(MBES acoustic reflection intensity)

Each seamount has different form and thus the MBES acoustic reflection intensity map for each seamount has its unique characteristics.

The seamount in M11 is guyot with dome-shaped summit and the summit is all covered by unconsolidated sediments and thus pale color tone indicating low acoustic reflection intensity extends over the entire summit. But at pinnacles, summit periphery, and parts of the upper slope, however, dark tones appear.

The seamount in area MS13 which is a guyot but with rugged summit, generally show pale color on the summit, but dark colored parts are conspicuous corresponding to the many pinnacles in the central part.

The MC12 seamount is a ridge-type without flat summit. The summit to the upper slope is steep and the distribution of sediments is limited, and thus dark tone is widely distributed.

The summit of the seamount in MC13 area is large and pale tone indicating unconsolidated sediments appears over the whole summit area. Dark parts are observed at the linear steep cliff in the northeastern to the eastern part of the summit and also near the pinnacles in the northern periphery. Also slightly higher acoustic pressure is observed in linear pattern parallel to the steep cliff.

The exposed bedrocks of seamounts are often covered by cobalt-rich crusts, and thus the dark parts corresponding to exposed bedrocks indicate the possibility of cobalt-rich crust distribution. In the present survey area, cobalt-rich crust samples were collected from the dark-colored parts of all areas.

(SBP survey)

The seamount with dome-shaped summit in MC11 area tend to have thicker unconsolidated sediments toward the central part of the summit. The maximum thickness is 60m. The vicinity of the pinnacles is exposed and thus the isopach contours have irregular shape.

The summit and slope of the seamount in MS13 area are covered by thick unconsolidated sediments, but exposure of acoustic basement was observed in the central part of the summit corresponding to pinnacles and many other protrusions.

In MC12 area, the bedrocks are exposed generally on the summit and exposure occur scattered on the slope reflecting the ridge-type morphology, the unconsolidated sediments are thin.

The seamount of MC13 area has large rugged summit area, but it is generally covered by thick

sediments. The thickest is 80m.

(SSS survey)

SSS survey was carried out on the seamounts of the MS13 and MC13 areas.

In the MS13 area seamount, SSS survey was carried out in the depressions between the pinnacles in the summit center. It was confirmed that the distribution of the unconsolidated sediments is local not only in the protrusions but also in the depression, and that exposures occur widely.

The seamount in the MC13 area, SSS survey was carried out in the vicinity of the pinnacles in the northern summit periphery. With the exception of parts of the foot of the western slope of the pinnacles, pebbles were recognized on the bedrock exposures of step topography.

(Sampling)

Sampling by dredges and a large corer was carried out at 49 sites in four areas, MC11 to MC13 and MS13. Cobalt-rich crusts were recovered from 39 sampling points, of which crusts or cobble crusts were collected from 34 points and nodules were recovered from two points by large corer and three points by dredge. Ores from 37 samples from 30 sites were assayed. Also representative samples of rocks and bottom sediments and those which were considered to be necessary for assessing the occurrence of cobalt-rich crusts were studied microscopically, chemically analysed, and fossils identified.

(Geology)

The rocks collected from the four areas, MC11~MC13 and MS13, were basalt, limestones, tuffaceous rocks, hyaloclastite, and pumice.

In all seamounts, basalt and limestone occur from the summit to the slope.

The lithology of the basalt differs somewhat by the scamount, but majority are aphyric or those with minute phenocrysts. Basalt samples from MC11 and MS13 are strongly weathered and fresh samples were not obtained. But fresh blackish gray samples were recovered from the seamounts in MC12 and MC13 areas.

Conglomerate samples with foraminiferal limestone matrix containing foraminiferal limestone and basalt pebbles were recovered from the summit to the slope of each seamount. In MC11 and MS13 seamounts most of the conglomerate have relatively good consolidation, while those of MC12 and MC13 seamounts are mostly fragile and merely cementing the pebbles. At the summit of MC12 seamount consists of reefal limestone indicating the formation of coral reef, and basalt was not recovered. Calcareous mudstone was collected from the MC12 and MC13 areas.

Occurrence of tuff and tuff breccia are confirmed in all seamounts, but their distribution is heterogeneous, and wide occurrence such as seen in basalt and limestone is not observed. Hyaloclastite

samples were collected near the pinnacles in summit center of MS13 seamount, and some from the upper slope of MC12 seamount.

From the summit of MC13 seamount, chert has been collected and the radiolaria fossils in this chert was identified to be Middle Cretaceous in age.

Pumice samples were collected from various localities of the survey area.

(Seafloor observation)

Seafloor was observed by FDC along five track lines in four areas. In all seamounts, crust occurrence was confirmed in exposed zones over wide areas from the summit peripheries to the upper slopes. Sedimentary cover was observed in many localities of the upper slope terrace of MS13 area, but cobble crusts and nodules were distributed on the sediments. In the MC12 seamount, angular pebbles considered to be talus deposits were seen on the gentle slope. In the seamount of the MC10 area, cobble crusts were observed to be mixed with angular fragments. And in MC12 area, parts of seamount slope were observed to be covered by angular pebbles, but occurrence of crusts was confirmed in the exposed parts.

(Thickness of cobalt-rich crusts)

Thick crusts occur on each seamount. The average thickness of the samples recovered from each seamount ranges more than 35mm, and the maximum thickness of the samples of each seamount (except MC11) exceeds 140mm.

The crusts in many parts of the seamounts in MC12 and MC13 areas are less than 10mm in average thickness, but there are parts of these seamounts where the average exceeds 100mm.

In MS13 area, the occurrence of thick crusts are limited to parts of northwestern periphery of the summit, but crusts and cobble crusts thicker than 100mm occur near the pinnacles in the central part of the summit.

The crusts of the seamount of the MC11 area is 36.1mm in average thickness. It is the thinnest average of the four areas, and regarding the maximum thickness those exceeding 55mm and 100mm were not obtained. The distribution is also heterogeneous. But crusts also occur below 2,700m water depth, and it was confirmed that thick crusts occur even on small seamounts most of which are deeper than 2,500m of water depth.

(Chemical analysis of cobalt-rich crusts)

Thirty-seven samples were selected from cobalt-rich crust samples collected at 30 sites in four areas of MC11~MC13 and MS13, and these 37 samples were chemically analyzed for 29 elements. The number of analyzed samples including layer analysis was 69 samples. The average grades of the major elements of the four areas are; Co 0.45%, Ni 0.35%, Cu 0.04%, Mn 20.0%, Fe 17.6%. The grade differs

considerably by the area. With the exception of Fe, samples from the two areas in the Eastern Sea tend to have somewhat higher grade compared to those from the two areas in the Western Sea. The content of all elements of the cobalt-rich crusts samples collected this year from the Western Sea is lower than the results from MC02~MC10 areas in the northwestern~western seas surveyed in 1997.

The rate of growth of crusts was calculated using cobalt-rich crusts with coral nucleus from MC12 area. The result was cobalt-rich crusts grew from about 20,000BP to the present at a rate of $5\sim10/Ma$. This figure is relatively large for crust layer growth in general.

(Mode of occurrence of cobalt-rich crusts)

The occurrence of crusts and cobble crusts with average thickness exceeding 35mm is confirmed from all four areas. In the three areas excluding MC11, the maximum thickness is 140~190mm.

Based on results in 1997 and this year, The characters of condition of cobalt-rich crust in this area of sea are arranged follows.

The crust is well developed and thick on guyots older than Paleogen, and those on seamounts younger than Paleogene are thin.

The thickness of the crust on seamounts younger than Paleogene depends on topography and geology than the age.

The crust on pinted seamoutains which slopes are shallow, is very thin.

The average grade of the majar elements also vary by area. Cu contain is higher at MC02, MC08 and MC10areas and Co, Mn contains are lower than at other areas. The Co contain at areas which are closed to FEZ of the Repablic of Marshall Islands, are high, $0.51 \sim 0.61\%$. In the northern part of its west area, the Co contain is lower $0.35 \sim 0.41\%$, and in the southern part, it is also lower $0.38 \sim 0.48\%$.

To summarize the above conditions regarding the occurrence of cobalt-rich crusts in the survey area, MC11 and MS13 areas which are closed FEZ of the Republic of Marshall Islands, with large ore reserves are prospective. MC12 and Mc13 areas are next to MC11 and MS13 areas. In the whole, the old seamounts of northern part of this area of sea, are asscessed high on the basis of cobalt-rich crust occurrence.

(Hydrothermal activity)

Indications regarding occurrence of hydrothermal activities were obtained by the 1997 survey in MC02 area. This year survey of this area was carried out in order to clarify the state of hydrothermal activity. Direct evidences concerning hydrothermal activity were not obtained by the present survey, but stratigraphic relations indicating the occurrence of hydrothermal activities in the unconsolidated sediments in the small depression on the northern side of the seamount was confirmed, and mound topography was observed under the unconsolidated sediments. As a result, the possibility of hydrothermal sulfide deposit occurrence under the sediments in the northern small depression was shown aside from the foot of the steep northern slope where pyrite disseminated rocks were collected in 1997.

(Consideration)

The MC13 and MC12 areas are located in the sea northwest of the Caroline Islands. The seamounts in these areas were formed in Mesozoic-early Paleogene, and it was proven by the present survey that they are a part of the seamount chain extending in the east-west direction on the northern side of the Caroline Islands. In these seamounts, the possibility of the occurrence of thick cobalt-rich crusts is high, and thick crusts and cobble crusts have been collected from the two areas. The thickness of the cobalt-rich crusts, however, vary widely and the reason for this variation is considered to be volcanic activities after the formation of the seamounts and the effect of geologic structure. For investigating the occurrence of cobalt-rich crusts in this area, further acquisition of geologic and geologic structural data is necessary.

Also the chemical nature, namely the metal content, of the crusts vary widely by area, and further survey is desirable for clarifying the trend of ore grades and to understand the occurrence of crusts in the whole waters of Micronesia.

-142--

[REFERENCES]

Bonani G., Hofmann H.J., Morenzoni E., Nessi M., Suter M., and Wolfli W. 1984, ¹⁰Be dating of the inner structure of Mn-encrustations applying the Zurich Tandem Accelerator, Nuclear Instruments and Methods in Physics Research B5, 359-364

Brevart O., B. Dupre and C.J. Allegre, 1981, Metallogenesis at spreading centers; lead isotope systematics for sulfides, manganese-rich crusts, basalts and sediments from Cyamax and Alvin areas (East Pacific Rise). Econ. Geol. Bull. Soc. Econ. Geologists., 76, 5, p. 1205-1210.

De Carlo E.R. and C.M. Fraley, 1992, Chemistry and mineralogy of ferromanganese deposits from the equatorial Pacific Ocean., Geology and offshore mineral resources of the central Pacific basin, p. 225-245.

Hart S., 1984, A large scale anomaly in the Southern Hemisphere mantle. Nature 309, 753-757.

Haynes B.W. and M.J. Magyar, 1987, Analysis and metallurgy of manganese nodules and crusts., Marine Minerals, p. 235-246.

Hein J.R., M.S. Schulz, and L.M. Gein, 1992, Central Pacific cobalt-rich ferromanganese crusts: Historical perspective and regional variability., Geology and offshore mineral resources of the central Pacific basin, p. 261-283.

Hein J.R., W.C. Schwab and A.S. Davis, 1988, Cobalt-and Platinum-rich ferromanganese crusts and associated substrate rocks from the Marshall islands., Marine Geology, v.78, p. 255-283.

Hein J.R. et al., 1990, Geological, Geochemical, Geophysical, and Oceanographic Data and Interpretations of Seamounts and Co-rich Ferromanganese Crusts from the Marshall Islands, KORDIUSGS R.V. Farnella Cruise F10-89-CP.

Janney P.E. and P.R. Castillo, 1996, Basalts from the central Pacific basin: Evidence for the origin of Cretaceous igneous complexes in the Jurassic western Pacific., vol.101, no. B2, p. 2875-2893.

JICA-MMAJ, 1997, Report on the cooperative study project on the deepsea mineral resources in selected offshore areas of the SOPAC region sea area of the Republic of the Marshall Islands, P.180

Lincoln J., M.S. Prigle and I.P. Silva, 1993, Early and late Cretaceous volcanism and reef-building in the Marshall Island. in The Mesozoic Pacific; Geology, Tectonics, and Volcanism., Geophysical Monograph 77.

Mangini A., P. Halbach, D. Puteanus, and M. Segl, 1987, Chemistry and growth history of central Pacific Mn-crusts and their economic importance., Marine Minerals, p. 205-220.

Mullen E.D., 1983, MnO/TiO₂/P₂O₅:a minor element discriminant for basalt rocks of oceanic environments and its implications for petrogenesis. Earth Planet. Sci. Lett., 62, 53-62.

Sharma P. and B.L.K. Somauajulu, 1982, 10Be dating of large manganese nodules from world oceans., Earth abronology, Earth Planet. sci. Let., v.36, p. 359-362.

KORDI-USGS (Hein J.R. et al.), 1992, Geology, Geophysics, Geochemistry, and Deep-Sea Mineral Deposits, Federated States of Micronesia: R.V.Farnella Cruise F11-90-CP, USGS Open File Report 92-218.

Usui A., 1995, Studies of marine manganese deposits: Review and perspectives., Chishitsu News, no. 493, p. 30-41. (Japanese)

Verma S.P., 1992, Seawater alteration effects on REE, K, Rb, Cs, Sr, U, Th, Pb and Sr-Nd-Pb isotope systematics of Mid-ocean ridge basalt. Geochem. Jour., 36, 159-178.

Woodhead J.O. and C.W. Devey, 1993, Geochemistry of the Pitcairn seamounts, I: source character and temporal trends. Earth Planet. Sci. Left., 116, 81-99.

Zindler A. and S. Hart, 1986, Chemical geodynamics. Ann. REv. Earth Planet. Sci., 14, 493-571.

Appendix

< Analysis of biogenic materials in bottom sediments >

Several to 20cm-thick organic-appearing, jelly-like material with sulfur odor was collected as an intercalation in viscous mud in all samples by LC from three site in the northern depression.

If this material is really organic, the following is inferred;

- 1. The rate of deposition in the area was very high and organic matter deposited on the seafloor was buried before transformation to inorganic matter.
 - Or

2. Reaction took place under anaerobic environment forming organic matter.

The tests shown in Table 1 were conducted in order to confirm the organic nature. The samples used for the tests are shown in Table 2. The results of analysis are shown in Table 3.

① Microscopic observation of biogenic material

By optical microscopy, plant planktons were observed with high frequency in samples 1 and 2, while in comparative sample 3 mineral grains were predominant and the frequency of plant planktons appearance was low. Observed plant plankton was all diatom of genus Ethmodicus.

② Chemical analysis

Organic carbon content

All samples contain less than 1% organic carbon, and have low organic content.

• Biogenic silicates (opal)

The opal content is lowest in sample 3 at 18.6%, while the other two contain over 30%. The total silica content is $61.1 \sim 64.0\%$ for samples 1 and 2 respectively, indicating the existence of mineral-origin silica in amount similar to opal.

Calcium carbonate

Calcium carbonate content is highest in sample 3 at 51.0%, while samples 1 and 2 contain 20.3 and 15.6% respectively, indicating reverse relation to biogenic silica content.

③ Dyeing nucleic acid (total bacilli: number of bacteria cells)

Least number of cells are contained in sample 3 at 1.35×10^7 cells/Dg, and the largest is in sample 1 at 2.50×10^7 cells/Dg. But in this case, the content of samples 1 and 2, and of the comparative sample 3 is not very different.

④ Physical properties of soil

Water content of all samples is 60~70%.

The specific gravity of all samples was within the range of 2.19~2.49g/cm³.

It was clarified from the above that the jelly-like or organic-appearing fine soil was not very

Table 1 Analysis items

ltems	Specify
Microsorpic observation	Observation, Photographs
Chemical analysis	Organic maturity oxygen
	Life origin silicic acid (opal)
	Calcium carbonite
Dyeing nucleic acid	DAPI dyeing
Soil physics test	Water content
	Specific gravity

		•		
Sample No.	sampling date	sampling point	Sampling depth	description
Sample No.1 (98MCO2LC08)	1998.6.26	9° 13.974N 141° 34.568E	190cm	greenishi gray jelly-like
Sample No.2 (98MCO2LC14)	1998.7.12	9° 13.757N 141° 32.402E	175cm	greenishi gray jelly-like
Sample No.3 (ditto)	(ditto)	(ditto)	176cm	grayish porous

Table 2 Sample list

* No.3 is compare sample.

		caulta t	n niaiyai	.	
	ltem	Unit	Sample No.1	Sample No.2	Sample No.3
	TOC	mg/Dg	7.2.9	6.92	4.73
Oranic maturity oxgen	TN	mg/Dg	0.91	0,8	0.59
and total nitrogen	TOC	%	0.729	0.692	0.473
	TN	%	0.091	0.08	0.059
	C/N		8.01	8.65	8.02
Life origine silicic acid	Total silica	%	61.1	64	37.9
and total silica	Opal	%	31.6	30.1	18.6
Total calcium carbonate	CaCO3	%	20.3	15.6	51
Number of bacteria cell	Total cell	cells/Dg	2.50E+07	1.97E+07	1.35E+07
	SD		1.21E+07	6.34E+06	6.21E+06
Pail abusing test	Water contain	%	67.6	64.5	62.9
Soil physics test	Specific gravity	g/cm ³	2.19	2.3	2.5

Table 3 Results of Analysis

different chemically and physically from the general bottom clay collected simultaneously. Thus the organic-appearing material is not organic. Also the total number of bacteria is almost the same as that of ordinary bottom clay, and the possibility of anaerobic bacteria activity in the formation of organic-appearing material is considered to be low.

Supplement

The above organic-appearing material is different from material derived from minerals in that it has high water content and high elasticity. The possibility of organic carbon was denied, but the possibility of some type of biogenic origin still remains.

Typical biogenic material is opal, its origin is diatoms, radiolaria, bone fragments of sponges, and others. Sediments rich in the remains of the above are called siliceous ooze (siliceous clay).

The analytical results show that the opal content of samples 1 and 2 is clearly high compared to other constituents. The opal content of sample 3 is about 1/2 of that of samples 1 and 2. Thus the samples in question can be characterized by high opal content. This is not contradictory to the results of microscopy that samples 1 and 2 contain many remains of diatom consisting of genera Ethmodicus, Coscinodiscus, and Asteromophalus, while sample 3 contain few such fossils. From the above, it is clear that samples in question contain large percentage of opal, and that it is composed of the remains of diatom, particularly that of Ethmodiscus. The above results indicate that the samples investigated are ethmodiscus ooze.

Ethmodiscus ooze containing many genus Ethmodiscus (mainly Ethmodiscus rex) have been reported widely (Wieseman and Hendey, 1953; Mikkelsen, 1977; Tanimura, 1981). This sediment occur widely in equatorial deep seafloor, but the reason and process of sedimentation is not clear (Mikkelsen, 1977). It is interesting to note that Ethmodiscus rex is distributed widely at present in the Pacific ocean, but the its density is reported to be only one cell/2-50m3 (MC Hugh, 1954; Belyayeva, 1968). Such low density diatom remains becoming a main component at certain period is a "Ethmodiscus rex" problem which is still not solved.

[Appendix]

Table 1(1),(2) Summary of sampling results

Table 2(1)~(4) List of rock samples (MC11,MS13,MC12,and MC13 Area)

Table $3(1)\sim(6)$ Description of microscopic observation for rock thin section

Table 4 Results of FDC survey

Table 5(1),(2) Results of chemical analysis of cobalt-rich crust

Table 6 Sea-water sound velocity for MBES

Table 7Weather and sea-state data



Appendix Table 1(1) Summary of Sampling Results

	Tvne of rocks trock fragments	bottom cediments (LC)	Foreminiferel cand, bacett.	Batalt, itnestone, pumice.	Basait, limestone, pumice,	Basalt, conglomerate, pumice.		Bassit, congiomerate, pumice.	ictone.		Basalt, tuff, limestones.	Coral limestone, limestones	Coral limestone, limestones,	Tuff, calcaroous conglomerate.			tore.	Limestones, tuff, basalt I imestones, tuff, hesalt	Limectones, tuff, basalt	Limestones tuff. basett	Limestones. tuff, besalt	ral sand.	Mudstone, limestone, beselt, tuff,		bæsalt	berett.		Limectone. basatt, tuff.	Bacalt, foraminiferal limestone.		al sand.	Basalt, tuff, mucistone,	Límestone, basatt, tuff.	
			Foraminife	Bacett, lim	Baset, lim	Basalt, coi	Pumice.	Bacalt, col	Oeze, mudstone	Bacult, tuff.	Basalt, tuf	Coral lime:	Coral lime	Tuff, calca	Tuff. basek	Tuff.		Limestone Limestone	Limectone	Limestone	Limestone	Foreminiferal send	Mudstone,	Limestone	Mudstone, basalt	Mudstone, besaft	Tuff.	Limectone.	Basalt, for		Foraminiferal sand.	Beselt, tuff	Limestone.	
		Type of substrates nuclei		Basaft	Basalt			Basalt		Basalt	Limestones	Crust fragment	Limestones	Hyałoclastite		Tuff	Coral limestone. limestones.	Limestones, tuff. Tuff: baselt		Linestores.	Linestones.	Phosphorite	Mudstone	Phosphorite. limestones.	e e e e e e e e e e e e e e e e e e e	Not collected.	Calcareous conglomerato. basalt.	mudstone, bacatt. limestones.	Bacatt			Not collected.	Tuff, bacalt, chert.	
	Crust thickness (mm)	Âv.		7	\$		35	35		e	91	15	26	101	-	4	<u></u>	0 8		3	45	ŝ	2	32		15	20	ŝ	4			5	15	•
	ust thio! (mm)	Min			80		2	2		-	-	S.	-	-	~		•			-	12		-	0		<i>с</i> о	0	0	-			~	0	
		XaM		en L	55	<u> </u>	4	123	┣	12	150	55	20	190	8	2	\$	30		8	180	2	25	120		8	105	100	15			-		-
		(cm)	F						98 8													140								•	129			
	Amount of	seimpies (kg)		0.134	2.520		0. 560	2.910		0.015	128.060	15.200	7, 610	173.360	5. 790	8.170	25.080	0.470		1.520	231,400	0.047	5. 490	136.000		0.205	200.400	130.870	4 000			0, 003	72.400	
	- (COURT DAG		C고왕.	Orust, crust fragments.		Crust fragments.	Crust, crust fragments.		Nodules	Crust, cobble crust, nodule	Nodules	Crust, crust fragments, cobble crust	Cruct, cruct fragment, cobble crist rodisie	Crust fragment, nodule.	Crust. crust fragment.	Crust fragment, cobble crust	Crust crust fragment, Crust, crust fragment, nodule		Crust crust fragment	Crust crust fragment.	Nodules	Crust, cobble crust, nodule	Cobble crust, module.		Crust fragment.	Cruct, crust fragment, cobble crust.	Crust fragment, cobble crust, nodule.	Cobble crust.			Crust fragment.	Cobble crust, nodulo.	
	Topographic	division	Western summit periohery	Upper northern slope	Western summit peripheny	Upper couthern slope	Western summit periphery	Upper southern slope	Lower eastern stope	Middle SW slope	Upper SW slope	Northwest Derichery	Central summit	Lower NW slope	Middle NW slope		Central summit	Maddie VE stope Madde NE stope	Lover northern	Middle SE clope	Middle NW slope	Lower castern siope	Western summit periphery	Western central	Northern summit periphery	Upper NE slope	Southern summit periphery	SE Pointed summit	Upper SE slope	Northeast summit periphery	Southern summit periphery	Upper Northeast slope	Southern central summit	
	CTD-BR	Depth(m)	2, 389	2. 492	1, 981	2. 526	2, 246	2, 526	3, 773	1.961	1, 768	I	1, 269	2, 260	1,915	1		2, 053	2, 832	2, 017	1.970	3, 413	2, 133	1.684	2.034	2, 473	2.116	1, 849	2.354	2, 219	2, 131	2, 550	1.900	
	C10-81	Depth(m)	2. 422	2, 609	2, 110	2.822	2. 377	2.607	3. 788	2, 160	1, 903	1	1, 218	2.474	2, 159	1	1.106	2.256	2. 931	2, 309	2.269	3, 462	2.299	1, 750	2. 298	2. 798	2.347	2.043	2.499	2, 232	2. 141	2.974	1, 975	
ĺ	MBES	Depth (m)	2, 432	2. 656	2. 155	2.785	2:413	2. 679	3, 798	2, 158	1. 929	1. 424	1, 260	2, 518	2.213	1, 736	1.150	2.392	2.944	2, 308	2.326	3, 441	2.319	1. 795	2, 069	2. 796	2.363	2.042	2. 538	2. 247	2, 149	3, 020	2. 007	
			022' E	19, 084' E	221' E	16 243' E	20.028'E	21.311' E	20. 797' E	56.512'E		59.877'E	03, 094' E	49.630'E	971' E	099'E	шļ	06. 798' E	щ	+ +	w	ш	673' E	57.924'E	296' E	01. 135' E	605' E	120' E	04.231'E	ш	02.513′E	03. 166' E	979'E	
	ng site	Longhude	161° 15.	161° 19.	161° 20.	161° 16	161° 20.	161°.21.	146°20	1 1			146°03.	145°49	145°54.	145°59	146 04	146 06.	146°03.		145°52.		144°52.	144°57.	8	145°01.	145°06.	145°02.	145° 04.		145°02.	145°03.	144° 59.	
	Sampling: site		z	z	z	z	z	2	z	z	z	z	2	z	7	7	-		-	z	z	z	z	z	z	Z,	z	z	z	z	z	z	z	ł
		Latitude	7°29.996′	7° 32. 646′	7° 29. 774'	7°27.563′	7° 28, 580′	7° 29.487′	9°22 013'	9° 19.712'				9°21.478′	° 21, 740	9°21 483	20,004	9°21.102′1	3° 25.340	9°17.498')°21.966	0° 20.03		25.	10°26.797	10°27.181	0° 19.407	10° 18. 208	10° 15.301'	0° 22. 70		0°26.607′	0°24.305	
	<u> </u>		1001		· ·	<u> </u>	•		<u> </u>	98SMC12AD02 9					┝╌┥			98SMC12AD11 9		98SMC12AD13 9							KD06 10°				.c10 10°	o1 110	D12 10°	ł
	- 2	~ I	Ξ	11	۱ <u>۲</u> ۰	E	11	110	012	53	12 N	98SMC12AD04	98SMC12AD05	98SMC12AD06	98SMC12AD07	98SM012AD08	98SMC12AD09	1212	98SMC12AD12	MC12/	1012)	MC131	98SMC13AD02	98SMC13AD03	98SMC13AD04	98SMC13AD05	98SMC13AD06	98SMC13AD07	98SMC13AD08	10131	985MC13LC10	98SMC13AD11	98SMC13AD12	
			98SMC11LC01	98SMC11AD02	98SMC11AD03	98SMC11AD04	98SMC11:AD05	98SM	98SMC12LC01	98SM	1886	98S	98S	98 S	8	985	286	586 585	98 S	<u>98S</u>	98S	98S	98S	98S	985	985	98S	985	<u>98S</u>	98S	98S	98SN	98SH	

Appendix Table 1(2) Summary of Sampling Results

Standilic Edation Elite of D19-bit D10-bit D10	Structure Currents	Type of rocks rock fragments	bottom sediments (LC)										Tuff. Basalt. Limestone	Tuff, Basalt Limestone	Tuff. Basait. Limestone			umestone. Basalt	Calcereous clay (potorsand, nodule)	Basalt, tuff, limestone.	Basalt, pumice. Basalt, tuff breocia, limestone.		Calcarsous conglomerate, basalt, ourrise				Foraminiferal sand.	pumice.		
Sample eta. Sample eta. Metal OTD-361 CTD-361 Toronganity Metal Conditionant 1 Lundinge abs Lundinge abs Metal State Freeseratio Conditionant Metal Annual Conditionant Conditionant Conditionant Conditionant Annual Conditionant Colditionant Colditionant	Same by by Landard Developing Developin										0oze	Ooze	Tuff 8	1 1 1 1 1 1	T off B	Ooze	Ooze	L'nest	Calcare	Baselt	Beat	pumice.	Calcare	Basalt	Pumice	Pumice	Foramic	Basak		
Sampling constrained MBS GTD-B1 GTD-B3 GTD-B4	Same heta Lundand Description Description <thdescripion< th=""> <thdescripion< th=""> <thdes< td=""><td>Tvae of substrates nuclei.</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>÷</td><td></td><td></td><td>Bacalt</td><td>Basalt, phosphorita.</td><td></td><td>Basait calcaroous consiomanate</td><td>Basett</td><td>Calcareous constomerate, hasalt</td><td>Besett</td><td>Basalt, limestone.</td><td>Basat, phosphorita.</td><td></td><td></td></thdes<></thdescripion<></thdescripion<>	Tvae of substrates nuclei.															÷			Bacalt	Basalt, phosphorita.		Basait calcaroous consiomanate	Basett	Calcareous constomerate, hasalt	Besett	Basalt, limestone.	Basat, phosphorita.		
Sameling and amounts and services MER CT0-ET CT0-ER Trenographic division Amounts at Lumphode Amount at Lumphode Amount at Lumphode Amount at Lumphode Amount at Lumphode Amount at Lumphode <td>Samue beholds Learchands Sinth Link Sinth Sinth Sinth Link Sinth Link Sinth Sinth Sinth Sinth Link Sinth Sinth Sinth Link Sinth Sinth</td> <td>39903</td> <td></td> <td>1</td> <td>1</td> <td>۲.</td> <td>30</td> <td>32</td> <td>22</td> <td>1</td> <td>1</td> <td>I</td> <td>3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>01</td> <td></td> <td></td> <td></td> <td>1.1</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	Samue beholds Learchands Sinth Link Sinth Sinth Sinth Link Sinth Link Sinth Sinth Sinth Sinth Link Sinth Sinth Sinth Link Sinth	39903		1	1	۲.	30	32	22	1	1	I	3						01				1.1							
Sameling and amounts and services MER CT0-ET CT0-ER Trenographic division Amounts at Lumphode Amount at Lumphode Amount at Lumphode Amount at Lumphode Amount at Lumphode Amount at Lumphode <td>Summer he he Lungtune Lungtune Dearth(a) Lungtune Dearth(a) <thdearth(a)< th=""> <thdearth(a)< th=""> <thd< td=""><td>st tho (mn)</td><td></td><td>1</td><td>-</td><td></td><td>V.</td><td>30</td><td>÷</td><td>1</td><td>•</td><td>i</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td>L</td><td>-</td><td>-</td><td></td><td></td><td></td><td></td><td>10</td><td>\$</td><td>-</td><td></td><td></td></thd<></thdearth(a)<></thdearth(a)<></td>	Summer he he Lungtune Lungtune Dearth(a) Lungtune Dearth(a) Dearth(a) <thdearth(a)< th=""> <thdearth(a)< th=""> <thd< td=""><td>st tho (mn)</td><td></td><td>1</td><td>-</td><td></td><td>V.</td><td>30</td><td>÷</td><td>1</td><td>•</td><td>i</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td>L</td><td>-</td><td>-</td><td></td><td></td><td></td><td></td><td>10</td><td>\$</td><td>-</td><td></td><td></td></thd<></thdearth(a)<></thdearth(a)<>	st tho (mn)		1	-		V.	30	÷	1	•	i	1						L	-	-					10	\$	-		
Samoling etch MEES CTD-Bit Curdent Tropographic Tropographic Churat type Mmount of working 9 10.162 N 141" 33.500 3.256 Fear of SE Fear of SE 3.55 500 9 10.162 N 141" 33.500 3.256 1.500 bear mortherm working 9 0.0.457 N 141" 33.450 3.256 3.330 bear mortherm 56. 3.55 500 9 0.0.607 N 141" 3.53 3.256 3.335 bear mortherm 56. 0.1300 9 0.0.607 N 141" 3.335 1.481 1.482 3.353 bear mortherm 56. 0.1300 9 0.0.607 N 141" 3.333 bear mortherm 56. 0.045 0.1300 9 0.0.607 N 141" 3.333 bear mortherm 56. 0.445 0.1300 9 0.1.607 N	Same hol Luttude <		Ž	1 . 	1	۲ ۷	2 0	35	25	1	+	1	υ					-	15	8	\$		ŝ	18	8	8	8	8		
Samoling scha MBES CTD-BT CTD-BT Topographic Outst type 9' 10, 152' N 141' 37, 456' E 1, 364 0esth (a) 0esh (a) 0esth 0esth (a) 0esth <td>Same hol. Lathuae Lathua <</td> <td>LC core</td> <td>(E)</td> <td>215</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>23</td> <td>328</td> <td>95</td> <td></td> <td></td> <td></td> <td>262</td> <td>262</td> <td></td> <td>215</td> <td></td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>6</td> <td>0</td> <td></td>	Same hol. Lathuae Lathua <	LC core	(E)	215						23	328	95				262	262		215		-							6	0	
Sampling stan MEIS CTD-BT CTD-BT Topographic Outst types 1_untrude Longtoute Over think Over think <td< td=""><td>Same hol. Lathuae Lathua <</td><td>mount of</td><td>(Fe)</td><td>35, 600</td><td></td><td>81. 200</td><td>58.700</td><td>0, 190.</td><td>1 080</td><td>1. 900</td><td></td><td></td><td>0. 029</td><td></td><td></td><td></td><td></td><td></td><td>0.24</td><td>0.26</td><td>220.99</td><td></td><td>145.58</td><td>46.96</td><td>161.92</td><td>11.20</td><td>37.85</td><td>1.73</td><td></td><td></td></td<>	Same hol. Lathuae Lathua <	mount of	(Fe)	35, 600		81. 200	58.700	0, 190.	1 080	1. 900			0. 029						0.24	0.26	220.99		145.58	46.96	161.92	11.20	37.85	1.73		
Sameling scia MBES CID-BI CID-BI Lutitude Longitude Deeth (m) Deeth (m) Deeth (m) 9° 08.457' N 141° 37.456' E 1.953 1.370 9° 08.457' N 141° 37.456' E 1.956 1.370 9° 08.457' N 141° 37.456' E 1.956 1.370 9° 01.162' N 141° 37.456' E 1.956 1.370 9° 01.162' N 141° 37.456' E 1.633 1.370 9° 10.162' N 141° 37.456' E 1.256 3.320 9° 10.162' N 141° 3.3321' E 1.486 1.482 9° 10.403' N 141° 3.3496' E 3.564' G 3.533 9° 10.444' N 141° 3.456' E 3.564' G 3.533 9° 14.153' N 141° 3.3496' E 3.564' G 3.533 9° 14.153' N 141° 3.3496' E 3.564' G 3.569' G </td <td>Samele No. Lustitude Lustitude Lustitude Lustitude Lustitude Lustitude Depth (m) <thdepth (m)<="" th=""> <thdepth (m)<="" th=""> <th< td=""><td></td><td></td><td></td><td></td><td>Stain</td><td>Crust</td><td>Crust</td><td>Crust</td><td></td><td></td><td></td><td>Nodule.</td><td></td><td></td><td></td><td></td><td></td><td>Nodule</td><td>Cruet, nodule.</td><td>Crust, cobble crust, nodule.</td><td></td><td>Crust, nodule.</td><td>Crust, cobbie crust, nodule.</td><td>Crust, cobble crust, rodule.</td><td>Crust cobble crust.</td><td>Crust, cobble crust, nodule.</td><td>Crust fragment, nodule,</td><td></td><td></td></th<></thdepth></thdepth></td>	Samele No. Lustitude Lustitude Lustitude Lustitude Lustitude Lustitude Depth (m) Depth (m) <thdepth (m)<="" th=""> <thdepth (m)<="" th=""> <th< td=""><td></td><td></td><td></td><td></td><td>Stain</td><td>Crust</td><td>Crust</td><td>Crust</td><td></td><td></td><td></td><td>Nodule.</td><td></td><td></td><td></td><td></td><td></td><td>Nodule</td><td>Cruet, nodule.</td><td>Crust, cobble crust, nodule.</td><td></td><td>Crust, nodule.</td><td>Crust, cobbie crust, nodule.</td><td>Crust, cobble crust, rodule.</td><td>Crust cobble crust.</td><td>Crust, cobble crust, nodule.</td><td>Crust fragment, nodule,</td><td></td><td></td></th<></thdepth></thdepth>					Stain	Crust	Crust	Crust				Nodule.						Nodule	Cruet, nodule.	Crust, cobble crust, nodule.		Crust, nodule.	Crust, cobbie crust, nodule.	Crust, cobble crust, rodule.	Crust cobble crust.	Crust, cobble crust, nodule.	Crust fragment, nodule,		
Sameling sta MBES CID-BT Lentitude Longetude Deerth (m) Deerth (m) 14, 967 N 141° 37, 456' E 1, 954 1, 933 9° 08, 457' N 141° 37, 456' E 1, 953 3, 355 9° 10, 162' N 141° 37, 456' E 1, 953 3, 355 9° 10, 162' N 141° 33, 325' E 3, 255 3, 335 8° 58, 516' N 141° 33, 321' E 1, 485 1, 588 8° 58, 516' N 141° 33, 321' E 1, 486 1, 482 9° 10, 403' N 141° 33, 321' E 1, 486 1, 482 9° 10, 403' N 141° 33, 321' E 1, 486 1, 482 9° 10, 444' N 141° 33, 3321' E 1, 486 1, 482 9° 10, 444' N 141° 33, 3321' E 1, 486 1, 482 9° 14, 141° 33, 333 364' E 3, 564 3, 505 9° 14, 141° 33, 333 375' E 3, 496' E 3, 564 9° 14, 141°	Samele No. Laritude Lonatiude Deeth (m) Deeth (m) 975M002L001 9° 14, 967 / N 141° 37, 456 ′ E 1, 954 1,933 975M002L001 9° 10, 162 / N 141° 37, 456 ′ E 1, 957 1,933 975M002L002 9° 10, 162 / N 141° 33, 32, 235 ′ E 1, 487 1,558 975M002L005 8° 58, 516 / N 141° 33, 344 ′ E 1, 487 1,558 975M002L006 8° 58, 516 / N 141° 33, 3745 ′ E 1, 487 1,558 975M002L007 9° 07, 601 ′ N 141° 33, 374 ′ E 1, 421 1,632 975M002L007 9° 07, 601 ′ N 141° 33, 374 ′ E 1, 421 1,632 975M002L007 9° 07, 601 ′ N 141° 33, 375 ′ E 1,421 1,422 955M002L001 9° 10, 403 ′ N 141° 33, 345 ′ E 3,540 3,540 955M002L010 9° 10, 403 ′ N 141° 33, 350 ′ E 3,540 3,540 955M002L010 9° 10, 403 ′ N 141° 33, 327 ′ E 3,540 3,540 955M002L010 9° 10, 403 ′ N 141° 33, 3,277 ′ E	Topographic	division	(5	Upper northern slope	Lower northern slope	Pinnaole on SE	Pinnacle on SE	Pinnecle on SE summit	Northern summit periphery	Northern debression	Northern depression	Lower northern slope	Lower northern slope	Northern depression	Lower northern slope	Northern	Middle northern slope	Lower western slope	Western summit.	Western summit	upper mescern slope	Western summit	Western summit	Southwest summit	Southwest summit	Central summit	Eastern summit	Western summit	
Sameling sta MBES CID-BT Lentitude Longetude Deerth (m) Deerth (m) 14, 967 N 141° 37, 456' E 1, 954 1, 933 9° 08, 457' N 141° 37, 456' E 1, 953 3, 355 9° 10, 162' N 141° 37, 456' E 1, 953 3, 355 9° 10, 162' N 141° 33, 325' E 3, 255 3, 335 8° 58, 516' N 141° 33, 321' E 1, 485 1, 588 8° 58, 516' N 141° 33, 321' E 1, 486 1, 482 9° 10, 403' N 141° 33, 321' E 1, 486 1, 482 9° 10, 403' N 141° 33, 321' E 1, 486 1, 482 9° 10, 444' N 141° 33, 3321' E 1, 486 1, 482 9° 10, 444' N 141° 33, 3321' E 1, 486 1, 482 9° 14, 141° 33, 333 364' E 3, 564 3, 505 9° 14, 141° 33, 333 375' E 3, 496' E 3, 564 9° 14, 141°	Samele No. Laritude Lonatiude Deeth (m) Deeth (m) 975M002L001 9° 14, 967 / N 141° 37, 456 ′ E 1, 954 1,933 975M002L001 9° 10, 162 / N 141° 37, 456 ′ E 1, 957 1,933 975M002L002 9° 10, 162 / N 141° 33, 32, 235 ′ E 1, 487 1,558 975M002L005 8° 58, 516 / N 141° 33, 344 ′ E 1, 487 1,558 975M002L006 8° 58, 516 / N 141° 33, 3745 ′ E 1, 487 1,558 975M002L007 9° 07, 601 ′ N 141° 33, 374 ′ E 1, 421 1,632 975M002L007 9° 07, 601 ′ N 141° 33, 374 ′ E 1, 421 1,632 975M002L007 9° 07, 601 ′ N 141° 33, 375 ′ E 1,421 1,422 955M002L001 9° 10, 403 ′ N 141° 33, 345 ′ E 3,540 3,540 955M002L010 9° 10, 403 ′ N 141° 33, 350 ′ E 3,540 3,540 955M002L010 9° 10, 403 ′ N 141° 33, 327 ′ E 3,540 3,540 955M002L010 9° 10, 403 ′ N 141° 33, 3,277 ′ E	CTD-BR	Depth(m)	. *	1,370	3,320	1 268				3,533	3.489	3,278	3.220	3,487	3.258	3.500	2,801	4.021	1.799	220	7.000		2.082	2.120	1 927	1.816	2.211	2077	
Sameling site Lutitude Lowkiude 9° 14, 967' N 141° 37, 456' E 9° 08, 457' N 141° 37, 456' E 9° 10, 162' N 141° 37, 456' E 8° 58, 259' N 141° 32, 225' E 8° 58, 516' N 141° 33, 923' E 8° 58, 516' N 141° 33, 423' E 9° 10, 403' N 141° 33, 423' E 9° 10, 403' N 141° 33, 423' E 9° 10, 403' N 141° 33, 425' E 9° 11, 444' N 141° 33, 425' E 9° 14, 158' N 141° 33, 425' E 9° 14, 158' N 141° 33, 425' E 9° 14, 313' N 141° 33, 405' E 9° 14, 313' N 141° 33, 405' E 9° 14, 313' N 141° 33, 405' E 9° 15, 75' N 141° 33, 405' E 9° 15, 70' N 160° 35, 903' E 8° 15, 237' N 160° 33, 830' E 8° 10, 239' N 160° 33, 830' E 8° 10, 239' N 160° 33, 830' E 8° 10, 239' N 160° 33, 839' E 8° 10, 239' N 160° 30, 303' E 8° 10, 239' N 160° 30, 839' E 8° 10, 239' N 160° 30, 230' E	Samele No. Lutitude Lonatrude 975MC02LC01 9° 14, 957' N 141° 35, 009' E 975MC02LC01 9° 10, 182' N 141° 32, 345' E 975MC02L002 9° 08, 457' N 141° 33, 456' E 975MC02L003 9° 10, 182' N 141° 33, 345' E 975MC02L004 8° 58, 505' N 141° 33, 321' E 975MC02L007 9° 07, 601' N 141° 33, 321' E 975MC02L007 9° 13, 974' N 141° 31, 942' E 975MC02L007 9° 14, 158' N 141° 31, 052' E 975MC02L007 9° 10, 403' N 141° 31, 052' E 955MC02L007 9° 10, 403' N 141° 31, 052' E 955MC02L010 9° 10, 403' N 141° 31, 052' E 955MC02L01 9° 10, 403' N 141° 31, 052' E 955MC02L01 9° 11, 153' N 141° 33, 23' 20' E 955MC02L01 9° 11, 155' N 141° 33, 23' 20' E 955MC02L01 9° 11, 157' N 141° 33, 23' 20' E 955MC02L01 9° 13, 757' N 141° 33, 23' 20' E 955MC02L01 9° 13, 757' N 141° 33, 23' 20' E 955MC02L01	cTD-BT	lepth (m)	3.256	1,933	3.335	1.558	1.636	1.482	1.412	3,540	3.505	3,311	3.248	3,494	3.266	3.513	3.175	4,029	1.912	2.527	1067		2,289	2,469	2.054	1.837	2333	2.082	
Sameling site Lutitude Lowkiude 9° 14, 967' N 141° 37, 456' E 9° 08, 457' N 141° 37, 456' E 9° 10, 162' N 141° 37, 456' E 8° 58, 259' N 141° 32, 225' E 8° 58, 516' N 141° 33, 923' E 8° 58, 516' N 141° 33, 423' E 9° 10, 403' N 141° 33, 423' E 9° 10, 403' N 141° 33, 423' E 9° 10, 403' N 141° 33, 425' E 9° 11, 444' N 141° 33, 425' E 9° 14, 158' N 141° 33, 425' E 9° 14, 158' N 141° 33, 425' E 9° 14, 313' N 141° 33, 405' E 9° 14, 313' N 141° 33, 405' E 9° 14, 313' N 141° 33, 405' E 9° 15, 75' N 141° 33, 405' E 9° 15, 70' N 160° 35, 903' E 8° 15, 237' N 160° 33, 830' E 8° 10, 239' N 160° 33, 830' E 8° 10, 239' N 160° 33, 830' E 8° 10, 239' N 160° 33, 839' E 8° 10, 239' N 160° 30, 303' E 8° 10, 239' N 160° 30, 839' E 8° 10, 239' N 160° 30, 230' E	Samele No. Lutitude Lonatrude 975MC02LC01 9° 14, 957' N 141° 35, 009' E 975MC02LC01 9° 10, 182' N 141° 32, 345' E 975MC02L002 9° 08, 457' N 141° 33, 456' E 975MC02L003 9° 10, 182' N 141° 33, 345' E 975MC02L004 8° 58, 505' N 141° 33, 321' E 975MC02L007 9° 07, 601' N 141° 33, 321' E 975MC02L007 9° 13, 974' N 141° 31, 942' E 975MC02L007 9° 14, 158' N 141° 31, 052' E 975MC02L007 9° 10, 403' N 141° 31, 052' E 955MC02L007 9° 10, 403' N 141° 31, 052' E 955MC02L010 9° 10, 403' N 141° 31, 052' E 955MC02L01 9° 10, 403' N 141° 31, 052' E 955MC02L01 9° 11, 153' N 141° 33, 23' 20' E 955MC02L01 9° 11, 155' N 141° 33, 23' 20' E 955MC02L01 9° 11, 157' N 141° 33, 23' 20' E 955MC02L01 9° 13, 757' N 141° 33, 23' 20' E 955MC02L01 9° 13, 757' N 141° 33, 23' 20' E 955MC02L01	BES	th (m)	306	954	255	481	631	486	421	558	554	347	280	547	280	562	159	990	927	524	20	833	- Nor	513	110	861	88	2.079	
Sameling site Leftude Londeude Leftude Leftude 9° 08, 457 N 141° 31, 456' 9° 08, 457 N 141° 31, 456' 9° 10, 162 N 141° 32, 235' 9° 10, 162 N 141° 33, 346' 8° 58, 509 N 141° 33, 344' 8° 58, 516 N 141° 33, 321' 8° 53, 516 N 141° 33, 321' 9° 10, 444 N 141° 33, 230' 9° 10, 444 N 141° 33, 230' 9° 10, 420' N 141° 33, 230' 9° 10, 420' N 141° 33, 230' 9° 11, 153' N 141° 33, 230' 9° 13, 757' N 141° 33, 230' 9° 13, 757' N 141° 33, 230' 9° 13, 757' N 160° 31, 594' 8° 15, 237' N 160° 31, 592' 8° 14, 600' N 141° 33, 230' 9° 13, 757' N 160° 31, 592' 8° 14, 600' N 160° 31, 592' <	Samela No. Latitude Londitude 975MC02L001 9° 14, 967 / N 141° 37, 456' 975MC02L001 9° 14, 967 / N 141° 37, 456' 975MC02L002 9° 08, 457 / N 141° 37, 456' 975MC02L003 9° 10, 162 / N 141° 33, 7456' 975MC02L005 8° 58, 209 / N 141° 33, 33, 274' 975MC02L005 8° 58, 500 / N 141° 33, 33, 221' 975MC02L005 8° 58, 500 / N 141° 33, 33, 221' 975MC02L005 8° 58, 500 / N 141° 33, 33, 221' 975MC02L005 9° 10, 403 / N 141° 33, 33, 201' 955MC02L006 8° 14, 158' N 141° 33, 33, 201' 955MC02L010 9° 10, 403 / N 141° 33, 33, 201' 955MC02L011 9° 10, 403 / N 141° 33, 33, 231' 955MC02L011 9° 10, 403 / N 141° 33, 33, 230' 955MC02L013 9° 10, 403 / N 141° 33, 233, 240' 955MC02L014 9° 13, 757' N 141° 33, 234' 955MC02L014 9° 13, 510' N 141° 33, 234' 955MC02L014 9° 13, 510' N 141° 33, 246' <t< td=""><td>3</td><td>8</td><td>[</td><td></td><td></td><td></td><td></td><td>1 .</td><td>,</td><td>ы Ш</td><td></td><td>1</td><td></td><td></td><td>1</td><td></td><td></td><td>E</td><td></td><td></td><td></td><td>ł.</td><td></td><td></td><td>1</td><td></td><td>in h</td><td>÷</td><td></td></t<>	3	8	[1 .	,	ы Ш		1			1			E				ł.			1		in h	÷	
	Sample No. 975MC02LC01 975MC02LC01 975MC02CB04 975MC02CB04 975MC02LC05 975MC02LC05 975MC02LC07 975MC02LC07 975MC02LC07 975MC02LC07 975MC02LC07 975MC02LC07 975MC02LC07 965MC02LC11 965MC02LC11 965MC02LC13 965MC02LC11 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AL011	ng site	Longitude	141° 35, 009′	141°							141° 33.496′	141°	141°	8		141° 32.402′			100°	8	8	160° 33.630′	160°	8	160° 31 617'	160° 34 599'	160° 36. 793′	160° 33 343°	
	Sample No. 975MC02LC01 975MC02LC01 975MC02CB04 975MC02CB04 975MC02LC05 975MC02LC05 975MC02LC07 975MC02LC07 975MC02LC07 975MC02LC07 975MC02LC07 975MC02LC07 975MC02LC07 965MC02LC11 965MC02LC11 965MC02LC13 965MC02LC11 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965MC02LC13 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AD03 965M513AL011	Sampli	Letitude	14, 967'	08, 457	10. 162'	58, 209'	58.602'	58.516′	07.601	13, 974'	14, 158′	10, 403	Z	14, 313'	10.827′	13, 757'	09, 790	18, 070'	8° 19.567' N	8° 18 503' N	N 162.61 B	8° 11.657' N	8° 09 509' N	8°05,486 N	8° 03 827' N	8° 11, 470' N	8° 10, 239′ N	8° 11 959' N	
	ゆうののの の の の の 10 10 10 10 10 10 10 10 10 10 10 10 10		No.	ISMC02LC01	7SMC02AD02	7SMC02CB03	7SMC02CB04	7SMC02LC05	7SMC02LC06	7SMC02LC07	SSMC02LC08	ASMC02LC09	BSMC02AD10	BSMC02AD11	BSMC02AD12	BSMC02LC13	18SMC021.C14	BSMC02CB15	BSMS13LC01	8SMS13AD02	6SMS13AD03	BSMS13AD04	BSMS13AD05	REMETRADOR	ISMS13AD07		+		1.	



Appendix Table 2 (1) Rock Samples from MC11 Area

On bettom Off bettom 2.065 1.866 Reatt Weathered brown 2.005 1.866 Reatt Course grained Promo 2.005 1.866 Reatt Course grained Promo 2.005 1.866 Reatt Course grained Promo 2.005 1.866 Foraminiferal limeatone Pakito 2.532 2.511 Beakt Course grained porous Vaciolar Phenocry 2.552 2.511 Beakt Corran grained porous Vaciolar Phenocry 2.552 2.511 Beakt Corran grained porous Vaciolar Matrix Pakito, fragia 2.544 2.477 Beakt For grained compact but porous Proceus Proceus Proceus 2.511 Beakt For grained compact but porous Proceus Pro	Oncert eubertrate. On bettom Off bottom 30 Churet eubertrate. 2.095 1.806 Baait 31 Rocks 2.095 1.806 Baait 32 Rocks 2.095 1.806 Beait 33 Rocks 2.095 1.806 Forminiferal limestone 33 Rocks 2.392 2.511 Beakt 34 Rocks 2.592 2.511 Beakt 35 Rocks 2.592 2.511 Beakt 36 Rocks 2.592 2.511 Beakt 37 Rocks 2.593 2.511 Beakt 36 Rocks 2.594 2.417 Beakt 37 Rocks 2.503 2.511 Beakt 38 Rocks 2.503 2.511 Beakt 38 Rocks 2.503 2.511 Beakt	Sample	Reck type	÷.	pth (m)	Substrate		Description
2 1366 Baselt 2.035 1.866 Reast 2.035 1.806 Reast 2.035 1.806 Reast 2.532 2.511 Baselt 2.532 2.511 Baselt 2.532 2.511 Baselt 2.534 2.511 Baselt 2.534 2.517 Baselt 2.534 2.517 Baselt 2.534 2.417 Baselt 2.534 2.417 Baselt 2.503 2.511 Baselt 2.504 2.417 Baselt 2.501 2.511 Baselt	a 2085 1.868 Baselt 2.035 1.866 Baselt 2.035 1.866 Baselt 2.035 1.866 Baselt 2.532 2.511 Baselt 2.534 2.477 Baselt 2.534 2.417 Baselt 2.531 Baselt Baselt 2.531 Baselt Baselt 2.307 2.511 Calcarous conformerate	number		On bottom	Off bottom			
03 Recier 2.085 1.966 Staalt 03 Recier 2.033 1.966 Forantificral lineatore 03 Checks 2.333 1.966 Forantificral lineatore 04 Recier 2.592 2.511 Baakt 06 Recier 2.592 2.511 Baakt 08 Recier 2.532 2.511 Baakt 08 Routie subbranke 2.532 2.511 Baakt 02 Coust subbranke 2.532 2.471 Baakt 03 Rocke 2.594 2.477 Baakt 04 Rocke 2.594 2.477 Baakt 04 Rocke 2.594 2.477 Baakt	03 Recie 2.085 1.866 Staalt 03 Rouka 2.033 1.866 Foraminiferal lineatone 03 Rouka 2.592 2.511 Baaitt 03 Rouka 2.592 2.511 Baaitt 03 Rouka 2.592 2.511 Baaitt 03 Rouka 2.532 2.511 Baaitt 03 Rouka 2.532 2.511 Baaitt 04 Rouka 2.554 2.477 Baaitt 04 Rouka 2.554 2.511 Calareous confidmentia 04 Rouka 2.307 2.511 Baaitt	08 AD 03	Crust substrate.	2.095	1,966	Basalt	M ·	leathered brown
03 Rocke 2.085 1.806 Forminieral limestone 09 Route substrate 2.592 2.511 Baakt 08 Roote 2.592 2.511 Baakt 08 Roote 2.592 2.511 Baakt 09 Roote 2.592 2.511 Baakt 09 Roote 2.594 2.477 Baakt 02 Creat substrate 2.594 2.477 Baakt 03 Roote 2.594 2.477 Baakt 04 Roote 2.594 2.477 Baakt 04 Roote 2.594 2.477 Baakt	03 Recke 2.085 1.866 Formririeral limestone 08 Crust substrate. 2.592 2.511 Baakt 08 Rocke 2.592 2.511 Baakt 08 Rocke 2.592 2.511 Baakt 08 Rocke 2.592 2.511 Baakt 02 Crust substrate. 2.594 2.477 Baskt 02 Rocke 2.594 2.477 Baskt 04 Rocke 2.594 2.477 Baskt 04 Rocke 2.594 2.477 Baskt 04 Rocke 2.594 2.511 Baskt	AD 03	Rocks	2,095	1,966	Basalt	0	oarea grainad. Pyroxene phenocryste.
08 Create substrate. 2.582 2.511 Basekt 08 Rocks 2.582 2.511 Basekt 08 Rocks 2.582 2.511 Basekt 02 Crust substrate. 2.582 2.511 Basekt 02 Crust substrate. 2.554 2.477 Basekt 02 Rocks 2.594 2.477 Basekt 03 Rocks 2.594 2.477 Basekt 04 Rocks 2.591 2.511 Basekt	08 Count substrate. 2.582 2.511 Basekt 08 Rooke 2.592 2.511 Basekt 08 Rooke 2.592 2.511 Basekt 02 Crust substrate. 2.592 2.511 Basekt 02 Crust substrate. 2.594 2.477 Basekt 02 Rooke 2.594 2.477 Basekt 04 Rooke 2.807 2.511 Basekt 04 Rooke 2.807 2.511 Calcinsous congomerate	AD 03	Rocks	2.095	1,906	Foraminiferal limestone	e I	eitic. compact. fragile.
08 Recke 2.582 2.511 Basit 08 Roois 2.582 2.511 Claraneus congiomentia 02 Crust substrate. 2.534 2.477 Baseit 02 Rooks 2.534 2.477 Baseit 04 Rooks 2.397 2.511 Baseit 04 Rooks 2.807 2.511 Baseit 04 Rooks 2.807 2.511 Baseit	06 Recke 2.552 2.511 Baakt 02 Crust substrate. 2.392 2.511 Calareous confidmentate 02 Crust substrate. 2.594 2.477 Baakt 02 Rocke 2.594 2.477 Baakt 04 Rocke 2.507 2.511 Calareous confidmentate 04 Rocke 2.807 2.511 Calareous confidmentate	AD 08	Crust substrate.	2.592		Beealt		ne grained poroue. Acicular plagoclase prenocryste notable.
06 Reoke 2.532 2.311 Calicareous confiomenate 22 Crust substrate. 2.594 2.477 Baselt 20 Rooke 2.594 2.477 Baselt 04 Rooke 2.507 2.511 Carlos recours confiomenate 04 Rooke 2.507 2.511 Carlos recours confiomenate 04 Rooke 2.507 2.511 Carlos recours confiomenate	06 Rooke 2.532 2.311 Caleareous confidements 22 Crust substrate. 2.594 2.477 Basit: 04 Rooks 2.807 2.417 Basit: 04 Rooks 2.807 2.511 Calcareous confidements			2,592	2,511	Baesht	đ	hyno, fine grained, porous. Vesicles filled by opal, zeolite.
O2 Crust subierrate 2.554 2.477 Baselt 02 Rooke 2.304 2.477 Baselt 03 Rooke 2.303 2.471 Baselt 04 Rooke 2.307 2.511 Baselt 04 Rooke 2.307 2.511 Baselt	02 Crust substrate 2.554 2.477 Baselt 02 Rooke 2.594 2.477 Baselt 04 Rooke 2.807 2.511 Baselt 04 Rooke 2.807 2.511 Baselt	AD 06	Rooks	2.592	2.511	Caloareous conglomerate	Ċ	ontain authangular basait pabbisa. Matrix pejitic, fragje.
02 Rocke 2.594 2.477 Baselt 04 Rocke 2.807 2.511 Baselt 04 Rocke 2.807 2.511 Calcarsous congiomerate	02 Rooke 2.354 2.477 Baselt 04 Rooke 2.307 2.511 Baselt 04 Rooke 2.307 2.511 Baselt	AD 02		2,594	2,477	Baealt	E	rie grained, compact but porcus. Pyroxene, plagoclase phenocrysts.
2.511 Basalt 2.511 Calcareous considemenate	2.511 Basait 2.511 Calcareous conglomerate		Rooke	2,594	2,477	Basait		he grained compact but porcial Pyroxene, planoclase phenocryste.
2.511 Calcarsous conglomerate	2.511 Caloareous conglomerate	AD 04	Rocke	2,807		Basalt	ij,	ne grained compact, phyric.
		AD 04	Rocks	2,807		Calcarsous conglomerate	C	ontain axbangular basaht pebbles. Marinx phosphatized.

Appendix Table 2 (2) Rock Samples from MC12 Area

number		On bottom	Off bottom		
AD OI	98 AD 09 Congroweratic orner substrate	1.091	1.068	Reafal limestone	Crust cement coarse, soft limestone pebbles containing biologic fragments.
AD 0	AD 09 Rooks	1,091	1,068	Reefal limestone	Coral structure, coarse, soft.
4D 05	05 Crust substrate	1,203	1,254	Restal limestone	Corat structure, remeants, Contain nummulites,
AD O	AD 05 Rocks	1,203	1,254	Reefal limestone	Coral structure, remeants, Contain nummulites, gastropods,
AD 04	04 Rocks	1:424	1,372	Restal fimestone	Coral structure, remeants confirmed.
· .	04 Rocks	1.424	272.1	Foraminiferal limestone	Coarse grained fragile.
4D 08	08 Crust substrate	1,736	1.543	Tuff	Puniceous tuff. Coarse. soft, strongly altered
	08 Rocks	1.736	1,543	Tuff	Pumiceous tuff. Coarse, soft, strongly altered.
AD 03	03 Congromeratic crust substrate	1,888	1,753	Restal limestone	<u>Crust-coated baselt, contain rounded tuif pebbles. Biologic fragments mixed</u>
AD 07	07 [Reoks	2.144	1,900	Easait	Rock fragments. Porous.
AD 07	07 Rocks	2,144	006'1	Tuff	Subrounded pebbles. Strongly weathered, fragile.
AD 02	02 Nodule nuclaus.	2,145	846.1	Basalt	Aphyrio. vitreoue.
AD 02	02 Rocks	2,145	846.1	Basalt	Aphyric, vitreous
AD 02	02 Rocks	2,145	1,946	Tuff	Mainty purnice.
	11 Nodule nucleus,	2,241	2,263	Basalt	Aphyrie, poroue.
AD 1	11 Rocks	2.241	2,263	Basalt	Aphyric, porous.
AD 11	t Rocks	2.241	2,263	Tuff breecia	Contain pumice and small basalt fragments. Coarse, soft
AD 11	1 Rocks	2,241	2.263	Restal limestone	Coartes grained contain biologic fragments, but well consolidated hard.
AD. 14	14 Crust substrate	2.274	1,955	Calcarsous congiomerate	Contain angular basalt pabbles. Matrix mereky cementing rock fragments.
	14 Rocks	2,274	-556'1	Easait	Rock fragments. Phynic, poroue.
AD 14	14 Rooks	2.274	1,955	Basait	Rock fragments. Aphynio, vitreous, Parts hyslociastized
AD 14	14 Rocks	2.274	1,955	Tuff	Porous. Contain purnice.
AD 14	14 Rocks	2.274	556.1	Calcarsous conglomerate	Small angular and subrounded basaft pebbles. Matrix not phosphatized, but hard
AD 13	13 Crust substrate	2,294	2.002	Reefal limestone	Coral structure confirmed.
AD 13	13 Rock	2.294	2.002	Basat	Rock fragments, aphyric, porous
AD 13	13 Rock	2.294	2,002	נונוד	Rock fragments, coarse grained, strongly altered, soft.
AD 13	13 Rock	2,294	2.002	Reefal limestons	Contain biologic fragments, porous, But hard
AD 13	13 Rock	2.294	2.002	Foraminiferal kinestone	Pelibia. contain biologic fragments, soft
AD 10	10 Rock	2.296	2.047	Basalt	Aphyric, vitreous, Surface weathered, but innerside fresh.
	10 Rock	2,296	2.047	Tuff	Contain pumice. Coarse, soft Weathered, fragile.
AD 10	10 Rock	2,296	2.047	Reefal limestone	White, coarse, soft
AD 10	10 Rock	2,296	2.047	Foraminiferal limestone	Coarse grained, porture, but phosphatted and hard.
	06 Crust substrate	2.459	2,245	Phyaloclastite	Consist of aphyric, vitreous small baselt fragments.
	06 Rock	2.459	2,245	Calcareous conglomerate	Contain angular basait pebbles. Matrix phosphabized,
AD 05	05 Congromeratic cruct substrate	2,459	2.245	Mudstone	Solidified ocze, nodules attached.
AD 06	06 Nodule nucleus.	2.459	2.245	Mudstone	Solidified ooze.
	06 Nodule nucleus.	2,459	2.245	Hyaloclastite	Consist of aphyric, vitreous small basalt fragments.
AD 12	12 Rock	2,916	2,817	Basat	Mixture of aphyric porcus rocks and vitreous rocks.
	12 Rock	2,916	2.817	Tuff	Rock fragments. Coarse, fragile.
AD 12	12 Rock	2.516	2.817	Reefal limestone	Rock fragments. Coral structure confirmed.
		3 748		Mudstone	Coldified house and surface

Appendix Table 2 (3-1) Rock Samples from MC13 Area

Multicity Control Contro Control Control <		HOCK TYPE		Off bottem		
(1) Congrements: onust substrate 1/35 1/85 1/64 (2) Congrements: onust substrate 1/35 1/86 Formatificatificatification (3) Congrements: onust substrate 1/35 1/86 Formatificatificatification (3) Congrements: onust substrate 1/33 1/86 Formatificatificatificatificatification (3) Congrements: onust substrate 1/33 1/86 Formatificatifi						
03 Congrommetic cunst allofierate 1355 1688 Frommifical Immetical 03 Congrommetic cunst allofierate 1355 1688 Frommifical Immetical 03 Nodulis muclius. 1333 1885 Foramifical Immetical 12 Congrommetic cunst allofierate 1333 1885 Foramifical Immetical 12 Congrommetic cunst allofierate 1860 1885 Construction 12 Congrommetic cunst allofierate 1860 1885 Construction 13 Congrommetic cunst allofierate 1860 1885 Construction 14 Congrommetic cunst allofierate 1860 1885 Construction 15 Congrommetic cunst allofierate 1860 1885 Construction 16 Congrommetic cunst allofierate 1860 1885 Construction 17 Congrommetic cunst allofierate 1860 1885 Construction 18 Bould 1885 Construction 1885 Construction 19 Rock 1885 Construction 1885 Construction 11 Rock 1885 Foramitical Immetication 1860 1885 Construction 10 Rock 2160 1885 </td <td></td> <td>Congromeratic crust substrate</td> <td>1,735</td> <td>1.669</td> <td></td> <td>Micrite. White, hard bedded. Contain micronodules.</td>		Congromeratic crust substrate	1,735	1.669		Micrite. White, hard bedded. Contain micronodules.
Congrommeratic ortet substrates 1735 1689 Phosphoticia Media mucleus 1735 1689 Phosphoticia Media mucleus 1735 1689 Phosphoticia Media mucleus 1735 1689 Phosphoticia Rout 1735 1680 Phosphoticia Rout 1735 1680 Phosphoticia Congromentic courts substrates 1960 1885 Media mucleus Congromentic courts substrates 1960 1885 Chent Congromentic courts substrates 1960 1885 Chent Congromentic courts substrates 1960 1885 Chent Congromentic courts abstrates 1960 1885 Chent Congromentic courts abstrates 1960 1885 Chent Congromentic courts abstrates 1980 1885 Chent Congromentic courts abstrates 1980 1885 Chent Modula mucleus 1980 1885 Baukt Economicleus Modula 1980 1885	1	Congromeratio crust substrate	1.735	1,669	Foraminiferal limestone	Contain micronodules. Cracks developed, phosphatized along cracks.
Kocklin machesis 1735 1689 Muschenistis Kocklin machesis 1733 1689 Muschenistis Neekin machesis 1733 1689 Muschenistis Neekin machesis 1733 1689 Muschenistis Reistin machesis 1960 1885 Chent Congromentilic curit substrates 1960 1885 Chent Congromentilic curit substrates 1860 1885 Chent Innestons Congromentilic curit substrates 1860 1885 Chenterolic curit Innestons Congromentilic curit substrates 1860 1885 Presentificate linestons Congromentilic curit substrates 1860 1885 Presentificate Nodulin nucleus 1860 1885 Presentificate Presentificate Noduli		Concremeratio eruet substrate	1,735	1,669	Phosphorite	Pale brown. Phosphatized limettone, compact, hard.
Module machane 1.735 1.683 Mudatione Neekle machane 1.735 1.683 Forenniñeral limestone Neekle machane 1.735 1.885 Forenniñeral limestone Congrommatik cunst substrate 1.660 1.885 Cohenniñeral limestone Congrommatik cunst substrate 1.860 1.885 Calamout conformatik Neekle mucleuk		Nodule rucieus.	1,735	1.669	Phosphorite	Subrounded pebbles, Grayish brown, compact, hard
Nodule nucleue 1.735 1.683 Foreshnifteral limestone Rodin nucleue 1.720 1.835 Chart Rodin nucleue 1.860 1.885 Chartene Congromentic curst substrate 1.860 1.885 Chartene Congromentic curst substrate 1.860 1.885 Chartene Congromentic curst substrate 1.860 1.885 Foreminiteral limestone Rock 1.860 1.885 Foreminiteral limestone Nodelin nucleue 1.860 1.885 <t< td=""><td>L</td><td>Nedule nucleus.</td><td>1,735</td><td>1.669</td><td>Mudstone</td><td>Subrounded pebbles, reddish brown, veny fine, grained.</td></t<>	L	Nedule nucleus.	1,735	1.669	Mudstone	Subrounded pebbles, reddish brown, veny fine, grained.
Reek 1735 1680 Remniferat limestone Congromentic cuet extertate 1960 1885 Cherniferat limestone Congromentic cuet extertate 1960 1885 Cherniferat limestone Congromentic cuet extertate 1960 1885 Colarmout congromente Congromentic cuet extertate 1960 1885 Forminiferal limestone Reck 1980 1885 Forminiferal limestone Nodelin mucleuk 2146 2025 Enstmiferal limestone Nodelin mucleuk 2146 2025 Enstmiferal limestone Nodelin mucleuk 2146 2025 Enstmiferal limestone Nodelin mucleuk 2146	1	Nodule nucleus	1,735	1,669	Phosphorite	Flat pebbles, grayish brown, compact, hard
Congrementic crust abletrate 1 980 1 885 Connentic crust abletrate Congrementic crust abletrate 1 800 1 885 Foreminitic rust abletrate Congrementic crust abletrate 1 800 1 885 Foreminitic rust abletrate Congrementic crust abletrate 1 800 1 885 Foreminitic rust Congrementic crust abletrate 1 800 1 885 Foreminitic rule Congrementic crust abletrate 1 800 1 885 Foreminitical limestone Congrementic crust abletrate 1 800 1 885 Foreminitical limestone Congrementic crust abletrate 1 800 1 885 Foreminitical limestone Congrementic crust abletrate 1 800 1 885 Foreminitical limestone Noddle mucleur 1 800 1 885 Foreminitical limestone Rock 1 800 1 885 Foreminitical limestone Rock 1 800 1 885 Foreminitical limestone Rock 2 185 Foreminitical limestone Foreminitical limestone Rock 2 185 Foreminitical limestone Foreminitical limestone </td <td></td> <td>Rock</td> <td>1,735</td> <td>1,669</td> <td>Foraminiferal limestone</td> <td>Contain flat besait pebbles. Rejatively hard</td>		Rock	1,735	1,669	Foraminiferal limestone	Contain flat besait pebbles. Rejatively hard
Conferenserie: 1960 1885 Muditional Investigational Conferenserie: Muditional Investigational Conferenserie: 1960 1885 Calenseus confiornal Investigational Conferenserie: Muditional Investigational Conferenserie: Investigational Investigational Conferenserie: Investigational Investigational Conferenserie: Muditional Investigational Conferenserie: Investigational Investigational Conferenserie: Investigational Investigational Conferenserie: <thinvestion< th=""> Conferenserie:<td></td><td>Congromeratic cruet substrate</td><td>1.960</td><td>1,885</td><td>Chert</td><td>Hard, brown, translucent. Cleavages inside. Cracks with 3~4cm interval, but closely, stuck</td></thinvestion<>		Congromeratic cruet substrate	1.960	1,885	Chert	Hard, brown, translucent. Cleavages inside. Cracks with 3~4cm interval, but closely, stuck
Conferentatio enut aubertate 1 960 1 885 Formaritie remeit aubertate Congrementio enut abbrance 1 960 1 885 Formantion enut abbrance Congrementio enut abbrance 1 960 1 885 Formantion enut abbrance Congrementio enut abbrance 1 960 1 885 Formantion enut abbrance Congremention enut abbrance 1 960 1 885 Construction enut abbrance Congremention enut abbrance 1 960 1 885 Construction enut abbrance Nodula nucleure 1 960 1 885 Evention frait Innet enut Reak 1 960 1 885 Evention frait Innet enut Reak 1 960 1 885 Evention frait Innet enut Reak 1 960 1 885 Evention frait Innet enut Reak 1 960 1 885 Evention frait Innet enut Reak 1 980 1 885 Evention frait Innet enut Reak 2 035 Furt Evention frait Innet enut Reak 2 043 Bab E		Congromeratic crust substrate	1.960	1,885	Mudstone	Brown mudetone solidfied around 1.~2.5cm nodules. Fine grained compact
Congrementio crutit arbeitrates 1.860 1.885 Colamenous confidencial investores Congrementio crutit arbeitrates 1.800 1.885 Foundinienal investores Congrementio crutit arbeitrates 1.800 1.885 Foundinienal investores Congrementio crutit arbeitrates 1.800 1.885 Foundinienal investores Needule nucleus. 2.149 2.022 Hautitation Needule nucleus. 2.149 2.022 Turf Needule nucleus. 2.149 2.022 Hautitation Congrementic crunt subtrates 2.149 2.022 Hautitation Congrementic crunt subtrates 2.149 Needule nucleus. Destration Congrementic crunt subtra		Congromeratic crust substrate	1.960	1.885	Foraminiferal limestone	Brown clay mixed. Spongy, fragle.
Congrommeric 1960 1885 Foraminifeal Intractone Congrommeric crust exbetrate 1860 1885 Cherabinitieal Congrommeric crust exbetrate 1860 1885 Cherabinitieal Nedula nucleus. 1860 1885 Cherabinitieal Interaction Nedula nucleus. 1860 1885 Cheraminitieal Interaction Interaction Nedula nucleus. 1860 1885 Foraminitieal Interaction Interaction Rock 1860 1885 Foraminitieal Interaction Interaction Nodula nucleus. 2149 2023 Furf Interactions Nodula nucleus. 2149 2023 Nucleus 2149 2023 Nodula nucleus. 2149 2023 Interactions Interactions Construments curut attherete 2149 2023 Interactions Construments curut attherete 2149 2023 Interactions Construments curut attherete 2149 2023 Interactions Construments curut attherete		Congromeratic crust substrate	1,960	1.885	Calcareous conglomerate	Pebbies are nodules with basalt nuclei.
Congrementic erust exbetrate 1.860 1.853 Phosehofteta Congrementic erust exbetrate 1.800 1.855 Desart Desart Medule nucleus. 1.800 1.855 Desart Desart Medule nucleus. 1.800 1.855 Desart Desart Medule nucleus. 1.800 1.855 Desart Desart Nodule nucleus. 1.800 1.855 Desart Desart Reck 1.800 1.855 Desart Desart Desart Nodule nucleus. 2.149 2.052 Desart Desart Des		Congrameratic crugt substrate	1,960	1,885	Foraminiferal limestone	Phoephatized, pink Hard. Contain, micronodules.
Genergementic crust extertists 1860 1885 Celements 1860 1885 Beart Module nucleus 1960 1885 Eventificant 1860 1885 Eventificant Module nucleus 1960 1885 Eventificant 1860 1885 Eventificant Nodule nucleus 1860 1885 Mudteron 1860 1885 Eventificant Rock 1860 1885 Mudteron 1860 1885 Mudteron Nodule nucleus 2149 2025 Eventificat 1860 1885 Mudteron Nodule nucleus 2149 2025 Eventificat Innectons Eventificat Nodule nucleus 2149 2025 Eventificat Eventificat Eventificat Construments 2149 2025 Eventificat Eventificat Eventificat Construments 2149 2025 Eventificat Eventificat Eventificat Construments 2149 2025 Eventificat Eventificat	1	Constromenatio orust substrate	1,980	1.885	Phiosphorite	Subrounded pebbles, White, hard.
Nodule ructions 1.060 1.885 Descriptions Nodule ructions 1.800 1.885 Finamitieral linestone Nodule ructions 1.800 1.885 Foramitieral linestone Reak 1.960 1.885 Foramitieral linestone Nodula nucleuts 2.149 2.022 Foramitieral linestone Nodula nucleuts 2.149 2.023 Foramitieral linestone Nodula nucleuts 2.149 2.023 Heattene Constramentic cunt subtrate 2.149 2.023 Heattene Constramentic cunt subtrate 2.149 2.023 Heattene Constramentic cunt subtrate 2.144 0.444tene 1.444tene Constramentic cunt subtrate 2.023 I.841 I.844tene Constramentic cunt subtrate		Contromanatic crust substrate	1,960	1,885	Calcansous conglomerato	Contain about 20mm angular~ eubangular basait pebbles. Matrix phosphatized.
Nodule rucieus 1.560 1.855 Fromatrieral limestone Nodule rucieus 1.860 1.885 Forestrieral limestone Nodule rucieus 1.860 1.885 Forestrieral limestone Rock 1.860 1.885 Forestrieral limestone Rock 1.860 1.885 Forestrieral limestone Nodule rucieus 2.149 2.022 Enstminieral limestone Nodule rucieus 2.149 2.023 Enstminieral limestone Nodule rucieus 2.149 2.023 Enstminieral limestone Nodule rucieus 2.149 2.033 Bask Mustone Nodule rucieus 2.149 2.033 Mustone Immetone Nodule rucieus 2.033 1.854 Bask Immetone Coregromeratic curat substrate 2.331		Nothin ruciaut	1,860	1,885	Baselt	Aphyria, vitreeus.
Nodule nucleus 1860 1885 Feraminian limestone Rock 1800 1885 Mudetonian limestone Rock 1800 1885 Mudetonian Rock 1800 1885 Searth Rock 1800 1885 Mudetonian Rock 1800 1885 Searth Rock 1800 1885 Searth Nodule nucleus 2.149 2.022 Foraminian lineationa Nodule nucleus 2.149 2.022 Rest Mudetona Nodule nucleus 2.149 2.023 Mudetona Imestona Construmentic curut aubtrate 2.038 1.834 Mudetona Construmentic curut aubtrate 2.039 1.834 Limetona Construmentic curut aubtrate 2.031 2.101 Colemanted Construmentic curut aubtrate 2.031 2.101 Colemanted Construmentic curut aubtrate 2.031 2.101 Colemanted Construmentic curut aubtrate 2.010 Baatt L	Ł	Nodule curclette	1.960	1.885	Phosphorite	Gravish white, hard.
Rock 1,860		Nod is nucleus	1980	1 885	Forsminiferal limestone	Milly white Phosphatized hard
Reck 1360 1385 Tuff Rock 1960 1385 Tuff Rock 1960 1385 Tuff Nodule nucleus 2.149 2.022 Externinitienal line stoone Nodule nucleus 2.149 2.022 Externinitienal line stoone Nodule nucleus 2.149 2.022 Externinitienal line stoone Nodule nucleus 2.149 2.023 Fromsthineral line stoone Nodule nucleus 2.149 2.023 Fromsthineral line stoone Nodule nucleus 2.149 2.023 Housthineral line stoone Nodule nucleus 2.149 2.033 Bask Line stoone Conscience static crunt substrate 2.036 1.834 Matsteac 2.044 Conscience static crunt substrate 2.203 1.010 Cates weak conformerate 2.010 Conscience static crunt substrate 2.203 1.010 Cates weak conformerate 2.010 Conscience static crunt substrate 2.203 1.010 Cates weak conformerate 2.010 Cons	Ι.	Rock	1.960	1.885	Mudstone	Brown, very fine pained massive. Some parts white by calcite mixture, surface coated
Reck 1.560 1.856 Tuff Reck 1.960 1.885 Forenthieral lineatons Neddin nucleus 2.149 2.052 Eventhieral lineatons Neddin nucleus 2.149 2.052 Forenthieral lineatons Neddin nucleus 2.149 2.052 Forenthieral lineatons Neddin nucleus 2.149 2.052 Nucleus Neddin nucleus 2.149 2.052 Nucleus Construments 2.149 2.052 Nucleus Construments 2.149 2.053 Nucleus Construments 2.149 2.053 Nucleus Construments 2.043 Nucleus 2.044 Construments 2.043 Nucleus 2.044 Construments 2.044 Nucleus 2.044 Construments 2.044 Nucleus 2.044 Construments 2.044 Nucleus 2.044 Construments 2.043 Nucleus 2.044 Construments 2.041		Back	1 860	1,885	Baselt	Aphyric, vitreoue, Surface gradation~coated.
Rock 1360 1365 Farminieral lineatona Nodula mucleuts 2149 2.032 Examinieral lineatona Nodula mucleuts 2149 2.032 Examinieral lineatona Nodula mucleuts 2.149 2.032 Enaminieral lineatona Nodula mucleuts 2.149 2.032 Mudatona Congromentic crust substrate 2.149 2.032 Mudatona Congromentic crust substrate 2.149 2.032 Mudatona Congromentic crust substrate 2.038 1.834 Beath Calonumbed formitieral limettone publica Modula mucleus 2.038 1.834 Beath Calonumbed formitieral Enerodometric Modula mucleus 2.039 1.834 Beath Calonumbed formitieral Enerodometric Reck 2.030 1.834 Beath Calonumbed formitieral Enerodometric Reck 2.031 2.010 Cales enous coordometric Enerodometric Count substrate 2.031 2.010 Cales enous coordometric Enordometric Count substrate 2.031 1.010		000	1 960	1.885	Tuff	Fine grained compact Surface gradation ~ coated
Nodule nucleuts 2.149 2.032 Bash line stores Nedule nucleuts 2.149 2.032 Foremnifieral line stores Nedule nucleuts 2.149 2.032 Foremnifieral line stores Nedule nucleuts 2.149 2.032 Mudstores Centromeratic curst substrate 2.149 2.032 Mudstores Centromeratic curst substrate 2.149 2.033 1.041 Mestores Centromeratic curst substrate 2.033 1.864 Bask (Subrounded formmifieral limettore publics) Constructure stic curst substrate 2.033 1.010 Cales even constructures Constructure stic curst substrate 2.331 2.101 Cales even constructures Reck 2.331 2.101 Cales even constructures 2.331 Constructure substrate 2.331 2.101 Cales even constructures Constructure sub		Deet	1 980	1 885	Feraminieral limestone	Coartes grained no pebbles. Surface gradition~coarted.
Nedule nucleurs. 2.149 2.032 Ferrurriferal line stone Nedule nucleurs. 2.149 2.032 Turfi Nedule nucleurs. 2.149 2.032 Turfi Nedule nucleurs. 2.149 2.032 Neephone Nedule nucleurs. 2.149 2.032 Neephone Neutre nucleurs. 2.149 2.032 Neephone Compromentic crunt aubitratio 2.038 1.854 Menterion Compromentic crunt aubitratio 2.038 1.854 Limettone forminifieral limettone Construmentic crunt aubitratio 2.038 1.854 Limettone Limettone Construmentic crunt aubitratio 2.039 1.864 Limettone Limettone Construmentic crunt aubitratio 2.208 1.864 Limettone Limettone Construmentic crunt aubitratio 2.203 1.010 Limettone Limettone Resk 2.203 2.010 Mentere 2.010 Limettone Resk 2.203 2.010 Limettone Limettone			0140	2052	Real	Adrivnic, vitreeue, Subaneularr-subrounded pebblee.
Nodule muctions 2.149 2.022 Torif Nodule muclious 2.149 2.022 Proverbio-tris Nodule muclious 2.149 2.022 Proverbio-tris Construmentis crunt substrate 2.149 2.022 Proverbio-tris Construmentis crunt substrate 2.04 1.824 Muctionedimicity Construmentis crunt substrate 2.08 1.824 Muctionedimicity Construmentis crunt substrate 2.08 1.824 Bask Nodule muclis 2.09 1.824 Bask Construmentic crunt substrate Construmentis crunt substrate 2.09 1.824 Bask Construmentic crunt substrate ZOB 1.824 Determinition 2.09 1.834 Construmentic Reck 2.09 1.824 Determinition 2.09 Mucli trait Reck 2.09 1.844 Turf Mucli trait 2.01 Mucli trait Reck 2.09 1.844 Turf Mucli trait 2.01 Mucli trait Reck				2.0.50	Forminiferal limestone	Bassit stanulae. Contain small strist framents.
Module meneurs. 2149 2.032 Phosphorite Nodule meneurs. 2149 2.032 Mudsterrei Nodule meleus. 2.149 2.032 Mudsterrei Compenentis creat atherate 2.149 2.032 Mudsterrei Compenentis creat atherate 2.149 2.032 Mudsterrei Compenentis creat atherate 2.038 1.831 Musterneincick) Compenentis creat aubirtatio 2.038 1.831 Baak (Subounded formmifred limetrone public) Compenentis creat aubirtatio 2.038 1.831 Cales were conformatic Procession Compenentis creat aubirtatio 2.039 1.841 Cales were conformatic Procession Reck 2.208 1.861 Cales were conformatic Procession Procession Reck 2.209 1.864 Cales were conformatic Procession Procession Reck 2.208 1.861 Cales were conformatic Procession Procession Reck 2.209 1.861 Reference Procession Procession		Net in metric	0140	0.50	Teaff	Fine grained Contain micronodules. Subrounded~fiat pebbles.
Modeline monetaria 2.149 2.002 Mudiatement Congromentic curat subtrates 2.149 2.002 Mudiatement Congromentic curat subtrates 2.08 1.854 Limentonicitie) Congromentic curat subtrates 2.08 1.854 Limentonicitie) Congromentic curat subtrates 2.09 1.854 Limentonicitie) Congromentic curat subtrates 2.09 1.854 Limentonicitie) Congromentic curat subtrates 2.09 1.854 Limentonicitie) Modeling 2.09 1.854 Limentonicitie) Reck 2.09 1.854 Limentonicitie) Reck 2.00 1.864 Limentonicitie) Reck 2.00 1.864 Limentonicitie) Reck 2.00 1.864 Limentonicitie) Reck 2.00 Limentonicitie) Limentonicitie) Reck 2.00 1.864 Limentonicitie) Reck 2.00 Limentonicitie) Limentonicitie) Reck 2.00 Limentonicitie) <td>-1-</td> <td>Mornie Lincient.</td> <td></td> <td>000</td> <td></td> <td>Grouter Hand automotion of the second s</td>	-1-	Mornie Lincient.		000		Grouter Hand automotion of the second s
Construction 2,208 1,504 Limitorial Construmentic crunt atheritetic 2,08 1,564 Ministone Construmentic crunt atheritetic 2,08 1,564 Ministone Construmentic crunt atheritetic 2,08 1,564 Ministone Model mucleustic 2,08 1,564 Basis Ministone Construmentic crunt atheritetic 2,09 1,564 Basis Basis Construmentic crunt aubierratio 2,09 1,564 Calene event control and construction Reck 2,09 1,564 Calene event construction Basis Reck 2,09 1,564 Calene event construction Calene event construction Reck 2,201 2,010 Basis Construction Calene event construction Reck 2,203 2,101 Calene event construction Calene event construction Construction Construction 2,301 2,101 Calene event construction Construction Construction 2,301 2,101 Basis Construction <t< td=""><td>- 1</td><td>Nogula nucleus</td><td>2.148</td><td>2007</td><td></td><td>Prome Version for antison for the Submedian habitation</td></t<>	- 1	Nogula nucleus	2.148	2007		Prome Version for antison for the Submedian habitation
Consciencentic curst allabetrate 2.208 1.824 Muntamenanture Consciencentic curst allabetrate 2.208 1.824 Linematione/Accounded forminifieral limentone pubbles) Reck 2.208 1.824 Linematione/Accounded forminifieral limentone pubbles) Reck 2.208 1.824 Linematione/Accounded forminifieral limentone pubbles) Reck 2.208 1.824 Linematione/Accounded forminifieral limentone Reck 2.208 1.824 Consciencents/Count allocidity) Reck 2.201 1.844 Consciencents/Count allocidity Reck 2.201 2.010 Multitone Dimension Reck 2.201 2.010 Reat Dimension Consciencentic curst substrate 2.311 2.101 Dimension Dimension Consciencentic curst substrate 2.321	1	Nodule rucieus.		7007	11 the second seco	<u>Distorte segono de la construction de la construction de la construction de la construction de la construction</u> La la construction de la construction
Compromentation 2.08 1.83.4 Reador Commentation Compromentation Module mujeluus 2.08 1.83.4 Reador Commentation 2.08 1.83.4 Reador Commentation Module mujeluus 2.08 1.83.4 Reador Commentation 2.08 1.83.4 Reador Commentation Read 2.09 1.83.4 Reador Commentation 2.09 Reador Reador Reador Reador 2.09 Reador Reador Reador Reador Reador 2.09 Reador			802.2	1001		inited relation contentioned are accurately and the mean control of the mean of the second
Models 2.06 1.874 Deals Connections and count			0,00	1004	Renet C. brounded forgeniniferal limestone retries?	Fine-mained housed with 0.5~10mm chemocrysts Costanio silving and azvertie.
Construent ic curit tubritratio 2006 1 86.4 Limeticional/Interfet Reck 2208 1 86.4 Calene ever, constituente Reck 2208 1 86.4 Calene ever, constituente Reck 2208 1 86.4 Calene ever, constituente Reck 2201 Berk Calene ever, constituente Reck 2301 2 101 Calene ever, constituente Constructures its curit substrate 2 301 2 101 Calene ever, constituente Constructures its curit substrate 2 301 2 101 Calene ever, constituente Constructures its curit substrate 2 301 2 101 Calene ever, constituente Constructures its curit substrate 2 301 2 101 Calene ever, constituente Constructures its curit substrate 2 301 2 101 Benkt Constructures its curit substrate 2 301 2 101 Benkt Constructures its curit substrate 2 301 2 101 Benkt Constructures its curit substrate 2 301 2 101 Benkt Constructures		Notifier michaels	2208	1 834	Busak	Abhrite vitreeur
Reck 2.06 1.8.4 Cherresous conformente Reck 2.09 Mattone 2.00 Lenseous conformente Count substrate 2.301 2.010 Cherresous conformente Count substrate 2.301 2.101 Cherresous conformente Conscreentils crust substrate 2.301 2.101 Cherresous conformente Conscreentils crust substrate 2.301 2.101 Basett Conscreentils crust substrate 2.301 2.101 Baset		Congromeratic crust substrate	2208	1,834	Limestones(micrite)	Mhite, hærd. Stratified structure.
Reck 2.06 1.854 Cale resous confirmente Reck 2.090 1.864 Cale resous confirmente Reck 2.090 1.864 Cale resous confirmente Reck 2.090 1.864 Land resous Reck 2.091 Land resous Land resous Construentels 2.011 Cale resous conformente Land resous Construentels 2.011 Bash Land resous Land resous Construentels 2.011 Bash Land resous Land resous Land resous Construentels 2.011 Bash Land resous Land resous Land resous Construentels 2.011 Bash Land resous Land resons Land resons		Rock	2,206	1,834	Besalt of the second	Subrounded fight perposes Authors Surface gredation.
Reck 2.06 1.6.4 Tuff Reck 2.09 Machtee 20.9 Machtee Reck 2.380 2.019 Machtee 2.015 Reck Reck 2.380 2.019 Machtee 2.015 Reck Reck Reck 2.001 Retk 2.011 2.101 Characteriation 2.311 2.101 Reck	4	Rock	2 208	1,834	Caloar eous conglomerate	Coarse grained. Angular reubengular basait, tuff, phosphorite pobbles.
Rock 2053 2019 Baak Court substrate 2.331 2.101 Charamous conforments Concrements crutt substrate 2.331 2.101 Charamous conforments Congromments crutt substrate 2.331 2.101 Baset Rock 2.331 2.101 Baset Module muchus 2.384 2.118 Muchtone Congrommetic crust substrate 2.384 2.118 Bub Constrate 2.384 2.118 Bub Muchtone Module muchus 2.384 2.118 Bub Muchtone M	1	Rock	2208	1,834	Tuff	Fine greined, compact, but fragile: Surface stain.
Count emborrate 2.203 2.010 Loberrous Count emborrate 2.331 2.101 Calenerous conformente Consciencentis crunt substratio 2.331 2.101 Calenerous conformente Consciencentis crunt substratio 2.331 2.101 Calene ecous conformente Consciencentis crunt substratio 2.331 2.101 Calene ecous conformente Consciencentis crunt substratio 2.331 2.101 Date Date Consciencentis crunt substrate 2.331 2.101 Baset Baset Res 2.331 2.101 Baset Baset Baset Res 2.331 2.101 Baset Baset Baset Res 2.331 2.101 Baset Baset Baset Baset Conference crust substrate 2.331 2.118 Mattore Baset Baset<		Rock	2.283	2,019	Beusk	Fino grained, graviah block, Frosh, Phenocrysts small Augüe-guetz chearly observed.
Construction 2.331 2.101 Cleareredue Construction Constructed statistic 2.331 2.101 Date there 2.331 2.101 Constructed statistic 2.331 2.101 Beach 2.331 2.101 Beach Constructed 2.331 2.101 Beach 2.331 2.101 Beach Rook 2.331 2.101 Beach 2.331 2.101 Beach Module mucheus 2.331 2.101 Beach Mustation 2.341 Module mucheus 2.384 2.118 Beach Mustation 2.364 2.118 Mustation Module mucheus 2.384 2.118 Beach Mustation 2.364 2.18 Mustation Module mucheus	1.51		2,203	2,019	Mudatone	Pake reddish brown very fine grained, messive. Contain small crust fragments, Foreininferal innertone stuck on opper surface
Congressmentic crust subtrate 2.331 2.101 Classressments Congressments crust subtrate 2.331 2.101 Classressments Congressments crust subtrate 2.331 2.101 Classressments Congressments crust subtrate 2.331 2.101 Reads Congressments crust subtrate 2.331 2.101 Beach Congressments crust subtrate 2.331 2.101 Beach Rock 2.331 2.101 Beach Additione Congressments crust subtrate 2.331 2.101 Beach Rock 2.331 2.101 Beach Modifione Constrate 2.331 2.101 Beach Modifione Module multitude 2.334 2.118 Modifione Modifione Module multitude 2.384 2.118 Modifione Modifione Module multitude 2.384 2.118 Modifione Modifione Module multitude 2.384 2.118	÷ .	Cruxt substrate	2331	2,101	Calcareous conflomerate	Upper part weathered rounded brand petotes prosphatized, tower part, out any angular brand peroles.
Congromments 2.301 2.101 Density Congromments 2.301 2.101 Benefit Congromments 2.301 2.101 Benefit Congromments 2.301 2.101 Benefit Congromments 2.301 2.101 Benefit Rock 2.301 2.101 Benefit Rock 2.301 2.101 Benefit Rock 2.301 2.101 Benefit Rock 2.301 2.118 Mucletone Conference tils 2.381 2.118 Mucletone Conference tils 2.384 2.118 Mucletone Modube mucletus 2.384 2.118 Mucletone Nodube mucletus 2.384 2.118 Mucletone Nodube mucletus 2.384 2.118 Mucletone Rock 2.384 2.118 Mucletone Rock 2.384 2.118 Mucletone Rock 2.384 2.118 Mucletone Rock </td <td>1</td> <td>Congromeratic crust substrate</td> <td>2 331</td> <td>2.103</td> <td>Calcareous conflomerate</td> <td><u>() define a contenta a produce "catato" content un promova mantenta promova.</u> Indica concerte analicad harmade and that shoreshoride a publicade Marting francia</td>	1	Congromeratic crust substrate	2 331	2.103	Calcareous conflomerate	<u>() define a contenta a produce "catato" content un promova mantenta promova.</u> Indica concerte analicad harmade and that shoreshoride a publicade Marting francia
Congromments 2.01 2.10 Brank Congromments 2.01 2.01 Brank Congromments 2.01 Brank Example Congromments 2.01 Brank Example Rest 2.01 Brank Example Rest 2.01 Brank Example Rest 2.01 Brank Example Rest 2.01 Brank Example Rouck 2.03 2.10 Brank Module muchens 2.03 2.11 Brank Nodule muchens 2.03 2.11 Brank Nodule muchens 2.03 2.11 Brank Nodule muchens 2.04 2.11 Brank Rock 2.04 2.11 Brank Rock 2.04 2.01		Congromeratio crust substrate	102.0	21012	Latest congromerate https://	<u>Constructions and a construction constructions are constructions and and and and and and and and and and</u>
Construction 2,321 2,101 Benefit Benefit Rook 2,331 2,101 Benefit Rook 2,331 2,101 Benefit Rook 2,331 2,101 Benefit Rook 2,331 2,101 Benefit Corret substrate 2,331 2,101 Benefit Corret substrate 2,334 2,118 Muchanne Module muchaus 2,384 2,118 Benefit Nochle muchaus 2,384 2,118 Benefit Rock 2,384 2,118 Benefit Rock </td <td></td> <td>Composition of the state of the second state</td> <td>1331</td> <td>2,101</td> <td>Breat</td> <td>Phyric, wrreeus. Gradia develoced, Gradis filled by caloite, Strongly weathered</td>		Composition of the state of the second state	1331	2,101	Breat	Phyric, wrreeus. Gradia develoced, Gradis filled by caloite, Strongly weathered
Rock 2.201 2.101 Basels Flows 2.321 2.101 Und fromesia Flows 2.331 2.118 Muditore Conference tils 2.381 2.118 Muditore Conference tils 2.381 2.118 Muditore Conference tils 2.384 2.118 Muditore Modube multi-lens 2.384 2.118 Muditore Nodube multi-lens 2.384 2.118 Muditore Nodube multi-lens 2.384 2.118 Muditore Nodube multi-lens 2.384 2.118 Muditore Rock	1		2331	2.101	Basely and the second of the second and a second	Aphylic, Vitreous, Strongy weathered. Lineatone attached on sides.
Finds 2.331 2.101 Tuff Procesia Congromment enc. 2.384 2.119 Muchatoment Congromment enc. 2.384 2.119 Muchatoment Congromment enc. 2.384 2.119 Muchatoment Module muchans 2.384 2.118 Muchatoment Module muchans 2.384 2.118 Baant Module muchans 2.384 2.118 Baant Module muchans 2.384 2.118 Baant Module muchans 2.384 2.118 Muchatome Module muchans 2.384 2.118 Muchatome Module muchans 2.384 2.118 Muchatome Rock 2.384 2.118 Muchatome	8	•	2.331	2,101	Basalt	Fine grained, phyric, manute versioles filled by nephrite.
Curat substrate 2.884 2.118 Mudstone Module muchus 2.894 2.118 Mudstone Module muchus 2.894 2.118 Mudstone Module muchus 2.894 2.118 Bust Module muchus 2.894 2.118 Mudstone Rock 2.18 Mudstone 2.884 Rock 2.894 2.118 Mudstone Rock 2.18 Mudstone 2.884 Rock 2.894 2.118 Bust Rock 2.984 2.118 Bust Rock 2.994 2.118 Bu	8		2 331	2,101-	Tuff breccia	Pumiceous, tuff with onion type weathering baselt granules (zenolikhs) and phosphorite contained.
Congrommeric Longrommeric 2.844 2.118 Basefil Multiple	l i E		2384	2.118	Mudatone	Pate brown, very fire grained, clear bedding, microsodules on bedding planes.
Medide muchens 2.384 2.118 Beauth Medide muchens 2.384 2.118 Mediatrone Medide muchens 2.384 2.118 Mediatrone Reak 2.18 Mediatrone 2.04 Reak 2.18 Mediatrone Mediatrone Reak 2.384 2.118 Foreminificial Immetone Rock 2.394 2.118 Foreminificial Immetone Rock 2.393 2.303 Beach Rock 2.393 2.303 Beach Rock 2.303 2.303 Mediatrone			2.384	2,118	Mudstone	Heddish brown mucktone. Very the gramed, Hogoogrameous and missione, Jontain micromodules.
Module muchans: 2.384 2.118 Examinities in intension Module muchas: 2.384 2.118 Examinities in intension Module muchas: 2.304 2.118 Module muchan Module muchas: 2.304 2.118 Module muchan Rock 2.304 2.118 Module muchan Rock 2.384 2.118 Module muchan Rock 2.384 2.118 Basit Rock 2.384 2.118 Basit Rock 2.384 2.118 Basit Rock 2.384 2.118 Basit Rock 2.384 2.118 Examinificial intestone Rock 2.384 2.118 Examinificial intestone Civici suptivides 2.343 2.379 Basit	1		2384	2,118	Besatt	First pobbles. Porque, phyric
Nordelle mucheurs 2.084 2.118 Nordentieren innessene Nordelle mucheurs 2.084 2.118 Nordentieren innessene Rock 2.084 2.118 Baselt Rock 2.084 2.118 Baselt Rock 2.084 2.118 Daselt Rock 2.084 2.118 Daselt Rock 2.084 2.118 Daselt Rock 2.091 2.118 Daselt Constructionate 2.443 2.209 Baselt Grout subtrate 2.443 2.209 Baselt	AD 00	Nodule nucleus.	2,384	2.18	(Cutstaft	Subrounded problem Porous, DYVIX
Real 2.118 Mentane Reak 2.118 Mentane Reak 2.118 Mentane Reak 2.128 Basaik Reak 2.138 2.141 Reak 2.138 2.141 Reak 2.138 2.141 Reak 2.138 2.141 Reak 2.239 2.218 Reak 2.239 Basaik Fock 2.443 2.239 Coust substrate 2.443 2.329		Nodele mucleus.	2.384	2110	I toramare eral innestone	<u> Supravidant Brookses, menting pare tractor statisticantes), voise se suri.</u> Subravidad nadabies Varev fine ersteined fack brown. Condition micrimotobiles: France forstills.
Reack 2.384 2.118 Beadt Rock 2.384 2.118 Furf Rock 2.384 2.118 Furf Rock 2.384 2.118 Furf Rock 2.384 2.118 Forzynthiforral Immestone Coust substrate 2.443 2.379 Breah	38		2.004	2118	Manufact states	Paie reddieb brown verv (ne graened: Messive. Gontain mis/ onodvies. Subcounded 1 cm baselt petobles mixed.
Reck 2,894 2,118 Tuff Rock 2,384 2,118 Enginificatif intestone Rock 2,384 2,118 Enginificatif intestone Currat 2,443 2,378 Baselt Civit suptivitie 2,443 2,379 Baselt	le	Reck	2 384	2118	Basat	Minute vusicies. Phyric: Matrix fine granted rock forming materials clearly observed.
Rock 2394 2.118 feagurinfarual Imericane Cross substrate 2.443 2.278 feagurinfarual Imericane Cross substrate 2.443 2.278 fearer	8		2.384	2118	Tuff	Pumisseur, contain onion-type weathered tuff. Vesicles filled by catchte.
Crust substrate 2,443 2,328 Baselt Crust substrate 2,443 2,379 Baselt	8		2,384	2,118	Foraminiferal limestone	Lower part nodulo-containing subrounded tuff. Upper part contains appulge baselt pobbles. Parthe phosphatized,
13 Crust substrate 2 443 2 329 [Basalt	AD 13		2,443	2,328	Brsalt	Aphysic, fine-meined baseh. Contain minute meins with metallic bistiz:
	2	Crust substrate	2 443	2,329	Basat	<u>Aphr ic, porous baselt. Minute vesicles, filled by rephrace</u>

٩	

Appendix Table 2 (3-2) Rock Samples from MC13 Area

Sample.	Dark time			Substrate	
number	addi yooy	On bottom	Off bottom		
98 AD 08	Congromeratic crust substrate	2,484	2,338	Batalt	Porous, 5~100mm phenoorysts. Cracks developed, weathered.
AD 08	Congromeratic crust substrate	2,484	2.339	Foraminiferal limestone	Subrounded pebbies. Pipe trace fossils and vesicles abundant, coarse, soft
8	08 Reck	2.484	2.339	Baselt	Flat pebbles, porous, 5~10mm phenocrysts, Surface coated.
8	Rock	2.484	2338	Calcareous consiomerate	White coarse, soft, Contain angular basait pebbles. Surface merely staned
AD 05	05 Rook	2.783	2.458	Basat	Gravith black frash. Aphyric, vitreous, Minute augte occur throughout
	05 (Reek	2 783	2.458	Muditon	Pale radiati brown, very fine grained, homogeneous, massive. Hard
AD 11	Rock	2.959	2,535	Basait	Aphyric, fine grained Back spherical mineral smaller, than o.2mm observed. Surface mersiy stained
=	Rock	2,959	2,535	Basait	Very fine grained Lightgray irregular 2~ 7mm phenocrysts. Surface gradation.
F	Rock	2.959	2,535	Tuff	Contain green tuff pebbies (xenofiths). Matrix pumiceous, surface stained~ gradation.
1	Rock	2.959	2.535	Tuffaceou mudstone	Subrounded pebbies. Fine grained compact, homogeneous, but light fragile. Surface less than stain.
AD 11	Rock	2,958	2,535	Chert	Hard. Opaque, but vitraous luster. Calcite attached on curface.
5	Nodule nucleus.	3.422		Phosphorite	Gray, Hard, flat pebbles
98 AD 09	Substrate rook of crust	1.822	1.801	Linestone	Petitic. fragle, contain micronodules, some what phosphatized
8	Substrate rock of	1822	1 801	Eastalt	Fine grained porous, accular plagociase crystals, vesicles filled by opal.
8	Substrate rock of Nodula	1 822	1 801	Bacatt	Pine stained porous acioular plasodates crystals.
8	09 Substrate rook of Not-ile	1 822	1 801	Photorita	White hards
1.	(18) Root	1 822	1 801	l inactona	Petitic fradie contain micromodules some what phosphatited
	02 Rubstrate cock of caust	1 807	PBC 1	Treat	Fina evided convert scindlar desirelses aveals
3	C.L	1 001	101 1		1 A chiving first services preprior and increase increase.
3 8		1 807	1 784	1.040 miles	
T.	Koor 4	1001	101.1		
ÿ	HOCK	1.89/	1,144		
	Substrate rock of	2.033	C211	Calcaraous congiomarata	Matrix Pericio, sort, recorde Dasait, prospinorte, nodules.
8	Substrate rock of anutt	2.033	1,885	Calcareous conglomerate	Matrix pelitic, soft. Pebbles basait, subangular lime stone.
S	Substrate rock of crust	2.033	1,885	Caloareous conglomerate	Contain angular basait pebbles. Matrix phosphatized, hard.
AD- 05	Substrate rock of crust	2.033	1,885	Basalt	Fine grained compact. Three but phencerysts not clear,
ន	Substrate rook of Nodule	2,033	1,885	Eacalt	Fine grained, compact. Phyric but phenocrysts not clear.
8	Substrate rock of Nodule	2.033	1,885	Phospharite	
AD 05	Rock	2.033	1,985	Calcarsous conglomerate	Matrix pelitic, soft. Baselt granules.
	05 Rock	2,033	1,885	Bacalt.	Fine grained, compact Phyric but phenocrysts not clear.
		2,039	1,912	Baealt	Fine grained hard, aphyric.
8	Substrate rock of orust	2.274	2,067	Basalt	Physic, porous, phenocrysts not clear.
8		2.274	2,087	Basalt	Phyric, perous, phenocrysts not clear.
8	Rock	2.274	2.067	Basalt	Phyric. poroug, phenocryste not clear.
위	Substrate rock of Nodule	2,318	2,196	Baealt	Fine grained aphyric.
2	Substrate rock of Nodule	2,318	2,196	Prosphorite	White, hard, contain micronodules,
	Substrate rock of crust	2.449	2.424	Bacait	Fire grained appyring yesicles partly filled with calcita.
2	Substrate rock of orust	2,449	2,424	Limestone	White, paintic, traple.
AD 13	13 Rock	2.449	2.424	Basalt	Fine grained, porque, aphyrio.
6	Substrate rock of Cobble crust	2.454	2.105	Calcareous conglomerate	Contain weathered basalt granules. Matrix phosphatized
5	Substrate rock of Cobble crust	2.454	2.105	Basalt	Cracks developed and filled by phosphate minerals.
AD 07	Substrate rock of Cobble crust	2.454	2,105	Phosphorite	White, hard.
AD 07	Substrate rock of Nodule	2,454	2.105	Basalt	
AD 07	Substrate rock of Nodule	2,454	2.105	Prosphonite	
8	Substrate rock of crust	2,512	2,185	Basait	Fine grained aphyric, porous,
ខ	Substrate rock of crust	2,512	2,185	Basalt .	Fine grained porcus, rarely acicular plagociase.
AD 03	Substrate rock of Cobble crust	2.512	2.185	Easalt	Fine grained porous rarely acicular plagociase.
8	03 Substrate rock of Nodule	2,512	2,185	Basalt	Fine grained aphyric, porous,
AD 14	Substrate rock of erust	2.731	2.770	Basalt	Fine grained, hard, advyrio,
14	14 Rook	2.731	2.770	Basalt	Fine grained hand aphyric
AD 14	Rock	2.731	2.770	Lime stone	Pelitic fragle. Pipe trace fossils on surface.
	04 Rock	2,886	2.318	Basalt	Fine graiced compact, acioular plagoolase notable.
AD 04	Rock	2,886	2.318	Tuff braccia	Fine grained, compact Argilized by weathering.
04	Rock	2.886	2,318	Limestone	Pelitio fragle, contain micronodules.
AD 15	Substrate rosk of srust	3,120	2.910	Lime stone	Pelitic, but coarse-grained material mixed. Brown by weathering,
LC 01	Substrate rock of Nodule	4.017		Basalt	Aphyric, porous,
ì					

Appendix Table 2 (4) Rock Samples from MS13 Area

Table nock of Grunt Un bettern Urt bettern Un bettern <thunbettern< th=""></thunbettern<>	Paitic, fragie, contain microrodules, some what phosphatized. Fine grained porous, acioular phagoclares crystals, vesicles filled by coal. Fine grained porous, acioular phagoclares crystals, vesicles filled by coal. Wine, grained porous, acioular phagoclares crystals, vesicles filled by coal. Wine, fragie, contain microrodules, some what phosphatized. Paitic, fragie, contain microrodules, some what phosphatized. Fine grained conneact, acicular physiciaes notable. Antrice fine grained, hard. Matrix paitic, edd. Pabbles baselt, tobandules, modules. merate Matrix paitic, edd. Pabbles baselt, tobandules. merate Matrix patric, but phenocrysts not clear. fine grained compact. Phyric but phenocrysts not clear. Fine grained compact. Phyric but phenocrysts not clear. fine grained convect and convect. Fine grained convect end clear. fine grained convect and clear. Phyric. prorous phenocrysts not clear.
00 Substrate rock of coulds 1.822 1.801 01 Substrate rock of Nodule 1.822 1.801 03 Substrate rock of crust 1.897 1.784 03 Substrate rock of crust 2.033 1.885 04 Substrate rock of crust 2.033 1.885 05 Substrate rock of Nodule 2.033 1.885 05 Substrate rock of Codble crust 2.033 1.885 06 Substrate rock of Codble crust 2.449 2.424	
06 Substrate nock of Cookle crust 1,822 1,801 01 Substrate nock of Nodule 1,822 1,801 03 Substrate nock of Nodule 1,822 1,801 04 Substrate nock of Nodule 1,822 1,801 05 Substrate nock of Nodule 1,822 1,801 05 Substrate nock of crust 1,897 1,784 02 Substrate nock of crust 2,033 1,885 05 Substrate nock of Nodule 2,214 2,097 06 Substrate nock of Nodule 2,214 2,097 07 Substrate nock of route 2,214 2,097 08 Substrate nock of route 2,214 2,097	
08 Subetrate rock of Module 1,822 1,801 08 Subetrate rock of Module 1,822 1,801 09 Subetrate rock of Module 1,822 1,801 02 Subetrate rock of Module 1,827 1,734 02 Subetrate rock of Module 1,887 1,734 02 Subetrate rock of Tourit 2,033 1,885 03 Subetrate rock of Tourit 2,033 1,885 05 Subetrate rock of Tourit 2,033 1,885 05 Subetrate rock of Nodule 2,033 1,885 06 Subetrate rock of Nodule 2,033 1,885 07 Subetrate rock of Nodule 2,274 2,097 08 Subetrate rock of Nodule 2,318 2,424 10 Subetrate rock of Nodule 2,318 2,424	
00 Substrate rock of Nodule 1822 1.801 00 Rockt 1.87 1.784 02 Substrate rock of curst 1.897 1.784 02 Substrate rock of curst 1.897 1.784 02 Substrate rock of crust 1.897 1.784 05 Substrate rock of crust 2.033 1.985 05 Substrate rock of Nodule 2.033 1.985 05 Substrate rock of Crubie 2.033 1.985 06 Substrate rock of Crubie 2.033 1.985 07 <td< td=""><td></td></td<>	
(0) Reck. 1.822 1.801 1.784 (2) Substrates rock of crutt 1.897 1.784 (2) Substrates rock of crutt 2.033 1.885 (3) Substrates rock of crutt 2.033 1.885 (4) Substrates rock of crutt 2.033 1.885 (5) Substrates rock of notatis 2.033 1.885 (5) Substrates rock of Nodatis 2.033 1.885 (5) Substrates rock of Nodatis 2.033 1.885 (6) Substrates rock of Nodatis 2.033 1.885 (6) Substrates rock of Nodatis 2.214 2.097 (6) Substrates rock of Nodatis 2.214 2.097 (7) Substrates rock of route 2.218 2.196 (9) Substrates rock of route 2.214 2	
02 Substrate neck of crutet 1.897 1.784 02 Substrate neck of crutet 2.033 1.885 05 Substrate neck of crutet 2.033 1.885 05 Substrate neck of nodule 2.033 1.885 05 Substrate neck of nodule 2.033 1.885 05 Substrate neck of nodule 2.033 1.885 05 Rock 2.033 1.885 06 Substrate neck of Nodule 2.033 1.885 06 Substrate neck of Nodule 2.033 1.885 06 Substrate neck of Nodule 2.033 1.885 07 Substrate neck of Nodule 2.214 2.097 08 Substrate neck of Nodule 2.214 2.097 08 Substrate neck of Nodule 2.214 2.097 08	
02 Substrate rock of Nodula 1,897 1,784 02 Rubertrate rock of Fourt 1,897 1,784 05 Substrate rock of Fourt 2,033 1,885 06 Substrate rock of Fourt 2,033 1,885 06 Substrate rock of Fourt 2,033 1,885 07 Substrate rock of Fourt 2,033 1,885 08 Substrate rock of Fourt 2,041 2,047 10 Substrate rock of Fourt 2,134 2,047 11 <td></td>	
Q2 Reck 1.897 1.784 02 Reck 1.897 1.784 05 Substrate reck of crutet 2.033 1.885 05 Substrate reck of crutet 2.033 1.885 05 Substrate reck of nutet 2.033 1.885 05 Substrate reck of Nocials 2.033 1.885 05 Substrate reck of Nocials 2.033 1.885 05 Substrate reck of Nocials 2.033 1.885 05 Reck 2.033 1.885 05 Reck 2.033 1.885 05 Reck 2.033 1.885 06 Reck 2.033 1.885 05 Reck 2.033 1.885 06 Substrate reck of Cobble crutet 2.033 1.885 07 Substrate reck of Cobble crutet 2.214 2.097 08 Substrate reck of Cobble crutet 2.105 2.424 13 Substrate reck of Cobble crutet 2.449 2.105 <	
Col. Revi. 1.897 1.734 C2 Revi. 1.897 1.734 C5 Subertrate resk of crutet 2.033 1.885 C5 Subertrate resk of crutet 2.033 1.885 C6 Subertrate resk of number 2.033 1.885 C6 Subertrate resk of Nodule 2.033 1.885 C7 Subertrate resk of Nodule 2.033 1.885 C7 Subertrate resk of Nodule 2.214 2.097 C7 Subertrate resk of Nodule 2.218 2.424 C7 Subertrate resk of Nodule 2.318 2.424 C7 Subertrate resk of Cobble crutet 2.449 2.424 C7 Subertrate resk of Cobble crutet 2.449 2.105 <td< td=""><td></td></td<>	
Construction Construction<	
Obs Substrate rock of crutt 2.003 1.895 05 Substrate rock of crutt 2.003 1.895 05 Substrate rock of crutt 2.003 1.895 05 Substrate rock of crutt 2.003 1.885 05 Substrate rock of Nodule 2.003 1.885 05 Substrate rock of Nodule 2.003 1.885 05 Substrate rock of Couble crutt 2.003 1.885 05 Rock 2.003 1.885 06 Substrate rock of Couble crutt 2.033 1.885 06 Substrate rock of Nodule 2.214 2.097 06 Substrate rock of Nodule 2.214 2.097 07 Substrate rock of Nodule 2.214 2.097 13 Substrate rock of Nodule 2.214 2.097 13 Substrate rock of Nodule 2.214 2.097 13 Substrate rock of Couble crutt 2.449 2.105 13 Substrate rock of Couble crutt 2.449 2.105	
Display=rate reck of crunt 2.033 1.935 05 Subertrate rock of crunt 2.033 1.985 05 Subertrate rock of crunt 2.033 1.985 05 Subertrate rock of rockia 2.033 1.985 05 Subertrate rock of rockia 2.033 1.985 06 Subertrate rock of rockia 2.033 1.985 07 Subertrate rock of rockia 2.033 1.985 08 Subertrate rock of rockia 2.033 1.985 08 Subertrate rock of rockia 2.033 1.985 08 Subertrate rock of rockia 2.033 1.985 09 Subertrate rock of rockia 2.274 2.097 08 Subertrate rock of rockia 2.214 2.097 09 Rockia 2.214 2.097 10 Subertrate rock of rockia 2.214 2.097 11 Rockia 2.449 2.424 11 Subertrate rock of rockia 2.449 2.424 11 Subertrate roc	
OG Substrate rock of crutet 2.033 1.985 05 Substrate rock of crutet 2.033 1.985 05 Substrate rock of Nodals 2.033 1.985 05 Substrate rock of Nodals 2.033 1.985 05 Substrate rock of Nodals 2.033 1.985 06 Rubstrate rock of Codble crutet 2.033 1.985 06 Substrate rock of Codble crutet 2.033 1.985 07 Substrate rock of Codble crutet 2.033 1.985 08 Substrate rock of Nodals 2.274 2.097 09 Substrate rock of nodals 2.318 2.196 10 Substrate rock of crutet 2.449 2.454 13 Substrate rock of crutet 2.449 2.424 13 Rock 2.449 2.405 13 Substrate rock of crutet 2.449 2.405 13 Substrate rock of crutet 2.449 2.105 13 Substrate rock of crutet 2.449 2.105	
05 Suberrate rock of nodule 2.033 1.885 06 Ruck 2.033 1.885 05 Ruck rate rock of Nodule 2.033 1.885 06 Suberrate rock of Nodule 2.033 1.885 08 Suberrate rock of Nodule 2.214 2.097 08 Suberrate rock of Nodule 2.214 2.097 08 Ruck 2.449 2.424 10 Suberrate rock of Codble cruck 2.449 2.424 13 Suberrate rock of Codble cruck 2.449 2.424 13 Ruck 2.449 2.424 2.105 13 Suberrate rock of Codble cruck 2.449 2.424 2.105 13 Ruck 2.448 2.424 2.105 13 Suberrate rock of Codble cruck 2.449 2.105	
05 Suberrate rock of Nodule 2.033 1.885 05 Suberrate rock of Nodule 2.033 1.885 05 Suberrate rock of Nodule 2.033 1.885 06 Rock 2.033 1.885 06 Suberrate rock of Nodule 2.033 1.885 06 Suberrate rock of Nodule 2.037 2.097 08 Suberrate rock of Nodule 2.274 2.097 08 Rock 2.218 2.196 10 Suberrate rock of Nodule 2.214 2.097 11 Suberrate rock of Nodule 2.214 2.097 12 Suberrate rock of Nodule 2.318 2.196 13 Rock 2.449 2.424 13 Rock 2.449 2.105 13 Rock	
05 Subertrate reck of Nodula 2.033 1.885 05 Reack 2.033 1.885 06 Reack 2.033 1.885 08 Subertrate reck of Codble oruet 2.033 1.885 08 Subertrate reck of Codble oruet 2.033 1.885 08 Subertrate reck of Nodula 2.274 2.097 09 Subertrate reck of Nodula 2.274 2.097 10 Subertrate reck of Nodula 2.318 2.196 11 Subertrate reck of nodula 2.318 2.196 12 Subertrate reck of nodula 2.318 2.196 13 Subertrate reck of nodula 2.318 2.196 13 Subertrate reck of notet 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.105 13 Rock 2.449 2.105 13 Rock 2.449 2.105 13 Rock 2.449 2.105	
OS Reack 2.033 1.885 05 Reack 2.033 1.885 05 Subbetrate reck of Cobble ornet 2.033 1.815 06 Subbetrate reck of Yockie 2.033 1.815 06 Subbetrate reck of Nockie 2.274 2.097 08 Subbetrate reck of Nockie 2.214 2.097 09 Rock 2.214 2.097 01 Subbetrate reck of Nockie 2.214 2.097 10 Subtrate reck of Nockie 2.318 2.196 11 Subtrate reck of Cobble ornet 2.449 2.424 13 Subtrate reck of Cobble ornet 2.448 2.105 13 Rock 2.448 2.105 13 Su	
05 Rock. 2.033 1.885 06 Subetrate reck of Cobbi eruet. 2.039 1.912 06 Subetrate reck of Cobbi eruet. 2.039 1.912 06 Subetrate reck of Noduis 2.274 2.097 01 Subetrate reck of Noduis 2.274 2.097 10 Subetrate reck of Noduis 2.214 2.097 11 Subetrate reck of Noduis 2.318 2.136 13 Subetrate reck of routet 2.449 2.424 13 Rock 2.449 2.405 13 Rock 2.449 2.424 13 Rock 2.454 <td></td>	
(B) Substrate rock of Codble crust 2.039 1.912 (B) Substrate rock of rocki 2.274 2.097 (B) Substrate rock of Nodule 2.274 2.097 (B) Substrate rock of Nodule 2.274 2.097 (B) Substrate rock of Nodule 2.214 2.097 (B) Substrate rock of Nodule 2.318 2.196 (B) Substrate rock of nodule 2.318 2.196 (B) Substrate rock of notet 2.449 2.424 (B) Substrate rock of notet 2.449 2.424 (B) Substrate rock of notet 2.449 2.424 (B) Substrate rock of notet 2.449 2.105 (C) Substrate rock of Nodule 2.449 2.105 (C) Substrate rock of Nodule 2.449 2.105 (C) Substrate rock of Nodule 2.454 2.105 (C) Substrate rock of Nodule 2.454 2.105 (C) Substrate rock of Nodule 2.454 2.105 <	From grained, hard, achtyrin. Phyrice, porouts, phenocrystis net clear. Phyrice, conceuse, chanocorystis net clear.
OB Substrate rock of nuet 2.274 2.087 06 Substrate rock of Nodule 2.214 2.087 10 Bhock 2.318 2.196 10 Bhothattate rock of Nodule 2.318 2.196 13 Substrate rock of nodule 2.318 2.196 13 Substrate rock of nodule 2.449 2.424 13 Rouk 2.449 2.105 07 Substrate rock of Cobble crust 2.454 2.105 07 Substrate rock of Cobble crust 2.454 2.105 07 Substrate rock of Cobble crust 2.454 2.105 08 Substrate rock of Cobble crust 2.454 2.105 09 Substrate rock of Cobble crust 2.454 2.105 08 Substrate rock of Cobble crust 2.454	Phyric, porous prenocrysts not clear. Phyric, porous chanocrysts not clear.
OS Substrate rock of Nodule 2.274 2.087 06 Rock 2.214 2.087 1 Substrate rock of Nodule 2.214 2.087 1 Substrate rock of Nodule 2.318 2.1396 13 Substrate rock of Codule 2.318 2.1396 13 Substrate rock of crust 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.105 13 Rock 2.449 2.105 13 Rock 2.449 2.105 13 Rock 2.454 2.105 15 Substrate rock of Cobble crust 2.454 2.105 16 Substrate rock of Cobble crust 2.454 2.105 17 Substrate rock of Cobble crust 2.454 2.105 18 Substrate rock of crust 2.454 2.105 19	Phyric. poreus. phenocrysts not clear.
Old Substrate rock of nodule 2.27.4 2.087 10 Substrate rock of Nodule 2.318 2.196 11 Substrate rock of nodule 2.318 2.196 13 Substrate rock of nodule 2.318 2.196 13 Substrate rock of nodule 2.449 2.424 13 Substrate rock of notet 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.424 14 Rock 2.449 2.105 15 Substrate rock of Cobble numet 2.454 2.105 15 Substrate rock of Nodule 2.454 2.105 16 Substrate rock of Nodule 2.454 2.105 17 Substrate rock of Nodule 2.454 2.105 18 Substrate rock of Nodule 2.454 2.105 19 Substrate rock of Nodule 2.454 2.105 <	
06 Rock 2,213 2,01 10 Substrate rock of Nodule 2,318 2,196 11 Substrate rock of nodule 2,318 2,196 13 Substrate rock of nodule 2,318 2,196 13 Substrate rock of nodule 2,449 2,424 13 Rock 2,449 2,424 13 Rock 2,449 2,105 13 Substrate rock of Cobble crust 2,454 2,105 10 Substrate rock of Nodule 2,454 2,105 11 Substrate rock of Nodule 2,454 2,105 12 Substrate rock of Nodule 2,454 2,105 13 Substrate rock of routet 2,454 2,105 14 Substrate rock of routet 2,454 2,105 <td< td=""><td></td></td<>	
10 Substrate rock of Nodule 2.318 2.198 10 Substrate rock of nodule 2.318 2.186 13 Substrate rock of notet 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.105 13 Rock 2.449 2.105 13 Rock 2.449 2.105 13 Rock 2.449 2.105 15 Substrate rock of Cobble crust 2.454 2.105 16 Substrate rock of Nodule 2.454 2.105 17 <substrate nodule<="" of="" rock="" td=""> 2.454 2.105 18 Substrate rock of Nodule 2.454 2.105 19 Substrate rock of Nodule 2.454 2.105 10 Substrate rock of Nodule 2.454 2.105 10 Substrate rock of or out 2.454 2.105 10</substrate>	Invite, porque, printer not pran.
10 Substrates rook of Nodule 2.318 2.196 13 Substrates rook of crust 2.449 2.424 13 Substrates rook of crust 2.449 2.424 13 Ruck 2.449 2.424 13 Ruck 2.449 2.424 13 Ruck 2.449 2.105 07 Substrate rook of Cobble crust 2.454 2.105 08 Substrate rook of Cobble crust 2.454 2.105 09 Substrate rook of crust 2.454 2.105 07 Substrate rook of crust 2.454 2.105 08 Substrate rook of crust 2.512 2.135 08 Substrate rook of crust 2.512 2.135 08 <t< td=""><td></td></t<>	
33 Substrate rock of crutt 2.449 2.424 15 Substrate rock of crutt 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.424 13 Rock 2.449 2.105 13 Rock 2.444 2.105 15 Substrate rock of Cobble crust 2.454 2.105 17 Substrate rock of Cobble crust 2.454 2.105 18 Substrate rock of Nodule 2.454 2.105 19 Substrate rock of Nodule 2.454 2.105 10 Substrate rock of Nodule 2.454 2.105 10 Substrate rock of Nodule 2.454 2.105 10 Substrate rock of route 2.512 2.105 10 Substrate rock of route 2.512 2.185 10 Substrate rock of route 2.512 2.185 10 Substrate rock of route 2.731 2.730 11 Rock 2.731	White, hard, contain micronodules.
15 Subetrate rock of crute 2.448 2.424 13 Rook 2.449 2.424 13 Rook 2.446 2.105 15 Substrate rock of Cobble crutet 2.446 2.105 17 Substrate rock of Cobble crutet 2.454 2.105 17 Substrate rock of Cobble crutet 2.454 2.105 17 Substrate rock of Cobble crutet 2.454 2.105 10 Substrate rock of Cobble crutet 2.454 2.105 10 Substrate rock of Cobble crutet 2.454 2.105 10 Substrate rock of crutet 2.454 2.105 10 Substrate rock of crutet 2.454 2.105 10 Substrate rock of crutet 2.451 2.105 10 Substrate rock of crutet 2.512 2.185 10 Substrate rock of ortet 2.313 2.135 11 Substrate rock of ortet 2.731 2.130 13 Substrate rock of ortet 2.731 2.770	Fine grained, aphyric, vesicles partly filed with calotte.
13 Reck 2.449 2.424 07 Substrate reck of Cobble screet 2.454 2.105 07 Substrate reck of Nodals 2.454 2.105 07 Substrate reck of Nodals 2.454 2.105 08 Substrate reck of Nodals 2.454 2.105 08 Substrate reck of Nodals 2.454 2.105 08 Substrate reck of routet 2.512 2.135 08 Substrate reck of routet 2.512 2.135 08 Substrate reck of routet 2.512 2.135 08 Substrate reck of routet 2.731 2.135 08 Substrate reck of routet 2.731 2.135 08 Substrate reck of routet 2.731 2.730 14 Rock 2.731 2.770	White, pelitic, fragile.
07 Substrate rook of Cobble crust 2.454 2.105 09 Substrate rook of Cobble crust 2.454 2.105 07 Substrate rook of Cobble crust 2.454 2.105 07 Substrate rook of Nodule 2.454 2.105 08 Substrate rook of Cobble crust 2.512 2.185 08 Substrate rook of routit 2.731 2.730 14 Rook 2.731 2.770	Fine grained, porous, aphyric.
01 Substrate rook of Cobble crust 2.454 2.105 07 Substrate rook of Cobble crust 2.454 2.105 07 Substrate rook of Cobble crust 2.454 2.105 07 Substrate rook of Nodule 2.454 2.105 08 Substrate rook of Nodule 2.454 2.105 09 Substrate rook of Nodule 2.454 2.105 08 Substrate rook of route 2.512 2.195 08 Substrate rook of route 2.512 2.185 08 Substrate rook of route 2.731 2.730 14 Rook 2.731 2.770	
07 Substrate reck of cobble crust 2.454 2.105 07 Substrate reck of Nodule 2.454 2.105 07 Substrate rock of nodule 2.512 2.135 08 Substrate rock of crust 2.512 2.185 08 Substrate rock of crust 2.512 2.185 08 Substrate rock of crust 2.512 2.185 08 Substrate rock of cobble orust 2.512 2.185 08 Substrate rock of orust 2.731 2.730 14 Rock 2.331 2.770	
OT Substrates rock of Nodule 2.454 2.105 OT Substrates rock of Nodule 2.454 2.105 OT Substrate rock of route 2.454 2.105 OS Substrate rock of route 2.512 2.185 OS Substrate rock of crust 2.512 2.185 OS Substrate rock of could 2.512 2.185 OS Substrate rock of Coulds or route 2.512 2.185 OS Substrate rock of Nodole 2.512 2.193 14 Substrate rock of route 2.731 2.770 14 Rock 2.731 2.770	Month, and a second
Or. Substrate more of Nodels 2.464 2.105 2.05 2.105 2.05 2.105 2.05 2.105 2.05 <	
OS Substrate mode of crust 2.512 2.185 OS Substrate mode of Cobble strate 2.512 2.185 OS Substrate mode of Nodals 2.512 2.185 14 Substrate mode of nutet 2.731 2.770 14 Rock 2.731 2.770	
000 Substrate rook of crutet 2,512 2,135 000 Substrate rook of crutet 2,512 2,135 000 Substrate rook of could 2,512 2,135 000 Substrate rook of could 2,512 2,135 01 Substrate rook of notet 2,512 2,135 14 Substrate rook of orust 2,731 2,770 14 Rook 2,731 2,770	Fire grained aptivito porout.
us Substrate rook of Cobble crutst 2,512 2,185 Substrate rook of Cobble crutst 2,512 2,185 08 Substrate rook of routs 2,512 2,195 14 Rook 1 2,731 2,770	Fine. mained borous ranky solouist plasoolase.
000 Substantian models 2,512 2,185 14 Substantiants models 2,731 2,770 14 Rock 2,731 2,770	Fine trained porout rately actuals pagociase.
Outpetrate rock of crust 2.731 2.770 14 Substrate rock of crust 2.731 2.770	Fine grained aphynic, porout.
14 Rock 2.731 2.770	Fine strained hard advite.
2.731 2.770	Petro Tagle. Foe user of an autor
-	Fine grained, compact, accular plagoclase notable
04 Rock 2.318 Tuff breocia	Fine grained, compact Argilized by weathering
04 Rock 2.318 Limestone	Politici fragila, contain micronodules.
mate rock of crust 3.120 2.910	Pelitic. but coarse-grained material raixed. Brown by weathering
Substrate rock of Nockije	Aphydo, porous
C. harden at Namila 4017	Fine grained compact

Appendix Table 3(1) Description of microscopic observation for rock thin section

Sample: SMC11/	00101			
	yroxene olivine basa	lt		
	led eves): Reddish l		ire.	
Description (mic	roscopic) :			· · · · · · · · · · · · · · · · · · ·
		cryst plagioclase s	how strong flow	structure. Vitreous matrix (devitrified).
	rals description:	······		
Mineral	Shape	Grain diameter	Content	Description
Plagioclase	Subhedral, Prismatic	0.1 × 0.5mm	~40%	Crystals well-oriented, show marked flow structure.
Clinopyroxene	Subhedral, Granular	0.3 × 0.5mm	5~10%	Paragenetic with opaque minerals, unaltered.
Olivine	Short prismatic	0.4 × 0.3mm	~5%	Altered (iddingsite), pseudomorph.
	n: Vitreous matrix,	T		· · · · · · · · · · · · · · · · · · ·
Mineral	Shape	Grain diameter	Content	Description
Volcanic glass.	irregular.		~40%	Reddish brown, partly devitrified.
Alteration: Alter	ation medium. Volca	nic glass of matrix	and phenocryst	olivine altered to smectite and iddingsite respectively.
Altered mineral o	escription:	· · ·		
Mineral	Shape	Grain diameter	Content	Description
Smectite	Patch		~10%	Patches of volcanic glass, form as product of devitrification.
Iddingsite	Olivine Pseudomorph			Pseudomorphic alteration of olivine.
Rock: Vitreous p Description(unai	oorous basalt. ded eyes): Brown, p	orous basalt with b	olackish brown c	rust on surface. Spherulitic~amygdaloidal phenocrysts.
Description (mic Rock texture: Pl	vorous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo	· · · · · · · · · · · · · · · · · · ·	· · · · · · ·	rust on surface. Spherulitic~amygdaloidal phenocrysts. weak flow structure. Smectite fills voids with spherulitic~
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex	vorous basalt. ded eyes): Brown, p roscopic): nyric, porous, vitreo ture.	· · · · · · · · · · · · · · · · · · ·	· · · · · · ·	
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine	vorous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description:	us matrix. Matrix pl	lagioclase show	weak flow structure. Smectite fills voids with spherulitic \sim
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex	vorous basalt. ded eyes): Brown, p roscopic): nyric, porous, vitreo ture.	· · · · · · · · · · · · · · · · · · ·	· · · · · · ·	
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine	vorous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description:	us matrix. Matrix pl	lagioclase show	weak flow structure. Smectite fills voids with spherulitic \sim
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description: Shape Prismatic	us matrix. Matrix pl Grain diameter	lagioclase show Content	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description: Shape Prismatic Subhedral Subhedral, (Pseudomorph)	us matrix. Matrix pl Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm	lagioclase show Content ~20% ~2%	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture.
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description: Shape Prismatic Subhedral Subhedral, (Pseudomorph)	us matrix. Matrix pl Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm	lagioclase show Content ~20% ~2%	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture. Pseudomorph (iddingsite)
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine Matrix descriptio Mineral	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description: Shape Prismatic Subhedral Subhedral, (Pseudomorph) on: Vitreous, very fir Shape	us matrix. Matrix p Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm ne acicular plagioch Grain diameter	lagioclase show Content ~20% ~2% ase (weak flow s Content	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture. Pseudomorph (iddingsite) structure) observed locally. Description
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine Matrix descriptic Mineral Plagioclase	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description: Shape Prismatic Subhedral Subhedral, (Pseudomorph) on: Vitreous, very fin Shape Acicular	us matrix. Matrix pl Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm ne acicular plagioch	lagioclase show Content ~20% ~2% ase (weak flow s Content ~1%	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture. Pseudomorph (iddingsite) structure) observed locally. Description Occur with weak flow structure in the vitreous matrix.
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl anygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine Matrix descriptic Mineral Plagioclase Volcanic glass	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erais description: Shape Prismatic Subhedral (Pseudomorph) on: Vitreous, very fir Shape Acicular Irregular	us matrix. Matrix pl Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm ne acicular plagioch Grain diameter 0.01 × 0.1mm	lagioclase show Content ~20% ~2% ase (weak flow s Content ~1% ~40%	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture. Pseudomorph (iddingsite) structure) observed locally. Description Occur with weak flow structure in the vitreous matrix. Weakly devitrified.
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine Matrix descriptic Mineral Plagioclase Volcanic glass Silica minerals	oorous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description: Shape Prismatic Subhedral (Pseudomorph) on: Vitreous, very fin Shape Acicular Irregular Fine granular	us matrix. Matrix pl Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm ne acicular plagioch Grain diameter 0.01 × 0.1mm 0.01mm	lagioclase show Content ~20% ~2% ase (weak flow s Content ~1% ~40% ~10%	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture. Pseudomorph (iddingsite) structure) observed locally. Description Occur with weak flow structure in the vitreous matrix. Weakly devitrified. Pools in matrix.
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine Matrix descriptic Mineral Plagioclase Volcanic glass Silica minerals Alteration: Alter phenocrysts cor	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description: Shape Prismatic Subhedral (Pseudomorph) on: Vitreous, very fin Shape Acicular Irregular Fine granular ation generally weal roded vermicularly.	us matrix. Matrix pl Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm ne acicular plagioch Grain diameter 0.01 × 0.1mm 0.01mm	lagioclase show Content ~20% ~2% ase (weak flow s Content ~1% ~40% ~10%	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture. Pseudomorph (iddingsite) structure) observed locally. Description Occur with weak flow structure in the vitreous matrix. Weakly devitrified.
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine Matrix descriptio Mineral Plagioclase Volcanic glass Silica minerals Alteration: Alter phenocrysts cor Altered mineral	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. rals description: Shape Prismatic Subhedral (Pseudomorph) on: Vitreous, very fin Shape Acicular Irregular Fine granular ation generally weak roded vermicularly. description:	us matrix. Matrix pl Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm re acicular plagioch Grain diameter 0.01 × 0.1mm 0.01mm c. Mostly devitrifica	lagioclase show Content ~20% ~2% ase (weak flow s Content ~1% ~40% ~10%	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture. Pseudomorph (iddingsite) structure) observed locally. Description Occur with weak flow structure in the vitreous matrix. Weakly devitrified. Pools in matrix. nd iddingsitization of olivine (pseudomorph). Plagioclase
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine Matrix descriptic Mineral Plagioclase Volcanic glass Silica minerals Alteration: Alter phenocrysts cor	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. erals description: Shape Prismatic Subhedral (Pseudomorph) on: Vitreous, very fin Shape Acicular Irregular Fine granular ation generally weal roded vermicularly.	us matrix. Matrix pl Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm ne acicular plagioch Grain diameter 0.01 × 0.1mm 0.01mm	lagioclase show Content ~20% ~2% ase (weak flow s Content ~1% ~40% ~10%	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture. Pseudomorph (iddingsite) structure) observed locally. Description Occur with weak flow structure in the vitreous matrix. Weakly devitrified. Pools in matrix.
Rock: Vitreous p Description(unai Description (mic Rock texture: Pl amygdaloidal tex Phenocryst mine Mineral Plagioclase Olivine Matrix descriptio Mineral Plagioclase Volcanic glass Silica minerals Alteration: Alter phenocrysts cor Altered mineral	orous basalt. ded eyes): Brown, p roscopic) : nyric, porous, vitreo ture. rals description: Shape Prismatic Subhedral (Pseudomorph) on: Vitreous, very fin Shape Acicular Irregular Fine granular ation generally weak roded vermicularly. description:	us matrix. Matrix pl Grain diameter Max 5.0 × 7.0mm 0.4 × 0.5mm re acicular plagioch Grain diameter 0.01 × 0.1mm 0.01mm c. Mostly devitrifica	lagioclase show Content ~20% ~2% ase (weak flow s Content ~1% ~40% ~10%	weak flow structure. Smectite fills voids with spherulitic~ Description Twinned, unaltered, weak zonal structure, vermicular corroded texture. Pseudomorph (iddingsite) structure) observed locally. Description Occur with weak flow structure in the vitreous matrix. Weakly devitrified. Pools in matrix. nd iddingsitization of olivine (pseudomorph). Plagioclase

Appendix Table 3(2) Description of microscopic observation for rock thin section

Sample: SMO12AD				
Deale: Disalitia nal		ne (contain microf	ancile)	
		rown. Pisolitic~su	ibrounded pebb	iles, tragile.
Description (micro				
Rock texture: Ooli	tic \sim pisolitic, partl	y colloform.		
Clastics descriptio crystals are obser	÷ .	ear clastic, polymic	tic clastic mate	erial, microfossils (radiolaria etc.), and authigenic prismatic
Mineral	Shape	Grain diameter	Content	Description
Microfossil	·····		~5%	Radiolaria, foraminifera (?)
Clastics 1	Subrounded Pebble	~1.5mm	~30%	Original material unknown.
Unidentified nineral	Prismatic, radial	0.1 × 0.02mm	~ 10%	Authgenic, zeolite a possibility.
Matrix description:	: Smectite, carbon	ate minerals forme	d in metrix.	
Mineral	Shape	Grain diameter	Content	Description
Carbonate	Granular~void filling	~0.02mm	~5%	Formed in matrix.
Hematite I	Minute Aggregates.	~0.1mm		Fragmented parts hematitized.
	irregular		~40%	Partly smeotitized.
		ormation of smect		and authigenic mineral (zeolite ?).
Altered mineral de				
Mineral	Shape	Grain diameter	Content	Description
Smectite	Irregular	~0.01mm	~10%	Minute amount formed in volcanic glass. Partly vein.
Authigenic Unidentified mineral(zeolite ?)	Prismatic, radial,	0.1 × 0.02mm	~10%	Authigenic mineral (?), possibility of zeolite (same as phenocryst).
Sample: SMC124E	13702			
Sample: SMC12AE		·····		
Rock: Porous apt	nyric basalt.			
Rock: Porous apr Description(unaide	nyric basalt. ed eyes): Greenisł			amygdaloidal texture developed. Spherulites are white~brown
Rock: Porous aph Description(unaide material filling void	nyric basalt. ed eyes): Greenisł ds.			amygdaloidal texture developed. Spherulites are white~brown
Rock: Porous ap Description(unaide material filling void Description (micro	nyric basalt. ed eyes): Greenisł ds. oscopic) :	-brown gray, porou	us, spherulitic∼	
Rock: Porous ap Description(unaide material filling void Description (micro	nyric basalt. ed eyes): Greenisł ds. oscopic) :	-brown gray, porou	us, spherulitic∼	amygdaloidal texture developed. Spherulites are white~brown voids and show spherulitic~amygdaloidal texture.
Rock: Porous ap Description(unaide material filling void Description (micro Rock texture: Cry	nyric basalt. ed eyes): Greenish ds. oscopic) : rptocrystalline. Cal	-brown gray, porol oite-brown carbon	us, spherulitic∼	amygdaloidal texture developed. Spherulites are white~brown voids and show spherulitic~amygdaloidal texture.
Rock: Porous apl Description(unaid material filling void Description (micro Rock texture: Cry Phenocryst miner	nyric basalt. ed eyes): Greenish ds. oscopic) : /ptocrystalline. Cal als description: Ap	-brown gray, porou cite-brown carbon phyric	us, spherulitic~ ate minerals fill	voids and show spherulitic~amygdaloidal texture.
Rock: Porous ap Description(unaide material filling void Description (micro Rock texture: Cry	nyric basalt. ed eyes): Greenish ds. oscopic) : rptocrystalline. Cal	-brown gray, porol oite-brown carbon	us, spherulitic∼	
Rock: Porous apl Description(unaid material filling void Description (micro Rock texture: Cry Phenocryst miner Mineral	nyric basalt. ed eyes): Greenish ds. pscopic) : rptocrystalline. Cal rals description: Ap Shape	-brown gray, porou oite-brown carbon ohyric Grain diameter	us, spherulitic~- ate minerals fill <u>Content</u>	voids and show spherulitic~amygdaloidal texture.
Rock: Porous apl Description(unaid material filling void Description (micro Rock texture: Cry Phenocryst miner Mineral	nyric basalt. ed eyes): Greenish ds. pscopic) : rptocrystalline. Cal rals description: Ap Shape	-brown gray, porou cite-brown carbon phyric Grain diameter , vermicular plagiou	us, spherulitic~ ate minerals fill Content clase and devit	voids and show spherulitic~amygdaloidal texture.
Rock: Porous apl Description(unaide material filling void Description (micro Rock texture: Cry Phenocryst miner Mineral Matrix description Mineral	nyric basalt. ed eyes): Greenish ds. pscopic) : rptocrystalline. Cal rals description: Ap Shape 1: Cryptocrystalline	-brown gray, porou oite-brown carbon ohyric Grain diameter	us, spherulitic~- ate minerals fill <u>Content</u>	voids and show spherulitic~amygdaloidal texture.
Rock: Porous apl Description(unaid material filling void Description (micro Rock texture: Cry Phenocryst miner Mineral Matrix description Mineral	nyric basalt. ed eyes): Greenish ds. pocopic) : rptocrystalline. Cal rals description: Ap Shape n: Cryptocrystalline Shape	-brown gray, porou cite-brown carbon ohyric Grain diameter , vermicular plagio Grain diameter	us, spherulitic~ ate minerals fill Content clase and devitu Content	voids and show spherulitic~amygdaloidal texture. Description rified vitreous matrix. Description
Rock: Porous apl Description(unaid material filling void Description (micro Rock texture: Cry Phenocryst miner Mineral Matrix description Mineral Plagioclase Volcanic glass	nyric basalt. ed eyes): Greenish ds. oscopic) : optocrystalline. Cal als description: Ap Shape Shape Vermicular Irregular	-brown gray, porot oite-brown carbon ohyric Grain diameter o, vermicular plagion Grain diameter 0.01 × 0.04mm	us, spherulitic~ ate minerals fill Content clase and devitu Content ~35% ~20%	voids and show spherulitic~amygdaloidal texture. Description ified vitreous matrix. Description Vermicular, flow structure not clear. Devitrified.
Rock: Porous apl Description(unaide material filling void Description (micro Rock texture: Cry Phenocryst miner Mineral Matrix description Mineral Plagioclase Volcanic glass Alteration: Alteral	nyric basalt. ed eyes): Greenish ds. pscopic) : rptocrystalline. Cal als description: Ap als description:	-brown gray, porou cite-brown carbon ohyric Grain diameter , vermicular plagio Grain diameter	us, spherulitic~ ate minerals fill Content clase and devitu Content ~35% ~20%	voids and show spherulitic~amygdaloidal texture. Description ified vitreous matrix. Description Vermicular, flow structure not clear. Devitrified.
Rock: Porous apl Description(unaide material filling void Description (micro Rock texture: Cry Phenocryst miner Mineral Matrix description Mineral Plagioclase Volcanic glass Alteration: Alterat Altered mineral de	nyric basalt. ed eyes): Greenish ds. pscopic) : rptocrystalline. Cal als description: Ap Shape Cryptocrystalline Shape Vermicular Irregular tion not significant escription:	-brown gray, porou cite-brown carbon hyric Grain diameter , vermicular plagio Grain diameter 0.01 × 0.04mm except devitrificat	us, spherulitic~ ate minerals fill Content clase and devit Content ~35% ~20% ion of matrix. A	voids and show spherulitic~amygdaloidal texture. Description rified vitreous matrix. Description Vermicular, flow structure not clear. Devitrified. Iteration minor.
Rock: Porous apl Description(unaide material filling void Description (micro Rock texture: Cry Phenocryst miner Mineral Matrix description Mineral Plagioclase Volcanic glass Alteration: Alteral	nyric basalt. ed eyes): Greenish ds. pscopic) : rptocrystalline. Cal als description: Ap als description:	-brown gray, porot oite-brown carbon ohyric Grain diameter o, vermicular plagion Grain diameter 0.01 × 0.04mm	us, spherulitic~ ate minerals fill Content clase and devitu Content ~35% ~20%	voids and show spherulitic~amygdaloidal texture. Description ified vitreous matrix. Description Vermicular, flow structure not clear. Devitrified.
Rock: Porous aph Description(unaide material filling void Description (micro Rock texture: Cry Phenocryst miner Mineral Matrix description Mineral Plagioclase Volcanic glass Alteration: Alterat Altered mineral de	nyric basalt. ed eyes): Greenish ds. pscopic) : rptocrystalline. Cal als description: Ap Shape Cryptocrystalline Shape Vermicular Irregular tion not significant escription:	-brown gray, porou cite-brown carbon hyric Grain diameter , vermicular plagio Grain diameter 0.01 × 0.04mm except devitrificat	us, spherulitic~ ate minerals fill Content clase and devit Content ~35% ~20% ion of matrix. A	voids and show spherulitic~amygdaloidal texture. Description rified vitreous matrix. Description Vermicular, flow structure not clear. Devitrified. Iteration minor.

Appendix Table 3(3) Description of microscopic observation for rock thin section

	microphyric altered	basalt.		
Description(unai	ded eyes): Yellowist	n brown basalt. Clay	yey, fragile, micro	ophyric, contain vein~pipe white clayey parts.
Description (mic	roscopic) :			
Rock texture: Mi	crophyric texture,	vitreous matrix, cry	stallites notable.	**************************************
Phenocryst mine	erals description:			······································
Mineral	Shape	Grain diameter	Content	Description
Plagioclase	Subhedral Prismatic	0.4 × 1.8mm	~5%	Altered pseudomorph (clay minerals formed).
Clinopyroxene	Subhedral, sort Prismatic	0.5 × 0.9mm	~1%	Altered pseudomorph (smectite formed)
Matrix descriptio	on:Crystallite minera	als formed in the vi	treous matrix.	
Mineral	Shape	Grain diameter	Content	Description
Crystallite		Max 0.3~0.4mm	~20%	Rapid growth (quench), mineral unknown
Hematite	Stain		~10%	Matrix partly red.
Volcanic glass	irregular		~60%	
Alteration: Alter	ation weak. Weak de	evitrification observ	ed in volcanic g	lass matrix.
Altered mineral (description:			
Mineral	Shape	Grain diameter	Content	Description
				Clinopyroxene (?), plagioclase (?), pseudomorph. Product of
Sample: SMC13/	Pseudomorph AD04T01		~10%	vitreous matrix devitrification.
	AD04T01 ded eyes): Yellowisi	h green brown. Fine		
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic	AD04T01 ded eyes): Yellowist roscopic) :		e grained, compa	vitreous matrix devitrification. ct, aphyric, Weakly altered.
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He	AD04T01 ded eyes): Yellowis roscopic) : plocrystalline, coars		e grained, compa	vitreous matrix devitrification. ct, aphyric. Weakly altered.
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He	AD04T01 ded eyes): Yellowisi roscopic) : plocrystalline, coars rals description:		e grained, compa	vitreous matrix devitrification. ct, aphyric, Weakly altered.
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He Phenocript mine	AD04T01 ded eyes): Yellowis roscopic) : plocrystalline, coars	e grained, ophitic t	e grained, compa exture character	vitreous matrix devitrification. ot, aphyric. Weakly altered. ristic of dolerite.
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He Phenocript mine Mineral	AD04T01 ded eyes): Yellowisi roscopic) : plocrystalline, coars rals description: Shape Subhedral,	e grained, ophitic t Grain diameter	e grained, compa exture character Content	vitreous matrix devitrification. ct, aphyric. Weakly altered. ristic of dolerite. Description
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He Phenocript mine Mineral Plagioclase Clinopyroxene	AD04T01 ded eyes): Yellowisi roscopic) : plocrystalline, coars rals description: Shape Subhedral, Prismatic. Subhedral, sort Prismatic.	e grained, ophitic t Grain diameter 1 × 0.1mm Max: 1 × 2mm	e grained, compa exture character Content ~40% ~40%	vitreous matrix devitrification. ct, aphyric. Weakly altered. ristic of dolerite. Description Twinned, fresh, partly skeleton crystal.
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He Phenocript mine Mineral Plagioclase Clinopyroxene Matrix descriptio	AD04T01 ded eyes): Yellowis roscopic) : olocrystalline, coars rals description: Shape Subhedral, Prismatic. Subhedral, sort Prismatic. on: Matrix microholo	e grained, ophitic t Grain diameter 1 × 0.1mm Max: 1 × 2mm corystalline. Vermic	e grained, compa exture character Content ~40% ~40% ular plagioclase,	vitreous matrix devitrification. ct; aphyric. Weakly altered. ristic of dolerite. Description Twinned, fresh, partly skeleton crystal. Fresh, ophitic texture with plagioclase. devitrified glass observed.
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He Phenocript mine Mineral Plagioclase Clinopyroxene Matrix descriptio Mineral	AD04T01 ded eyes): Yellowisi roscopic) : plocrystalline, coars rals description: Shape Subhedral, Prismatic. Subhedral, sort Prismatic. on: Matrix microhok Shape	e grained, ophitic t Grain diameter 1 × 0.1mm Max: 1 × 2mm crystalline. Vermic Grain diameter	e grained, compa exture character Content ~40% ~40% ular plagioclase, Content	vitreous matrix devitrification. ct, aphyric. Weakly altered. ristic of dolerite. Description Twinned, fresh, partly skeleton crystal. Fresh, ophitic texture with plagioclase.
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He Phenocript mine Mineral Plagioclase Clinopyroxene Matrix descriptio	AD04T01 ded eyes): Yellowis roscopic) : olocrystalline, coars rals description: Shape Subhedral, Prismatic. Subhedral, sort Prismatic. on: Matrix microholo	e grained, ophitic t Grain diameter 1 × 0.1mm Max: 1 × 2mm corystalline. Vermic	e grained, compa exture character Content ~40% ~40% ular plagioclase,	vitreous matrix devitrification. ct, aphyric. Weakly altered. ristic of dolerite. Description Twinned, fresh, partly skeleton crystal. Fresh, ophitic texture with plagioclase. devitrified glass observed. Description
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He Phenocript mine Mineral Plagioclase Clinopyroxene Matrix descriptio Mineral Plagioclase Volcanic glass	AD04T01 ded eyes): Yellowisi roscopic) : plocrystalline, coars rals description: Shape Subhedral, Prismatic. Subhedral, sort Prismatic. on: Matrix microhok Shape	e grained, ophitic t Grain diameter 1 × 0.1mm Max: 1 × 2mm corystalline. Vermic Grain diameter 0.2 × 0.02mm	e grained, compa exture character Content ~40% ~40% ular plagioclase, Content ~10% ~5%	vitreous matrix devitrification. ct; aphyric. Weakly altered. ristic of dolerite. Description Twinned, fresh, partly skeleton crystal. Fresh, ophitic texture with plagioclase. devitrified glass observed. Description Vermicular in matrix.
Sample: SMC13) Rock: Dolerite Description(unai Description (mic Rock texture: He Phenocript mine Mineral Plagioclase Clinopyroxene Matrix descriptio Mineral Plagioclase Volcanic glass Alteration: Alter	AD04T01 ded eyes): Yellowisi roscopic) : plocrystalline, coars rals description: Shape Subhedral, Prismatic. Subhedral, sort Prismatic. on: Matrix microholo Shape Prismatic. ation weak. Devitrif	e grained, ophitic t Grain diameter 1 × 0.1mm Max: 1 × 2mm corystalline. Vermic Grain diameter 0.2 × 0.02mm	e grained, compa exture character Content ~40% ~40% ular plagioclase, Content ~10% ~5%	vitreous matrix devitrification. ct; aphyric. Weakly altered. ristic of dolerite. Description Twinned, fresh, partly skeleton crystal. Fresh, ophitic texture with plagioclase. devitrified glass observed. Description Vermicular in matrix.
Sample: SMC13/ Rock: Dolerite Description(unai Description (mic Rock texture: He Phenocript mine Mineral Plagioclase Clinopyroxene Matrix descriptio Mineral Plagioclase Volcanic glass	AD04T01 ded eyes): Yellowisi roscopic) : plocrystalline, coars rals description: Shape Subhedral, Prismatic. Subhedral, sort Prismatic. on: Matrix microholo Shape Prismatic. ation weak. Devitrif	e grained, ophitic t Grain diameter 1 × 0.1mm Max: 1 × 2mm corystalline. Vermic Grain diameter 0.2 × 0.02mm	e grained, compa exture character Content ~40% ~40% ular plagioclase, Content ~10% ~5%	vitreous matrix devitrification. ct; aphyric. Weakly altered. ristic of dolerite. Description Twinned, fresh, partly skeleton crystal. Fresh, ophitic texture with plagioclase. devitrified glass observed. Description Vermicular in matrix.

Appendix Table 3(4) Description of microscopic observation for rock thin section

Semple: SMC13AI	008T01		<u></u>	
Rock: Pyroxene b	esalt.	***************************************		· · · ·
Description(unaide	ed eyes): Green bro	own, porous, weak	ly altered. Phyrid	with fine plagioclase phenocrysts (~8mm).
Description (micro	scopic) :			·····
	• •	amvedaloidal textu	re. Phenocryst	matrix plagioclase show weak flow structure.
^o henocript minera				
Mineral	Shape	Grain diameter	Content	Description
Plagioclase	Subhedral, Prismatic.	Max 0.8 × 1.2mm	20~30%	Coarse grained, large phenocrysts, medium-grained phenocrysts. Magma inclusions observed.
Clinopyroxene (amygdaloidal)	Subhedral, Granular, Spheroidal~ Ellipsoidal.	0.2~0.4mm	~10%	Granular aggregates, closely attached to plagioclase, smectite fills interstices (incrustations~colloform).
Matrix description	:			
Mineral	Shape	Grain diameter	Content	Description
Plagioclase	Subhedral, prismatic.	0.04~0.3mm	10~20%	Vermicular in matrix.
Opaque minerals.	Subhedral Granular.		~5%	Scattered in matrix.
Volcanic glass	L	l	~20%	Void filling in matrix. Devitrified.
Alteration: Alterat	ion generally weak	Veins, alteration	of volcanic glass	s. Partly plagioclase altered.
Altered mineral de	escription: The de	scription is for me	trix.	
Mineral	Shape	Grain diameter	Content	Description
Smeatite	Splintery.	0.05~0.1mm		Occur as fillings in amygdaloids, and veins.
Quartz	Very fine grained. Mosaic.	0.01mm	~1%	Patch-form alteration product of plagioclase.
Sample: SMC13A	Diatoi			
Rock: Dolerite				<u>an an a</u>
	ed eves): Yellowish	areen brown fine	grained weakly	altered. Microdorerite (?).
Description (micro		i Breen proniti inte	- granou, nounij	
		aquimanular Oph	tic texture char	ecteristic of dolerite.
Phenocript miner		edailli anaiai . Obu	IC LEXILIE CITAL	
Mineral	Shape	Grain diameter	Content	Description
Plagioclase	Subhedral, Prismatic	0.04 × 0.2mm	~40%	Prismatic, flow structure not observed.
Clinopyroxene	Subhedral, Granular.	0.1~0.3mm	~40%	Granular, ophitic texture,
Opaque minerals.	Anhedral, Granular.	0.1~0.2mm	~5%	Scattered throughout
Matrix description	n: Smeetite (mixed	layer with chlorite	e ?) fills the crys	tal grain interstices of the matrix.
Mineral	Shape	Grain diameter	Content	Description
Alteration: Altera	tion generally wea	k. Smectite-like m	ineral observed	as a product of matrix volcanic glass devitrification.
Altered mineral d	escription:	and the second		
Mineral	Shape	Grain diameter	Content	Description
Smectite	Spherulitic, Corona form	0.02~0.05mm	~5%	Altered volcanic glass (devitrification product ?).
1	1	1	1	Occurs filling the interstices of crystal grains (possibility of

Appendix Table 3(5) Description of microscopic observation for rock thin section

Sample: SMS13A	D02T02			
Rock: Hyaloclast				
Description(unaid	ed eyes): Brown hy	alociastite. Do no	t contain pebble:	s. Coarse grained~pisolitic. Voids (milky white incrustation
inside) observed l	ocally.			
Description (micr	oscopic) :			
Rock texture: Cla	stic, network veins	developed. Pocke	ets of calcite.	
Clasts description	n: Consist of clay n	ninerals and opaqu	e minerals.	
Mineral	Shape	Grain diameter	Content	Description
Clay minerals	Colloform	~0.05mm	20~30%	Formed as clast grains or cementing matter.
Opaque minerals.	Fine granular	~0.02mm	~20%	Developed as clast grains.
Matrix description	n: Very minor amou	nt of microfossil f	ragments (specie	es unknown) observed.
Mineral	Shape	Grain diameter	Content	Description
Calcite	Spheroidal	~0.1mm	Rare	Pocket-form aggregates, developed as secondary veinlets.
Volcanic glass	irregular		~ 20%	
	tion intermediate. I product. These occ			als formed as cementing matter (colloform, void filling). Believe
Altered mineral d	escription:			
Mineral	Shape	Grain diameter	Content	Description
Smectite	Colloform	0.01~0.05mm	~20%	Alteration product of calcite grains or cementing matter.
	Anhedral fine			
Silica minerals.	Granuler	~0.01mm	~5%	Formed together with smectite. Veinlets also developed.
	Aggregate.			
·	Fine granule,	~0.01mm	5~10%	Developed filling clastic grain interstices
	Anhedral.	0.011111	0 10%	Portoreport man.B offere Bran interaction

Sample: SMS13A	003T01	 		a contraction and the second
	rous basait. Altere	d basalt.		
			ick-like appears	ance). Gravish white filling observed locally.
Description (micn	<u> </u>			
-	nyric porous. Matrix ing spherulitic~an		-	v weak flow structure. Vitreous \sim cryptocrystalline. Voids filled
Phenocript miner	als description: Bas	ically aphyric.	-	
Mineral	Shape	Grain diameter	Content	Description
Plagioclase	Subhedral,	0.1 × 0.2mm	~2%	Very minor amount (fell out?)
Clinopyroxene	Subhedral, Granular	0.8 × 0.2mm	~2%	Pseudomorph, clay minerals.
Matrix description	n: Generally vitreou	s~cryptocrystallir	ie.	
Mineral	Shape	Grain diameter	Content	Description
Plagioclase	Acicular~ Prismatic	0.02 × 0.4mm	~40%	Repid growth (quenched product?)
Silica minerals	Cryptocrystalline	~0.01mm	~10%	Small amount in matrix.
Opaque minerals			~10%	
Volcanic glass	Irregular		~ 30%	
Alteration: In phe generally weak.	nocrysts, clinopyro	xene is argillized (s	mectite), altera	tion significant. Matrix partly argillized (smectite), but alteratio
Altered mineral d	escription:	· · · · · · · · · · · · · · · · · · ·		
Mineral	Shape	Grain diameter	Content	Description
Smectite	Splintery~Flat.	0.01~0.05mm	~5%	Replaced pyroxene phenocryst pseudomorphically. Also fill voids in matrix in pools and patches.
	Granular.	0.4~0.6mm	~5%	

.

Appendix Table 3(6) Description of microscopic observation for rock thin section

Sample: SMC02A	D11T01			
Rock: Basalt				
Description(unaide		green brown, relat	ively fresh, unal	tered. Microphyric, black-white speckled, plagioclase
henocrysts obse				
Description (micro				
lock texture: Mic structure.	rophyric texture (p	artiy splinter aggre	gate texture). F	Plagioclase in both phenocrysts and matrix shows flow
Phenocript minere	als description:			
Mineral	Shap e	Grain diameter	Content	Description
Plagioclase	Subhedral, Prismatic ~ Granular	Max 0.5 × 1.2mm Generally 0.05 × 0.02mm	20~30%	Many medium-grained prismatic plagioclase have skeleton crystal generally with flow structure. Few altered.
Matrix description	n: Vitreous matrix. (Clinopyroxene, plag	zioclase, opaque	minerals observed.
Mineral	Shape	Grain diameter	Content	Description
Plagioclase	Subhedral, Prismatic.	0.1 × 0.02mm	~10%	Flow structure. Acicular~skeleton crystals, unaltered.
Clinopyroxene	Subhedral, Sort Prismatic~ Granular.	0.02~0.05mm	~10%	Scattered in matrix. Alteration not observed.
Volcanic glass	Irregular		~40%	Partly altered to smectite.
		. Smectite formed		n of volcanic glass.
Altered mineral d		• • .• • • • •		
Mineral		Grain diameter	Content	Description
minerai	Shape	Grain diameter	Content	
Smectite	Platy~splintery	0.1~0.02mm	~10%	Inferred to be devitrification product of volcanic glass in matrix.
		ļi		n de la constante de la constan La constante de la constante de
Sample: SMC02A	D11T02		· · · ·	
	~siltstone (contai)	n foreminifere)	,	
	led eyes): Yellowish		vev microphyrit	e framle
Description (micr	· · · · · · · · · · · · · · · · · · ·	- Broon bronnik old	yey, morophyrie	of it oblige
	ssiliferous mudstor	eccilteone		· · · · · · · · · · · · · · · · · · ·
		····		siltstone (pelagic sedimentary rock). Clastic material are silica
	c glass, basaltic vol		ous muustone.	sitistone (pelagio seulmentary rock). Glastic material are silica
Mineral	Shape	Grain diameter	Content	Description
Silica minerals.	Anhedral	~0.2mm	~30%	
Volcanic glass.	Irregular		~10%	
	1	of opaque minerals		ed from volcanic glass.
Mineral	Shape	Grain diameter	Content	Description
Opaque minerals		~0.05mm	~10%	
	ation medium. Smed	1	L	
······································	·····		•	matrix altered to smectite, authigenic minerals partly remain.
Mineral	Shape	Grain diameter	Content	Description
Smectite				Formed by alteration of matrix and pyroclastic material

Appendix Table 4 Results of FDC survey

VTR 8mm 1 2 2 3 2 \sim -No. of Photos 111 182 182 102 182 211 8 30 Observation Observation Length 2.1 1.0 4 2 1.7 2 σ 4 2 Ś 3 ö ਂ and OD:FDC on the deck 2:15Time 2:42 3:02 2:201:38 1:15 0:45 2:01 summit of south part of seamount middle part of southeast flank summit of east part of seamount middle part of northeast flank part of seamount part of seamount north margin of seamount summit middle part of northeast flank northeast flank lower part of northeast flank 3,176 north flank of seamount 3,269 depression of skirt north flank of seamount seamount Legend IS:FDC into the sea, SP:Start point of observation, EP:End point of observation, Note FDC position is calculated by GPS ship position, CTD depth of FDC and wire length. skirt depression of skirt General Location summit of east summit of east middle part of 3,094 north flank of 3,317 depression of s depression of summit 20. 766 E 1, 829 22. 736 E 3, 036 05.274 E 1, 179 07.059 E 2, 514 1, 458 1 2, 707 2, 633 3, 287 3, 290 1 3, 269 4 Depth 1, 651 3, 187 Ē 00. 227 E 31. 030 E 3 34. 849 E 36. 782 E 32.916 E 33.874 E 3 33. 060 E 37.472 E Longitude(E) Position 161° 161° 141° 141° 160° 160° 160° 160° 141° 145° 145° 146° 141° 146° 141° 10.048 N 141° 10.397 N 141° 09. 999 N N 10. 700 N 1 26.095 N 27.343 N 30. 411 N 31. 231 N 10.664 N 10.682 N 10.447 N 09.310 N 27.502 [^] N 28.423 [^] N 904 [°] N 581 N FDC F Latitude (N) 19. 21. 10,10 °90 . ດິດ ° ° ထံထိ ∞° ∞ິ ზი ം ືດ ດີ 30 03:51 30 06:06 24 21:53 24 22:27 25 01:29 25 02:28 05 02:47 05 03:39 05 05:40 05 06:45 29 04:41 29 05:42 29 08:18 29 08:18 29 21:59 29 22:53 Jun 17 21:54 Jun 17 22:21 04 21:38 04 23:58 30 01:53 30 01:53 30 02:51 30 03:38 01:53 20:56 30,00:08 30 07:06 18 01:03 00:52 30.03:03 30 04:38 Date&Time (IJTC) Jun 18 04 05 04 May Jun May May lun Jun May Jun <u>I</u>un Jun Jun Iun Tun Цщ lun Jun Jun I tem N P F 8 N P F 8 **Track** Line No. MC11 98SMC11FDC01 98SMS13FDC02 98SMS02FDC02 98SMS02FDC03 M C 12 98SMS12FDC01 M C 13 98SMS13FDC01 98SMS13FDC01 98SMS02FDC01 MS13MC02SeaAppendix Table 5(1) Results of chemical analysis of cobalt-rich crust

The function of the fun
210 8 Nemer 6 0 </td
210 1
210 B - 1
210 B B B B B Col
7371 Å fargenes 25 45 100 131 020 131 100 131 020 131 031 </td
3800 A owner 1 0 30 0 200
3200 11 5 1 4
307 6 0 7 0 7 0 1 0 1 0 1 0 0 1 0 0 1 0 0 1 0 0 1 0 0 1
1 2786 A addition built 0011 0001 001 0001 0011 0001 0011 0001 00111 0011 0011
1 938 A autimation - </td
1 105 A cebbin 105 C limetrion bebrelie built 0.57 <t< td=""></t<>
1 12:8 A cebbie 9 B Immettion befine befin 05:8 05:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 01:0 17:5 1
0. 21/3 0. 0.000 1.000 1.000 2.000 1.000 2.000<
07. 07.
21/1 21/1 21/1 21/2 <th< td=""></th<>
2111 5121 <th< td=""></th<>
247 5 -
2113 0 modelie 8 6 modelie 8 6 modelie 9 6 modelie 715<
713 A Formula E Image of a bit is a control Bulk of a bit is a control 273 55 214 713
1736 A Terment 26 0.0 Left Dedrvitial Dells 0.945 0.245 0.716 0.71 0.75 1.44 0.096 0.077 3.55 1.35 0.301 3.75 1.41 0.095 0.055 0.15 1.15 1.15 1.15
1736 A Contant 20 Not BOD Not Description Descrip
1736 241 -
1738 A3 173 A13 273 2414 1010 165 1026 1075 147 1026 1075 147 1026 1075 147 1026 147 1175 1175 1175 1175 1175 118
1736 A3 Cookie 70 40 15 101 0.05 101 0.05 101 0.05 0.01 101 0.05 0.01 0.001 0.01 0.001 0.01 0.00
1106 A consta 20 40 100 200.4 10.00
286 A - Cust 3 1 1 3 1 1 0 1 0.00 1.66 1.86 0.00 0.00 1.66 1.8
2786 A Creat 51 73 90 153 15 16 15 <t< td=""></t<>
A 728 C Cruck 52 13 23 13 14 23 15 modeltome bet/veidal bufk 0.24 0.24 0.26 0.09 15 0.025 0.06 11 23 7 7729 A cobble 90 120 5 preservicial bet/veidal bet/v 0.254 0.264 0.000 11.95 0.025 0.01 1.95 0.025 0.01 1.17 0.025 0.01 1.17 0.025 0.05 1.17 1.17 0.025 0.025 0.01 1.17 0.025 0.025 0.01 1.17 1.17 0.025 0.025 0.01 0.025
2795 B cuart 15 75 72 000 14.82 20.96 0100 1.95 0707 0000 911 2.88 1 17260 A cobbbs 90 172 000 1.87 0.000 1.93 0.072 0.006 911 2.88 1 17260 A cobbbs 90 172 010 0.81 1.93 0.075 0.056 610 1.13 0.025 1.14 1.79 1.79 1.75 0.81 1.14 0.85 0.65 1.66 611 1.36 0.025 0.65 615 1.14 1750 A1 -<
C = 253 0 0 = 000 133 0 = 000 134 0.000 16.4 2.17 0.00 0.00 1.00 1.00 0.00 1.00 0.00
17.00 1.0 2.0 2.0 2.0 0.0 10.0 201<
1780 1/2 -
1790 A5 -
1730 M -
1750 F module 20 40 20 64.56 Del/s 10.56
2786 C fagment 15 200 0.001 <th0.001< th=""> <th0.001< th=""> <th0.001< td="" tht<=""></th0.001<></th0.001<></th0.001<>
2347 C cebble S0 105 - interstone Egynule bulk 0.328 0.325 18,24 22:10 0.12 0.06 1.40 0.064 538 1.45 2347 E owai S0 60 40 confidence bulk 0.463 0.358 0.055 18,24 22:10 0.17 0.06 1.40 0.064 538 0.61 2047 E owai S0 60 400 confidence bulk 0.368 0.056 1.45 0.053 0.69 0.055 0.69 0.65 0.61 0.61 0.66 0.65 0.65 0.65 0.65 0.61 0.61 0.61 0.66 0.65
Zur E oute S0 E0 A0 Confidementation Eulit 0.483 0.358 0.027 11.4 0.00 0.96 0.0053 0.59 0.61 Zur F one S0 60 40 confidementation builk 0.358 0.254 12.64 10.07 1.42 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 1.45 0.031 0.58 0.58 1.45 0.041 0.58 1.45 0.041 0.58
2002 A cabbie 36 100 - limetone betreidal bulk 0.326 0.764 00.001 15.67 115.82 0.11 0.06 1.42 0.001 0.051 5.88 1.53 2003 0.007 22.42 19.49 0.13 0.07 055 0.052 4.24 0.94
2227 0220 0001 1322 2247 0.06 011 220 3021
200 200 200 200 200 200 200 200 200 200
2019 F CODIE 10 13 * CONTRACT LEVEN AND TOTAL
1375 H cobbie 100 140 - h-b-b granue dun ucos ucos ucos 100 100 55 55 55 100 100 2007 51 101 100 105 55 55 100
osecurizaruaziumi 21.6 201 21.20 1021 2021 2021 2021 2021 2021



	aampin a	sampling code denth(m)	type of crust	dictor.	thickness (mm)	0 substrate	condition of surface	analyzed part	8 ×	2 #	3.≠	£ ×	£ *	£ *	2- 1-2 *	**	× ×	iā v	₹ ×	8 ×	د ب	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	o maa	di b	ž	E E	3 14 0 16 14	Cd To Dy Dom Dom Dom	2 4 2 4	us la Pr	α μα 1 μα	<u>א</u> ב א ה	¢. V×¥
965MS13AD00002	1912	R.	-	2	2 2	besett	botryoidel	butk	0.529	0,472	0.065	17.51	17.23	011 0	0.09 1.19	1.19 0.018	0.045	6.03	220	5.00	1 10 0	0.500 289	80 755	400	8	8 37	8.81 3	35 6.3	41 9	9.2 30	4.28	25 4.31	8
965 NG13 ADDROWCZ	2527		const	5	8	be set	botryoidel	bulk	0.673			21.86	19.85	0.13 0	007 1.22	2 0.039	0.007	8	1,01	239	a37 0	0.282 274	74 815	5 43.5	191	37 9	9.49 3	36 5.8	\$	82 29	4.38	25 438	1.10
DESINE L'ACTORIZACIÓN D	2036		, terres	8	10	COL	betryoidet	bulk	a.532	0.362	0.028		18.05	18.05 012 0.06 1.25	06 1.25	5 0.041	0.041 0.061	4.01	1.00	2.91	0.48	0.349 29	296 820	14.6	g	38	9,31 3	36 6.9	4	9.2 30	4.44 2	26 445	1.15
965MS13AD06CMD1	380	<	crat				betryoideí	bulk	0.471 0.418	0.418	0.026	24.67	17.47	0.13 0	0.08 0.54	4 0.074	0.073	1.91	635	3.18	0.64	0.249 37	372 1154	1 22	×	51 12	12.80 4	46 8.8 8.8	8	11.0 34	488	28 4 .50	. 41
PREME 13 ADDS CAN'S	9 5	F		12				outer	0.997	0.512		27.00	17.85	0 14 0	007 1.14	4 0.069	0.065	239	042	266	024 0	0264 35	322 817		ŝ	1 1	11.60	- 80 - 80 - 80	5	10 33	511 3	30 513	152
BESNE1340060MD3	88 X	<u>-</u>		9	15		-	inner(1)	0503	0434	000	24.99	2035	C 14 0	0.08 1.35	5003	0,006	2.90	920	253	0 80	0.150 37	370 897	51.5	22	52	12.90 5	20 31	55	110 36	513 2	14 8	3
DESNETSADOSCANDA	5822			13	15 10			inner(2)	0722 ·	0.526	0003	2462	1731	0 110	000 100	0003	3 2075	27	80	247	024 0	0197 35	336 918	8 58.9	33	۰ کا	1410 5	51 93	8	110 23	485	28 435	142
PESME13 ADDSCANDS	8	3	ĥ		12 12		-	inner(3)	D 466	0759	0006	27.82	1528	0.12 0	0.09 0.76	008	000	9	031	271	2	0327 314	14 1581	n 865	82	्र इ	1090	37 73	8	85 26	373 2	2 36	8
BESNET 3 ALDOSCANOS	6827	ষ	1	2	01 01	1	•	inner(4)	0.418		2000	26.22	1914	0.15	0.09	¥ 0000	0020	8	- 98 0	316	0 0	0.631	407 1997	7 567	8	2 29	1070	34 70	ş	76 23	345 2	20 316	
965ME13AD06CMD7	88	-		2	- 3	,	1	innermost	D 299		- 900 Q	1886	17 13	021 0	0.08 115	5 0.067	003	20	047	106	2,71 0245		534 1840	0 11 0	30	51	1200	45 90	2	120 40	589 3	34 5.76	511
SESNE13ADDECHDE	5280	ω	cobbie	9	160	fragment	betryroidet		0.334	0.321			14.94	0,10 0.07	07 0.95	_	3 0.054	8	1.49	8.05	2.06 0.	0.455 23	332 1006	6. 49.2	210	33	9.87 3	35 6.8	42	91 20	4.06.2	24 3.94	1.12
SESNET 3 ADOSOM09	8			5			-	outer	0617	0.493		2421	1867	C 13 0	0.07 1.04	1900 M	0038		0.55	24	C 40	0.145	39 80	505	3	4	1130 4	44 82	- स	110136	531 3	30 515	
BESINE 13 ADOSCAND	83	ł	·	2	5 8	. 1	'	inner(1)	0651	0.423		wez	19.13	012 0	207 149	0.005	0008	4 83		240	0.26	0165 31	319 532	2 502	217	5 1	1060	38 75	q	100 31	4 58	27 4.52	
DESMET3ADOSOMI 1	88		і	8				inner(2)	0.647	040		2033	17.49	0 80 0	267 1.33	3 0,038	3 2 5 5	4 46	ğ		C 21	0.605 23	276 994		18		937 31	1 55	Ş	84 27	395 2	24 405	8
965MS13AD06CAM2	82	8		20	15 25	1	-	inner(3)	0.445	0419	0.130	22.80	2071	000	000 100 0	2 0006	0000			236	032 0	0.649 25	290 939	9 475	3 2	51 21	1310 4	47 87	¢	100 88	52	8 8	51
965MS13AD060M13	682Z	18	1	-8	100 100			innermost	0124	9109	0000	11.41	12:05	011 0	005 080	0001	- 0046	328	ě	1727	556 0	0324 33	8211 332	183 6	ş	5	732 2	27 52	<u>ज</u>	67 Z3	297 1	18 2.97	
985MS13AD070MG3	2469	9	cobble	2 22	. 0 4 06	baselt	betryoidal	bulk	0.399	0.364	0.054	21.98	16.97	010	0.08 1.04	4 001	0.078	31	82.0	ŝŝ.	0.87 0.417		330 1161	23	230	1	11.00 38	5 74	45	54 23	422	26 4 34	8
985MS13AD08CMD1	200	٩	cobbie	30	50 10	beselt	betryoidel	bulk	0.435	0.377	7 0.033	19.69	15.73	0.09	007 0.99	100 8	0.062	38	<u>87</u> 0	6.16	1.56 0.376	376 295	95 832		18	37 9	9.15 3	32 28	40 8,4	14 27 3.88		2 3.70	1.25
985MS13AD09CMD7	1837	0	terro	59	50 4 0	1	botryoidal	Ault Built	0.379	0.322	100.0	18.20	17.67	0 00 0	0.07 1.20	0 0.031	0.048	5.70-	1.74	3.51	3.51 0.82 0.404	5 5	296 673	3 425	188	37 9	3.52	89 (B9	5 53	9.7 31	4.43	26 4.70	8
98SMS13AD09CM13	1837	Ш	cobble	50 (50 40	basalt	botryoidal	bulk	0.484	0.481	0.062	22.51 13.32	13.32	010 0.07	07 0.52	2 0.02		0.053 2.45		6.51	0.73 6.51 1.33 0.469	469 260	615 08	392	Ĕ	8 8	821 3	30 5.0	88	83 27	27 402 2	24 4.25	1.69
985MS13AD10CM01	7333		fragment	27	30 25		granule	bulk	0.516 0.277		60 00	20.98	18.28	0.12 0	007 132		0.036 0.056 4.14	41	8	210 027	0.27 0	0.161 31	316 834	46.2	g	40 10	10.20 4	40 75	8 8	10.0 32	4.71 2	28 457	1 15
965MS13AD13CMD1	2464	8	cobble.	8	25 18	limestone	granula	bulk	0.769	0.51	0.015	23 43	16.09	23 43 15.09 010 006 1.19 0037 0045 3.58	36 1.15	6 0 03	0.045	3.58	0 93	2.45	0.26 0	2 45 0 26 0 248 270		807 413	ž	35 9	910	3 57		67 41 86 28 413		25 411	146
									•																								

Appendix Table 6 Sea-Water sound velocity for MBES

			MCT T	54]	MULZ		MC13	M	MS13
Lat.	9° 13. 974' N	Lat.	7° 29. 996' N	Lat.	9°21.013'N	Lat.	19° 28. 053' N	Lat.	8°18,070'N
Long.	141°34.568'E	Long.	161°15.022'E	Long.	146° 20. 787' E	Long.	158°09.993'E	Long.	160° 25. 125' E
Water depth	Soun	Water depth	Sound velocity	Water depth	Sou	Water depth	Sound velocity	Water depth	Sou
(m)	(m • S ⁺)	(III)	(S • W)				(m·s)		
10	1, 543. 8	10	1, 542. 3	- n 10	L, 543. 4	10	I, 543. U	10	1, 342. 4
20	1, 543. 9	20	1, 542. 4	20	1, 543. 5	20	1, 543. 2	20	1, 542. 4
35	1, 544. 2	35	1, 542. 7	35	1, 543. 8	35	1, 543. 4	35	1, 542. 9
50	1, 544. 4	50	1, 542. 9	50	1, 544. 1	50	1, 543. 7	50	1, 543. 5
10	1, 544. 2	. 70	1, 543. 1	70	1, 544. 4	70	1, 543. 9	70	1, 543. 8
100	1,541.6	100	1, 543.8	100	1, 542. 4	001	1, 539. 5	100	1,541.1
200	1, 503. 1	200-	1, 505. 3	200	1, 506. 4	200	1, 509. 2	200	1, 503. 8
300	1, 492. 3	300	1, 493. 7	300	1, 495. 7	300.	1, 494. 7	300	1, 493. 4
500	1,488.3	500	1, 489. 9	500	1, 489. 7	500	1, 489. 5	500	1, 491. 3
700	1, 487. 1	200	1, 486. 4	002	1, 487. 9	002	1, 487. 1	700	1, 487. 3
1,000	1, 485, 5	1,000	1, 485. 5	1, 000	1, 486. 3	1,000	1, 486. 1	1, 000	1, 484. 6
1, 500	1,486.2	1,500	1, 486. 9	1, 500	1, 486. 1	1, 501	1, 486. 6	1, 500	1, 486. 9
2,000	1,491.5	2,000	1, 491. 7	2, 000	1, 491. 3	2,000	1, 491. 4	2, 000	1, 491.8
2, 500	1,498.8	2, 364	1, 496. 6	2, 500	1,498.1	2, 501	1, 498. 5	2, 364	1, 498. 7
3,000	1, 507. 2	2, 750	1, 502. 4	3, 000	1, 506. 1	3, 001	1, 506. 3	2, 750	1, 506. 3
3, 488	1, 515. 9	3, 500	1, 514. 4	3, 500	1, 514. 6	3, 380	1, 512. 4	3, 500	1, 514. 4
4,000	1, 523. 1	4, 000	1, 522. 9	3, 705	1, 518, 1	3, 500	1, 514. 6	4, 000	1, 522. 4
4, 500	1, 531. 9	4, 470	1, 531. 1	4, 000	1, 523. 1	4, 000	1, 523. 1	4,470	1, 531. 1
5, 153	1, 543. 8	5, 000	1, 540. 9	4, 500	1, 531. 9	4, 500	1, 531. 9	5,000	1, 540. 9
5, 458	1, 549. 4	5, 458	1, 549. 4	5, 153	1, 543. 8	5, 153	1, 543. 8	5, 458	1, 549. 4
Åvo.	6.0	Ave	1.509.5	Ave.	1.507 4	Ave.	1, 507.4	Ave.	1, 509, 9

Appendix Table 7 Weather and sea-state data

1.Monthly frequency distriction of wind direction in 1998

W.D.	C A L M	N	N N E	N E	E N E	E	E S E	S E	S S E	S	s s ¥	s w	W S W	w	≲ ≾ ≲	N W	N N N N N	Not Clear	Total
May	0	5	0	42	294	178	27	4	0	0	0	0	0	0	0	2.	0	24	576
X	0.00	0.87	0.00	7.29	51.04	30,90	4.69	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	4.17	100.00
June	0	.2	6	45	265	181	44	22	6	1	1	1	1	0	0	0	1	24	600
%	0.00	0,33	1.00	7.50	44.17	30,17	7.33	3.67	1.00	0.17	0.17	0,17	0.17	0.00	0.00	0.00	0.17	4.00	100.00
July	0	0	0	0	0	14	90	72	15	1	0	0	0	0	0	0	0	0	192
%	0.00	0.00	0.00	0.00	0.00	7.29	46.88	37.50	7.81	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

2.Monthly frequency distriction of wind velocity in 1998

															-						(W	.V:m	/sec)
	С											ľ											·
w.v.	A	0	1	2	3	4	5	6	7	8	9 -	10	11	12	13	14	15	16	17	18	19	20	Total
	м				 1																	н. 	
May	1	0	3	2	3	1	12	25	83	133	127	98	49	29	8	2	0	0	0	0	0	0	576
%	0.17	0.00	0.52	0.35	0.52	0.17	2.08	4.34	14.41	23.09	22.05	17.01	8.51	5.03	1.39	0.35	0.00	0.00	0.00	0.00	0.00	0.00	100.00
June	1	0	5	4	10	18	54	76	95	120	106	84	23	2	0	0	1.	0	1	0	0	0	600
X	0.17	0.00	0.83	0,67	1.67	3.00	9.00	12.67	15.83	20.00	17.67	14.00	3,83	0.33	0.00	0.00	0.17	0.00	0.17	0.00	0.00	0.00	100.00
July	0	0	0	0	0	5	33	80	50	22	2	Ó	0	0	0	0	0	0	0	0	0	0	192
*	0.00	0.00	0.00	0.00	0.00	2.60	17.19	41.67	26.04	11.46	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

3.Monthly frequency distriction of weather in 1998

Weather	Fine	Cloudy	Rain	Not clear	Total	Light Rain
May	21	2	1		24	12
×	87.50	8.33	4.17	0.00	100.00	50.00
June	13	8	4		25	10
*	52.00	32.00	16.00	0.00	100.00	40.00
July	7	1	0	T	8	4
. %	87.50	12.50	0.00	0.00	100.00	50.00

Monthly frequency distriction of atmospheric pressure(daily average) in 1998

A.P.	-980	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019-	Not Clear	Total
May	0	0	0	0	0	. 0	0	0	3	. 34	96	151	163	100	26	2	0	0	1	0	576
%	0,0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	5,9	16.7	26.2	28.3	17.4	4.5	0.3	0.0	0.0	0.2	0,0	100.0
June	0	1	0	0	Q	0	0	0	28	138	203	163	53	12	2	0	0	0	Ϊ0	0	600
%	0,0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	4.7	23.0	33.8	27.2	8.8	2.0	0.3	0.0	0.0	0.0	0.0	0.0	100.0
July	0	0	0	0	0	0	0	0	0	0	0	0	0	16	49	65	43	17	1	1.	192
*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0,0	0.0	8.3	25.5	33.9	22.4	8.9	0.5	0.5	100.0

Monthly frequency distriction of no.1 swell direction in 1998

S.D.	N	N N E	N E	E N E	E	E S E	S E	S S E	S	S S W	s W	¥ \$ ¥	W.	W N W	N W	N N W	Not Clear	Total
May	0	0	8	147	144	20	8	0	0	0	0	0	Q	0	0	0	249	576
% -	0.0	0.0	1.4	25.5	25.0	3.5	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.2	100.0
June	0	0	27	181	119	4	1	0	1	1	0	0	0	0	0	0	266	600
8	0.0	0.0	45	30.2	19.8	0.7	0.2	0.0	0.2	0.2	0.0	0.0	0.0 -	0.0	0.0	0.0	44.3	100.0
July	0	-0	0	0	15	87:	10	O	0	0.	0	0	0	0	0	.0	80	192
N	0.0	0.0	0.0	0,0	7.8	45.3	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.7	100.0

Monthly frequency distriction of no.1 swell cycle in 1998

																(W.)	<u>√ :m</u> /	(sec)
S.C.	0	1	2	3	- 4	5	6	7	8	9	10	11	12	13	14	15	Not Clear	Total
May	0	0	0	0	0	13	113	148	40	11	2	· 0	0	Ó	0	0	249	576
×	0.0	0.0	0.0	0.0	0.0	2.3	19.6	25.7	6.9	1,9	0.3	0.0	0.0	0.0	0.0	0.0	43.2	100.0
June	0	0	0	0	1	29	151	147	15	4	0	0	0	0	0	0	253	600
X	0.0	0.0	0.0	0.0	0.2	4.8	25.2	24.5	2.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	42.2	100.0
July	0	0	0	0	5	29	65	13	0	0	0	0	0	0	. 0	Ó	80	192
*	0.0	0.0	0.0	0.0	2.6	15.1	33.9	6,8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.7	100.0

(0

See. 2

Monthly frequency distriction of no.1 swell height in 1998

											· (<u>S. H</u>	.:m/
S.H.	0	1	2	3	4	5	6	7	8	9	10	Nöt Glear	Total
May	0	29	150	140	8	0	0	0	0	0	0	249	576
<u>×</u>	0.0	5.0	26.0	24.3	1.4	0.0	0.0	0.0	0.0	0.0	0.0	43.2	100.0
June	0	25	187	134	2	0	0	0	0	0	0	252	600
*	0.0	4.2	31.2	22.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	42.0	100.0
July	0	31	80	1	0	0	0	0	0	0	0	80	192
8	0.0	16.1	41.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.7	100.0

Monthly frequency distriction of degree of cloudiness in 1998

D.C.	0	1	2	3	4	5	6	7	8	9	10	Not Glear	Total
May	0	0	12	99	154	175	71	45	20	0	0	0	576
%	0.0	0.0	2.1	17.2	26.7	30.4	12.3	7.8	3.5	0.0	0.0	0.0	100.0
June	0	1	12	119	109	142	91	42	84	0	0	0	600
%	0.0	0.2	2,0	19.8	18.2	23.7	15.2	7.0	14.0	0.0	0,0	0.0	100.0
July	0	0	1	48	53	48	33	6	0	0	0	3	192
%	0.0	0,0	0.5	25.0	27.6	25.0	17.2	3.1	0.0	0.0	0.0	1.6	100.0

Monthly frequency distriction of no.2 swell direction in 1998

S.D.	N	NИ	N E	E N E	Е	шSШ	S E	S S E	S	s s W	s W	W S W	w	≷ z ≷	N W	z z X	Not Clear	Total
May	0	0.	6	11	10	3	Q	0	0	0	0	0	0	0	0	0.	546	576
X	0.0	0.0	1.0	1.9	1.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.8	100.0
June	0	0	7	9 -	8	24	15	0	2	0	0	0	0	0	- 0	0	535	600
*	0.0	0.0	1.2	1.5	1.3	4.0	2.5	0.0	0.3	0.0	0,0	0.0	0,0	0,0	0,0	0,0	89.2	100.0
July	0	0	0	2	0	0	2	3	0	0	0	0	0	0	0	4	181	192
X	0.0	0.0	0.0	1.0	0.0	0.0	1.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	94.3	100.0

Monthly frequency distriction of no.2 swell cycle in 1998

	-				· ·											(W.)	/ :m/	/sec)
s.c.	0	1	2	3	4	5	6	17	8	9	10	11	12	13	14	15	Not Clear	Total
May	0	0	• 0	0	ï	11	6	12	0	0	0	0	0	0	0	0	546	576
8	0,0	0.0	0.0	0.0	0.2	1,9	1.0	2.1	0,0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.8	100,0
June	0	0	2	2	4	32	. 11	14	0	0	0	0	0	0	0	0	535	600
×	0.0	0,0	0.3	0,3	0.7	5.3	1.8	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.2	100.0
July	0	. 0	0	0	7	4	0	0	0	0	0	0	0	0	0	0	181	192
%	0.0	0.0	0.0	0.0	3.6	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.3	100.0

Monthly frequency distriction of no.2 swell height in 1998

S.H.	. 0	1	2	3	4	5	6	7	8	9	10	Not Clear	Tota
May	0	1	29	0	0	0	0	0	0	0	0	546	576
8	0.0	0.2	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.8	100
June	0	49	16	0	Q	0	0	0	0	0	0	535	600
*	0.0	8.2	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.2	100
July	0	8	- 3	0	0	0	0	0	0 .	0	0	181	19:
- %	0.0	4.2	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.3	100