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METAL CONTENT OF FERROMANGANESE DEPOSITS OF THE OCEANS

D. R. HORN, M. N. DELACH AND B. M. HORN
LAMONT-DOHERTY GEOLOGICAL OBSERVATORY OF COLUMBIA UNIVERSITY
PALISADES, NEW YORK

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ABSTRACT

A compilation of published and unpublished chemical analyses of samples of ferromanganese deposits from the ocean floor reveals that only in relatively few areas of the world are the copper and nickel contents sufficiently high for the nodules to represent a potential source of metals.

The North and South Atlantic and Indian Oceans are characterized by deposits whose metal content (Cu, Ni, Mn and Co) are well below the minimum values necessary for economic exploitation.

The situation is more favorable in the Pacific Ocean and most encouraging in the North Pacific. In the South Pacific, nodules containing over 1% Ni and lesser amounts of copper occur in the Peru Basin, in deep waters east of the Marquesas Islands and Tuamotu Plateau, and within the Southwest Pacific Basin. The relatively low Cu and Ni values obtained in these areas may eliminate them as prospective mining sites.

Only in the North Pacific do the analyses consistently show values greater than 1% Cu and 1% Ni, and these nodules, therefore, are the immediate target of the ocean mining industry. The deposits of interest lie north of the equator in a broad band between 6°30'N and 20°N and stretching from 110°W to 180°W. Maximum copper and nickel values occur along a line 8°N to 10°30'N and 131°30'W to 145°W.

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INTRODUCTION

In response to the needs of the mining industry and government, research institutions of the United States have been asked to compile, print and distribute data in hand related to the various aspects of ferromanganese deposits of the oceans (Maps 1-8). The work is sponsored by the International Decade of Ocean Exploration of the National Science Foundation. This second report in a series by the authors presents listings of chemical analyses of ferromanganese nodules and crusts. The previous report dealt with ferromanganese deposits of the North Pacific (Horn et al., 1972a). A later report will deal with metal values and sites for research and mining (Horn et al., 1973). The purpose of these reports is to assemble existing data rather than to conduct fundamental research on the deposits.

A list is given below of the sources of data and procedures of chemical analysis followed by investigators. Six hundred and five analyses are listed in the Appendices. Two-thirds are samples from the North and South Pacific where most interest lies. The number of analyses increases each year and regional trends in the distribution of metals of interest to the ocean mining community are beginning to appear (See maps 1-8 in pocket). There is also the problem of the chemical analyses being conducted by many different methods - some being considered less reliable than others. Because the data are often not directly related, remarks made in this report should be considered general in nature and tentative.

LIST OF SOURCES, PROCEDURE FOLLOWED AND NUMBER OF SAMPLES ANALYZED.

Author or Source	Method	North Pacific	North Atlantic	South Pacific	South Atlantic	Indian	Worldwide
Mero, 1965	X-ray fluorescence	79	12	11	4		106
	Emission	1		11			12
Cronan and Tooms 1967 and 1969	Emission + X-ray fluorescence	49		25		42	116
Menard et al., (Scripps - unpub.)	Emission	13		40	5		58
Lamont-Doherty (unpublished)	Wet chemical	48	12	31	29	18	138
	Atomic absorption	9	7	7	5	3	31
Ahrens et al., 1967	X-ray fluorescence	5	4	5	2	10	26
Willis and Ahrens, 1962	Emission		2	2	3	4	11
Murray and Renard, 1891	Wet chemical	6		21			27
Skornyakova, 1968 Skornyakova et al., 1962, 1964	Wet chemical and colorimetry	24		18			42
Hewett et al., 1963	? Spectrography	5		3			8
Goldberg, 1954	Colorimetry			1			1
Goldberg and Arrhenius, 1958	?	1					1
Dietz, 1955	Colorimetry	2					2
	Wet chemical	1					1
Grant, 1967	X-ray fluorescence			14	9		23
Riley and Sinhaseni, 1958	Emission	2					2
	Totals	245	37	189	57	77	605

NORTH ATLANTIC OCEAN

The Atlantic Ocean and Indian Ocean have considerably higher rates of deposition than does the Pacific Ocean. The former, therefore, have ferromanganese deposits which are more erratically distributed and less extensive than those of the Pacific Ocean. The North Atlantic Ocean is relatively narrow with an influx of large volumes of terrigenous debris from the eastern and western limits. This material accumulates on vast abyssal plains at the foot of continental margins. In addition to this rapidly accumulating sediment is the quickly deposited carbonate of the Mid-Atlantic Ridge. The Ridge occupies approximately half the area of the North Atlantic seafloor. The widespread rapid accumulation of terrigenous and biogenic debris precludes initiation and growth of ferromanganese deposits throughout much of the ocean.

Samples of ferromanganese have been recovered from three different situations: 1) the Blake Plateau, 2) a red clay region 1100 miles east of Florida and 3) submarine elevations (Kelvin Seamounts and Mid-Atlantic Ridge). These areas represent very little or no net accumulation of sediment at the site. The Blake Plateau appears to offer very little in the way of value from the point of view of economic recovery: the metals of interest occur in very low amounts in the nodules and crusts (averages Cu .08%, Ni .50%, Mn 14.5%, Co .42%, n=5) and there is the additional problem of high incorporated carbonate in the deposits (Table 2).

Topographic barriers and great water depth have resulted in a protected region of the seabed 1100 miles east of Florida. This area, referred to as the red clay province for convenience, contains many nodules. However, as is true of most nodules from areas of red clay, these have Ni and Cu values far below those needed for commercial recovery. The average values are Cu .24%, Ni .36%, Mn 13.9%, Co .35%, (n=8). The encrusting deposits of the flanks, shoulders

and summits of submarine elevations are equally low in the metals of interest (averages Cu .14%, Ni .39%, Mn 13.5% and Co .36%). Ferromanganese is generally associated with rugged topographic features and rock exposures. Low metal values plus hazardous conditions for dredging operations suggest that it is highly unlikely that these deposits will be of interest to the mining industry.

SOUTH ATLANTIC AND INDIAN OCEANS

The South Atlantic and Indian Oceans are very similar to the North Atlantic in that their framework of sedimentation is dominated by large-scale input of continental debris and significant contributions from a mid-ocean ridge system. Prevailing rates of sedimentation throughout much of these oceans are above those which favor ferromanganese accretion. As a result, the metal-rich deposits are confined to specific areas of slow deposition in protected basins or on topographic highs. Because the content of Ni and Cu in the ferromanganese deposits is very low, no attempt is made to differentiate them. Although of great interest to researchers concerned with genesis of the sediments, the crusts and nodules of the South Atlantic and Indian Oceans do not appear to offer much to the ocean miner. When the values of the various metals are averaged for the two oceans we find Ni .54%, Cu .20%, Mn 16.28% and Co .26% (Tables 2, 3, 4). These numbers reveal the poor value of the deposits.

NORTH PACIFIC OCEAN

The North Pacific is not like the Atlantic and Indian Oceans in that continental debris is trapped in secondary basins at the periphery of the ocean and there is no large mid-ocean ridge system over which carbonate sediment can accumulate and be re-sedimented in adjacent deep water. The Emperor Seamount Chain and the Hawaiian Ridge

cannot be equated with features like the Mid-Atlantic Ridge. Consequently, the rates of sedimentation over vast areas of the North Pacific are exceedingly low and growth of nodular deposits is extensive over vast areas (Fig. 1).

Based on data in hand on the worldwide distribution of ferromanganese, Horn and others (1972b, 1972c, 1972d) considered the nodules to occur most frequently and over greater areas in the deep waters of the North Pacific than in any other area of the world. Dredging and coring operations have reported the deposits most often between 6°30'N and 20°N from deep waters off Central America at 110°W to 180°W.

Inspection of the analyses of ferromanganese deposits from the red clays of the North Pacific reveals that the average values are Ni .76%, Cu .49%, Mn 18.2% and Co .25% (Table 1). The band of siliceous radiolarian ooze and clay south of the red clays is covered with nodules which are richer in the metals of interest. Averages for Ni are 1.28%, Cu 1.16%, Mn 24.6% and Co .23%. Copper and nickel values are nearly twice as great for nodules obtained from the siliceous oozes suggesting that they should be of particular interest to the ocean miner (Fig. 2). These represent the highest values of copper and nickel determined on ferromanganese deposits of the world's oceans. The siliceous oozes also consistently include approximately 6% more Mn than their counterparts taken from red clay regions. Cobalt does not follow the trends of Ni, Cu, and Mn; its value is essentially the same for both deep-water sediment regions. Co is less abundant in nodules from the areas of red clay and siliceous ooze but is enriched in deposits located on submarine elevations such as the Hawaiian Islands, Necker Ridge and Johnston Island. Analyses indicate the nodules from red clay have .25% Co, those from the

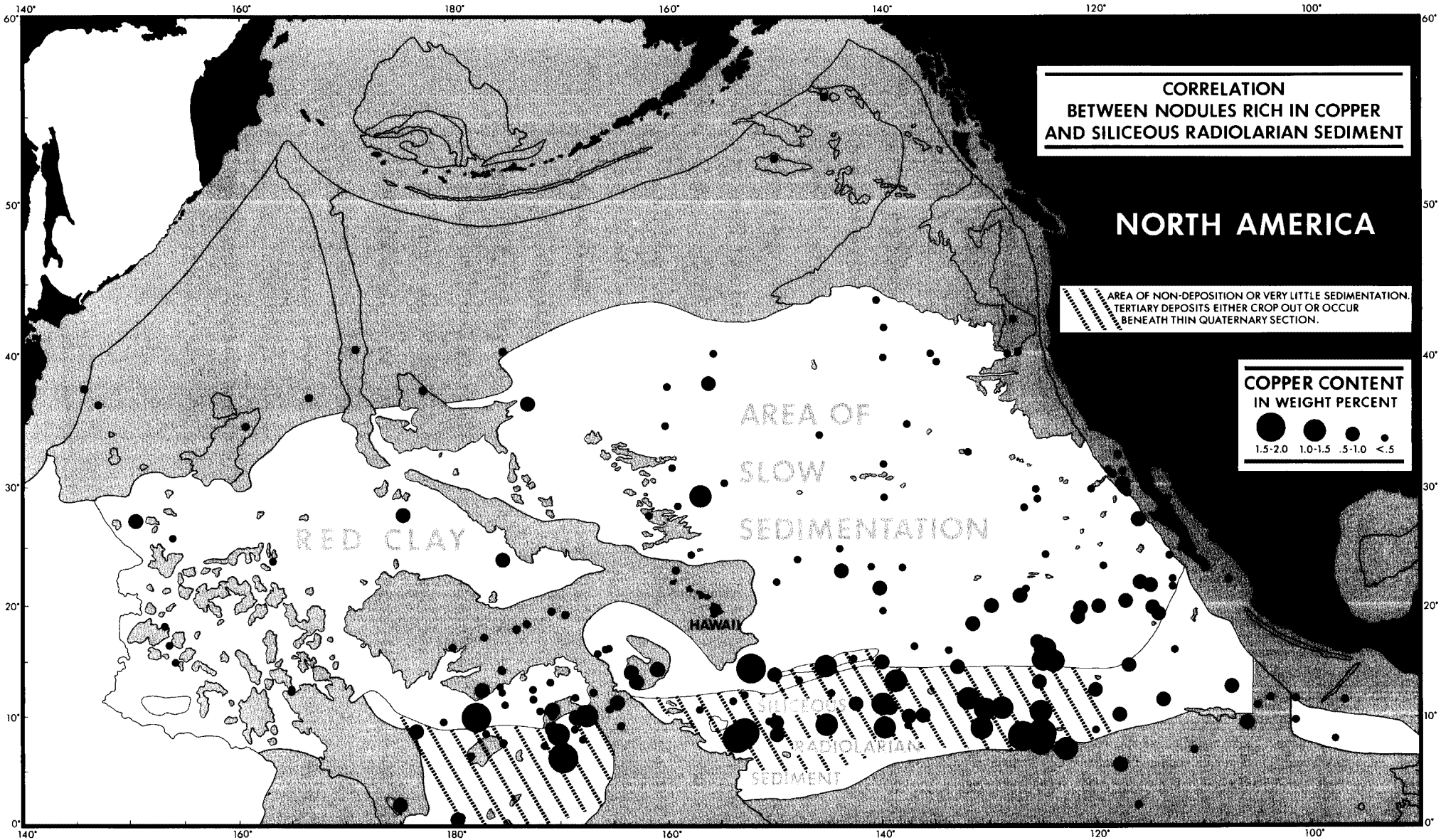

Figure 1. White area of map marks regions of very slow sedimentation of red clay and of non-deposition to extremely slow deposition of siliceous radiolarian sediment. There is a strong correlation between nodules rich in copper and nickel and Tertiary outcrop or subcrop. The metals are twice as abundant in the siliceous sediments as they are in the red clays to the north. It is suggested that the siliceous sediments just north of the equator offer the best prospect to the ocean miner.

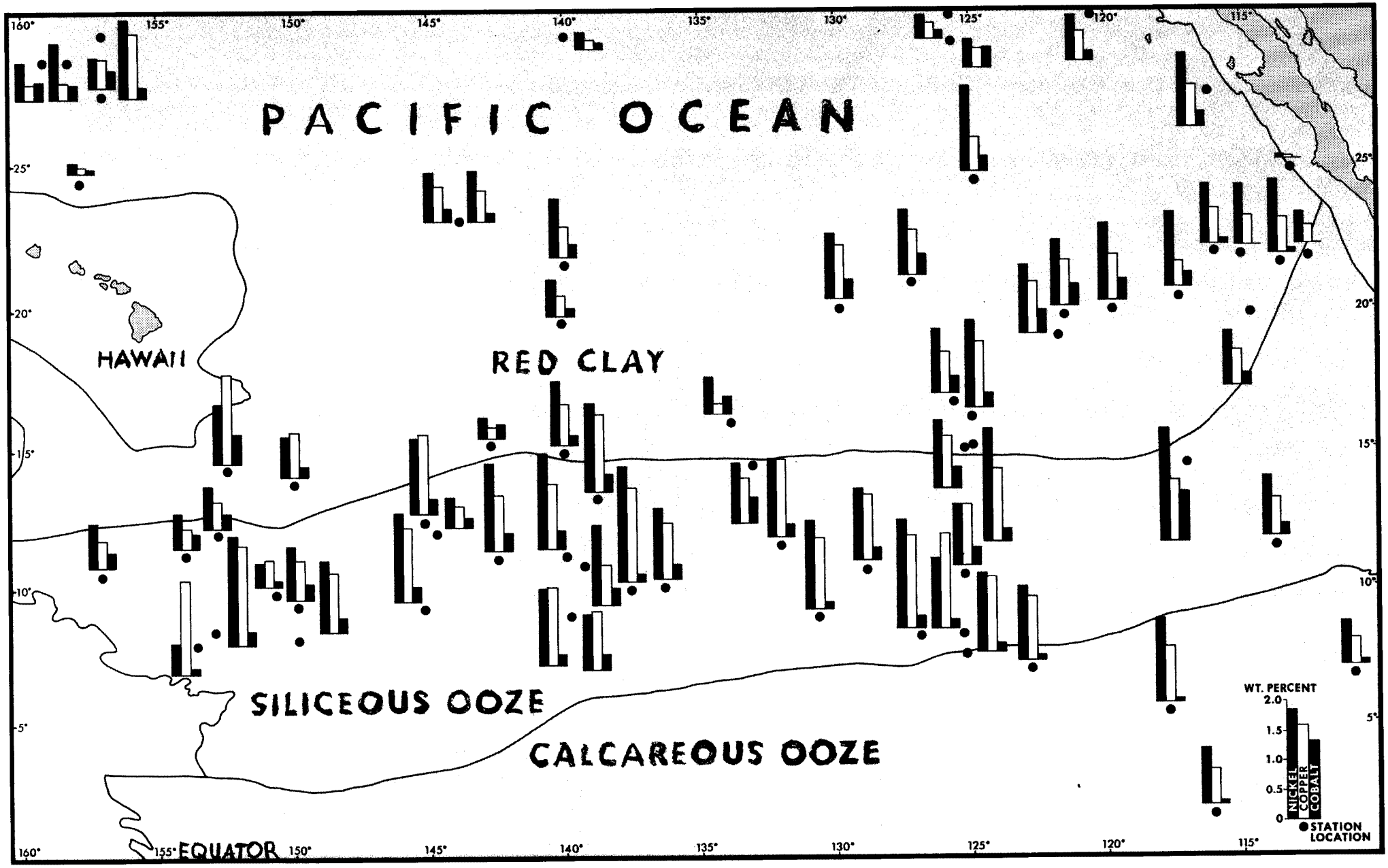

Figure 2. Histograms showing the progressive decrease in copper and nickel in a northerly direction. High metal values are characteristic of siliceous sediments whereas lower values represent samples taken from red clays. There is approximately twice as much copper and nickel in the siliceous deposits as there is in the red clay immediately to the north.

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siliceous ooze .23% and values leap to an average of .79% on seamounts associated with or part of the Hawaiian Islands and surrounding seamounts.

SOUTH PACIFIC OCEAN

The South Pacific receives very little sediment from continental sources, far less than other oceans. Nodular deposits in brown clays are reported in the literature. However, based on the data in hand most ferromanganese is located on or in the vicinity of submarine highs such as the Line Islands, Manihiki Plateau, Cook Islands, Society Islands and Tuamotu Plateau.

Inspection of the maps reveals that, although ferromanganese concretions are very common here, the metal contents are lower than those required by the ocean miner. In regions of red clay such as the Peru Basin and deep waters east of the Marquesas Islands and Tuamotu Archipelago, however, there is a suggestion that nodules contain average values of Ni which may be attractive to the mining community in the future.

On the basis of the information listed in this report the South Pacific is not as attractive as the North Pacific. Average values for metals contained in ferromanganese deposits in deep-water clay regions of the South Pacific are Cu .23%, Ni .51%, Mn 15.1% and Co .34% (Table 3). Those deposits on submarine elevations have values of Cu .13%, Ni .41%, Mn 14.6% and Co .78%.

CONCLUSIONS

Inspection of the worldwide distribution of ferromanganese deposits reveals that they are most abundant within the North Pacific (Maps 1-8). They lie in an east-west band between 6°30'N and 20°N extending from 110°W to 180°W. Not only are they most widespread

here, they contain the highest values of copper and nickel of any nodular deposit in the world ocean. This region, therefore, offers the most promise to ocean miners.

The restricted distribution of the Cu-Ni rich deposits to a specific area of the North Pacific is best explained by non-deposition or minimal sedimentation in this area for millions of years. Tertiary exposures and subcrops lie immediately below the sediment-water interface. Such conditions are excellent for the development of ferromanganese deposits and possibly through time permit concentration of the metals of interest to the ocean mining community.

ACKNOWLEDGMENTS

Assembly of information on the metal contents of ferromanganese deposits of the oceans was sponsored by The Office for the International Decade of Ocean Exploration of the National Science Foundation (Grant GX 33616). Nodules in the Lamont-Doherty collection were obtained by R/V Vema and R/V Robert D. Conrad. Maintenance of the Deep-Sea Core Laboratory is supported by the Office of Naval Research (Contract N00014-67-A-0108) and the National Science Foundation (Grant NSF GA 29460).

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TABLE 1.

CHEMICAL ANALYSES

OF SURFACE FERROMANGANESE NODULES AND CRUSTS

NORTH PACIFIC

Note: This table is based on a quadrant system for ease of computer plotting. As a result a few stations fall outside the ocean identified by the table heading. Data in this table were obtained from 90°E - 90°W and 0° - 60°N.

TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
012	06°38'N 110°56'W	4,316	Lamont RC10-76	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.74	0.45	0.08		21.5			
012	01°27'N 116°13'W	4,000	Scripps DWBG-147B	Corer (gravity)	Nodule 1x1.5x1.5 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.76	0.47	0.05	12.6	18.8	3.5	1.8	1.5
					Nodule 1x1.5x1.5 cm	Scripps-NODC (unpublished)		Emission spectrography	1.1	0.68	0.07	18.2	27.2	5.1	2.6	1.5
012	05°20'N 117°55'W	4,330	Scripps Ris 14V	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.48	0.91	0.05	7.15	30.28			4.2
012	09°59'N 118°00'W	4,295	Scripps DWHH-92	Corer (gravity)	Nod. frag. 1.5x1.5x2 cm	Scripps-NODC (unpublished)		Emission spectrography	1.0	0.74	0.09	11.2	24.6	9.8	1.5	2.2
013	08°30'N 120°08'W	3,389	Lamont V20-31	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.74	0.10	0.25		20.0			
013	06°46'N 122°57'W	4,508	Lamont V21-199	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.26	1.08	0.08	4.8	26.4			5.5
013	07°18'N 125°20'W	4,610?	Lamont RC10-93	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	1.33	1.27	0.14		30.0			
013	08°09'N 125°20'W	4,360	Scripps Cb-39	Corer	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.16	1.36	0.18	6.3	28.1	5.8	1.5	4.5
013	08°05'N 125°25'W	4,453	Scripps Cb-17	Corer	Nodule 1.0 cm diam	Scripps-NODC (unpublished)	Whole nodule	X-ray fluorescence spectrography	1.19	1.59	0.17	6.7	26.2	6.1	1.2	3.9
013	07°41'N 125°37'W	4,416	Scripps Cb-19	Corer	Nodule 0.6 cm diam	Mero, 1965	Half nodule	X-ray fluorescence spectrography	0.40	0.55	0.09	9.2	9.3	14.3	0.7	1.0
013	08°01'N 126°58'W	4,440	Scripps Cb-34	Corer (gravity)	Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.8	1.6	0.18	5.3	34.1	7.5	1.4	6.4
014	08°48'N 130°48'W	4,917	Scripps DWBG-7	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.52	1.23	0.12	4.36	24.56			5.6
014	09°50'N 136°23'W	4,823	Lamont RC12-58	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.20	0.94	0.27	5.8	21.8			3.8
014	08°59'N 137°41'W	4,660	Lamont RC12-59	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.11	0.11	0.05	8.20	2.50			0.3
014	09°57'N 137°47'W	4,930	Harvard Alb-13	Trawl (Blake)	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.36	1.20	0.20	4.8	29.8		1.5	6.2
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	2.0	1.4	0.18	5.3	32.	7.5	1.8	6.0
					Nodule	Ahrens et al., 1967	2 pieces	Emission spectrography	1.70	1.21	0.25	4.43	38.1		1.7	8.7
					Nodule 2x3x3 cm	Hewett et al., 1963		Spectrography	1.5	1.5	0.3	7.0	>10.	7.0	3.	

TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
	014	09°57'N 137°47'W	4,930	2P-52	Dredge		Cronan and Tooms, 1969		Emission spectrography	1.93	1.59	0.14	5.41	23.46			4.3
	014	08°47'N 139°53'W	5,086	Lamont RC11-206	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.94	0.98	0.26	6.7	16.8			3.0
	014	08°47'N 139°53'W	5,086	Lamont RC11-D21	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	1.28	1.32	0.20	11.6	6.00		1.4	0.5
	015	09°06'N 145°18'W	5,400	Scripps Msn-148G	Corer (gravity)	Nodule 1.5x2.5x2.7 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.52	1.27	0.26	5.3	26.2	6.3	1.4	4.9
	015	09°13'N 149°49'W	5,073	Lamont RC12-69	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.90	0.66	0.28	10.1	17.0			1.7
	015	08°02'N 149°54'W	5,073	Scripps Jyn V-15PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.21	0.98	0.26	9.34	23.63			2.5
	016	09°27'N 150°42'W	5,100	Scripps Jyn V-13G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.41	0.45	0.12	10.50	5.41			0.5
	016	08°59'N 152°50'W	4,839	Scripps Wah-4PG	Corer		Cronan and Tooms, 1969		Emission spectrography	1.33	0.78	0.41	10.94	22.61			2.1
	016	08°16'N 153°01'W	5,143	Scripps Wah-24FF-8	Corer		Cronan and Tooms, 1969		Emission spectrography	1.86	1.65	0.25	7.31	24.89			3.4
	016	07°55'N 153°42'W		U.S.S.R. Vit-5124		Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.53	1.59	0.12	5.77	25.49			4.4
	017	09°57'N 167°51'W	5,279	Scripps Dodo-20C	Corer (camera)	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.08	1.09	0.27	9.43	22.75			2.5
	017	07°47'N 168°00'W	4,994	Scripps Msn-J	Corer	Nodule 2x2.5x2.5 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.60	0.43	0.39	13.8	20.2	4.4	1.7	1.5
	017	09°41'N 168°42'W	5,222	Lamont RC12-195	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.52	0.37	0.17	6.60	11.2			1.7
	017	09°20'N 168°50'W	5,240	Scripps Dodo-25PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.11	0.98	0.35	9.51	20.41			2.2
	017	08°34'N 168°52'W	4,397	Scripps Proa-151G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.55	0.45	0.44	12.04	18.38			1.5
	018	06°03'N 170°00'W	5,400	Scripps Msn-K	Corer	Nodule 1.5x1.5 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.54	1.90	0.16	5.25	29.0	5.2	1.5	5.5
32	018	08°06'N 170°25'W	5,444	Scripps Proa-139G	Corer (gravity	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.07	1.22	0.19	8.96	20.71			2.3
33	018	08°33'N 170°59'W	5,169	Lamont RC13-19	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	1.07	0.98	0.27	10.6	25.2			2.4

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TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
018	09°49'N 170°59'W	4,875	Scripps LSDH-93PG	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.67	0.43	0.29	13.03	20.94			1.6
018	07°04'N 171°42'W	5,386	Scripps Proa-137G	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.47	0.21	0.51	16.67	18.62			1.1
018	07°19'N 175°28'W	5,190	Scripps LSDH-90PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.69	0.35	0.46	14.78	17.80			1.2
018	09°46'N 175°37'W	5,760	Lamont RC12-197	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.90	0.90	0.26	8.80	18.4			1.2
018	08°08'N 177°10'W	5,435	Scripps LSDH-89PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.54	0.33	0.21	12.81	15.78			1.2
018	09°42'N 177°59'W	5,953	Lamont RC12-198	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.06	1.80	0.21	7.40	20.3			2.7
018	06°02'N 178°35'W	5,097	Scripps Proa-101PG	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.25	0.18	0.38	15.48	15.84			1.0
018	00°15'N 179°43'W	5,045	Scripps Proa-105G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.65	0.54	0.15	15.85	17.14			1.1
019	09°17'N 178°57'E	5,821/ 5,996	Lamont V24-D1	Dredge	Nodule	Lamont (unpublished)		Wet chemical	0.40	0.35	0.29	13.9	16.0			1.2
019	08°19'N 176°25'E	5,097	Lamont V24-102	Corer (piston)	Crust	Lamont (unpublished)		Wet chemical	1.04	0.60	0.37	10.8	17.2			1.6
019	01°28'N 174°52'E	4,691	Lamont RC12-200*	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.42	0.52	0.21	15.6	14.6			0.9
047	11°38'N 103°48'W	3,500	Scripps Acap-10	Corer	Nodule 0.1 cm diam	Mero, 1965		X-ray fluorescence spectrography	0.04	0.08	0.01	6.3	1.7	12.1	12.6	0.3
047	10°53'N 105°07'W	3,275	Scripps Acap-11	Corer	Nodule 1 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.04	0.08	0.03	15.5	3.4	13.3	3.0	0.2
048	11°25'N 113°48'W	4,085	Swed. Deep Sea SDSE-48	Corer	Nodule 1 cm diam	Mero, 1965		X-ray fluorescence spectrography	1.01	0.66	0.21	11.5	23.2	4.2	1.8	2.0
048	19°20'N 114°12'W	3,480	Trans-14D	Corer	Nodule 3x3x1 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.09	0.71	0.23	10.2	22.6	6.1	1.4	2.2
048	19°46'N 114°44'W	3,438	Trans-14C	Corer	Nodule 1x3x2 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.93	0.61	0.22	12.0	21.2	5.9	1.5	1.8
048	14°26'N 117°12'W	4,125	Scripps Ris-8V	Corer (heat probe)	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.89	1.06	0.08	10.30	26.84			2.6
048	19°52'N 119°53'W	4,226	Lamont RC12-47	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.30	0.76	0.36	9.50	22.7			2.4

TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
049	12°16'N 120°10'W	4,471	Lamont RC10-91	Corer (piston)	Crust	Lamont (unpublished)		Atomic absorption	1.68	1.4	0.16	5.08	31.5		1.3	6.2
049	19°49'N 121°44'W	4,138	UNK-RR	Dredge	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.09	0.76	0.36	9.6	21.4	7.9	1.3	2.2
049	19°00'N 121°53'W	4,138	Scripps Cb-1	Corer (gravity)	Nodule 0.1 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.16	0.87	0.40	9.5	22.4	6.8	1.3	2.4
049	14°55'N 124°12'W	4,270	Scripps Cap-50B	Corer		Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.15	1.25	0.39	7.6	22.4	7.6	1.2	3.0
049	16°03'N 125°01'W	4,354	Scripps Cb-2	Corer (gravity)	Nodule	Mero, 1965		X-ray fluorescence spectrography	1.22	1.05	0.27	7.3	23.8	7.4	1.4	3.3
049	15°04'N 125°05'W	4,500	Scripps Amp-3PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.91	1.24	0.23	5.95	23.19			4.0
049	15°00'N 125°26'W	4,380	Scripps Cb-3	Corer	Nodule 1 cm diam	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.00	0.82	0.38	9.7	22.2	5.9	1.4	1.9
						Scripps-NODC (unpublished)		X-ray fluorescence spectrography	1.23	0.95	0.34	8.3	24.0	5.4	1.5	2.9
049	10°19'N 125°27'W	4,545	Scripps Cb-9	Corer	Nodule 0.5 cm diam	Scripps-NODC (unpublished)		X-ray fluorescence spectrography	1.06	1.06	0.36	10.0	18.9	8.1	1.8	1.9
049	13°03'N 125°29'W	4,440	Scripps Cb-5	Corer (gravity)		Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.06	1.06	0.32	6.3	22.2	9.7	1.2	3.5
						Scripps-NODC (unpublished)		Emission spectrography	0.9	1.0	0.10	2.4	27.8	11.2	0.9	11.6
049	16°35'N 125°35'W	4,369	Lamont RC12-50	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.16	0.72	0.30	8.60	22.0			2.6
049	10°37'N 128°54'W	4,636	Lamont V20-D1	Dredge (rock)	Nodule	Lamont (unpublished)		Wet chemical	1.28	1.10	0.22	3.9	29.6		1.4	7.6
050	10°26'N 130°38'W	4,890	Scripps DWBD-2	Dredge	Nodule 4x3x1 cm	Mero, 1965	Half nodule	X-ray fluorescence spectrography	1.25	1.21	0.26	7.6	22.7	7.3	1.5	3.0
					Nodule 2.4 cm diam	Scripps-NODC (unpublished)		Emission spectrography	1.7	1.4	0.17	5.9	31.6	7.5	1.8	5.4
050	18°16'N 131°46'W	5,210	Scripps Jyn V-50PG	Corer		Cronan and Tooms, 1969		Emission spectrography	1.09	0.74	0.22	9.58	24.26			2.5
050	11°24'N 132°07'W	4,843	Lamont V20-36	Corer	Nodule	Lamont (unpublished)		Wet chemical	1.34	1.32	0.24	0.50	28.5		0.7	57.0
050	14°22'N 133°07'W	4,816	Scripps MP-5	Corer	Nodule	Mero, 1965	Outer 1 cm	X-ray fluorescence spectrography	1.05	0.78	0.45	9.2	22.9	7.0	1.4	2.5

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TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
050	15°54'N 133°57'W	4,606	Scripps Jyn V-48PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.66	0.20	0.32	13.57	20.52			1.5
050	16°15'N 137°06'W	4,553	Scripps Car-78	Snapper	Nodule 1 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.46	0.40	0.20	8.9	10.0	13.7	0.8	1.1
050	13°07'N 138°56'W	4,927	Scripps Msn-153PG	Corer	Nodule 1x1.2x1 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.50	1.31	0.33	5.1	25.0	6.3	1.4	5.0
050	10°45'N 139°24'W	4,770	Lamont V21-D13	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	1.36	0.68	0.30	7.4	20.8		1.5	2.8
050	11°01'N 139°58'W	4,877	Lamont RC11-D20	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	1.62	1.10	0.32	6.0	30.5		1.4	5.1
051	19°29'N 140°02'W	5,574	Lamont RC11-D18	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.64	0.36	0.16	9.0	13.6		0.8	1.5
051	14°52'N 140°02'W	4,828	Lamont RC11-D19	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	1.10	0.70	0.18	8.5	21.0		1.3	2.5
051	10°59'N 142°37'W	4,978	Scripps Msn-150G	Corer (gravity)	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.23	0.96	0.31	6.4	17.0	9.9	1.2	2.7
051	15°03'N 142°46'W	4,526	Lamont V20-44	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.38	0.20	0.27	16.4	20.6		2.2	1.3
051	11°55'N 144°54'W	5,539	Scripps Jyn V-31PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.52	0.37	0.18	10.61	19.45			1.8
051	12°19'N 145°08'W	5,550	Lamont V21-D11	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	1.28	1.36	0.27	5.4	25.6		1.5	4.7
051	14°26'N 145°21'W	4,640	Lamont V20-48	Corer	Nodule	Lamont (unpublished)		Wet chemical	1.18	1.08	0.27	5.6	24.0		1.5	4.3
051	14°25'N 145°52'W	4,618	Lamont V20-D4	Dredge (rock)	Nodule	Lamont (unpublished)		Wet chemical	0.52	0.39	0.26	9.60	13.4			1.4
051	13°10'N 147°45'W	5,603	Lamont V21-D10	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	1.12	0.40	0.32	9.5	16.4		1.8	1.7
052	13°44'N 150°00'W	5,218	Lamont V21-D9	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.69	0.75	0.18	4.25	17.5			4.1
052	14°19'N 152°37'W	5,480	Challenger Chal-264	Trawl	Nodule	Murray and Renard, 1891	Whole nodule	Wet chemical	~1.	~1.5	~0.5	16.15	18.4	13.2	1.5	1.1
052	11°51'N 152°56'W	5,221	Scripps Wah-2PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.72	0.46	0.26	11.98	15.44			1.3
052	11°17'N 154°08'W		U.S.S.R. Vit-5126		Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.64	0.35	0.26	9.32	20.19			2.2

TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
052	10°22'N 157°08'W	5,343	Lamont RC13-58 *	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.74	0.45	0.27	12.4	19.6			1.6
053	14°11'N 161°08'W	5,652	Scripps Msn-G	Corer	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.98	0.81	0.31	9.2	23.3	5.6	1.5	2.5
053	13°05'N 163°10'W	5,413	Scripps Tet-27A	Corer	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.86	0.65	0.31	10.0	18.5	8.8	1.6	1.9
053	13°50'N 163°32'W	5,460	Lamont RC12-79 *	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.84	0.58	0.26	10.2	21.2			2.0
053	11°01'N 164°56'W	4,835	Scripps Proa-148G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.60	0.65	0.44	17.08	19.23			1.1
053	10°30'N 165°33'W	4,341	Scripps Proa-147V	Corer (heat probe)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.66	0.32	0.88	16.38	14.18			0.9
053	16°06'N 165°45'W	2,400	Scripps Tet-22	Corer	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.25	0.04	0.73	17.2	16.0	6.0	2.0	0.9
053	16°05'N 165°52'W	5,295	Lamont RC12-193 *	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.64	0.45	0.29	11.0	16.8			1.5
053	15°36'N 166°40'W	5,440	Scripps Proa-169G	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.34	0.16	0.84	16.95	16.70			1.0
053	19°07'N 169°44'W	1,740	Scripps MP-25F1	Dredge (chain bag)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.44	0.07	1.28	12.72	13.38			1.0
053	19°07'N 169°44'W	1,741/ 1,786	Scripps MP-25F2	Dredge (chain bag)	Nodule 3x2x2 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.42	0.10	0.95	14.5	20.5	3.3	2.1	1.4
						Hewett et al., 1963		Emission spectrography	0.7	0.15	1.5	>10.	>10.	3.	1.5	
054	10°23'N 170°57'W	4,469	Scripps Proa-156G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.77	0.63	0.69	14.54	17.01			1.2
054	19°25'N 171°00'W	1,320/ 1,410	Scripps MP-26A-3	Dredge (chain bag)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.47	0.06	1.17	11.68	12.28			1.0
					Nodule 3x3x3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.60	0.15	0.95	13.3	22.7	2.7	2.2	1.7
					Nodule	Goldberg, 1954		Colorimetry	0.31	0.19	0.46					
					Nodule	Dietz, 1955		Colorimetry	0.52		0.8	16.8	16.9			1.7
054	12°59'N 171°05'W	5,546	Lamont RC13-18	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.59	0.46	0.31	13.6	19.6			1.4

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TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
054	10°20'N 172°06'W	5,106	Scripps Proa-157G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.40	0.24	0.43	13.72	20.63			1.5
054	11°23'N 172°47'W	5,380	Scripps Proa-159G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.49	0.27	0.43	14.80	17.12			1.2
054	12°16'N 172°48'W	2,708	Scripps Proa-161G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.31	<0.05	0.90	16.03	13.02			0.8
054	18°20'N 173°17'W	3,950	Scripps MP-32	Corer	Crust	Mero, 1965		X-ray fluorescence spectrography	0.30	0.17	0.42	14.6	13.1	7.1	1.5	0.9
054	17°48'N 174°22'W	1,810/ 2,290	Scripps MP-33K	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.23	0.08	0.88	14.49	11.13			0.8
					Crust 1 cm	Mero, 1965		X-ray fluorescence spectrography	0.29	0.07	0.70	14.05	14.4	4.9	6.8	1.0
						Hewett et al., 1963		Emission spectrography	0.3	0.15	1.5	>10.	>10.	3.	7.	
054	12°01'N 175°37'W	5,280	Lamont V24-77	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.20	0.28	0.16	15.2	17.3			1.1
054	12°31'N 175°51'W	5,464	Scripps Proa-162G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.53	0.43	0.72	12.88	15.85			1.2
054	17°10'N 177°10'W	2,016	Scripps MP-37C	Dredge	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.34	0.09	0.88	13.27	14.97			1.1
054	17°04'N 177°15'W	2,010 1,830	Scripps MP-37A	Dredge	Crust 2 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.47	0.19	0.45	10.7	13.0	4.1	8.5	1.2
						Goldberg, 1954		Colorimetry	0.58	0.48	0.54	13.4	21.7			1.6
						Dietz, 1955		Wet chemical	0.58		0.54	13.19	21.03			1.6
055	16°08'N 179°44'E	5,330	Lamont V24-100	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.28	0.35	0.16	15.8	16.8			1.1
056	11°57'N 164°59'E	1,500/ 2,100	Scripps MP-43D	Dredge	Crust 5 cm	Mero, 1965		Emission spectrography	0.42	0.11	1.05	11.5	19.5	1.7	1.6	1.7
056	12°09'N 164°44'E	1,480/ 1,880	Scripps MP-43A	Dredge		Goldberg, 1954		Colorimetry	0.61	0.47	0.61	15.6	23.6			1.5
						Cronan and Tooms, 1969		Emission spectrography	0.52	0.04	1.60	13.53	19.40			1.4

TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
057	19°55'N 155°59'E	5,643	U.S.S.R. Vit-3631	Spoon	Nodule 4 cm diam	Skornyakova et al., 1962		Wet chemical and colorimetry	0.33		0.53	14.4	17.2	6.2	1.8	1.2
057	14°48'N 154°03'E	5,460	Lamont RC10-153	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.46	0.24	0.37	19.2	18.0		2.0	1.0
057	18°05'N 152°57'E	5,218	Lamont RC12-129*	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.50	0.32	0.34	15.0	14.8			1.0
083	22°18'N 107°48'W	3,000	Scripps VS-B11-35	Trawl	Nodule 5x2x1 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.12	0.05	0.02	1.36	24.8	13.4	0.9	18.2
084	21°53'N 112°47'W	3,385	Scripps DH-10	Dredge	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.54	0.31	0.01	5.7	30.3			5.3
084	21°48'N 113°03'W	3,450	Scripps DH-9	Dredge	Nodule	Mero, 1965	Half nodule	X-ray fluorescence spectrography	1.10	0.47	0.04	8.3	31.0			3.7
084	22°30'N 113°08'W	3,604	UNK-MS	Dredge	Nodule 5x3x3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.63	0.42	0.26	4.85	28.8	7.9	1.3	5.9
084	24°24'N 113°16'W	1,950	Scripps MV 65-1-38	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.11	0.09	0.01	1.99	33.92			17.0
084	24°23'N 113°18'W	3,550	Scripps Mag Bay-A35	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.11	0.06	0.01	1.69	33.90			20.1
084	24°58'N 113°25'W	3,315/ 3,340	U.S.S.R. Vit-4265	Trawl (camera)	Nodule	Skornyakova et al., 1962	Outer 1 cm	Wet chemical and colorimetry	0.18		0.00	1.2	32.8	5.4	1.8	27.3
084	24°34'N 113°28'W	3,510	Scripps MV 65-1-41	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.07	0.05	0.01	1.18	34.12			19.0
084	21°40'N 113°30'W	3,420	Scripps DH-8	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.24	0.60	0.07	9.4	28.9			3.1
084	29°03'N 113°33'W	384/ 493	Scripps VS-78	Dredge	Nodule 8x6x5 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.04	0.01	0.01	0.86	38.9	1.2		4.8
084	21°33'N 113°48'W	3,660	Scripps DH-7	Dredge	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.24	0.62	0.05	7.5	24.4			3.3
084	21°21'N 114°06'W	3,660	Scripps DH-6	Dredge	Nodule	Mero, 1965	Half nodule	X-ray fluorescence spectrography	1.35	0.72	0.08	9.0	28.9			3.2
084	21°27'N 114°07'W	3,800	Scripps DH-5	Dredge	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.23	0.62	0.11	10.9	27.6			2.5
084	21°31'N 114°08'W	3,800	Scripps DH-4	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.46	0.77	0.05	8.1	28.2			3.5

TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
084	21°40'N 114°11'W	3,800	Scripps DH-3	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.19	0.64	0.09	9.9	28.8			3.0
084	21°50'N 115°12'W	3,430	Scripps DH-2	Dredge	Nodule 1 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.02	0.50	0.11	13.0	25.1			2.0
084	27°20'N 116°10'W	4,030	Scripps PAS-19121	Corer	Nodule 0.5x2x2 cm	Mero, 1965	Whole nodule	Emission spectrography	1.25	0.70	0.27	9.3	21.2	6.2	1.0	2.3
084	22°00'N 116°14'W	3,480	Scripps DH-1	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.02	0.61	0.08	10.4	27.8			2.7
084	29°31'N 117°17'W	540/ 820	Scripps SOB-13D	Dredge	Crust	Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.22	0.04	0.73	15.6	21.1	1.1	2.1	1.4
084	20°19'N 117°29'W	4,010	Scripps Ris-5V	Corer (heat probe)	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.26	0.68	0.26	10.46	24.13			2.3
084	23°30'N 119°35'W	440	Hend-1	Dredge	Crust	Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.36	0.04	0.62	13.5	20.5	1.2	2.1	1.5
084	25°15'N 119°40'W		U.S. Navy NEL-Hend	Dredge		Goldberg, 1954		Colorimetry	0.30	0.22	0.32	20.1	21.3			1.1
085	29°57'N 120°42'W	4,078/ 4,017	U.S.S.R. Vit-4217	Trawl	Nodule 4x2x2 cm	Skornyakova et al., 1962	X-sect.	Wet chemical and colorimetry	0.74	0.45	0.15	11.2	16.7	10.1	1.3	1.5
085	24°22'N 125°00'W	4,330	Scripps DWHH-4	Corer	Nodule 1x2x2 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.21	0.49	0.24	9.5	18.5	5.7	1.3	2.0
					Nodule 0.8x2x2 cm	Scripps-NODC (unpublished)		Emission spectrography	1.7	0.69	0.33	13.3	25.9	7.9	0.5	1.1
085	28°59'N 125°40'W	4,000	Wig-6	Corer	Nodule 0.3 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.51	0.34	0.37	13.6	14.3	8.7	1.1	1.2
085	29°58'N 125°55'W	4,325	U.S.S.R. Vit-4221		Nodule 2x1.5x1.5 cm	Mero, 1965	Half nodule	X-ray fluorescence spectrography	0.41	0.25	0.15	7.0	8.3	16.8	0.7	1.2
085	21°27'N 126°43'W	4,300	Scripps DWBD-1	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.35	0.20	0.34	12.91	16.92			1.3
					Nodule 4x4x4 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.13	0.19	0.30	11.5	9.7	18.8	1.0	0.8
					Nodule 3.5 cm diam	Scripps-NODC (unpublished)		Emission spectrography	0.46	0.36	0.50	18.2	24.6	7.0	1.8	1.4
					Nodule 3.5 cm diam	Scripps-NODC (unpublished)		Emission spectrography	0.39	0.28	0.07	7.9	7.0	21.5	0.6	0.9
085	28°23'N 126°57'W	4,340	Harvard Alb-2	Trawl	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.67	0.44	0.19	10.6	10.4	14.7	0.7	1.0

TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
085	20°51'N 127°16'W	4,702	Scripps MP-3	Corer	Nodule	Mero, 1965	Outer 2 cm	X-ray fluorescence spectrography	1.10	0.76	0.36	9.2	21.2	7.9	1.4	2.3
086	20°00'N 130°01'W	4,895	U.S.S.R. Vit-4289	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.10	0.91	0.33	8.7	21.8	7.3	1.5	2.5
086	23°17'N 138°15'W	4,890	Scripps Naga-8C	Dredge		Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.35	0.20	0.52	14.1	15.9	6.5	1.4	1.1
086	29°10'N 139°55'W	4,890	Lamont RC11-D15	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.26	0.14	0.09	17.4	12.5		1.4	0.7
087	21°30'N 140°00'W	5,378	Lamont RC11-D17	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	1.00	0.54	0.23	10.5	21.0		1.0	2.0
087	23°17'N 141°13'W	5,540	Scripps Naga-10C	Corer	0.5x3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.44	0.45	0.14	4.7	7.0	3.	0.7	0.7
						Hewett et al., 1963		Emission spectrography	0.7	0.3	0.3	>10.	>10.	3.	3.	
087	22°57'N 143°58'W	4,750	Scripps Hilo-4G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.84	0.56	0.22	8.19	10.67			1.3
087	22°57'N 143°58'W	4,850	Scripps Hilo-5G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.87	0.53	0.16	9.31	10.81			1.2
087	24°50'N 144°05'W	5,190	U.S.S.R. Vit-4239	Trawl (camera)		Mero, 1965		X-ray fluorescence spectrography	0.44	0.45	0.14	4.7	7.0	18.1	0.7	1.5
						Skornyakova et al., 1964		Wet chemical and colorimetry	0.46	0.43	0.10	5.17	12.49		1.3	2.4
087	23°54'N 148°00'W	5,220	Scripps Naga-15	Dredge	Nodule 1x3x3 cm	Mero, 1965		X-ray fluorescence spectrography	0.49	0.43	0.20	7.2	10.9	13.8	0.6	1.5
088	24°16'N 157°56'W	~3,968	Lamont RC12-188 *	Corer	Nodule	Lamont (unpublished)		Wet chemical	0.18	0.12	0.08	6.6	6.0			0.9
088	27°15'N 157°00'W	5,720	Lamont V21-D6	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.52	0.49	0.32	10.0	18.8		1.3	1.9
088	29°15'N 157°02'W	5,830	Lamont V21-D5	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	1.36	1.10	0.22	3.9	28.0		1.5	7.1
088	28°20'N 158°20'W	~5,360	Lamont RC12-187 *	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.96	0.30	0.28	10.1	15.2			1.5
088	28°24'N 159°11'W	5,680	Lamont V21-D4	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.62	0.27	0.32	11.6	16.4		1.6	1.4
088	23°01'N 159°21'W	4,856	Lamont V21-D8	Trawl (biology)	Crust	Lamont (unpublished)		Wet chemical	0.01	0.02	0.01	3.00	0.40			0.1

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TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
089	27°36'N 161°54'W	4,947	Lamont RC13-15	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.54	0.32	0.24	10.0	16.0			1.6
090	20°03'N 171°38'W	3,477	U.S.S.R. Vit-4331	Spoon	Nodule	Skornyakova et al., 1962	Outer layer	Wet chemical and colorimetry	0.27		0.46	17.7	26.8	6.6	2.3	1.5
090	24°00'N 175°40'W	5,318	U.S.S.R. Vit-4347	Scoop	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.76	0.53	0.42	12.38	20.16			1.6
091	27°42'N 175°10'E	5,750	Scripps Jyn IV-11G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.81	0.52	0.26	13.87	20.20			1.5
091	23°55'N 173°40'E		U.S.S.R. Vit-3782		Crust	Nikolayev and Yefimova, 1963			0.38			13.40	19.15		1.6	1.4
091	23°57'N 170°58'E	5,817	U.S.S.R. Vit-4351	Spoon	Nodule	Skornyakova et al., 1964	Outer layer	Wet chemical and colorimetry	0.53	0.38	0.46	11.91	20.22	6.0	1.8	1.7
						Skornyakova et al., 1964		Wet chemical and colorimetry	1.09		0.39	13.24	20.69		1.7	1.6
092	24°01'N 163°02'E	5,542	U.S.S.R. Vit-4359	Spoon	Nodule	Skornyakova et al., 1962	Core	Wet chemical and colorimetry	0.54		0.32	11.2	17.2	9.5	2.4	1.5
					Nodule	Skornyakova et al., 1964		Wet chemical and colorimetry	0.41	0.29	0.36	14.59	16.08		1.6	1.1
					Nodule	Skornyakova et al., 1964		Wet chemical and colorimetry	0.48		0.25	14.52	17.10		1.7	1.2
092	24°04'N 160°46'E	3,951	U.S.S.R. Vit4362	Spoon	Nodule	Skornyakova et al., 1962		Wet chemical and colorimetry	0.49		0.47	11.3	22.5	6.1	2.8	2.0
093	26°12'N 153°44'E	6,120	U.S.S.R. Vit-4370	Trawl	Crust	Skornyakova et al., 1962	Outer layer	Wet chemical and colorimetry	0.41		0.36	14.6	16.1	7.2	1.6	1.1
					Nodule	Mero, 1965	Whole nodule	Emission spectrography	0.41	0.27	0.14	14.0	12.2	8.2	1.5	0.9
093	27°20'N 150°10'E	5,286			Nodule	Goldberg, 1954		Colorimetry	0.27	0.50	0.19	17.0	14.5			0.9
120	30°12'N 117°38'W	1,300	Scripps SOB-10D	Dredge	Crust	Cronan and Tooms, 1969		Emission spectrography	0.20	0.03	0.56	15.15	14.23			0.9
					Crust	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.18	0.04	0.40	14.7	10.7	11.8	1.5	0.7
120	31°19'N 117°38'W	2,100/ 2,120	Scripps SOB-5D	Trawl	Crust	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.34	0.06	0.08	11.4	13.4	12.5	0.9	1.2
120	30°18'N 117°40'W	1,060	Scripps SOB-27D	Dredge	Crust	Cronan and Tooms, 1969		Emission spectrography	0.59	0.04	0.59	11.85	14.40			1.2
						Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.24	0.08	0.23	12.3	7.8	15.6	1.0	0.6

TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
120	32°50'N 118°00'W	~2,000	S Clem	Dredge	Mn coated steel frag.	Goldberg and Arrhenius, 1958	Coating		0.02	0.05	0.01		0.1		0.2	
120	31°23'N 118°03'W	1,040	Scripps SOB-20D	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.45	0.06	0.58	12.92	19.40			1.5
					Crust	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.23	0.05	0.53	14.5	13.7	12.5	1.6	0.9
120	32°45'N 118°13'W	1,588	S Clem-SV	Dredge	15 cm diam	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.19	0.05	0.14	16.1	14.5	9.8	1.6	0.9
120	31°05'N 118°37'W	1,830/ 1,650	Scripps SOB-25D	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.48	0.13	0.20	9.22	14.59			1.6
						Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.13	0.04	0.26	16.4	11.8	12.0	1.6	0.7
120	31°21'N 119°03'W	695	Scripps SOB-22D	Dredge	Crust	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.24	0.06	0.19	10.3	11.7	12.4	0.7	1.1
122	32°56'N 132°30'W	710	U.S. Navy NEL-667	Dredge	Crust	Dietz, 1955		Colorimetry	0.40		0.90	11.4	25.6			2.2
122	39°38'N 135°06'W	4,790	Lamont V20-72 *	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.46	0.24	0.30	16.1	17.0		0.9	1.1
122	35°07'N 137°53'W	5,035	U.S.S.R. Vit-4199	Dredge		Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.33	0.29	0.29	13.0	10.4	13.4	1.1	0.8
122	31°51'N 139°58'W	4,991	Lamont RC11-D14	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.62	0.38	0.31	18.5	17.3		1.2	0.9
123	39°56'N 140°02'W	~4,748	Lamont RC11-D13	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.50	0.28	0.26	14.3	15.5		1.2	1.1
123	34°04'N 145°56'W	5,390	Scripps UPWD-1	Dredge		Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.67	0.45	0.34	11.8	15.7	11.3	1.1	1.3
123	34°08'N 145°57'W	5,300	Scripps UPWD-2	Dredge		Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.59	0.34	0.34	11.6	15.0	11.3	1.2	1.3
124	30°22'N 154°56'W	5,400	Challenger Chal-256	Dredge	Nodule 3x4x3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.68	0.43	0.31	10.4	13.9	14.6	1.2	1.3
					Nodule 3 cm diam	Murray and Renard, 1891		Wet chemical	~1.	~1.5	~0.5	13.7	25.0	9.3	1.4	1.8
124	38°09'N 156°25'W	5,720	Challenger Chal-253	Dredge		Murray and Renard, 1891		Wet chemical	~1.	~1.	~0.5	15.48	16.6	10.9	2.0	1.1

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TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
124	31°31'N 159°42'W	5,720	Lamont V21-D3	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.52	0.44	0.40	12.2	19.2		1.3	1.6
125	37°52'N 160°17'W	5,020	Challenger Chal-252	Trawl	Nodule 6x6x8 cm	Riley and Sinhaseni, 1958	Whole nodule	Spectrography	0.40	0.26	0.13	12.4	19.9	8.8	1.0	1.6
					Nodule	Murray and Renard, 1891		Wet chemical	~1.	~0.2		14.32	18.0	13.0	1.8	1.3
					Nodule	Murray and Renard, 1891		Wet chemical	0.4	0.5	0.25	13.10	16.05	10.0	2.0	1.2
					Nodule	Murray and Renard, 1891		Wet chemical		~0.5		12.48	16.1	12.9	2.0	1.3
125	34°54'N 160°19'W	5,577	Lamont V21-D2	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.07	0.05	0.04	10.6	5.00		2.1	0.5
125	35°02'N 166°28'W	5,902/ 5,913	U.S.S.R. Vit-4090	Trawl	Nodule	Skornyakova et al., 1962	Outer 0.8 cm	Wet chemical and colorimetry	0.61		0.36	11.2	15.9	10.7	1.6	1.4
					Nodule	Skornyakova et al., 1962		Wet chemical and colorimetry	0.41		0.33	12.13	15.77	8.7	1.6	1.3
					Nodule	Skornyakova et al., 1962		Wet chemical and colorimetry	0.64		0.31	10.57	18.69	8.5	1.4	1.8
126	35°00'N 172°57'W	5,971	U.S.S.R. Vit-4084	Spoon	Nodule	Skornyakova et al., 1962	Outer 0.5 cm	Wet chemical and colorimetry	0.29		0.22	10.8	13.1	12.9	1.6	1.2
126	36°30'N 173°16'W	4,195	Scripps Ck-16	Corer		Scripps-NODC (unpublished)		Emission spectrography	0.50	0.50	0.39	9.5	14.5	13.1	1.4	1.5
127	37°41'N 177°04'E	5,300	Challenger Chal-248	Trawl	Nodule	Riley and Sinhaseni, 1958	Whole nodule	Spectrography	0.28	0.43	0.09	10.3	16.5	11.2	1.2	1.6
128	37°03'N 166°34'E	4,978	Lamont RC11-D5	On camera frame	Nodule	Lamont (unpublished)		Wet chemical	0.26	0.14	0.09	17.4	12.5		1.4	0.7
128	34°47'N 160°40'E	4,226	Lamont RC10-176	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.12	0.16	0.10	15.9	9.60		1.1	0.6
130	36°29'N 146°43'E	5,720	Scripps Jyn II-21	Corer (gravity)	Nodule 2.5x1x1 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.12	0.07	0.00	11.8	1.9	26.4	1.3	0.2
130	38°00'N 146°00'E	3,500	Univ. of Tokyo JEDS-5	Trawl	Crust 3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.38	0.10	0.29	13.9	19.8	3.3	2.2	1.4
157	40°23'N 127°59'W	1,260	Scripps Fan-BD-25	Dredge	Crust 1 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.61	0.04	0.43	8.8	23.5	7.1	1.2	2.7
						Ahrens et al., 1967		Emission spectrography	0.42	0.02	0.50	14.1	21.0		2.4	1.5
						Hewett et al., 1963		Emission spectrography	0.3	0.07	0.3	>10.	>10.		3.	

TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
157	42°45'N 128°03'W	2,520	Cas D-5	Dredge		Scripps-NODC (unpublished)		Emission spectrography	0.16	0.06	0.17	21.7	15.2	13.5	1.8	0.7
						Scripps-NODC (unpublished)		Emission spectrography	0.15	0.05	0.16	21.7	17.5	13.	2.1	0.8
						Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.11	0.04	0.12	15.7	12.8	9.4	1.5	0.8
					Nodule 3x2x2 cm	Ahrens et al., 1967		Emission spectrography	0.32	0.03	0.45	19.6	22.8		2.2	1.2
157	40°16'N 128°28'W	4,060/ 4,400	Scripps Fan-BD-20	Dredge	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.44	0.37	0.10	10.12	11.76			1.2
					Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.56	0.37	0.07	8.4	18.8	12.6	1.1	2.2
					Nodule	Ahrens et al., 1967	Pieces	Emission spectrography	0.55	0.45	0.12	8.75	20.3		1.3	2.3
158	40°20'N 135°47'W	4,471/ 4,477	U.S.S.R. Vit-4191	Corer, Trawl	Nodule 3 cm diam	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.58	0.22	0.36	9.5	16.5	13.3	1.4	1.7
					Nodule	Skornyakova et al., 1964		Wet chemical and colorimetry	0.48	0.21	0.29	14.05	16.06		1.7	1.1
					Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.47	0.21	0.29	11.51	16.65			1.5
158	42°02'N 139°57'W	~ 4,116	Lamont RC11-D12	Dredge (pebble)	Nodules 2x2x1 cm	Lamont (unpublished)		Wet chemical	0.24	0.08	0.24	23.0	19.0		1.6	0.8
159	43°58'N 140°38'W	4,350	Scripps Cusp-8P	Corer	Nodule 1.2 cm diam	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.72	0.42	0.23	9.4	17.7	11.8	1.7	1.9
160	40°14'N 155°55'W	4,938			Nodule from crust	Ahrens et al., 1967	Half nodule	Emission spectrography	0.28	0.29	0.35	12.0	14.3		1.5	1.2
160	40°14'N 155°55'W	5,029	Scripps NH-C10	Caught in core wire	Crust ("Horizon")	Mero, 1965	Outer 2 cm	X-ray fluorescence spectrography	0.45	0.47	0.23	6.9	11.9	13.9	1.0	1.7
						Goldberg, 1954		Colorimetry	0.63		0.25	11.6	13.2			1.1
160	41°08'N 159°54'W	5,435/ 5,456	U.S.S.R. Vit-4104	Trawl	Nodule	Skornyakova et al., 1962	Outer layer	Wet chemical and colorimetry	0.43		0.31	8.92	13.25	14.7	1.9	1.5
162	40°24'N 175°42'W	6,065	U.S.S.R. Vit-4074	Trawl	Nodule	Skornyakova et al., 1962	Outer layer	Wet chemical and colorimetry	0.22	0.16	0.13	10.7	12.0	14.4	1.9	1.1

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TABLE 1. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
163	40°30'N 170°48'E	5,460	Scripps Jyn II-9G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.22	0.12	0.15	12.77	6.97			0.5
163	44°28N 170°15'E	1,258	U.S.S.R. Vit-3150	Trawl	Nodule	Skornyakova et al., 1962	Outer 1 cm	Wet chemical and colorimetry	0.42		0.41	7.8	33.9	2.8	1.9	4.3
195	56°10'N 145°15'W	1,370/ 1,800	Scripps NH-D7	Dredge (chain bag)	Crust	Goldberg, 1954		Colorimetry	0.45	0.40	0.26	13.1	20.9			1.6
196	52°47'N 150°05'W	1,500	Scripps NH-D1	Dredge (chain bag)	Crust	Goldberg, 1954		Colorimetry	0.32	0.21	0.31	14.8	19.4			1.3

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TABLE 2.

CHEMICAL ANALYSES

OF SURFACE FERROMANGANESE NODULES AND CRUSTS

NORTH ATLANTIC AND NORTHERN INDIAN OCEANS

Note: This table is based on a quadrant system for ease of computer plotting. As a result a few stations fall outside the ocean identified by the table heading. Data in this table were obtained from 90°W - 90°E and 0° - 60°N.

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH ATLANTIC AND NORTHERN INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
002	00°21'N 17°31'W	1,712	Lamont V22-184	Corer (piston)	Crust	Lamont (unpublished)		Wet Chemical	0.28	0.06	0.32	14.8	17.3			1.2
008	05°44'N 79°20'W	3,300	Dan. Deep Sea Gal 724			Ahrens et al., 1967		X-ray fluorescence spectrography	0.01	0.18	0.05	12.3	11.5		1.1	0.9
009	06°21'N 81°44'W	1,061	Alb 4622	Dredge	Nodule 3x4x1.5cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.76	0.05	0.36	17.7	15.1	7.2	1.7	0.8
040	17°54'N 31°57'W	4,868	Lamont V19-305	Corer (piston)	Crust	Lamont (unpublished)		Wet chemical	0.17	0.12	0.30	23.8	15.2		1.5	0.6
075	25°45'N 20°14'W	2,790	Challenger Chal 3	Dredge		Murray and Renard, 1891		Wet chemical				23.0	16.2	2.8		0.7
								Wet chemical				28.9	14.4	3.1		0.5
077	23°46'N 46°37'W	3,155	Lamont V25-D9	Dredge (box)	Crust	Lamont (unpublished)		Atomic absorption	0.18	0.12	0.38	19.0	10.4			0.5
078	24°47'N 50°26'W	5,726	Lamont V25-D13	Dredge (box)		Lamont (unpublished)		Atomic absorption	0.30	0.15	0.36	18.8	14.0			0.7
078	26°21'N 51°18'W	5,455	Lamont V26-27	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.15	0.12	0.26	21.6	10.9			0.5
078	24°57'N 51°45'W	5,960	Lamont V25-D14	Dredge (box)		Lamont (unpublished)		Atomic absorption	0.47	0.20	0.49	17.0	15.2			0.9
078	21°51'N 56°09'W	4,049	Lamont RC5-D1	Dredge (rock)		Lamont (unpublished)		Wet chemical	0.30	0.09	0.23	15.0	10.5		1.5	1.4
078	29°18'N 57°20'W	5,781	Brit. Mus. BM198a(1960)			Willis and Ahrens, 1962		Emission spectrography	0.36	0.20	0.30	17.5		8.2		
078	29°17'N 57°23'W	5,840	Bedford Inst. Theta 1-6	Dredge	Nodule 8x9x10cm	Mero, 1965	Outer 1 cm	X-ray fluorescence spectrography	0.49	0.28	0.54	15.9	16.2	6.3	0.4	1.0
078	26°26'N 58°38'W	5,141	Lamont RC10-5	Corer (piston)	Crust	Lamont (unpublished)		Wet chemical	1.56	0.41	0.24	9.44	20.0			2.1
078	28°38'N 59°43'W	5,319	Lamont V25-6	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.41	0.19	0.31	17.2	16.0			0.9
079	25°60'N 60°19'W	5,868	Lamont V23-135	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.44	0.60	0.56	20.8	12.5			0.6
079	28°05'N 60°49'W	5,760	Swed. DeepSea SDSE 270	Corer	Nodules 2-3cm diam.	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.57	0.26	0.33	1.54	18.9	5.7	1.3	12.3
079	20°21'N 66°24'W	5,722	Lamont V15-T151	Trawl (biology)	Nodules 4-5cm diam.	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.27	0.19	0.24	19.8	12.9	6.6	1.1	0.6
					Nodule	Lamont (unpublished)		Wet chemical	0.17	0.13	0.19	22.6	13.0		1.1	0.6
079	20°49'N 66°55'W	4,878	Lamont RC8-D8	Dredge (rock)	Nodule	Lamont (unpublished)		Wet chemical	0.13	0.12	0.17	25.7	8.4		1.3	0.3
114	31°49'N 43°25'W	3,700	Brit. Mus. BM197(1960)			Willis and Ahrens, 1962		Emission spectrography	0.19	0.10	0.48	24.3		4.3		
114	32°26'N 58°58'W	3,433	Lamont V26-D1	Dredge (crown)	Crust	Lamont (unpublished)		Atomic absorption	0.32	0.14	0.42	14.0	14.4			1.0
114	32°26'N 58°58'W	3,453	Lamont V26-3	Corer (piston)	Crust	Lamont (unpublished)		Wet chemical	0.24	0.14	0.34	20.2	11.9			0.6
114	30°52'N 59°23'W	5,616	Lamont RC8-143	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.25	0.07	0.24	14.0	10.0		1.8	0.7
115	38°04'N 60°13'W	~3,007	Lamont V19-D11	Dredge (rock)		Lamont (unpublished)		Atomic absorption	0.11	0.04	0.04	10.4	1.8		4.2	0.2

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH ATLANTIC AND NORTHERN INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
115	34°52'N 62°30'W	1,460	Muir Smt	Dredge	Crust 2 cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.27	0.04	0.91	18.9	16.9	0.9	2.2	0.9
115	39°57'N 66°49'W	3,710	Blake T	Trawl (Blake)	Nodules 1-4cm diam.	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.21	0.10	0.12	16.9	10.1	12.6	0.9	0.6
115	31°01'N 67°07'W	4,764	Lamont V26-159	Corer (piston)	Crust	Lamont (unpublished)		Wet chemical	0.20	0.12	0.18	20.6	13.3			0.6
115	32°13'N 69°06'W	5,290	Bedford Inst. Theta 1-7	Dredge	Nodule 0.5x0.5x3cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.29	0.30	0.14	9.3	14.8	11.8	1.2	1.6
116	30°00'N 76°00'W	2,645	U.S. Navy USN	Dredge	Nodules 1-2cm diam.	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.27	0.10	0.40	20.0	14.8	3.5	1.9	0.7
116	30°59'N 78°14'W	879	Woods Hole A266-41	Dredge	Nodule 8x6x6cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.53	0.10	0.48	10.4	13.6	2.3	8.9	1.3
116	30°57'N 78°21'W	810	Woods Hole A266-45	Dredge	Nodule 2.5x8.5x18cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.33	0.03	0.38	14.1	11.1	1.1	11.1	0.8
116	30°51'N 78°27'W	732	Woods Hole WHOI	Dredge	Nodule 4-8cm diam.	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.59	0.14	0.41	15.5	15.7	1.4	7.3	1.0
116	30°58'N 78°30'W	810	Woods Hole A266	Dredge	Nodule 9x7x6cm	Ahrens et al., 1967		X-ray fluorescence spectrography	0.77	0.09	0.45	10.4	21.5		11.6	2.1
					11x7x2cm	Ahrens et al., 1967		X-ray fluorescence spectrography	0.58	0.06	0.46	16.0	21.1		8.2	1.3
					15x10x2cm	Ahrens et al., 1967		X-ray fluorescence spectrography	0.51	0.05	0.44	15.1	18.5		10.6	1.2
116	30°53'N 78°47'W	815	Woods Hole A266-40	Dredge	Nodule 2x10x13cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.42	0.06	0.39	14.3	11.8	1.4	9.9	0.8
145	45°05'N 07°57'W	2,481	Lamont V27-133	Corer (piston)		Lamont (unpublished)		Atomic absorption	0.57	0.20	0.21	9.6	19.2			2.0
147	42°57'N 25°04'W	3,243	Lamont V27-138	Corer (piston)		Lamont (unpublished)		Atomic absorption	0.27	0.06	0.29	16.5	12.0			0.7
NORTHERN INDIAN OCEAN																
030	06°55'N 67°11'E	4,793	J. Murray Exp. BM96626F	Dredge	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.81	0.26	0.06	13.27	17.25			1.3
					Nodule	Willis and Ahrens, 1962	Central core	Emission spectrography	0.23	0.12	0.21	18.9		8.3		
					Nodule	Cronan and Tooms, 1967	Central core	Emission spectrography	0.29	0.16	0.33	20.7		5.8		
					Nodule	Willis and Ahrens, 1962	Outer layer	Emission spectrography	0.95	0.40	0.15	14.3		9.5		
					Nodule	Cronan and Tooms, 1967	Outer layer	Emission spectrography	1.1	0.39	0.15	11.4		7.6		
					Nodule	Willis and Ahrens, 1962	Second layer	Emission spectrography	0.81	0.38	0.17	17.0		8.4		
					Nodule	Cronan and Tooms, 1967	Second layer	Emission spectrography	0.97	0.37	0.20	14.6		6.0		
					Nodule	Willis and Ahrens, 1962	Third layer	Emission spectrography	0.73	0.27	0.16	17.7		7.7		
					Nodule	Cronan and Tooms, 1967	Third layer	Emission spectrography	0.86	0.31	0.21	17.0		5.0		

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TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH ATLANTIC AND NORTHERN INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
030	05°36'N 61°53'E	2,176	CambridgeU. Dis 5106.12	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.28	0.03	0.41	19.78	13.82			0.7
030	05°34'N 61°52'E	2,331	CambridgeU. Dis 5123.3	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.25	0.05	0.26	22.48	16.59			0.7
030	02°45'N 60°03'E	3,859/ 3,969	CambridgeU. Dis 5133	Dredge		Cronan and Tooms, 1967		Emission spectrography	1.12	0.18	0.18	9.55	19.95	6.1		2.1
					Nodule (small)	Cronan and Tooms, 1967		Emission spectrography	1.27	0.15	0.15	8.25	19.99	3.6		2.4
					Nodule (small)	Cronan and Tooms, 1967		Emission spectrography	1.42	0.28	0.09	7.79	25.80	2.8		3.3
					Nodule	Cronan and Tooms, 1967	Outer 3mm	Emission spectrography	0.63	0.15	0.22	15.76	16.67	7.7		1.1
031	02°47'N 59°53'E	3,374/ 3,548	CambridgeU. Dis 5136	Dredge		Cronan and Tooms, 1967		Emission spectrography	0.25	0.03	0.49	14.36	14.36	2.6		1.0
					Nodule (small)	Cronan and Tooms, 1967		Emission spectrography	0.19	0.03	0.53	13.03	15.36	2.5		1.2
					Nodule (small)	Cronan and Tooms, 1967		Emission spectrography	0.27	0.02	0.66	14.21	13.82	2.3		1.0
					Crust	Cronan and Tooms, 1967		Emission spectrography	0.08	0.04	0.45	20.63	15.50	7.3		0.8
031	02°48'N 59°52'E	3,246/ 3,365	CambridgeU. Dis 5138	Dredge	Nodule (large)	Cronan and Tooms, 1967		Emission spectrography	0.24	0.07	0.24	17.54	12.83			0.7
					Nodule (large)	Cronan and Tooms, 1967		Emission spectrography	0.23	0.13	0.25	19.51	14.45			0.7
					Nodule (large)	Cronan and Tooms, 1967		Emission spectrography	0.29	0.16	0.28	18.02	13.33			0.7
					Nodule (large)	Cronan and Tooms, 1967		Emission spectrography	0.33	0.06	0.34	17.39	12.90			0.7
					Nodule (large)	Cronan and Tooms, 1967		Emission spectrography	0.38	0.13	0.33	16.91	12.51			0.7
					Nodule (large)	Cronan and Tooms, 1967	Outer 2mm	Emission spectrography	0.39	0.13	0.32	17.60	16.64	6.7		0.9

TABLE 3.

CHEMICAL ANALYSES

OF SURFACE FERROMANGANESE NODULES AND CRUSTS

SOUTH PACIFIC AND INDIAN OCEANS

Note: This table is based on a quadrant system for ease of computer plotting. As a result a few stations fall outside the ocean identified by the table heading. Data in this table were obtained from 90°E - 90°W and 0° - 60°S.

TABLE 3. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH PACIFIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
309	07°48'S 94°06'W	4,100	Harvard Alb-4711	Trawl (ring)	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	1.10	0.57	0.05	3.68	36.5	3.7	1.7	9.9
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	2.00	0.64	0.40	5.5	37.9	3.1	1.9	6.8
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.6	0.65	0.03	4.5	41.1	3.3	1.8	9.1
310	08°08'S 104°11'W	3,820	Harvard Alb-4721	Trawl	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.00	0.70	0.55	14.3	23.0	4.7	1.4	1.6
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	0.90	0.51	0.04	23.8	17.1	10.3	1.1	0.7
312	07°01'S 128°25'W	4,574	Lamont RC11-D25	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	1.42	1.30	0.36	8.0	31.6			3.9
313	06°05'S 132°53'W	4,855	Scripps DWBG-16	Corer (gravity)	Nodule	Scripps-NODC (unpublished)		Emission spectrography	0.46	0.56	0.05	11.9	8.2	20.1	1.4	0.7
315	09°42'S 151°24'W	4,803	Lamont RC13-70			Lamont (unpublished)		Atomic absorption	0.81	0.44	0.29	13.4	19.0			1.4
315	07°25'S 152°15' W	5,030	Challenger Chal-274		Nodule	Murray and Renard, 1891	Whole nodule	Wet chemical	~1.00	0.67		7.37	35.27	5.3	2.1	4.7
					Nodule	Murray and Renard, 1891		Wet chemical	~1.00	0.79		6.3	32.5	6.3	2.5	5.2
					Nodule	Murray and Renard, 1891		Wet chemical	~1.00	0.79		9.04	33.04	5.8	2.4	3.7
315	04°49'S 152°37'W	5,332	Lamont RC13-66			Lamont (unpublished)		Atomic absorption	0.59	0.36	0.32	17.2	21.0			1.2
315	06°59'S 154°04'W	5,040	U.S.S.R. Vit-5112	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.56	0.30	0.24	10.77	15.82	7.8	1.4	1.4
315	02°59'S 154°18'W	4,980	U.S.S.R. Vit-5114	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.87	0.10	0.45	6.97	18.19	8.0	1.9	2.6
315	00°02'S 159°52'W	5,163	U.S.S.R. Vit-5429	Grab	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.72	0.57	0.14	19.23	11.82	5.2	1.4	1.6
316	08°49'S 168°33'W	4,550	Scripps Proa-116P	Corer (piston)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.54	0.57	0.24	11.14	14.78			1.3
317	03°31'S 178°25'W	5,582	Scripps Proa-108PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.5	0.39	0.33	14.69	12.39			0.8
317	03°17'S 172°52'W	5,329	U.S.S.R. Vit-3802	Trawl	Nodule	Skornyakova et al., 1962		Wet chemical and colorimetry	0.75		0.24	7.2	24.4	6.9	2.1	3.4
317	09°34'S 176°13'W	4,837	Scripps Proa-113PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.24	0.21	0.37	16.55	9.56			0.6
318	09°00'S 171°28'E	5,000	Scripps Msn-S	Dredge	Nodule	Mero, 1965		X-ray fluorescence spectrography	0.63	0.71	0.13	11.1	19.5	7.3	1.8	1.8
318	07°03'S 174°12'E	5,378	Scripps Msn-Q	Corer	Nodule	Mero, 1965		X-ray fluorescence spectrography	0.45	0.45	0.26	15.5	15.7	6.5	1.4	1.0
322	05°36'S 131°01'E	7,480	Dan. DeepSea Gal-494		Nodule 1.5x2cm	Ahrens et al., 1967		X-ray fluorescence spectrography				33.8	0.21		0.9	0.0
326	05°23'S 97°29'E	3,558	Scripps Dodo-232D	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.36	0.30	0.07	15.92	14.59			0.9
345	10°37'S 91°19'W	3,819	Lamont RC 8-99	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.01	0.01	0.01	1.36	0.32		28.8	0.2

TABLE 3. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH PACIFIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
346	19°12'S 102°24'W	4,142	Harvard Alb-4701	Trawl	Nodule	Mero, 1965	Whole nodule	Emission spectrography	1.52	0.59	0.16	11.6	17.2	8.2	1.0	1.5
						Scripps-NODC (unpublished)		Emission spectrography	1.9	0.74	0.20	13.3	21.5	10.3	1.3	1.6
						Scripps-NODC (unpublished)		Emission spectrography	1.2	0.58	0.11	11.2	19.6	11.2	1.6	1.8
						Scripps-NODC (unpublished)		Emission spectrography	1.3	0.64	0.11	10.5	19.6	11.7	2.1	1.9
346	18°53'S 103°39'W	4,122	Lamont RC13-92	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	1.09	0.43	0.14	8.3	15.2			1.8
349	10°38'S 134°52'W	3,860	Lamont RC11-D24	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.29	0.22	0.03	10.8	7.0		5.8	0.6
349	12°51'S 135°13'W	4,318	Scripps DWBG-17	Corer (gravity)	Nodule	Mero, 1965	Whole nodule	Emission spectrography	1.46	0.92	0.08	7.0	23.9	4.7	1.6	3.4
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.9	1.2	0.11	9.1	31.0	6.1	2.1	3.4
349	14°59'S 136°02'W	4,465	Scripps DWBG-19	Corer (gravity)	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.77	0.53	0.12	9.8	12.0	14.2	0.9	1.2
						Scripps-NODC (unpublished)		Emission spectrography	0.9	0.44	0.14	14.7	15.2	13.5	1.4	1.0
349	15°23'S 136°18'W	4,480	Scripps DWHD-15	Dredge		Cronan and Tooms, 1969		Emission spectrography	1.29	0.74	0.07	8.1	21.5			2.6
					Nodule 0.5x3x3	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.12	1.07	1.17	8.1	20.3	7.4	1.4	2.5
					Nodule 0.6x3x3	Scripps-NODC (unpublished)		Emission spectrography	1.0	0.64	0.14	18.2	19.6	9.0	1.4	1.1
350	17°36'S 141°55'W	2,132	Scripps Car 46	Snapper	Nodule 1 cm	Mero, 1965	Whole nodule	Emission spectrography	0.34	0.09	0.49	16.2	16.0	3.2	2.0	1.0
					Nodule 1 cm	Scripps-NODC (unpublished)		Emission spectrography	0.48	0.13	0.7	19.6	22.8	4.5	2.8	1.2
350	18°31'S 143°18'W	4,319	Lamont RC13-74	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.33	0.14	0.39	18.0	16.4			0.9
350	18°31'S 143°18'W	4,319	Lamont RC13-75	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.31	0.12	0.32	15.0	13.6			0.9
350	12°20'S 144°15'W	4,840	Harvard Alb-31	Trawl (Blake)	Nodule 1 cm	Mero, 1965	Whole nodule	Emission spectrography	0.81	0.61	0.15	7.9	19.3	6.8	2.0	2.4
					Nodule 1.3 cm	Scripps-NODC (unpublished)		Emission spectrography	0.9	0.52	0.18	10.5	15.8	14.0	1.4	1.5
					Nodule 1.3 cm	Scripps-NODC (unpublished)		Emission spectrography	1.0	0.76	0.18	9.8	24.0	8.4	1.5	2.4
350	11°59'S 144°22'W	4,970	Scripps Amp-124C	Corer		Cronan and Tooms, 1969		Emission spectrography	0.44	0.42	0.26	12.9	15.3			1.2
350	11°59'S 144°22'W	4,972	Scripps Amp-125PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.84	0.77	0.12	9.8	19.9			2.0
350	16°29'S 145°33'W	1,270	Scripps DWHD-16	Dredge	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.62	0.09	1.8	11.3	16.9			1.5
					Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.58	0.17	1.1	13.8	22.4	1.3	2.9	1.6
					Nodule 4.5 cm	Scripps-NODC (unpublished)		Emission spectrography	0.77	0.14	1.4	17.5	29.7	2.0	2.6	1.7
					Nodule 4.5 cm	Scripps-NODC (unpublished)		Emission spectrography	0.64	0.12	1.6	18.9	30.3	1.5	3.1	1.6
					Nodule 4.5 cm	Scripps-NODC (unpublished)		Emission spectrography	0.72	0.12	1.4	17.5	32.2	1.7	3.0	1.8

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TABLE 3. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH PACIFIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
350	12°52'S 145°33'W	4,662	Lamont RC11-D22	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.52	0.28	0.29	20.3	16.5		1.8	0.8
350	16°10'S 146°00'W	1,190	Scripps DWBD-5	Dredge		Scripps-NODC (unpublished)		Emission spectrography	0.30	0.08	0.46	7.0	9.5	0.7	24.0	1.4
350	17°00'S 146°00'W	1,700	Scripps DWBD-4	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.35	0.07	2.53	10.8	21.24			2.0
					Nodule 3x4x7	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.58	0.09	1.53	12.6	23.2	0.7	3.1	1.8
					Nodule 2.5x4x7	Scripps-NODC (unpublished)		Emission spectrography	0.8	0.10	2.3	18.2	27.8	1.3	3.6	1.5
350	18°55'S 146°32'W	4,460	Harvard Alb-173	Trawl (Blake)	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.23	0.17	0.50	16.1	15.0	6.3	2.1	0.9
					Nodule 4x10x10	Scripps-NODC (unpublished)		Emission spectrography	0.34	0.20	0.49	22.4	16.4	7.9	2.6	0.7
						Hewett et al., 1963		Emission spectrography	0.30	0.15	0.30	>10	>10	7.1	3.0	
					Nodule 2.5 cm	Willis and Ahrens, 1962	Middle layer	Emission spectrography	0.30	0.16	0.36	21.4		9.9		
					Nodule 2.5 cm	Willis and Ahrens, 1962	Outer layer	Emission spectrography	0.29	0.14	0.47	18.5		8.7		
					Nodule 2.5 cm	Ahrens et al., 1967	Nodule without core	X-ray fluorescence spectrography	0.30	0.15	0.60	18.6			2.3	
350	11°26'S 149°17'W	5,106	Scripps Amp-116PG	Corer		Cronan and Tooms, 1969		Emission spectrography	0.80	0.32	0.65	15.5	18.07			1.2
350	13°28'S 149°30'W	4,300	Challenger Chal-276	Trawl	Nodule 2 cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.77	0.35	0.35	12.0	21.6	5.8	1.9	1.8
						Murray and Renard, 1891		Wet chemical	1.43	~1.0	~.5	29.35	7.22	7.3	2.8	0.2
						Murray and Renard, 1891		Wet chemical	~.5	~1.0	~.5	32.4	9.38	6.8	2.5	0.3
						Murray and Renard, 1891		Wet chemical		~.5		16.08	1.2	21.6	1.8	0.1
350	14°18'S 149°32'W	1,937/ 2,087	Lamont V18-D32	Dredge (rock)		Lamont (unpublished)		Wet chemical	0.32	0.11	0.42	11.0	10.8			1.0
351	14°29'S 150°01'W	1,659/ 1,919	Lamont V18-D29	Dredge (rock)	Crust	Lamont (unpublished)		Wet chemical	0.40	0.18	0.46	16.7	12.5			0.7
351	14°29'S 150°01'W	1,082/ 1,269	Lamont V18-D30	Dredge (rock)		Lamont (unpublished)		Wet chemical	0.40	0.12	0.48	17.8	9.8			0.6
351	13°53'S 150°35'W	3,695	2P-50	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.24	0.12	0.42	15.04	12.14			0.8
351	13°53'S 150°35'W	3,623	Scripps Msn-128G	Corer (gravity)		Cronan and Tooms, 1969		Emission spectrography	0.35	0.22	0.50	15.84	14.44			0.9
					Nodule 3x3x2	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.31	0.21	0.43	17.5	15.7	4.2	2.0	0.9
351	12°38'S 150°46'W	4,784	Lamont RC13-73	Corer (piston)		Lamont (unpublished)		Atomic absorption	.40	.20	.46	18.2	19.6			1.1
351	11°56'S 150°56'W	4,980	Lamont RC13-72	Corer (piston)		Lamont (unpublished)		Atomic absorption	.62	.38	.33	15.1	20.4			1.4

TABLE 3. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH PACIFIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
351	17°49'S 154°01'W	1,027/ 1,492	Lamont V18-BBD4	Dredge (bucket)	Crust	Lamont (unpublished)		Wet chemical	0.20	0.09	0.54	13.6	8.1			0.6
351	17°48'S 154°02'W	1,082/ 884	Lamont V18-BBD5	Dredge (bucket)	Crust	Lamont (unpublished)		Wet chemical	0.50	0.15	1.48	16.5	20.7			1.3
351	12°59'S 154°06'W	5,222	U.S.S.R. Vit-5110	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.50	0.10	0.55	0.01	0.02	4.6	2.1	1.8
351	17°52'S 154°08'W	1,994/ 1,679	Lamont V19-D1	Dredge	Nodule	Lamont (unpublished)		Wet chemical	0.42	0.08	0.64	12.9	15.6		3.8	1.2
351	17°52'S 154°53'W	4,790	Lamont V19-D2	Dredge	Nodule	Lamont (unpublished)		Wet chemical	0.24	0.08	0.58	15.5	14.0			0.9
351	14°05'S 155°09'W	5,002/ 5,022	Lamont V18-BBD1	Dredge (bucket)	Nodule	Lamont (unpublished)		Wet chemical	0.72	0.06	0.17	9.7	12.9			1.4
351	16°32'S 156°04'W	4,618	Lamont RC10-110	Corer (piston)		Lamont (unpublished)		Wet chemical	0.50	0.16	0.34	17.0	18.6		1.5	1.1
351	12°51'S 156°11W	4,980/ 4,989	Lamont V18-T122	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.72	0.43	0.39	11.6	21.2			1.8
351	11°25'S 157°37'W	5,302	Scripps Amp-86GV	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.69	0.39	0.30	12.14	17.34			1.4
351	12°24'S 157°49'W	5,095/ 5,152	Lamont V18-T121	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.41	0.19	0.41	11.9	15.6		2.2	1.3
351	12°26'S 158°19'W	5,220/ 5,240	Lamont V18-T120	Trawl (biology)		Lamont (unpublished)		Wet chemical	0.46	0.18	0.43	5.6	7.9		3.7	1.4
351	12°27'S 159°25'W	5,008/ 5,026	Lamont V18-T119	Trawl (biology)		Lamont (unpublished)		Wet chemical	0.64	0.27	0.40	12.7	15.6		2.8	1.2
352	10°01'S 160°01'W	4,833	U.S.S.R. Vit-5423	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.24	0.16	0.24	19.08	15.96	4.8	2.1	0.8
352	15°49'S 160°10'W	5,102	U.S.S.R. Vit-5420	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.13	0.10	0.31	22.54	11.36	6.0	1.1	0.5
352	12°05'S 160°26'W	5,618	U.S.S.R. Vit-5422	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.54	0.26	0.29	15.80	18.14	4.9	1.7	1.1
352	11°51'S 160°51'W	3,803	Scripps Amp-80G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.30	0.17	0.51	18.00	16.90			0.9
352	16°41'S 161°22'W	4,685	Scripps Cap-24HG	Corer (gravity)		Cronan and Tooms, 1969		Emission spectrography	0.22	0.18	0.43	26.32	16.27			0.6
352	18°08'S 161°29'W	4,839	Lamont V19-80	Corer (piston)		Lamont (unpublished)		Wet chemical	0.04	0.05	0.06	8.55	2.50		1.8	0.3
352	18°36'S 161°32'W	4,998	U.S.S.R. Vit-5398	Dredge		Skornyakova et al., 1968		Wet chemical and colorimetry	0.11	0.12	0.44	18.35	14.41	5.8	2.2	0.7
354	11°30'S 177°48'E	5,520	Scripps LSDH-87P	Corer (piston)	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.41	0.89	0.39	10.50	17.86			1.7
360	10°51'S 113°01'E	5,150	Dan. DeepSea Gal-469			Ahrens et al., 1967		X-ray fluorescence spectrography	0.68	0.19	0.09	12.6	18.4			1.4
361	10°38'S 100°52'E	5,273	Lamont RC14-49	Corer (piston)		Lamont (unpublished)		Atomic absorption	0.69	0.48	0.12	14.2	20.4			1.4
361	18°12'S 101°10'E	5,991	Lamont RC14-55	Corer (piston)		Lamont (unpublished)		Atomic absorption	0.86	0.75	0.18	10.6	22.8			2.2
361	16°18'S 104°16'E	5,660	Scripps Dodo-62D	Dredge	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.38	0.24	0.33	10.93	18.46			1.7

TABLE 3. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH PACIFIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
361	16°17'S 106°30'E	5,918	Scripps Dodo-60P	Corer (piston)		Cronan and Tooms, 1969		Emission spectrography	0.47	1.06	0.15	13.06	14.55			1.1
361	13°15'S 93°12'E	5,325	Scripps Dodo-75P	Corer (piston)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.57	0.83	0.12	10.49	15.39			1.5
362	19°56'S 100°00'E	5,860	Scripps Dodo-66D	Dredge	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.076	0.053	0.20	9.11	16.51			1.8
381	21°36'S 96°56'W	4,040	Harvard Alb-4685	Trawl	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.09	0.62	0.18	10.6	15.5	9.2	1.4	1.5
					Nodule 2 cm	Scripps-NODC (unpublished)		Emission spectrography	0.39	0.22	0.14	11.9	12.6	15.0	1.4	1.1
						Scripps-NODC (unpublished)		Emission spectrography	0.42	0.26	0.14	15.4	13.3	12.1	1.9	0.9
386	29°09'S 143°01'W	4,120	Scripps DWBG-37	Corer	Nodule	Mero, 1965	X-Sect.	Emission spectrography	0.33	0.16	0.26	15.5	12.7	5.4	3.1	0.8
						Scripps-NODC (unpublished)		Emission spectrography	0.46	0.22	0.36	21.7	17.7	7.5	4.4	0.8
387	22°21'S 150°17'W	4,360	Challenger Chal-281	Trawl	Nodule 1 cm	Murray and Renard, 1891	Whole nodule	Wet chemical	~1.0	~1.0	~0.5	21.2	14.1	10.6	1.8	0.7
						Murray and Renard, 1891		Wet chemical		~1.0		23.8	12.6	11.4	1.9	0.5
						Murray and Renard, 1891		Wet chemical	~0.5	~0.5	~0.5	23.0	4.12	20.0	3.1	0.2
387	22°35'S 150°55'W	807	Scripps Amp-9D	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.41	0.05	2.57	11.80	16.07			1.4
387	20°30'S 152°14'W	4,375	U.S.S.R. Vit-5414	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.15	0.12	0.35	18.75	13.94	5.8	2.1	0.7
387	24°41'S 154°45'W	4,542	Scripps Msn-126G	Corer (gravity)	Nodule 1x3x3	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.41	0.26	0.57	17.0	15.7	4.4	1.7	0.9
387	23°55'S 155°09'W	4,430	U.S.S.R. Vit-5412	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.12	0.17	0.39	18.22	16.5	5.1	1.9	0.9
387	26°01'S 155°59'W	5,038	Scripps Msn-125G	Corer (gravity)	Nodule 3x3.5x4cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.32	0.14	0.73	18.2	14.1	5.9	1.4	0.8
387	25°58'S 156°50'W	5,130	U.S.S.R. Vit-5411	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.59	0.25	0.42	15.49	17.48	5.7	1.5	1.1
387	27°58'S 158°46'W	5,163	U.S.S.R. Vit-5410	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.79	0.14	0.32	18.09	15.68	5.9	1.5	0.9
387	29°35'S 158°58'W	5,252	Scripps Msn-121G	Corer (gravity)	Nodule 1.5x1.5x2.4cm	Mero, 1965	0.5 nodule	X-ray fluorescence spectrography	0.29	0.20	0.49	17.8	12.8	6.9	1.0	0.7
387	26°01'S 159°50'W	5,134	U.S.S.R. Vit-5409	Dredge	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.33	0.18	0.38	17.43	16.57	5.6	1.5	0.9
387	24°00'S 159°55'W	4,947	U.S.S.R. Vit-5408	Dredge	Nodule	Skornyakova et al., 1968	Nucleus	Wet chemical and colorimetry	0.13	0.12	0.37	14.35	15.82	7.5	1.9	1.1
					Nodule	Skornyakova et al., 1968	Ore cover	Wet chemical and colorimetry	0.37	0.25	0.40	18.49	16.24	5.2	1.3	0.8
390	26°34'S 174°40'E	~4,244	Lamont RC9-123	Corer (piston)		Lamont (unpublished)		Wet chemical	0.16	0.08	0.16	29.0	15.5			0.5
398	20°52'S 91°29'E	4,565	U.S.S.R. Vit-5202	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.53	0.30	0.20	9.8	14.53			1.5

TABLE 3. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH PACIFIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
398	23°52'S 91°39'E	4,560	U.S.S.R. Vit-5200	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.33	0.12	0.19	11.39	13.71			1.2
418	39°04'S 105°05'W	3,705	Challenger Chal-293	Trawl	Nodule 2 cm	Murray and Renard, 1891		Wet chemical	~1.0	~1.0		14.6	23.8	7.8	2.7	1.6
421	39°41'S 131°23'W	4,665	Challenger Chal-289	Trawl	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.82	0.30	0.18	10.36	16.62			1.6
					Nodule 6 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.82	0.41	0.31	12.0	20.7	5.5	2.0	1.7
					Nodule	Murray and Renard, 1891		Wet chemical		0.31	0.25	14.68	20.25	10.1	2.1	1.4
421	33°29'S 133°22'W	4,270	Challenger Chal-286	Trawl	Nodule 0.5 cm	Murray and Renard, 1891	Whole nodule	Wet chemical	~1.0	~1.0	~0.5	12.5	24.1	9.4	2.6	1.9
						Murray and Renard, 1891		Wet chemical	~1.0	~1.0	~0.5	17.63	17.3	12.2	2.9	1.0
						Murray and Renard, 1891		Wet chemical	~1.0	~1.0	~0.5	16.85	14.4	13.3	1.8	0.9
421	35°11'S 135°32'W	4,700	Scripps DWHG-31	Corer (gravity)		Cronan and Tooms, 1969		Emission spectrography	0.33	0.05	0.73	14.16	19.56			1.4
421	37°05'S 137°00'W	4,940	Scripps DWBG-48	Corer (gravity)	Nodule 1.5x1.5x3cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.91	0.43	0.38	11.2	18.9	5.4	1.1	1.7
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	0.66	1.5	0.28	11.2	26.5	7.5	2.5	2.4
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	0.53	0.9	0.33	15.4	24.6	7.0	1.5	1.6
421	36°23'S 137°15'W	4,680	Scripps DWBG-46	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.97	0.35	0.43	13.13	16.8			1.3
					Nodule 2.5x2.5x2.5cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.69	0.33	0.38	13.0	18.7	5.7	1.5	1.4
421	36°33'S 137°24'W	4,700	Scripps DWBG-47	Corer (gravity)	Nodule 2x1.5x2 cm	Mero, 1965	0.5 nodule	X-ray fluorescence spectrography	0.64	0.29	0.36	12.4	14.1	8.8	1.4	1.1
421	32°36'S 137°43'W	4,350	Challenger Chal-285	Trawl	Nodule 3 cm	Murray and Renard, 1891	Whole nodule	Wet chemical	0.77	0.30	0.22	10.1	16.7	6.3	1.6	1.7
					Nodule	Murray and Renard, 1891		Wet chemical		~1.0		9.92	14.05	10.4	2.9	1.4
421	34°01'S 138°55'W	4,721	Scripps DWBG-43	Corer (gravity)	Nodule 0.5x2x2 cm	Mero, 1965	X-Sect.	Emission spectrography	0.50	0.21	0.45	21.7	19.6	7.6	2.2	0.9
						Scripps-NODC (unpublished)		Emission spectrography	0.50	0.21	0.45	21.7	19.6	7.5	2.2	0.9
422	31°13'S 141°12'W	4,280	Scripps DWBG-40	Corer (gravity)		Scripps-NODC (unpublished)		Emission spectrography	0.35	0.42	0.17	26.6	20.9	4.7	2.2	0.8
						Mero, 1965		Emission spectrography	0.24	0.29	0.12	18.2	14.3	3.2	1.5	0.8
423	39°30'S 157°42'W	4,826	Lamont RC12-218	Corer (piston)		Lamont (unpublished)		Wet chemical	0.72	0.38	0.15	6.3	15.9			2.5
424	35°50'S 163°01'W	4,950	Scripps Msn-116P	Corer (piston)	Nodule	Mero, 1965		X-ray fluorescence spectrography	1.08	0.79	0.20	5.2	17.8	7.5	1.3	3.4
424	36°16'S 164°20'W	4,896	Lamont RC12-216	Corer (piston)		Lamont (unpublished)		Wet chemical	0.18	0.13	0.11	10.7	7.9			0.7

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TABLE 3. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH PACIFIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
425	35°51'S 178°31'W	6,840	Dan. DeepSea Gal-658		Nodule	Ahrens et al., 1967	Nodule without core	X-ray fluorescence spectrography	0.20	0.07	0.25	20.4	20.5		1.9	1.0
428	39°45'S 159°39'E	4,800	Dan. DeepSea Gal-574		Nodule	Ahrens et al., 1967	Core 3 cm diam.	X-ray fluorescence spectrography	1.25	0.60	0.19	8.19	26.2		1.3	3.2
431	37°50'S 124°30'E	5,667/ 5,663	Lamont V16-T29	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	1.29	0.64	0.13	11.7	18.5		0.6	1.6
433	32°32'S 103°22'E	5,245	Lamont RC11-132	Corer (piston)		Lamont (unpublished)		Wet chemical	0.32	0.18	0.20	15.4	12.5			0.8
433	32°48'S 105°52'E	5,300	U.S.S.R. Vit-5193	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.49	0.30	0.24	12.92	14.5			1.1
454	44°08'S 100°58'W	4,100	Scripps DWBG-78	Corer (gravity)	Nodule	Mero, 1965	Whole nodule	Emission spectrography	0.67	0.32	0.10	9.9	19.5	4.1	1.5	2.0
					Nodule 1.3x2x2	Scripps-NODC (unpublished)		Emission spectrography	1.0	0.48	0.15	14.7	29.1	6.1	2.2	2.0
454	42°00'S 102°00'W	4,240	Scripps DWHG-48	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.99	0.51	0.14	10.34	22.7			2.2
454	41°59'S 102°01'W	4,200	Scripps DWHD-47	Dredge	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	1.02	0.59	0.13	9.6	24.5	5.1	1.6	2.6
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	0.9	0.4	0.11	18.2	22.1	8.4	1.6	1.2
					Nodule	Hewett et al., 1963		Emission spectrography	0.7	0.3	0.15	>10	>10	3.0	3.0	
					Nodule	Skornyakova et al., 1962	Outer layer	Wet chemical and colorimetry	0.92	0.18	0.20	9.9	24.2	4.9	2.4	2.4
455	46°44'S 123°01'W	4,100	Scripps DWBD-7	Dredge	Nodule 1 cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.86	0.46	0.23	9.6	16.2	9.6	1.5	1.7
					Nodule 1.2 cm	Scripps-NODC (unpublished)		Emission spectrography	0.29	0.22	0.07	11.9	7.6	19.6	3.4	0.6
456	44°23'S 124°39'W	4,500	Scripps DWBG-59	Corer (gravity)		Cronan and Tooms, 1969		Emission spectrography	0.87	0.29	0.11	5.43	20.4			3.8
456	43°07'S 125°23'W	4,640	Scripps DWBG-58	Corer (gravity)	Nodule 1 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.14	0.62	0.25	6.4	20.1	9.9	1.5	3.1
456	42°16'S 125°50'W	4,560	Scripps DWBG-56	Corer (gravity)	Nodule 1 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.10	0.45	0.40	9.1	22.6	4.8	1.5	2.5
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.4	0.54	0.36	10.5	32.9	5.1	2.0	3.1
456	44°13'S 127°20'W	4,600	Scripps DWHG-34	Corer (gravity)	Nodule	Scripps-NODC (unpublished)		Emission spectrography	0.45	0.24	0.20	11.2	15.2	16.3	1.8	1.4
456	41°32'S 128°15'W	4,750	Scripps DWBG-55	Corer (gravity)		Scripps-NODC (unpublished)		Emission spectrography	1.5	0.43	0.36	14.0	24.6	4.9	1.6	1.8
456	41°24'S 129°06'W	4,880	Scripps DWBG-54	Corer (gravity)	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.8	0.37	0.39	11.7	19.6	6.9	1.5	1.7
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.1	0.42	0.36	14.0	20.9	11.7	1.8	1.5
457	40°36'S 132°49'W	5,120	Scripps DWBG-52	Corer (gravity)	Nodule 1x1x1.5 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.89	0.47	0.43	10.3	18.6	6.8	1.2	1.8
					Nodule 3 cm	Scripps-NODC (unpublished)		Emission spectrography	1.3	0.69	0.38	14.7	22.8	4.9	1.4	1.6

TABLE 3. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH PACIFIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
458	43°25'S 141°17'W	4,314	Lamont RC8-84	Corer (piston)		Lamont (unpublished)		Wet chemical	0.74	0.27	0.33	12.0	17.2		2.3	1.4
458	45°53'S 149°45'W	4,738	Lamont RC8-83	Corer (piston)		Lamont (unpublished)		Wet chemical	1.10	0.35	0.018	1.1	17.3		1.1	15.7
459	43°42'S 151°17'W	5,293	Lamont RC12-220	Corer (piston)		Lamont (unpublished)		Wet chemical	0.76	0.52	0.17	6.6	17.6			2.7
459	46°56'S 154°15'W	4,308	Lamont RC8-82	Corer (piston)		Lamont (unpublished)		Wet chemical	0.36	0.15	0.03	20.6	18.6		1.7	0.9
466	42°42'S 134°10'W	4,760	Challenger Chal-160	Trawl	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.32	0.75	0.20	8.84	20.2			2.3
					Nodule	Goldberg, 1954		Colorimetry	1.05	1.65	0.75	9.34	19.7	11.7		2.1
489	59°01'S 99°36'W	4,901	Fla. State U. Elt-15-3T	Trawl (Menzies)	Crust	Grant, 1967		X-ray fluorescence spectrography	0.49	0.25	0.17	13.10	9.2			0.7
490	55°35'S 100°18'W	4,420	Lamont RC12-228	Corer (piston)		Lamont (unpublished)		Wet chemical	0.24	0.02		3.8	0.5			0.1
490	59° 09'S 104° 58'W	4,662	Fla. State U. Elt-15-6D	Dredge (rock)		Grant, 1967		X-ray fluorescence spectrography	0.50	0.28	0.08	8.6	1.1			0.1
491	54°55'S 114°49'W	3,840/ 3,795	Fla. State U. Elt-11-1	Trawl (Blake)	Crust	Grant, 1967		X-ray fluorescence spectrography	0.26	0.10	0.42	28.60	15.2			0.5
491	57°44'S 114°58'W	4,523/ 4,513	Fla. State U. Elt-11-3	Trawl (Blake)	Nodule	Grant, 1967		X-ray fluorescence spectrography	0.24	0.14	0.30	25.50	16.0			0.6
					Nodule	Grant, 1967		X-ray fluorescence spectrography	0.35	0.12	0.42	26.20	19.9			0.7
492	57°53'S 125°21'W	3,877/ 3,767	Fla. State U. Elt-14-7	Dredge (rock)	Nodule	Grant, 1967		X-ray fluorescence spectrography	0.73	0.90	0.23	19.90	17.9			0.9
493	59°22'S 132°49'W	3,975/ 3,990	Lamont V16-T35	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.07	0.09	0.02	6.60	2.8			0.4
493	51°13'S 133°41'W	~4,663	Lamont RC12-224	Corer (piston)		Lamont (unpublished)		Wet chemical	0.64	0.28	0.15	13.5	15.2			1.1
494	52°10'S 142°10'W	2,203/ 2,286	Fla. State U. Elt-17-1	Dredge (rock)	Crust	Grant, 1967		X-ray fluorescence spectrography	0.42	0.07	1.51	18.6	22.2			1.2
496	54°30'S 163°19'W	4,640/ 4,658	Lamont V16-T34	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.66	0.13	0.22	11.9	15.4			1.3
					Crust 1 cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.37	0.15	0.3	14.9	14.4	9.8	1.3	1.0
499	57°43'S 169°12'E	5,288	Scripps Msn-85G	Corer (gravity)	Nodule 2x2x3	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.19	0.10	0.17	19.2	10.7			0.6
499	57°16'S 165°32'E	4,960	Fla. State U. Elt-16-7	Corer (piston)	Nodule	Grant, 1967		X-ray fluorescence spectrography	0.52	0.05	1.00	27.90	29.5	12.1	1.4	1.1

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TABLE 4.

CHEMICAL ANALYSES

OF SURFACE FERROMANGANESE NODULES AND CRUSTS

SOUTH ATLANTIC AND INDIAN OCEANS

Note: This table is based on a quadrant system for ease of computer plotting. As a result a few stations fall outside the ocean identified by the table heading. Data in this table were obtained from 90°W - 90°E and 0° - 60°S.

TABLE 4. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH ATLANTIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
330	02°08'S 57°24'E	4,135/ 4,280	CambridgeU. Dis-5179	Dredge	Nodule	Cronan and Tooms, 1967		Emission spectrography	0.47	0.05	0.81	16.35	18.4			1.1
330	02°06'S 57°23'E	4,041	CambridgeU. Dis-5175.1	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.34	0.07	0.59	17.89	15.4			0.9
330	09°39'S 56°25'E	2,800	Scripps Dodo-125D	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.39	0.07	0.99	13.55	15.25			1.1
330	06°40'S 51°54'E	2,900	Scripps Dodo-127D	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.34	0.04	0.88	15.64	13.49			0.9
300	09°58'S 05°23'W	1,536/ 1,207	Lamont RC13-D5	Dredge	Crust	Lamont (unpublished)		Atomic absorption	0.43	0.05	1.44	18.0	24.0			1.3
308	06°55'S 83°34'W	4,060	Harvard Alb-4656	Trawl	Nodule 4x8x10cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.11	0.19	0.03	7.71	9.6	20.5	0.7	1.2
					Nodule 4x7x9cm	Scripps-NODC (unpublished)		Emission spectrography	0.25	0.11	0.01	5.7	31.0	10.7	1.0	5.4
308	08°30'S 85°36'W	4,334	Harvard Alb-4658	Trawl	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.14	0.13	0.006	0.83	42.3	2.8	1.2	50.9
308	09°56'S 87°30'W	4,434	Harvard Alb-4660	Trawl	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.57	0.30	0.03	1.98	39.1	4.4	1.1	19.7
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.5	0.49	0.07	8.4	35.4	5.1	1.8	4.2
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.7	0.63	0.09	9.1	34.1	5.6	1.8	3.7
363	14°07'S 89°35'E	5,225	Scripps LSDH-45G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.32	0.24	0.04	9.65	11.76			1.2
363	15°51'S 85°18'E	4,750	Scripps Dodo-84G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.29	0.11	0.22	17.92	18.96			1.1
363	16°11'S 82°06'E	5,400	Lamont V19-166	Corer (piston)		Lamont (unpublished)		Wet chemical	0.74	0.48	0.24	12.2	23.0		1.1	1.9
364	11°59'S 79°05'E	5,445	U.S.S.R. Vit-5270	Dredge		Cronan and Tooms, 1969		Emission spectrography	1.35	0.77	0.06	4.5	19.56			4.3
364	18°48'S 78°09'E	4,934	Lamont V20-D5	Dredge (rock)	Crust	Lamont (unpublished)		Wet chemical	0.46	0.27	0.16	11.2	12.8		1.5	1.1
338	13°04'S 24°41'W	4,415	Lamont V16-T3	Trawl (biology)	Nodule 2x1.5x1cm	Lamont (unpublished)		Wet chemical	0.32	0.13	0.36	18.0	14.0			0.8
344	14°29'S 81°24'W	4,964	Harvard Alb-4676	Trawl	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	1.25	0.8	0.05	7.75	23.4	8.0	1.8	3.0
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.3	0.75	0.04	9.8	29.7	7.9	1.7	3.0
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.0	0.6	0.04	8.4	29.1	9.0	1.4	3.5
					Nodule	Willis and Ahrens, 1962		Emission spectrography	0.03	0.04	0.007	0.38	2.7			7.1
344	13°32'S 89°05'W	4,080	Scripps Ris-45V	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.83	0.45	0.10	10.83	23.55			2.2
344	18°47'S 89°26'W	4,390	Harvard Alb-4681	Trawl	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	1.26	0.76	0.24	8.8	26.6	4.7	1.7	3.0
					Nodule 2.5 cm	Scripps-NODC (unpublished)		Emission spectrography	1.7	0.9	0.18	12.6	27.8	6.1	2.1	2.2

TABLE 4. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH ATLANTIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
344	11°14'S 89°35'W	4,460	Harvard Alb-4662	Trawl	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	1.1	0.78	0.13	8.8	25.1	5.7	1.4	2.8
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.5	0.72	0.11	11.9	29.1	7.0	1.8	2.4
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.2	0.67	0.11	10.5	31.0	7.0	1.9	2.9
					Nodule	Hewett et al., 1963		Emission spectrography	1.5	0.7	0.15	>10	>10	7.0	3.0	
400	21°31'S 78°01'E	4,610	Scripps Dodo-110P	Corer (piston)		Cronan and Tooms, 1969		Emission spectrography	0.54	0.18	0.21	16.44	18.27			1.1
400	23°16'S 74°59'E	4,520	Scripps Dodo-113D	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.29	0.11	0.22	17.92	18.96			1.0
401	23°07'S 63°05'E	3,928	Lamont V20-178	Corer (piston)		Lamont (unpublished)		Wet chemical	0.18	0.08	0.36	21.0	15.9		2.6	0.8
401	29°52'S 62°36'E	4,609/ 4,426	Lamont V16-T19	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.18	0.14	0.18	19.6	12.3		1.4	0.6
401	29°54'S 61°53'E	4,400	Scripps LSDA-122G	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.14	0.14	0.48	17.92	10.72			0.6
401	26°56'S 61°49'E	4,700	Scripps Dodo-130G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.14	0.13	0.43	18.30	9.48			0.5
402	22°29'S 59°31'E	4,960	Lamont V20-180	Corer (piston)		Lamont (unpublished)		Wet chemical	0.11	0.07	0.22	19.8	11.4		2.6	0.6
402	24°28'S 56°37'E	4,689	Lamont V24-199	Corer (piston)		Lamont (unpublished)		Wet chemical	0.24	0.15	0.46	16.9	11.7			0.7
402	23°26'S 50°49'E	4,847/ 3,950	Lamont RC14-D4	Dredge	Nodule	Lamont (unpublished)		Atomic absorption	0.24	0.12	0.25	15.0	11.0			0.7
372	23°03'S 03°36'W	5,305	Lamont V27-222	Corer (piston)		Lamont (unpublished)		Atomic absorption	0.51	0.29	0.31	14.0	17.2			1.2
374	29°27'S 21°51'W	4,510	Lamont V26-66	Corer (piston)		Lamont (unpublished)		Wet chemical	0.07	0.07	0.21	21.4	6.2			0.3
374	28°30'S 28°58'W	3,781	Lamont V22-54	Corer (piston)		Lamont (unpublished)		Wet chemical	0.38	0.12	0.46	17.0	12.7			0.7
374	28°32'S 29°00'W	3,566	Lamont V22-50	Corer (piston)		Lamont (unpublished)		Wet chemical	0.24	0.09	0.21	9.4	6.6			0.7
374	28°32'S 29°00'W	4,361	Lamont V22-52	Corer (piston)		Lamont (unpublished)		Wet chemical	0.30	0.13	0.37	15.7	11.3			0.7
375	20°59'S 31°48'W	4,301/ 4,254	Lamont V15-T135	Trawl (biology)		Lamont (unpublished)		Wet chemical	0.05	0.04	0.05	10.0	3.0		1.6	0.3
375	28°42'S 38°14'W	4,777	Lamont RC11-39	Corer (piston)		Lamont (unpublished)		Wet chemical	0.24	0.14	0.04	13.2	11.3			0.9
380	22°37'S 80°15'W	4,243	Lamont RC9-88	Corer (piston)		Lamont (unpublished)		Wet chemical	0.44	0.26	0.26	22.4	18.0		1.4	0.8
380	25°31'S 85°14'W	920	Scripps DWHD-72	Dredge	Nodule	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.26	0.15	0.17	2.47	42.3	0.3	1.7	17.1
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	0.56	0.16	0.7	11.2	37.3	2.6	2.1	3.3
					Nodule 3 cm	Ahrens et al., 1967		X-ray fluorescence spectrography	0.33	0.11	0.15	9.41	33.9		1.4	3.6
					Nodule	Skornyakova et al., 1962		Wet chemical and colorimetry	0.28		0.27	13.63	24.04	5.0	1.2	1.8

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TABLE 4. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH ATLANTIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
437	31°02'S 64°52'E	4,805	Scripps Dodo-132P	Corer (piston)		Cronan and Tooms, 1969		Emission spectrography	0.49	0.22	0.45	16.07	13.27			0.8
437	39°46'S 64°00'E	4,980	Scripps LSDA-126G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.49	0.24	0.11	8.0	12.5			1.6
440	33°28'S 38°32'E	5,140	Dan. DeepSea Gal-182		Nodule 6x4x2cm	Ahrens et al., 1967	Core	X-ray fluorescence spectrography		0.11		35.7			1.1	
					Nodule 6x4x2cm	Ahrens et al., 1967	Outer layer	X-ray fluorescence spectrography	0.03	0.08	0.02	29.5	1.46		0.8	0.1
440	31°52'S 37°13'E	4,960	Lamont V24-210	Corer (piston)		Lamont (unpublished)		Wet chemical	0.11	0.05	0.08	8.6	4.5			0.5
440	33°01'S 34°49'E	1,280	A1254		Nodule 1.5 cm	Ahrens et al., 1967		X-ray fluorescence spectrography	0.43	0.10	0.24	4.57	5.63		16.2	1.2
					Nodule	Ahrens et al., 1967		X-ray fluorescence spectrography	0.46	0.08	0.09	1.27	7.43		15.3	5.8
					Nodule	Ahrens et al., 1967		X-ray fluorescence spectrography	0.59	0.12	0.13	1.84	6.27		16.7	3.4
					Nodule 4x3x2cm	Ahrens et al. 1967	Outer layer	X-ray fluorescence spectrography	0.59	0.13	0.42	5.68	9.86		14.0	1.7
440	35°44'S 34°16'E	3,800	Dan. DeepSea Gal-179		2 nodules 2 cm	Ahrens et al., 1967		X-ray fluorescence spectrography	0.55	0.13	0.41	17.7	20.7		1.9	1.2
441	38°38'S 26°08'E	2,960	Nat. Inst. Ocean. NIOE-135		Nodule 6.5 cm	Ahrens et al., 1967		X-ray fluorescence spectrography	0.58	0.17	0.58	19.7	11.8		1.2	0.6
441	37°47'S 25°04'E	3,040	Nat. Inst. Ocean. NIOE-42		2 nodules 3 cm	Ahrens et al., 1967		X-ray fluorescence spectrography	1.27	0.15	0.32	12.2	27.2		2.2	2.2
441	37°03'S 24°57'E	3,290	Lamont V24-214	Corer (piston)		Lamont (unpublished)		Wet chemical	1.22	0.18	0.28	22.0	16.1			0.7
441	39°05'S 24°09'E	4,517	Lamont V22-134	Corer (piston)		Lamont (unpublished)		Wet chemical	0.78	0.16	0.19	10.0	12.0			1.2
441	38°54'S 21°27'E	5,176	Lamont V22-120	Corer (piston)		Lamont (unpublished)		Wet chemical	0.56	0.15	0.17	14.0	14.0			1.0
442	37°33'S 18°06'E	1,796	Lamont V22-118	Corer (piston)		Lamont (unpublished)		Wet chemical	0.31	0.05	0.46	14.5	16.0			1.1
442	37°33'S 18°06'E	3,147	Lamont V22-D7	Dredge		Lamont (unpublished)		Wet chemical	0.28	0.08	0.26	17.2	10.5			0.6
442	38°57'S 17°27'E	4,854	Lamont RC13-279	Corer (piston)		Lamont (unpublished)		Atomic absorption	0.72	0.18	0.16	14.0	18.6			1.3
442	34°36'S 17°00'E	2,740	A322			Willis and Ahrens, 1962		Emission spectrography	0.71	0.08	0.20	9.3		5.3		
						Ahrens et al., 1967		X-ray fluorescence spectrography	0.68	0.08	0.26	17.4	26.8		1.8	1.5
442	34°42'S 16°54'E	3,200	A316			Willis and Ahrens, 1962		Emission spectrography	0.75	0.10	0.20	15.5		7.9		
						Ahrens et al., 1967		X-ray fluorescence spectrography	0.88	0.10	0.29	14.1	26.9		2.0	1.9
442	36°13'S 14°12'E	4,583	Lamont V22-136	Corer (piston)		Lamont (unpublished)		Wet chemical	0.25	0.10	0.11	13.3	6.9			0.5
443	37°55'S 08°56'E	5,185	Lamont V22-111	Corer (piston)		Lamont (unpublished)		Wet chemical	0.64	0.21	0.15	13.7	16.4			1.2

TABLE 4. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH ATLANTIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
443	31°11'S 08°46'E	4,768	Lamont RC12-302	Corer (piston)		Lamont (unpublished)		Atomic absorption	0.64	0.37	0.12	6.0	12.0			2.0
443	35°05'S 08°22'E	4,825	Lamont V22-139	Corer (piston)		Lamont (unpublished)		Wet chemical	1.30	0.50	0.13	6.8	22.0		1.5	3.2
443	35°58'S 07°04'E	5,039	Lamont V24-218	Corer (piston)		Lamont (unpublished)		Wet chemical	1.18	0.29	0.17	9.7	15.7			1.6
443	32°20'S 02°10'E	2,047	Lamont V22-148	Corer (piston)		Lamont (unpublished)		Wet chemical	0.56	0.10	0.84	16.0	17.0			1.1
443	32°21'S 02°07'E	1,675	Lamont V22-147	Corer (piston)		Lamont (unpublished)		Wet chemical	0.36	0.03	0.84	18.0	17.0			0.9
443	31°29'S 01°02'E	3,043	Lamont V22-151	Corer (piston)		Lamont (unpublished)		Wet chemical	0.28	0.07	0.48	18.0	13.0			0.7
443	31°27'S 00°57'E	4,136	Lamont V22-150	Corer (piston)		Lamont (unpublished)		Wet chemical	0.38	0.20	0.22	15.8	18.0		2.1	1.1
408	34°15'S 01°25'W	2,158	Lamont V27-202	Corer (piston)		Lamont (unpublished)		Atomic absorption	0.37	0.28	0.46	17.6	17.2			1.0
410	32°12'S 26°44'W	4,193	Lamont V24-237	Corer (piston)		Lamont (unpublished)		Wet chemical	0.21	0.09	0.32	18.8	11.7			0.6
411	30°11'S 39°22'W	4,813	Lamont V24-250	Corer (piston)		Lamont (unpublished)		Wet chemical	0.38	0.11	0.12	13.6	12.1			0.9
411	30°08'S 39°28'W	4,111	Lamont V24-251	Corer (piston)		Lamont (unpublished)		Wet chemical	0.25	0.08	0.22	15.0	11.7			0.8
415	33°31'S 74°43'W	3,950	Challenger Chal-299	Trawl		Mero, 1965		Emission spectrography	0.15	0.15	0.008	2.5	29.0	5.7	1.3	11.6
					Nodule 4 cm	Scripps-NODC (unpublished)		Emission spectrography	0.18	0.18	0.01	3.1	35.3	7.0	1.6	11.4
						Murray and Renard, 1891		Wet chemical	~0.2	~0.5		4.7	35.2	6.6	2.8	7.4
						Murray and Renard, 1891		Wet chemical	~0.2	~0.5		10.28	29.6	8.2	1.6	2.8
						Murray and Renard, 1891		Wet chemical	~0.2	~0.5		4.52	40.0	5.2	1.5	8.8
416	37°04'S 81°05'W	4,000	Scripps DWHD-55	Dredge	Nodule	Mero, 1965		Emission spectrography	1.2	0.52	0.08	7.1	19.1	6.2	1.2	2.7
					Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.6	0.72	0.11	9.8	26.5	8.4	1.7	2.7
416	37°29'S 83°07'W	3,245	Challenger Chal-297	Trawl		Cronan and Tooms, 1969		Emission spectrography	0.69	0.33	0.08	12.34	18.5			1.5
					Nodule 2x2x2cm	Mero, 1965	X-Sect.	X-ray fluorescence spectrography	0.78	0.45	0.12	12.7	17.2	6.7	1.4	1.3
					Nodule 3 cm	Murray and Renard, 1891		Wet chemical	~0.2	~0.2	~0.2	20.8	19.4	6.9	3.2	0.9
473	47°39'S 61°29'E	4,292	Lamont RC11-98	Corer (piston)		Lamont (unpublished)		Wet chemical	0.34	0.05	0.04	4.8	2.3			0.5
473	44°50'S 60°52'E	4,742	Lamont RC11-100	Corer (piston)		Lamont (unpublished)		Wet chemical	0.48	0.13	0.14	13.3	14.0			1.1
474	44°04'S 59°50'E	4,819	Lamont RC11-D3	Dredge (rock)		Lamont (unpublished)		Wet chemical	0.64	0.14	0.14	17.9	17.3		1.8	1.0

TABLE 4. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH ATLANTIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of Fe Mn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
474	43°42'S 58°48'E	4, 709	Lamont RC11-102	Corer (piston)		Lamont (unpublished)		Wet chemical	0. 38	0. 13	0. 17	12. 5	12. 7			1. 0
474	40°55'S 57°39'E	4, 885	Lamont RC11-104	Corer (piston)		Lamont (unpublished)		Wet chemical	0. 16	0. 09	0. 09	17. 8	5. 4			0. 3
477	41°18'S 26°43'E	2, 932	Lamont V22-127	Corer (piston)		Lamont (unpublished)		Wet chemical	0. 25	0. 10	0. 28	18. 2	13. 2			0. 7
447	48°34'S 36°04'W	5, 185/ 5, 249	Lamont V17-T83	Trawl (biology)		Lamont (unpublished)		Wet chemical	0. 28	0. 13	0. 05	11. 1	9. 7			0. 9
449	47°56'S 57°06'W	2, 620/ 2, 549	Lamont V18-D6	Dredge (rock)	Crust	Lamont (unpublished)		Wet chemical	1. 10	0. 08	1. 20	18. 0	23. 0			1. 3
452	42°43'S 82°11'W	2, 650	Challenger Chal-302	Trawl		Murray and Renard, 1891 Mero, 1965		Wet chemical	~0. 2	~0. 2		28. 6	14. 1	7. 0	2. 3	0. 5
						Scripps-NODC (unpublished)		Emission spectrography	0. 18	0. 11	0. 08	19. 4	12. 9	5. 5	1. 7	0. 7
								Emission spectrography	0. 24	0. 15	0. 11	26. 6	17. 7	7. 5	2. 3	0. 7
482	50°11'S 22°24'W	4, 319	Lamont V22-102	Corer (piston)		Lamont (unpublished)		Wet chemical	0. 38	0. 27	0. 03	5. 3	12. 0			2. 3
483	50°15'S 35°53'W	4, 702	Lamont V17-T84	Trawl (biology)		Lamont (unpublished)		Wet chemical	0. 20	0. 16	0. 06	9. 8	9. 4			1. 0
484	53°06'S 44°58'W	2, 195/ 2, 173	Fla. StateU. Elt-7-1	Dredge (rock)	Crust	Grant, 1967		X-ray fluorescence spectrography	0. 05	0. 09	0. 09	7. 5	10. 3			1. 4
485	53°00'S 52°54'W	3, 131/ 3, 071	Lamont V18-D11	Dredge (rock)		Lamont (unpublished)		Wet chemical	0. 27	0. 11	0. 25	19. 0	10. 4		1. 3	0. 5
485	54°17'S 54°13'W	2, 316/ 2, 395	Lamont V18-D10	Dredge (rock)		Lamont (unpublished)		Wet chemical	0. 52	0. 10	0. 19	10. 8	10. 8		4. 2	1. 0
485	57°32'S 55°08'W	4, 067/ 4, 065	Lamont V15-T120	Trawl (biology)		Lamont (unpublished)		Wet chemical	0. 08	0. 04	0. 04	11. 3	5. 0			0. 4
485	55°06'S 55°50'W	2, 872/ 2, 890	Fla. StateU. Elt-6-10	Dredge (rock)	Crust	Grant, 1967		X-ray fluorescence spectrography	0. 08	0. 12	0. 14	18. 5	1. 1			0. 1
					Crust	Grant, 1967		X-ray fluorescence spectrography	0. 12	0. 09	0. 43	27. 5	10. 8			0. 4
					Crust	Grant, 1967		X-ray fluorescence spectrography	0. 92	0. 12	0. 19	19. 9	20. 0			1. 0
					Nodule	Grant, 1967		X-ray fluorescence spectrography	1. 10	0. 23	0. 26	19. 9	18. 9			1. 0
485	55°59'S 56°05'W	4, 144/ 4, 101	Fla. StateU. Elt-6-11	Dredge (rock)	Crust	Grant, 1967		X-ray fluorescence spectrography	0. 63	0. 16	0. 21	17. 9	8. 6			0. 5
					Nodule	Grant, 1967		X-ray fluorescence spectrography	0. 18	0. 12	0. 20	20. 1	2. 3			0. 1
485	56°15'S 58°20'W	3, 960/ 4, 115	Fla. StateU. Elt-6-5	Dredge (rock)	Nodule	Grant, 1967		X-ray fluorescence spectrography	0. 34	0. 16	0. 16	18. 9	2. 3			0. 1
					Crust	Grant, 1967		X-ray fluorescence spectrography	0. 32	0. 18	0. 14	16. 1	1. 1			0. 1
					Crust	Grant, 1967		X-ray fluorescence spectrography	0. 14	0. 17	0. 16	18. 2	1. 1			0. 1

TABLE 4. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - SOUTH ATLANTIC AND INDIAN OCEANS

Mrsdn. Square	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion Analyzed	Analytical Method	Results of Chemical Analyses in Weight Percent							
									Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
486	57°04'S 61°25'W	3,957/ 3,950	Lamont V15-T119	Trawl (biology)		Lamont (unpublished)		Wet chemical	0.02	0.02	0.01	5.6	0.7			0.1
486	50°46'S 67°28'W	90	Lamont V15-T95	Trawl (biology)		Lamont (unpublished)		Wet chemical	1.10	0.80	0.06	6.4	25.2			3.9
487	57°59'S 70°53'W	4,097/ 3,914	Fla. StateU. Elt-5-16	Dredge (rock)		Grant, 1967		X-ray fluorescence spectrography	0.42	0.07	1.51	18.6	22.2			1.3
						Grant, 1967		X-ray fluorescence spectrography	0.25	0.08	0.69	19.2	12.5			0.6
487	56°04'S 71°19'W	2,048/ 2,597	Fla. StateU. Elt-5-17(18)	Dredge (rock)		Grant, 1967		X-ray fluorescence spectrography	0.34	0.17	0.14	14.4	2.0			0.1
487	59°01'S 74°39'W	4,696	Fla. StateU. Elt-10-13T	Trawl (Blake)		Grant, 1967		X-ray fluorescence spectrography	0.15	0.41	0.55	23.4	9.5			0.4
487	56°20'S 78°56'W	4,389	Fla. State U. Elt-10-21D	Dredge (rock)	Crust	Grant, 1967		X-ray fluorescence spectrography	1.80	0.83	0.13	10.2	25.0			2.4
488	58°06'S 82°52'W		Fla. StateU. Elt-10-2D	Dredge (rock)		Grant, 1967		X-ray fluorescence spectrography	0.29	0.21	0.36	26.4	15.5			0.6
523	60°08'S 74°55'W		Lamont V17-T40	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.12	0.07	0.11	10.9	6.3			0.6

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FERROMANGANESE DEPOSITS OF THE NORTH PACIFIC OCEAN

D. R. Horn, B. M. Horn and M. N. Delach

Lamont-Doherty Geological Observatory of Columbia University

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FERROMANGANESE DEPOSITS OF THE NORTH PACIFIC OCEAN

by D. R. Horn, B. M. Horn and M. N. Delach, Lamont-Doherty Geological Observatory of Columbia University, Palisades, New York 10964

Abstract:

A compilation of existing data on distribution and composition of ferromanganese deposits of the North Pacific is presented. The information is overprinted on maps showing sedimentary provinces of the ocean. By doing this, several interesting relationships appear and suggest a tie between nodule distribution, metal content and properties of substrate.

Nodules occur within regions of extremely slow sedimentation of red clay and siliceous (Radiolarian) ooze and clay. They are most common in the Radiolarian ooze and clay comprising a 500-mile wide deposit stretching from Central America westward to the Marshall Islands.

Data on metal contents of nodules reveal those taken from siliceous or Radiolarian deposits of the Equatorial Pacific are twice as rich in Ni and Cu as the ones from red clays.

Properties of the siliceous ooze include very high porosity (88%) and moisture content (336%). These and other physical properties of the substrate show a correlation with high Ni, Cu and Mn content of nodules. Additional data is needed from the radiolarian oozes and associated nodules to confirm these relationships and to determine their significance in genesis and exploitation of the nodules.

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INTRODUCTION

A considerable volume of data related to properties and uses of the ocean floor are stored at oceanographic institutions throughout the world. Current interest in exploitation of the seabed has resulted in pressure from industry to have these data published. In this report the authors have compiled information available to them concerning ferromanganese deposits on the floor of the North Pacific Ocean. Chemical analyses of nodules and crusts are included as well as wet density, porosity, moisture content and texture of surface sediments.

The report is in three parts: 1) A brief statement about sampling methods and results obtained; 2) Three tables listing data available on ferromanganese deposits and their substrate; and 3) A set of maps showing the distribution and properties of ferromanganese deposits.

METHODS

Lamont-Doherty has recovered 775 piston cores from the North Pacific using an 1,800-lb coring head mounted on a core pipe with a 2.5-in. ID. The average length of core recovered in the North Pacific is 25 ft. Using these data it is possible to define the boundaries of major sedimentary provinces. The final decision as to which province a core belonged was based on the dominant sediment, not on the lithology of the surface deposit. The surface or capping layer of cores is often only a few inches thick and may not represent the prevailing sediment of a region. For this reason Map 1 differs from recent maps prepared by Fraser et al. (1972).

The distribution of ferromanganese deposits rests on sources of information given in Tables 1 and 2. The list of chemical analyses includes unpublished and published data on file at Lamont-Doherty, material from Scripps Institution of Oceanography obtained through the National Oceanographic Data Center, and results published in the literature.

Measurements of physical and textural properties of abyssal sediments given in Table 3 were conducted by the authors and are part of a data bank on ocean sediments at Lamont-Doherty. Bulk properties were determined using Beckman Manual Pycnometers on samples taken from cores when they were freshly extruded on deck. The samples were stored in plastic vials and flown back to the laboratory. Formulas used to determine the properties are:

$$\text{Wet Density} = \frac{\text{Wet weight}}{\text{Wet volume}}$$

$$\text{Porosity (\%)} = \frac{\text{Volume salt water}}{\text{Wet volume}} \times 100$$

$$\text{Moisture Content (\%)} = \frac{\text{Wet weight} - \text{Dry weight}}{\text{Dry weight} - \text{Salt weight}} \times 100$$

$$\text{Void Ratio} = \frac{\text{Volume salt water}}{\text{Dry volume}}$$

Grain size was determined using the combined sieve-pipette technique of Folk (1968).

Considerable emphasis has been placed on showing the results visually on maps. This has been done to keep the report brief yet informative.

SEDIMENTARY PROVINCES

Sediments of the North Pacific are best described if grouped in three categories: 1) terrigenous, 2) pelagic, and 3) material derived from topographic highs.

Terrigenous Sediments:

Land-derived or terrigenous deposits include gray and gray-green silts, muds and clays of the continental margin along with graded sands and silts laid down by turbidity currents. Seaward dispersal of sediment in the North Pacific is greatly restricted by an almost continuous line of barriers (island arcs) and deeps (trenches) at the periphery of the ocean. As a result, terrigenous deposits form a narrow ribbon of sediment 150 to 180 miles wide around the limits of the basin (Map 1). There is one area where coarse material penetrates the basin; this is in deep water off Oregon. Here sediment delivered to the coast by the Columbia River is resuspended offshore and carried by turbidity currents 1400 miles seaward of the continental rise.

Pelagic Sediments:

The second group of sediments includes the extensive pelagic deposits. They cover three-fourths of the area of the North Pacific and include biogenic debris and red clays. The pelagic sediments lie in broad east-west zones which traverse the Pacific and generally coincide with major current systems and depth zones (Map 1).

Lying farthest north are biogenic oozes (mainly diatomaceous), ice-rafted detritus, and volcanic silt. The width of these deposits varies from 390 miles to 850 miles (Map 1).

Immediately to the south is red clay covering an area equal to half the North Pacific. The red clay province is 5,000 miles long and ranges from 1,300 to 1,700 miles wide. Sediment is extremely uniform both laterally and vertically and has a mean particle size of less than a micron. Manganese micronodules, occasional volcanic ejecta, and fish teeth are associated with the clay.

The zone of siliceous ooze and clay lying immediately south of the red clay is made up of the remains of Radiolaria. These one-celled animals secrete a shell of opaline silica in the form of hollow, transparent, perforated spheres. Upon death, the skeleton sinks to the bottom and is added to billions of others already there. The tiny structures now form a deposit 500 miles wide and 4,500 miles long (Map 1).

Along the equator is a 450-mile wide band of chalk and calcareous ooze composed of the remains of Foraminifera. These lime deposits extend from Central America to the western limit of the North Pacific Basin (Map 1).

Sediment Derived from Topographic Highs:

The last sediment type includes all material derived from submarine topographic highs. It generally takes the form of volcanic or carbonate debris which has been transported downslope by normal bottom currents, slumping, or turbidity currents (Horn *et al.*, 1970). Distribution of the deposits reflects the location of major topographic elements (Map 1).

DISTRIBUTION OF FERROMANGANESE DEPOSITS

On Map 2 are shown locations at which ferromanganese crusts and nodules have been recovered. Sources of information are listed in Table 1.* Most data points are the result of dredging and coring operations of Scripps Institution of Oceanography and Lamont-Doherty Geological Observatory.

Map 2 reveals the areas of terrigenous sedimentation along continental margins and island arcs; sites of turbidite deposition; the northern zone of biogenic siliceous material; regions of sedimentation on aprons around topographic highs; and areas of calcareous deposits at the equator are generally barren of nodules. These provinces are sites of relatively rapid sedimentation, which precludes development of nodules. Crusts do occur on rock exposures associated with seamounts and along fracture zones. However, they are considered to form under a set of conditions distinct from those of deep-water nodules.

The great majority of nodules occur within the red clays and narrow band of siliceous ooze. Both are characterized by very low rates of sedimentation (i.e., red clay less than 1 mm/1,000 yrs - Opdyke and Foster, 1970; and Radiolarian ooze at 3.5 mm/1,000 yrs - Hays et al., 1969). From data given in Map 2 nodules seem most abundant between 6° 30'N and 17°N which are the approximate boundaries of radiolarian oozes and radiolarian clays.

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* Data of the U.S.S. NERO was collected using a sounding cup with only a 12-mm opening through which the bottom sediment could pass. In addition, sample descriptions did not distinguish between a nodule and crust. For these reasons it was decided not to plot the results on Map 2. However, information about these samples is included in Table 1.

NICKEL, COPPER AND COBALT CONTENT OF NODULES

In sections dealing with metal values, the reader understands that the average values of the metals for the nodules are a synthesis of the results of several workers who used a variety of analytical methods. The averages are used here to show trends, knowing that individual analyses may not be directly comparable. The trend of the metals are identified, and the reader can then refer to the tables and determine to his own satisfaction whether or not specific results are valid or invalid.

Chemical analyses of some nodules from red clays and several from radiolarian sediments are shown on Map 3. Results indicate the average analysis for red clays is .76% Ni, .50% Cu, and .28% Co. On the other hand, nodules from siliceous oozes have average values of 1.16% Ni, 1.02% Cu, and .25% Co.

The averages of the metals indicate nodules from radiolarian oozes of the southern siliceous zone contain nearly twice as much nickel and copper as their counterparts from red clays. It seems that if nodules were equally abundant in both provinces, industry's interest would lie only in those high in Ni and Cu from the radiolarian sediments.

IRON, MANGANESE AND CALCIUM CONTENT OF NODULES

Iron, manganese and calcium contents of nodules are given on Map 4. Nodules from regions of red clays are higher in iron (average 11.45%) than those from ooze (average 8.15%). Manganese content of of nodules from red clays (average 17.43%) is lower than those from siliceous ooze (average 22.36%). Calcium determinations indicate nearly equal values in both provinces.

Map 4 reveals these trends quite impressively. The left-hand column of the histogram represents the value for iron. There is a progressive increase of iron content from south to north. Manganese, on the other hand, is represented by the center column and is high within the siliceous oozes and shows a pronounced drop within the red clay regions.

PHYSICAL PROPERTIES OF THE SUBSTRATE

Textural and physical properties of red clays and siliceous oozes from the floor of the North Pacific are listed in Table 3. This information has been drawn from the Lamont-Doherty data bank of physical properties of ocean sediments. Results are for surface sediments only (Map 5).

Red clays have an average wet density of 1.49 g/cc, whereas that of siliceous ooze is 1.18 g/cc. Values of porosity and moisture content are extraordinary. Average porosity of red clay is 77%, which is high in itself; however, it is even higher for siliceous ooze with an average porosity of 88%. Average moisture content of the samples of red clay is 126%, siliceous ooze 336%. The very high porosity and moisture content of the southern siliceous oozes is due to the properties of the skeletal grains comprising the deposit.

Radiolarian ooze of the Equatorial Pacific appears to be one of the most porous materials on the ocean floor. Its high porosity is due in part to spines on the outer surfaces of the Radiolaria which hold the framework grains apart. This results in high interstitial porosity. Added to this is the hollow skeleton with porous walls which many Radiolaria possess. When dry, the ooze is similar to a foam or froth, ex-

tremely porous and with the capacity to filter or hold large volumes of water. It is speculated that these properties may assist in vertical flushing of metals through the sediment column (see Raab, 1972) and be of primary importance to genesis of nodules high in nickel and copper.

Several hundred textural analyses of red clay indicate its average particle size is less than a micron. Scant data on Radiolarian oozes give a mean grain size of 1 to 2 microns.

CONCLUSIONS

Sedimentary provinces of the North Pacific have been outlined and compared with the distribution of nodular ferromanganese deposits and their metal content. Nodules occur within provinces of red clay and radiolarian-bearing sediments. This relation suggests that an extremely low rate of deposition is a primary control on the development and distribution of nodules.

Existing data on metal contents of nodules reveal that those taken from the Radiolarian deposits of the Equatorial Pacific are twice as rich in Ni and Cu as the red clays to the north. The nodules from both provinces have similar amounts of Co and Ca, and those from red clay provinces are richer in Fe. From these results it would seem that the nodule deposits from the southern siliceous oozes offer most promise to those interested in exploitation of nodules as a source of metals.

Information on the physical properties of the substrate suggest that there is a correlation between the highly porous Radiolarian ooze and nodules rich in Ni, Cu and Mn. More data is needed to verify this relationship and to determine its meaning in the distribution and genesis of the nodules.

ACKNOWLEDGMENTS

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TABLE I

CORE AND DREDGE SAMPLES CONTAINING FERROMANGANESE DEPOSITS

FOREIGN AND DOMESTIC EXPEDITIONS

NORTH PACIFIC

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
010	06°31'N	92°52'W	3,563	Lamont V18-345	Corer (piston)	Lamont
010	08°49'N	97°16'W	3,799	Lamont V18-341	Corer (piston)	Lamont
010	07°52'N	97°39'W	3,484	Lamont RC13-132	Corer (piston)	Lamont
011	07°44'N	101°21'W	3,288	Lamont V20-20	Corer (piston)	Lamont
011	06°52'N	104°08'W	3,446	Lamont V20-24	Corer (piston)	Lamont
011	09°24'N	105°54'W	3,206	Lamont V18-325	Corer (piston)	Lamont
012	09°19'N	110°33'W	3,630	Lamont RC10-79	Corer (piston)	Lamont
012	06°38'N	110°56'W	4,316	Lamont RC10-76	Corer (piston)	Lamont
012	06°53'N	111°06'W	972	Lamont RC10-78	Corer (piston)	Lamont
012	07°15'N	111°21'W	4,136	Lamont RC10-77	Corer (piston)	Lamont
012	09°26'N	113°16'W	3,700	Scripps Carr-5		Barnes & Dymond, 1967
012	07°33'N	114°29'W	3,946	Lamont V20-28	Corer (piston)	Lamont
012	01°27'N	116°13'W	4,000	Scripps DWBG-147	Corer (gravity)	Scripps, 1958
012	05°20'N	117°55'W	4,330	Scripps Ris-14V	Corer (heat probe)	Scripps, 1962
012	09°59'N	118°00'W	4,295	Scripps DWHG-92	Corer (gravity)	Scripps, 1958
013	08°31'N	120°09'W	3,389	Lamont V20-31	Corer (piston)	Lamont
013	06°46'N	122°57'W	4,508	Lamont V21-199	Corer (piston)	Lamont
013	08°53'N	123°32'W	4,497	Lamont V20-33	Corer (piston)	Lamont

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
013	07°18'N	125°20'W	4,610	Lamont RC10-93	Corer (piston)	Lamont
013	08°09'N	125°20'W	4,360	Scripps Cb-39	Corer	Mero, 1965
013	08°05'N	125°25'W	4,453	Scripps Cb-17	Corer	Mero, 1965
013	07°41'N	125°37'W	4,416	Scripps Cb-19	Corer	Mero, 1965
013	08°01'N	126°58'W	4,440	Scripps Cb-34	Corer (gravity)	Scripps 1952-53
014	08°38'N	130°11'W	4,890	Lamont V21-197	Corer (piston)	Lamont
014	08°48'N	130°48'W	4,917	Scripps DWBG-7	Corer	Scripps 1957-58
014	09°48'N	136°01'W	4,813	Lamont V21-D14	Trawl (biology)	Lamont
014	09°50'N	136°23'W	4,823	Lamont RC12-58	Corer (piston)	Lamont
014	08°59'N	137°41'W	4,660	Lamont RC12-59	Corer (piston)	Lamont
014	09°57'N	137°47'W	4,930	Harvard Alb-13	Trawl (Blake)	Murray & Lee, 1909
014	09°57'N	137°47'W	4,930	2P-52	Dredge	Cronan & Tooms, 1969
014	00°50'N	137°54'W	4,510	Harvard Alb-17		Menard, 1964
014	08°47'N	139°53'W	5,086	Lamont RC11-206	Corer (piston)	Lamont
014	08°47'N	139°53'W	5,086	Lamont RC11-D21	Dredge (pebble)	Lamont
015	08°25'N	142°42'W	5,007	Scripps JynV-36	Corer (piston)	Scripps 1961
015	09°06'N	145°18'W	5,400	Scripps Msn-148G	Corer (gravity)	Scripps 1961
015	07°17'N	148°12'W	4,925	Scripps JynV-20	Corer (piston)	Scripps 1961

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
015	03°14'N	148°29'W	4,777	Lamont RC12-67	Corer (piston)	Lamont
015	06°05'N	148°52'W	5,036	Scripps JynV-17	Corer (gravity)	Scripps 1961
015	06°33'N	148°59'W	4,508	Lamont RC12-68	Corer (piston)	Lamont
015	09°13'N	149°49'W	5,073	Lamont RC12-69	Corer (piston)	Lamont
015	08°02'N	149°54'W	5,073	Scripps JynV-15PG	Corer	Scripps 1961
015	09°54'N	149°57'W	5,304	Scripps Stx-10FF	Grab	Scripps 1968
016	09°20'N	150°35'W	4,813	Scripps JynV-14G	Corer (gravity)	Scripps 1961
016	09°27'N	150°42'W	5,100	Scripps JynV-13G	Corer (gravity)	Scripps 1961
016	08°59N	152°50'W	4,839	Scripps Wah-4PG	Corer	Cronan & Tooms, 1969
016	08°16'N	153°01'W	5,143	Scripps Wah-24FF8	Corer	Cronan & Tooms, 1969
016	07°55'N	153°42'W		USSR Vit-5124		Skornyakova et al., 1968
016	00°00'N	159°53'W	5,163	USSR Vit-5429	Dredge	Skornyakova et al., 1968
017	08°53'N	164°26'W	4,925	Lamont RC13-56	Corer (piston)	Lamont
017	09°57'N	167°51'W	5,280	Scripps Dodo-20C	Corer (camera)	Scripps 1964
017	07°47'N	168°00'W	4,994	Scripps Msn-J	Corer	Mero 1965
017	07°36'N	168°06'W	4,994	Scripps Msn-10G	Corer (gravity)	Scripps 1960-61
017	09°41'N	168°42'W	5,222	Lamont RC12-195	Corer (piston)	Lamont

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
017	09°20'N	168°50'W	5,240	Scripps Dodo-25PG	Corer	Scripps 1964
017	08°34'N	168°52'W	4,397	Scripps Proa-151G	Corer	Scripps 1962
017	09°00'N	169°00'W	5,170	Scripps Dodo-27G	Corer (gravity)	Scripps 1964
017	06°04'N	169°58'W	5,400	Scripps Msn-11G	Corer (gravity)	Scripps 1960-61
018	06°03'N	170°00'W	5,400	Scripps Msn-K	Corer	Mero 1965
018	08°06'N	170°25'W	5,444	Scripps Proa-139G	Corer (gravity)	Scripps 1962
018	08°33'N	170°59'W	5,169	Lamont RC13-19	Corer (piston)	Lamont
018	09°49'N	170°59'W	4,875	Scripps LSDH-93PG	Corer (gravity)	Scripps 1962-63
018	07°04'N	171°42'W	5,386	Scripps Proa-137G	Corer	Scripps 1962
018	07°19'N	175°28'W	5,190	Scripps LSDH-90PG	Corer	Scripps 1962-63
018	09°46'N	175°37'W	5,760	Lamont RC12-197	Corer (piston)	Lamont
018	08°08'N	177°10'W	5,435	Scripps LSDH-89PG	Corer	Scripps 1962-63
018	09°42'N	177°59'W	5,953	Lamont RC12-198	Corer (piston)	Lamont
018	06°02'N	178°35'W	5,097	Scripps Proa-101PG	Corer	Scripps 1962
018	00°15'N	179°43'W	5,045	Scripps Proa-105G	Corer	Scripps 1962
019	09°17'N	178°57'E	5,821	Lamont V24-D1	Dredge (rock)	Lamont
019	09°17'N	178°37'E	5,704	Lamont V24-79	Corer (piston)	Lamont
019	09°19'N	177°59'E	5,698	Scripps Nv-A-7G	Corer (gravity)	Scripps 1967

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
019	08°19'N	176°25'E	5,097	Lamont V24-102	Corer (piston)	Lamont
019	01°28'N	174°52'E	4,691	Lamont RC12-200	Corer (piston)	Lamont
020	06°40'N	163°11'E	4,921	Lamont V19-101	Corer (piston)	Lamont
022	00°40'N	148°41'E	4,860	M-285		Menard 1964
023	06°08'N	136°11'E	4,600	Scripps Proa-11P	Corer	Scripps 1962
023	04°57'N	135°30'E	4,580	USSR Vit-3996	Trawl	Skornyakova et al., 1962
023	04°19'N	130°15'E	4,670	M-273		Menard 1964
046	11°34'N	96°45'W	4,330	Lamont RC13-131	Corer (piston)	Lamont
046	13°02'N	97°04'W	3,888	Lamont RC13-D1	Dredge (rock)	Lamont
046	12°30'N	97°36'W	3,660	USC&GS Expl-18	Corer (gravity)	NODC 1971
046	12°30'N	97°36'W	3,660	USC&GS Expl-60-6	Corer	Scripps 1960
047	11°38'N	101°20'W	3,197	Lamont V18-330	Corer (piston)	Lamont
047	11°04'N	102°17'W	3,191	Lamont V18-329	Corer (piston)	Lamont
047	11°38'N	103°48'W	3,500	Scripps Acap-10	Corer	Mero 1965
047	10°53'N	105°07'W	3,275	Scripps Acap-11	Corer	Mero 1965
047	15°06'N	107°09'W	3,891	Lamont RC10-82	Corer (piston)	Lamont
047	10°39'N	108°45'W	5,276	Scripps CarrII-9D	Dredge (bucket)	Scripps 1964
048	16°39'N	110°13'W	3,660	Lamont RC10-88	Corer (piston)	Lamont

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
048	14°28'N	111°50'W	3,644	Scripps Tri-7Go	Corer	Scripps 1966
048	19°39'N	113°44'W	4,000	Ken-6A		Ku & Broecker 1969
048	11°25'N	113°48'W	4,085	Swed. Deep Sea SDSE-48	Corer	Arrhenius 1952
048	19°20'N	114°12'W	3,480	Trans-14D	Corer	Mero 1965
048	16°37'N	114°31'W	3,598	Lamont RC10-240	Corer (piston)	Lamont
048	19°46'N	114°44'W	3,438	Trans-14C	Corer	Mero 1965
048	14°26'N	117°12'W	4,125	Scripps RIS-8V	Corer (heat probe)	Scripps 1961-62
048	11°28'N	117°38'W	4,300	Scripps RIS-10V	Corer (heat probe)	Scripps 1961-62
048	13°20'N	117°58'W	4,248	Swed. Deep Sea SDSE-50A	Corer	Arrhenius 1952
048	18°20'N	119°03'W	3,275	Lamont RC10-239	Corer (piston)	Lamont
048	19°52'N	119°53'W	4,226	Lamont RC12-47	Corer (piston)	Lamont
049	12°16'N	120°10'W	4,471	Lamont RC10-91	Corer (piston)	Lamont
049	19°48'N	120°16'W	4,104	USSR Vit-4279	Trawl (camera)	Menard 1964
049	18°41'N	120°36'W	4,006	Lamont RC10-238	Corer (piston)	Lamont
049	19°49'N	121°44'W	4,138	UNK-RR	Dredge	Mero 1965
049	19°00'N	121°53'W	4,138	Scripps Cb-1	Corer (gravity)	Scripps 1952-53
049	19°59'N	121°59'W	4,370	USSR Vit-4281	Trawl	Skornyakova et al., 1962

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
049	14°55'N	124°12'W	4,270	Scripps Cap-50B	Corer	Scripps 1952-53
049	17°09'N	124°36'W	4,321	Lamont RC12-49	Corer (piston)	Lamont
049	16°03'N	125°01'W	4,354	Scripps Cb-2	Corer (gravity)	Scripps 1952-53
049	15°04'N	125°05'W	4,500	Scripps Amp. 3PG	Corer	Scripps 1963-64
049	15°00'N	125°26'W	4,380	Scripps Cb-3	Corer	Mero 1965
049	10°19'N	125°27'W	4,545	Scripps Cb-9	Corer	Mero 1965
049	13°03'N	125°29'W	4,440	Scripps Cb-5	Corer (gravity)	Scripps 1952-53
049	16°35'N	125°35'W	4,369	Lamont RC12-50	Corer (piston)	Lamont
049	19°57'N	126°06'W	4,545	USSR Vit-4285	Corer (camera)	Menard 1964
049	15°09'N	127°41'W	4,660	Lamont RC12-51	Corer (piston)	Lamont
049	11°05'N	128°34'W	4,770	Scripps DWHH-7	Dredge	Scripps 1958
049	10°37'N	128°54'W	4,636	Lamont V20-D1	Dredge (rock)	Lamont
050	10°26'N	130°28'W	4,890	Scripps DWBD-2	Dredge	Scripps 1958
050	18°16'N	131°46'W	5,210	Scripps JynV-50PG	Corer	Cronan & Tooms, 1969
050	11°24'N	132°07'W	4,843	Lamont V20-36	Corer (piston)	Lamont
050	14°22'N	133°07'W	4,816	Scripps MP-5	Corer	Scripps 1950
050	15°54'N	133°57'W	4,606	Scripps JynV-48PG	Corer	Scripps 1961
050	14°05'N	134°11'W	2,327	Lamont RC15-13	Corer (piston)	Lamont

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
050	12°18'N	135°25'W	4,885	Lamont V20-38	Corer (piston)	Lamont
050	14°38'N	136°44'W	4,850	Harvard Alb-11		Menard 1964
050	16°15'N	137°06'W	4,553	Scripps Car-78	Snapper	Fleming et al., 1945
050	12°07'N	137°18'W	5,280	Harvard Alb-12		Menard 1964
050	12°40'N	137°32'W	4,918	Scripps Car-79	Snapper	Fleming et al., 1945
050	13°07'N	138°56'W	4,927	Scripps Msn-153PG	Corer	Scripps 1960-61
050	10°45'N	139°24'W	4,770	Lamont V21-D13	Trawl (biology)	Lamont
050	11°01'N	139°58'W	4,877	Lamont RC11-D20	Dredge (pebble)	Lamont
051	19°29'N	140°02'W	5,574	Lamont RC11-D18	Dredge (pebble)	Lamont
051	14°52'N	140°02'W	4,828	Lamont RC11-D19	Dredge (pebble)	Lamont
051	14°28'N	141°11'W	4,909	Lamont V20-D2	Dredge (rock)	Lamont
051	10°59'N	142°37'W	4,978	Scripps Msn-150G	Corer (gravity)	Scripps 1960-61
051	15°03'N	142°46'W	4,526	Lamont V20-44	Corer (piston)	Lamont
051	13°31'N	143°01'W	5,233	Scripps Stx-8FF	Grab	Scripps 1968
051	19°46'N	144°14'W	3,488	USC&GS Expl-14b	Corer	Mero 1965
051	14°11'N	144°28'W	4,896	Lamont V20-46	Corer (piston)	Lamont
051	11°55'N	144°54'W	5,539	Scripps JynV-31PG	Corer	Scripps 1961
051	12°19'N	145°08'W	5,550	Lamont V21-D11	Trawl (biology)	Lamont

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
051	14°26'N	145°21'W	4,640	Lamont V20-48	Corer (piston)	Lamont
051	12°02'N	145°46'W	5,330	Scripps Stx-9FF	Grab	Scripps 1968
051	14°25'N	145°52'W	4,618	Lamont V20-D4	Dredge (rock)	Lamont
051	13°10'N	147°45'W	5,610	Lamont V21-192	Corer (piston)	Lamont
052	13°44'N	150°00'W	5,218	Lamont V21-D9	Trawl (biology)	Lamont
052	14°04'N	150°37'W	5,563	Lamont RC12-71	Corer (piston)	Lamont
052	16°33'N	150°55'W	5,119	Lamont V20-52	Corer (piston)	Lamont
052	12°42'N	152°01'W	5,310	Challenger Chal-265	Dredge	Murray 1885
052	14°19'N	152°21'W	5,427	Lamont V21-190	Corer (piston)	Lamont
052	14°19'N	152°37'W	5,480	Challenger Chal-264	Trawl	Murray 1885
052	11°51'N	152°56'W	5,221	Scripps Wah-2PG	Corer	Scripps 1965
052	11°17'N	154°08'W		USSR Vit-5126		Skornyakova et al., 1968
052	14°19'N	154°48'W	5,272	Scripps Stx-13G	Corer	Scripps 1968
052	14°30'N	154°48'W	5,378	Scripps Stx-12G	Corer	Scripps 1968
052	15°49'N	157°04'W	5,233	Scripps Stx-25G	Corer	Scripps 1968
052	10°22'N	157°08'W	5,353	Lamont RC13-58	Corer (piston)	Lamont
053	15°51'N	160°37'W	5,550	Alpine G.A. BA-11-1	Corer	Alpine Geophys. Assoc., 1968
053	14°11'N	161°08'W	5,652	Scripps Msn-G	Corer	Mero 1965

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
053	14°09'N	161°08'W	5,652	Scripps Msn-7G	Corer (gravity)	Scripps 1960-61
053	15°02'N	162°31'W	5,666	Scripps Tet-24	Corer (gravity)	Scripps 1960
053	16°19'N	162°57'W	5,605	Swed. Deep Sea SDSE-80	Corer	Olausson 1960
053	16°57'N	163°00'W	5,773	Lamont RC12-192	Corer (piston)	Lamont
053	12°58'N	163°09'W	5,430	Scripps Tet-28	Corer (gravity)	Scripps 1960
053	13°05'N	163°10'W	5,413	Scripps Tet-27A	Corer	Scripps 1960
053	13°50'N	163°32'W	5,460	Lamont RC12-79	Corer (piston)	Lamont
053	11°01'N	164°56'W	4,835	Scripps Proa-148G	Corer (gravity)	Scripps 1962
053	14°28'N	164°59'W	5,455	Swed. Deep Sea SDSE-81	Corer	Olausson 1960
053	10°30'N	165°33'W	4,341	Scripps Proa-147V	Corer (heat probe)	Scripps 1962
053	16°06'N	165°45'W	2,400	Scripps Tet-22	Corer	Scripps 1960
053	16°05'N	165°52'W	5,295	Lamont RC12-193	Corer (piston)	Lamont
053	15°36'N	166°40'W	5,440	Scripps Proa-169G	Corer	Scripps 1962
053	12°16'N	166°48'W	5,080	Swed. Deep Sea SDSE-82	Corer	Kullenberg 1955
053	13°57'N	167°00'W	5,442	Lamont RC13-53	Corer (piston)	Lamont
053	11°59'N	167°02'W	5,176	Lamont RC13-52	Corer (piston)	Lamont
053	10°02'N	167°50'W	5,280	Scripps Dodo-20P	Corer (piston)	Scripps 1964
053	19°35'N	168°50'W	2,148	Scripps Stx-2D	Dredge	Scripps 1968

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
053	11°28'N	168°51'W	5,285	Scripps LSDH-95G	Corer (gravity)	Scripps 1962-63
053	19°07'N	169°44'W	1,740	Scripps MP-25F1	Dredge (chain bag)	Scripps 1950
053	19°07'N	169°44'W	1,741/ 1,786	Scripps MP-25F2	Dredge (chain bag)	Scripps 1950
054	10°23'N	170°57'W	4,469	Scripps Proa-156G	Corer (gravity)	Scripps 1962
054	19°25'N	171°00'W	1,320/ 1,410	Scripps MP-26A-3	Dredge (chain bag)	Hamilton 1956
054	19°30'N	171°00'W	1,250	Scripps MP-26A-1	Corer	Scripps 1950
054	19°30'N	171°00'W	1,240	Scripps MP-26A-2	Dredge (chain bag)	Hamilton 1956
054	19°30'N	171°00'W	1,290	Scripps MP-26B	Dredge (chain bag)	Hamilton 1956
054	12°59'N	171°05'W	5,546	Lamont RC13-18	Corer (piston)	Lamont
054	10°20'N	172°06'W	5,106	Scripps Proa-157G	Corer	Cronan & Tooms, 1969
054	11°23'N	172°47'W	5,380	Scripps Proa-159G	Corer (gravity)	Scripps 1962
054	12°16'N	172°48'W	2,708	Scripps Proa-161G	Corer	Scripps 1962
054	18°20'N	173°17'W	3,950	Scripps MP-32	Corer	Scripps 1950
054	17°54'N	174°16'W	1,770	Scripps MP-33D	Dredge	Scripps 1950
054	17°49'N	174°17'W	1,670	Scripps MP-33C	Dredge	Scripps 1950
054	17°49'N	174°17'W	1,824/ 1,786	Scripps Stx-5D	Dredge	Scripps 1968
054	17°48'N	174°22'W	1,810/ 2,290	Scripps MP-33K	Dredge	Mero 1965
054	10°51'N	175°03'W	4,605	Lamont RC13-25	Corer (piston)	Lamont

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
054	13°51'N	175°14'W	4,217	Lamont RC13-26	Corer (piston)	Lamont
054	13°53'N	175°18'W	4,488	Lamont RC13-28	Corer (piston)	Lamont
054	12°01'N	175°37'W	5,280	Lamont V24-77	Corer (piston)	Lamont
054	12°31'N	175°51'W	5,464	Scripps Proa-162G	Corer	Scripps 1962
054	17°10'N	177°10'W	2,016	Scripps MP-37C	Dredge	Scripps 1950
054	17°04'N	177°15'W	2,010/	Scripps MP-37A	Dredge	Scripps 1950
055	16°08'N	179°44'E	5,330	Lamont V24-100	Corer (piston)	Lamont
055	13°55'N	178°20'E	5,506	Lamont RC13-30	Corer (piston)	Lamont
055	12°25'N	176°56'E	5,570	Scripps LSDH-86G	Corer (gravity)	Scripps 1962-63
055	13°38'N	175°25'E	1,400	Scripps LSDH-85G	Corer (gravity)	Scripps 1962-63
056	11°27'N	165°51'E	4,487	Scripps MP-44L	Dredge	Scripps 1950
056	11°32'N	165°39'E	2,918	Scripps MP-44J	Dredge	Scripps 1950
056	11°47'N	165°11'E	1,570/ 2,100	Scripps MP-43E	Dredge	Scripps 1950
056	11°46'N	165°10'E	1,330	Scripps MP-43LL	Dredge	Menard 1964
056	12°03'N	165°00'E	1,500/ 2,080	Scripps MP-43B	Dredge	Scripps 1950
056	11°57'N	164°59'E	1,500/ 2,100	Scripps MP-43D	Dredge	Scripps 1950
056	12°03'N	164°57'E	1,510/ 2,100	Scripps MP-43C	Dredge	Scripps 1950

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
056	12°07'N	164°52'E	3,290	Scripps MP-43J	Corer	Scripps 1950
056	11°48'N	164°50'E	1,610	Scripps MP-43DD	Dredge	Menard 1964
056	12°09'N	164°44'E	1,480/ 1,880	Scripps MP-43A	Dredge	Scripps 1950
056	15°23'N	164°16'E	5,191	Lamont V24-83	Corer (piston)	Lamont
056	19°52'N	162°58'E	4,808	Lamont V24-88	Corer (piston)	Lamont
056	19°04'N	161°23'E	4,879	Lamont V24-87	Corer (piston)	Lamont
056	19°03'N	161°19'E	3,896	Lamont V24-86	Corer (piston)	Lamont
057	19°55'N	155°59'E	5,643	USSR Vit-3631	Sounding cup	Skornyakova et al., 1962
057	17°24'N	154°38'E	4,192	U.S. Navy Nero-430	Sounding cup	Flint 1905
057	17°24'N	154°33'E	3,650	U.S. Navy Nero-427	Sounding cup	Flint 1905
057	14°48'N	154°03'E	5,460	Lamont RC10-153	Corer (piston)	Lamont
057	16°35'N	153°16'E	5,840	U.S. Navy Nero-498	Sounding cup	Flint 1905
057	17°31'N	153°07'E	3,510	U.S. Navy Nero-463	Sounding cup	Flint 1905
057	18°05'N	152°57'E	5,218	Lamont RC12-129	Corer (piston)	Lamont
057	15°31'N	150°48'E	6,140	U.S. Navy Nero-521	Sounding cup	Flint 1905
058	14°57'N	149°17'E	5,710	U.S. Navy Nero-530	Sounding cup	Flint 1905
058	10°34'N	148°25'E	5,480	Harvard Alb-246		NODC 1971

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
058	14°25'N	147°38'E	7,700	U.S. Navy Nero-591	Sounding cup	Flint 1905
058	11°35'N	147°15'E	5,880	Harvard Alb-247		NODC 1971
058	15°30'N	146°31'E	4,640	U.S. Navy Nero-600	Sounding cup	Flint 1905
058	15°15'N	146°07'E	3,190	U.S. Navy Nero-603	Sounding cup	Flint 1905
058	14°41'N	146°06'E	4,310	U.S. Navy Nero-637	Sounding cup	Flint 1905
058	13°28'N	144°36'E	1,570	U.S. Navy Nero-990	Sounding cup	Flint 1905
058	13°26'N	144°36'E	840	U.S. Navy Nero-663	Sounding cup	Flint 1905
058	19°55'N	143°52'E	3,510	U.S. Navy Nero-1055	Sounding cup	Flint 1905
058	13°42'N	143°52'E	3,519	U.S. Navy Nero-985	Sounding cup	Flint 1905
058	13°27'N	143°42'E	3,202	U.S. Navy Nero-984	Sounding cup	Flint 1905
058	13°44'N	143°32'E	3,442	U.S. Navy Nero-983	Sounding cup	Flint 1905
058	13°25'N	143°19'E	3,208	U.S. Navy Nero-982	Sounding cup	Flint 1905
058	13°31'N	142°30'E	2,640	U.S. Navy Nero-688	Sounding cup	Flint 1905
058	17°00'N	141°43'E	4,620	USSR Vit-3899	Trawl	Skornyakova et al., 1962
058	13°54'N	140°34'E	4,960	U.S. Navy Nero-705	Sounding cup	Flint 1905
059	14°08'N	139°18'E	4,830	U.S. Navy Nero-715	Sounding cup	Flint 1905
059	12°32'N	138°24'E	4,022	Alpine G.A. RA12-133	Corer (piston)	Alpine Geophys. Assoc., 1969
059	14°31'N	138°07'E	4,675	U.S. Navy Nero-951	Sounding cup	Flint 1905

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
059	14°32'N	136°30'E	5,010	U. S. Navy Nero-740	Sounding cup	Flint 1905
059	19°40'N	135°57'E	2,378/ 2,871	Lamont V28-D11	Dredge	Lamont
059	18°39'N	135°01'E	5,630	Lamont V24-119	Corer (piston)	Lamont
059	15°32'N	134°30'E	3,590	USSR Vit-3729		Skornyakova et al., 1962
059	17°11'N	133°16'E	5,997	Lamont V20-142	Corer (piston)	Lamont
059	14°11'N	131°04'E	5,371	Lamont V21-123	Corer (piston)	Lamont
059	14°50'N	130°42'E	5,980	U. S. Navy Nero-783	Sounding cup	Flint 1905
060	13°37'N	126°27'E	5,180	UNK-BH2	Core wire	Mero 1965
060	13°04'N	126°27'E	5,150	Cable Ship		Menard 1964
061	10°49'N	117°51'E	796	ESSA Pio-2D	Dredge (chain)	ESSA 1965
061	14°35'N	116°02'E	3,913	Lamont RC14-84	Corer (piston)	Lamont
083	22°18'N	107°48'W	3,000	Scripps Vs-B11-35	Trawl	Mero 1965
084	20°51'N	112°40'W	2,478	Scripps Tri-1D	Dredge	Scripps 1966
084	21°18'N	112°42'W	2,496	Scripps Tri-3D	Dredge	Scripps 1966
084	20°45'N	112°47'W	1,711	Scripps Tri-2D	Dredge	Scripps 1966
084	21°53'N	112°47'W	3,385	DH-10	Dredge	Mero 1965
084	21°48'N	113°03'W	3,450	DH-9	Dredge	Mero 1965
084	22°30'N	113°08'W	3,604	UNK-MS	Dredge	Mero 1965

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
084	24°24'N	113°16'W	1,950	Scripps MV65-1-38	Dredge	Cronan & Tooms, 1969
084	24°23'N	113°18'W	3,550	Scripps Mag Bay-A35	Dredge	Cronan & Tooms, 1969
084	24°58'N	113°23'W	3,315/ 3,340	USSR Vit-4265	Trawl (camera)	Skornyakova et al., 1962
084	24°34'N	113°28'W	3,510	Scripps MV65-1-41	Dredge	Cronan & Tooms, 1969
084	21°40'N	113°30'W	3,420	DH-8	Dredge	Mero 1965
084	29°03'N	113°33'W	384/ 493	Scripps VS-78	Dredge	Mero 1965
084	21°33'N	113°48'W	3,660	DH-7	Dredge	Mero 1965
084	20°00'N	113°57'W	3,778	USSR Vit-4273	Corer (camera)	Menard 1964
084	21°21'N	114°06'W	3,660	DH-6	Dredge	Mero 1965
084	21°27'N	114°07'W	3,800	DH-5	Dredge	Mero 1965
084	21°31'N	114°08'W	3,800	DH-4	Dredge	Mero 1965
084	21°40'N	114°11'W	3,800	DH-3	Dredge	Mero 1965
084	20°45'N	114°27'W	3,840	Scripps Tri-4D	Dredge (pipe)	Scripps 1966
084	20°32'N	114°58'W	3,705	Scripps Tri-5D	Dredge (pipe)	Scripps 1966
084	20°32'N	114°58'W	3,705	Scripps Tri-6D	Dredge	Scripps 1966
084	21°50'N	115°12'W	3,430	DH-2	Dredge	Mero 1965
084	21°59'N	116°03'W	3,890	Scripps Cb-B-XIV	Corer	Menard 1964
084	27°20'N	116°10'W	4,030	Scripps PAS-19121	Corer	Menard 1964

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
084	22°00'N	116°14'W	3,480	DH-1	Dredge	Mero 1965
084	29°31'N	117°17'W	540/820	Scripps SOB-13D	Dredge	Cronan & Tooms, 1969
084	20°19'N	117°29'W	4,010	Scripps Ris-5V	Corer	Cronan & Tooms, 1969
084	24°58'N	117°50'W	3,765	USSR Vit-4261	Corer (camera)	Menard 1964
084	20°32'N	118°48'W	4,072	Lamont RC12-46	Corer (piston)	Lamont
084	27°43'N	119°17'W	1,100/1,520	Scripps SIO-DX-1	Dredge	Menard 1964
084	21°05'N	119°22'W	2,607/2,984	Scripps Tri-9D	Dredge (chain)	Scripps 1966
084	23°30'N	119°35'W	440	Hend-1	Dredge	Menard 1964
084	25°15'N	119°40'W		USN Electron. Lab. NEL-Hend	Dredge	Goldberg 1954
085	29°57'N	120°42'W	4,078/4,017	USSR Vit-4217	Trawl	Skornyakova et al., 1962
085	23°43'N	124°06'W	3,787	Scripps Stx-2FF	Grab	Scripps 1968
085	24°22'N	125°00'W	4,330	Scripps DWHH-4	Corer	Mero 1965
085	28°59'N	125°40'W	4,000	Wig.-6	Corer	Mero 1965
085	29°58'N	125°55'W	4,325	USSR Vit-4221		Mero 1965
085	24°18'N	126°30'W	4,414	Scripps Msn-157G	Corer (gravity)	Mero 1965
085	21°27'N	126°43'W	4,300	Scripps DWBD-1	Dredge	Scripps 1958
085	28°23'N	126°57'W	4,340	Harvard Alb-2	Trawl	Murray 1909
085	20°51'N	127°16'W	4,702	Scripps MP-3	Corer	Mero 1965

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
086	20°00'N	130°01'W	4,895	USSR Vit-4289	Dredge	Skornyakova et al., 1962
086	20°04'N	130°04'W	4,959	Scripps Stx-3FF	Grab	Scripps 1968
086	24°55'N	132°18'W	4,975	USSR Vit-4249	Trawl	Menard 1964
086	27°53'N	132°37'W	3,700	Scripps Ris-121V	Corer (heat probe)	Scripps 1962
086	20°26'N	133°28'W	5,150	Harvard Alb-6		Menard 1964
086	25°00'N	137°19'W	4,645	USSR Vit-4245	Scoop	Mero 1965
086	23°17'N	138°15'W	4,890	Scripps Naga-8C	Dredge	Mero 1965
086	24°56'N	139°51'W	4,368	USSR Vit-4243	Scoop	Mero 1965
086	29°10'N	139°55'W	4,890	Lamont RC11-D15	Dredge (pebble)	Lamont
086	26°24'N	139°59'W	4,409	Lamont RC11-D16	Dredge (pebble)	Lamont
087	21°30'N	140°00'W	5,378	Lamont RC11-D17	Dredge (pebble)	Lamont
087	21°26'N	140°23'W	5,200	Scripps LSDH-100G	Corer (gravity)	Scripps 1962-63
087	23°17'N	141°13'W	5,540	Scripps Naga-10B	Corer	Menard 1964
087	23°17'N	141°13'W	5,540	Scripps Naga-10C	Corer	Mero 1965
087	22°57'N	143°58'W	4,750	Scripps Hilo-4G	Corer (gravity)	Scripps 1962
087	22°57'N	143°58'W	4,850	Scripps Hilo-5G	Corer (gravity)	Scripps 1962
087	24°50'N	144°05'W	5,190	USSR Vit-4239	Trawl (camera)	Skornyakova et al., 1964
087	23°50'N	144°46'W	5,280	Scripps Naga-13A	Dredge	Menard 1964

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
087	26°42'N	147°29'W	5,365	Scripps Zs-VII-38G	Corer (gravity)	Scripps 1966
087	23°54'N	148°00'W	5,220	Scripps Naga-15	Dredge	Mero 1965
088	22°00'N	150°00'W	5,240	Scripps Naga-16	Corer	Mero 1965
088	23°12'N	154°27'W	1,556	Lamont RC12-76	Corer (piston)	Lamont
088	22°39'N	154°45'W	4,441	Scripps Sh-A-27GA	Corer	Scripps 1966
088	21°59'N	154°59'W	4,384	Scripps Sh-H-21G	Corer	Scripps 1966
088	26°11'N	155°12'W	5,080	Challenger Chal-258	Bottle	Menard 1964
088	27°15'N	157°00'W	5,720	Lamont V21-D6	Trawl (biology)	Lamont
088	29°15'N	157°02'W	5,830	Lamont V21-D5	Trawl (biology)	Lamont
088	22°42'N	157°02'W	4,526	Scripps Sh-H-7G	Corer	Scripps 1966
088	24°16'N	157°56'W	3,968	Lamont RC12-188	Corer (piston)	Lamont
088	21°10'N	157°57'W	590	U.S. Navy Nero-2067	Cup	Flint 1905
088	21°53'N	158°07'W	2,712	U.S. Navy Nero-2048	Cup	Flint 1905
088	28°20'N	158°20'W	5,360	Lamont RC12-187	Corer (piston)	Lamont
088	21°45'N	158°39'W	989	U.S. Navy Nero-2056	Cup	Flint 1905
088	28°24'N	159°11'W	5,680	Lamont V21-D4	Trawl (biology)	Lamont
088	23°01'N	159°21'W	4,856	Lamont V21-D8	Trawl (biology)	Lamont
089	29°44'N	161°10'W	5,760	Lamont RC13-12	Corer (piston)	Lamont

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
089	27°36'N	161°54'W	4,947	Lamont RC13-15	Corer (piston)	Lamont
089	25°41'N	167°18'W	2,680	U.S. Navy Nero-93	Cup	Flint 1905
089	26°23'N	168°35'W	3,700	U.S. Navy Nero-106	Cup	Flint 1905
090	20°00'N	171°00'W	3,750	Scripps MP27-1	Corer	Menard 1964
090	20°00'N	171°00'W	2,140/ 2,210	Scripps MP-28	Dredge	Scripps 1950
090	20°03'N	171°38'W	3,477	USSR Vit-4331	Spoon	Skornyakova et al., 1962
090	29°37'N	174°07'W	5,156	Scripps Zs-V-13G	Corer	Scripps 1966
090	24°00'N	175°40'W	5,318	USSR Vit-4347	Scoop	Skornyakova et al., 1968
090	28°41'N	176°43'W	2,914	U.S. Navy Nero-167	Cup	Flint 1905
090	28°41'N	176°45'W	2,266	U.S. Navy Nero-175	Cup	Flint 1905
090	28°54'N	176°48'W	4,419	U.S. Navy Nero-179	Cup	Flint 1905
090	28°53'N	177°52'W	1,567/ 1,825	Scripps Stx-25D	Dredge	Scripps 1968
090	29°05'N	178°03'W	1,611/ 1,675	Scripps Stx-24D	Dredge	Scripps 1968
091	24°00'N	179°58'E	5,815	USSR Vit-4343	Scoop	Mero 1965
091	25°48'N	176°13'E	5,782	Lamont V24-93	Corer (piston)	Lamont
091	25°45'N	175°53'E	5,894	Scripps Nv-A-5G	Corer (gravity)	Scripps 1967
091	25°47'N	175°32'E	5,850	U.S. Navy Nero-257	Cup	Flint 1905

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
091	27°42'N	175°10'E	5,750	Scripps Jyn-IV-11G	Corer (gravity)	Scripps 1961
091	23°55'N	173°40'E		USSR Vit-3782		Nikolayev & Yefimova, 1963
091	24°32'N	171°33'E	5,650	U.S. Navy Nero-285	Cup	Flint 1905
091	23°57'N	170°58'E	5,817	USSR Vit-4351	Spoon	Skornyakova et al., 1962
092	24°02'N	167°24'E	6,052	USSR Vit-4355	Scoop	Mero 1965
092	21°26'N	163°19'E	3,900	U.S. Navy Nero-338	Cup	Flint 1905
092	21°25'N	163°17'E	3,369	U.S. Navy Nero-339	Cup	Flint 1905
092	21°24'N	163°15'E	2,646	U.S. Navy Nero-340	Cup	Flint 1905
092	24°01'N	163°02'E	5,542	USSR Vit-4359	Spoon	Skornyakova et al., 1962
092	21°15'N	162°48'E	4,100	U.S. Navy Nero-350	Cup	Flint 1905
092	21°21'N	162°42'E	3,437	U.S. Navy Nero-1704	Cup	Flint 1905
092	20°38'N	161°11'E	4,160	U.S. Navy Nero-361	Cup	Flint 1905
092	20°38'N	160°58'E	3,930	U.S. Navy Nero-373	Cup	Flint 1905
092	24°04'N	160°46'E	3,951	USSR Vit-4362	Spoon	Skornyakova et al., 1962
093	26°12'N	153°44'E	6,120	USSR Vit-4370	Trawl	Skornyakova et al., 1962
094	28°23'N	148°15'E	2,423	Scripps Zs-IV-5D	Dredge	Scripps 1966
094	21°27'N	143°35'E	3,095	U.S. Navy Nero-1406	Cup	Flint 1905

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
094	25°14'N	143° 05'E	3,080	U.S. Navy Nero-1151	Cup	Flint 1905
094	25°46'N	143°01'E	3,658	U.S. Navy Nero-1340	Cup	Flint 1905
094	27°05'N	142°57'E	4,905	U.S. Navy Nero-1142	Cup	Flint 1905
094	23°12'N	141° 47'E	1,252	Lamont V21-94	Corer (piston)	Lamont
095	28°23'N	136° 17'E	4,518	Scripps Zs-IV-12G	Corer	Scripps 1966
120	32°17'N	117° 32'W	710	Scripps SIO-DX-2	Dredge	Menard 1964
120	30°12'N	117° 38'W	1,300	Scripps SOB-10D	Dredge	Krause 1964
120	31°19'N	117° 38'W	2,100/ 2,120	Scripps SOB-5D	Trawl (Otter)	Krause 1964
120	30°18'N	117° 40'W	1,060	Scripps SOB-27D	Dredge	Krause 1964
120	32°50'N	118° 00'W	2,000	S Clem	Dredge	Goldberg & Arrhenius, 1958
120	31°23'N	118° 03'W	1,040	Scripps SOB-20D	Dredge	Krause 1964
120	32°45'N	118° 13'W	1,588	S Clem-SV	Dredge	Mero 1965
120	31°05'N	118° 37'W	1,650/ 1,830	Scripps SOB-25D	Dredge	Krause 1964
120	31°21'N	119° 03'W	695	Scripps SOB-22D	Dredge	Krause 1964
121	30°25'N	122° 45'W	450	USN Electron Lab. NEL-292	Dredge	Menard 1964
121	32°24'N	127° 47'W	499/ 512	USN Electron Lab. NEL-662	Dredge	Menard 1964
121	33°21'N	128° 45'W	4,318	Lamont RC10-233	Corer (piston)	Lamont
122	32°51'N	132° 32'W	710	U.S. Navy NEL-667	Dredge	Carsola & Dietz, 1952

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
122	39°38'N	135°06'W	4,790	Lamont V20-72	Corer (piston)	Lamont
122	35°06'N	137°56'W	5,035	USSR Vit-4199	Dredge	Skornyakova et al., 1964
122	34°59'N	139°57'W	5,303	Lamont RC11-194	Corer (piston)	Lamont
122	31°51'N	139°58'W	4,934	Lamont RC11-195	Corer (piston)	Lamont
122	31°51'N	139°58'W	4,991	Lamont RC11-D14	Dredge (pebble)	Lamont
123	39°56'N	140°02'W	4,748	Lamont RC11-193	Corer (piston)	Lamont
123	39°56'N	140°02'W	4,748	Lamont RC11-D13	Dredge (pebble)	Lamont
123	34°04'N	145°56'W	5,390	Scripps UPWD-1	Dredge	Mero 1965
123	34°08'N	145°57'W	5,300	Scripps UPWD-2	Dredge	Mero 1965
124	35°13'N	154°43'W	5,540	Challenger Chal-254	Bottle	Murray 1885
124	30°22'N	154°56'W	5,400	Challenger Chal-256	Dredge	Murray 1885
124	38°09'N	156°25'W	5,720	Challenger Chal-253	Dredge	Murray 1885
124	31°31'N	159°42'W	5,720	Lamont V21-D3	Trawl (biology)	Lamont
125	37°52'N	160°17'W	5,020	Challenger Chal-252	Trawl	Murray 1885
125	34°54'N	160°19'W	5,577	Lamont V21-D2	Trawl (biology)	Lamont
125	35°02'N	166°28'W	5,902/ 5,913	USSR Vit-4090	Trawl	Skornyakova et al., 1962
126	35°00'N	172°57'W	5,971	USSR Vit-4084	Spoon	Skornyakova et al., 1962

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
126	37°18'N	178°10'W	5,449	Lamont V20-104	Corer (piston)	Lamont
127	37°41'N	177°04'E	5,300	Challenger Chal-248	Trawl	Murray 1885
127	39°38'N	173°43'E	4,312	Lamont RC10-179	Corer (piston)	Lamont
128	37°03'N	166°34'E	4,978	Lamont RC11-D5	Camera frame	Lamont
128	35°20'N	162°38'E	5,158	Lamont RC11-164	Corer (piston)	Lamont
128	37°16'N	162°24'E	1,295/ 1,110	Scripps Zs-III-2D	Dredge	Scripps 1966
128	34°47'N	160°40'E	4,226	Lamont RC10-176	Corer (piston)	Lamont
129	31°50'N	157°20'E	3,638	Lamont RC10-165	Corer (piston)	Lamont
130	36°29'N	146°43'E	5,720	Scripps JynII-21	Corer (gravity)	Scripps 1961
130	38°00'N	146°00'E	3,500	Univ. Tokyo JEDS-5	Trawl	Mero 1965
130	47°40'N	145°26'E	5,396	Scripps Car-57	Snapper	Menard 1964
130	30°59'N	141°09'E	2,730	U.S. Navy Nero-1185	Cup	Flint 1905
130	32°10'N	140°56'E	3,110	U.S. Navy Nero-1197	Cup	Flint 1905
131	34°23'N	139°05'E	260	Scripps Jap-B	Dredge	Mero 1965
131	34°33'N	139°05'E	260	Scripps Jap-A-1	Dredge	Menard 1964
131	33°51'N	138°41'E	110	Scripps Jap-A	Dredge	Mero 1965
131	35°15'N	138°41'E	114	Scripps Jap-B-2	Dredge	Menard 1964

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
157	40°23'N	127°21'W	1,700	CasD-8	Dredge	Menard 1964
157	40°22'N	127°33'W	1,450	Scripps Fan-S16	Corer	NODC 1971
157	40°23'N	127°59'W	1,260	Scripps Fan-BD-25	Dredge	NODC 1971
157	42°45'N	128°03'W	2,520	CasD-5	Dredge	Menard 1964
157	41°10'N	128°16'W	2,600	Scripps Fan-B24	Corer	NODC 1971
157	40°16'N	128°28'W	4,060/ 4,400	Scripps Fan-BD-20	Dredge	Scripps 1959
158	40°20'N	135°47'W	4,471/ 4,477	USSR Vit-4191	Corer & Trawl	Skornyakova et al., 1962
158	42°02'N	139°57'W	4,116	Lamont RC11-D12	Dredge (pebble)	Lamont
158	42°02'N	139°57'W	4,116	Lamont RC11-192	Corer (piston)	Lamont
159	43°58'N	140°38'W	4,350	Scripps Cusp-8P	Corer	Scripps 1952-53
160	40°11'N	151°39'W	5,081	Lamont V20-88	Corer (piston)	Lamont
160	40°14'N	155°55'W	4,938			Willis & Ahrens, 1962
160	40°14'N	155°55'W	5,029	Scripps NH-C10	Corer (wire)	Scripps 1951
160	41°08'N	159°54'W	5,435/ 5,456	USSR Vit-4104	Trawl	Skornyakova et al., 1962
162	40°24'N	175°42'W	6,065	USSR Vit-4074	Trawl	Skornyakova et al., 1962
162	44°45'N	173°02'W	4,835	Scripps Ck-13	Corer (gravity)	Menard 1964
163	40°30'N	170°48'E	5,460	Scripps JynII-9G	Corer	Scripps 1961
163	44°28'N	170°15'E	1,258	USSR Vit-3150	Trawl	Skornyakova et al., 1962

Marsden Square	Location Lat.	Long.	Depth in meters	Institution and number	Method of sampling	Reference or source
195	56°20'N	142°30'W	900	Scripps NH-D-5	Dredge (chain bag)	NODC 1971
195	53°32'N	144°17'W	1,000	Scripps NH-D-2	Dredge (chain bag)	NODC 1971
195	53°32'N	144°17'W	1,100/ 1,550	Scripps NH-D-3	Dredge (chain bag)	NODC 1971
195	56°10'N	145°15'W	1,370/ 1,800	Scripps NH-D-7	Dredge (chain bag)	NODC 1971
196	52°47'N	150°05'W	1,500	Scripps NH-D-1	Dredge (chain bag)	NODC 1971

TABLE 2

CHEMICAL ANALYSES

OF FERROMANGANESE NODULES AND CRUSTS

NORTH PACIFIC

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
1	012	06°38'N 110°56'W	4,316	Lamont RC10-76	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.74	0.45	0.08		21.5			
2	012	01°27'N 116°13'W	4,000	Scripps DWBG-147B	Corer (gravity)	Nodule 1x1.5x1.5 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.76	0.47	0.05	12.6	18.8	3.5	1.8	1.5
						Nodule 1x1.5x1.5 cm	Scripps-NODC (unpublished)		Emission spectrography	1.1	0.68	0.07	18.2	27.2	5.1	2.6	1.5
3	012	05°20'N 117°55'W	4,330	Scripps Ris 14V	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.48	0.91	0.05	7.15	30.28			4.2
4	012	09°59'N 118°00'W	4,295	Scripps DWHH-92	Corer (gravity)	Nod. frag. 1.5x1.5x2 cm	Scripps-NODC (unpublished)		Emission spectrography	1.0	0.74	0.09	11.2	24.6	9.8	1.5	2.2
5	013	08°30'N 120°08'W	3,389	Lamont V20-31	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.74	0.10	0.25		20.0			
6	013	06°46'N 122°57'W	4,508	Lamont V21-199	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.26	1.08	0.08	4.8	26.4			5.5
7	013	07°18'N 125°20'W	4,610?	Lamont RC10-93	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	1.33	1.27	0.14		30.0			
8	013	08°09'N 125°20'W	4,360	Scripps Cb-39	Corer	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.16	1.36	0.18	6.3	28.1	5.8	1.5	4.5
9	013	08°05'N 125°25'W	4,453	Scripps Cb-17	Corer	Nodule 1.0 cm diam	Scripps-NODC (unpublished)	Whole nodule	X-ray fluorescence spectrography	1.19	1.59	0.17	6.7	26.2	6.1	1.2	3.9
10	013	07°41'N 125°37'W	4,416	Scripps Cb-19	Corer	Nodule 0.6 cm diam	Mero, 1965	Half nodule	X-ray fluorescence spectrography	0.40	0.55	0.09	9.2	9.3	14.3	0.7	1.0
11	013	08°01'N 126°58'W	4,440	Scripps Cb-34	Corer (gravity)	Nodule	Scripps-NODC (unpublished)		Emission spectrography	1.8	1.6	0.18	5.3	34.1	7.5	1.4	6.4
12	014	08°48'N 130°48'W	4,917	Scripps DWBG-7	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.52	1.23	0.12	4.36	24.56			5.6
13	014	09°50'N 136°23'W	4,823	Lamont RC12-58	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.20	0.94	0.27	5.8	21.8			3.8
14	014	08°59'N 137°41'W	4,660	Lamont RC12-59	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.11	0.11	0.05	8.20	2.50			0.3
15	014	09°57'N 137°47'W	4,930	Harvard Alb-13	Trawl (Blake)	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.36	1.20	0.20	4.8	29.8		1.5	6.2
						Nodule	Scripps-NODC (unpublished)		Emission spectrography	2.0	1.4	0.18	5.3	32.	7.5	1.8	6.0
						Nodule	Ahrens et al., 1967	2 pieces	Emission spectrography	1.70	1.21	0.25	4.43	38.1		1.7	8.7
						Nodule 2x3x3 cm	Hewett et al., 1963		Spectrography	1.5	1.5	0.3	7.0	>10.	7.0	3.	

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
16	014	09°57'N 137°47'W	4,930	2P-52	Dredge		Cronan and Tooms, 1969		Emission spectrography	1.93	1.59	0.14	5.41	23.46			4.3
17	014	08°47'N 139°53'W	5,086	Lamont RC11-206	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.94	0.98	0.26	6.7	16.8			3.0
18	014	08°47'N 139°53'W	5,086	Lamont RC11-D21	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	1.28	1.32	0.20	11.6	6.00		1.4	0.5
19	015	09°06'N 145°18'W	5,400	Scripps Msn-148G	Corer (gravity)	Nodule 1.5x2.5x2.7 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.52	1.27	0.26	5.3	26.2	6.3	1.4	4.9
20	015	09°13'N 149°49'W	5,073	Lamont RC12-69	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.90	0.66	0.28	10.1	17.0			1.7
21	015	08°02'N 149°54'W	5,073	Scripps Jyn V-15PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.21	0.98	0.26	9.34	23.63			2.5
22	016	09°27'N 150°42'W	5,100	Scripps Jyn V-13G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.41	0.45	0.12	10.50	5.41			0.5
23	016	08°59'N 152°50'W	4,839	Scripps Wah-4PG	Corer		Cronan and Tooms, 1969		Emission spectrography	1.33	0.78	0.41	10.94	22.61			2.1
24	016	08°16'N 153°01'W	5,143	Scripps Wah-24FF-8	Corer		Cronan and Tooms, 1969		Emission spectrography	1.86	1.65	0.25	7.31	24.89			3.4
25	016	07°55'N 153°42'W		U.S.S.R. Vit-5124		Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.53	1.59	0.12	5.77	25.49			4.4
26	017	09°57'N 167°51'W	5,279	Scripps Dodo-20C	Corer (camera)	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.08	1.09	0.27	9.43	22.75			2.5
27	017	07°47'N 168°00'W	4,994	Scripps Msn-J	Corer	Nodule 2x2.5x2.5 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.60	0.43	0.39	13.8	20.2	4.4	1.7	1.5
28	017	09°41'N 168°42'W	5,222	Lamont RC12-195	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.52	0.37	0.17	6.60	11.2			1.7
29	017	09°20'N 168°50'W	5,240	Scripps Dodo-25PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.11	0.98	0.35	9.51	20.41			2.2
30	017	08°34'N 168°52'W	4,397	Scripps Proa-151G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.55	0.45	0.44	12.04	18.38			1.5
31	018	06°03'N 170°00'W	5,400	Scripps Msn-K	Corer	Nodule 1.5x1.5 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.54	1.90	0.16	5.25	29.0	5.2	1.5	5.5
32	018	08°06'N 170°25'W	5,444	Scripps Proa-139G	Corer (gravity	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.07	1.22	0.19	8.96	20.71			2.3
33	018	08°33'N 170°59'W	5,169	Lamont RC13-19	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	1.07	0.98	0.27	10.6	25.2			2.4

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
34	018	09°49'N 170°59'W	4,875	Scripps LSDH-93PG	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.67	0.43	0.29	13.03	20.94			1.6
35	018	07°04'N 171°42'W	5,386	Scripps Proa-137G	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.47	0.21	0.51	16.67	18.62			1.1
36	018	07°19'N 175°28'W	5,190	Scripps LSDH-90PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.69	0.35	0.46	14.78	17.80			1.2
37	018	09°46'N 175°37'W	5,760	Lamont RC12-197	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.90	0.90	0.26	8.80	18.4			1.2
38	018	08°08'N 177°10'W	5,435	Scripps LSDH-89PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.54	0.33	0.21	12.81	15.78			1.2
39	018	09°42'N 177°59'W	5,953	Lamont RC12-198	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.06	1.80	0.21	7.40	20.3			2.7
40	018	06°02'N 178°35'W	5,097	Scripps Proa-101PG	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.25	0.18	0.38	15.48	15.84			1.0
41	018	00°15'N 179°43'W	5,045	Scripps Proa-105G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.65	0.54	0.15	15.85	17.14			1.1
42	019	09°17'N 178°57'E	5,821/ 5,996	Lamont V24-D1	Dredge	Nodule	Lamont (unpublished)		Wet chemical	0.40	0.35	0.29	13.9	16.0			1.2
43	019	08°19'N 176°25'E	5,097	Lamont V24-102	Corer (piston)	Crust	Lamont (unpublished)		Wet chemical	1.04	0.60	0.37	10.8	17.2			1.6
44	019	01°28'N 174°52'E	4,691	Lamont RC12-200	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.42	0.52	0.21	15.6	14.6			0.9
45	047	11°38'N 103°48'W	3,500	Scripps Acap-10	Corer	Nodule 0.1 cm diam	Mero, 1965		X-ray fluorescence spectrography	0.04	0.08	0.01	6.3	1.7	12.1	12.6	0.3
46	047	10°53'N 105°07'W	3,275	Scripps Acap-11	Corer	Nodule 1 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.04	0.08	0.03	15.5	3.4	13.3	3.0	0.2
47	048	11°25'N 113°48'W	4,085	Swed. Deep Sea SDSE-48	Corer	Nodule 1 cm diam	Mero, 1965		X-ray fluorescence spectrography	1.01	0.66	0.21	11.5	23.2	4.2	1.8	2.0
48	048	19°20'N 114°12'W	3,480	Trans-14D	Corer	Nodule 3x3x1 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.09	0.71	0.23	10.2	22.6	6.1	1.4	2.2
49	048	19°46'N 114°44'W	3,438	Trans-14C	Corer	Nodule 1x3x2 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.93	0.61	0.22	12.0	21.2	5.9	1.5	1.8
50	048	14°26'N 117°12'W	4,125	Scripps Ris-8V	Corer (heat probe)	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.89	1.06	0.08	10.30	26.84			2.6
51	048	19°52'N 119°53'W	4,226	Lamont RC12-47	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.30	0.76	0.36	9.50	22.7			2.4

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
52	049	12°16'N 120°10'W	4,471	Lamont RC10-91	Corer (piston)	Crust	Lamont (unpublished)		Atomic absorption	1.68	1.4	0.16	5.08	31.5		1.3	6.2
53	049	19°49'N 121°44'W	4,138	UNK-RR	Dredge	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.09	0.76	0.36	9.6	21.4	7.9	1.3	2.2
54	049	19°00'N 121°53'W	4,138	Scripps Cb-1	Corer (gravity)	Nodule 0.1 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.16	0.87	0.40	9.5	22.4	6.8	1.3	2.4
55	049	14°55'N 124°12'W	4,270	Scripps Cap-50B	Corer		Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.15	1.25	0.39	7.6	22.4	7.6	1.2	3.0
56	049	16°03'N 125°01'W	4,354	Scripps Cb-2	Corer (gravity)	Nodule	Mero, 1965		X-ray fluorescence spectrography	1.22	1.05	0.27	7.3	23.8	7.4	1.4	3.3
57	049	15°04'N 125°05'W	4,500	Scripps Amp-3PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.91	1.24	0.23	5.95	23.19			4.0
58	049	15°00'N 125°26'W	4,380	Scripps Cb-3	Corer	Nodule 1 cm diam	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.00	0.82	0.38	9.7	22.2	5.9	1.4	1.9
							Scripps-NODC (unpublished)		X-ray fluorescence spectrography	1.23	0.95	0.34	8.3	24.0	5.4	1.5	2.9
59	049	10°19'N 125°27'W	4,545	Scripps Cb-9	Corer	Nodule 0.5 cm diam	Scripps-NODC (unpublished)		X-ray fluorescence spectrography	1.06	1.06	0.36	10.0	18.9	8.1	1.8	1.9
60	049	13°03'N 125°29'W	4,440	Scripps Cb-5	Corer (gravity)		Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.06	1.06	0.32	6.3	22.2	9.7	1.2	3.5
							Scripps-NODC (unpublished)		Emission spectrography	0.9	1.0	0.10	2.4	27.8	11.2	0.9	11.6
61	049	16°35'N 125°35'W	4,369	Lamont RC12-50	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	1.16	0.72	0.30	8.60	22.0			2.6
62	049	10°37'N 128°54'W	4,636	Lamont V20-D1	Dredge (rock)	Nodule	Lamont (unpublished)		Wet chemical	1.28	1.10	0.22	3.9	29.6		1.4	7.6
63	050	10°26'N 130°38'W	4,890	Scripps DWBD-2	Dredge	Nodule 4x3x1 cm	Mero, 1965	Half nodule	X-ray fluorescence spectrography	1.25	1.21	0.26	7.6	22.7	7.3	1.5	3.0
						Nodule 2.4 cm diam	Scripps-NODC (unpublished)		Emission spectrography	1.7	1.4	0.17	5.9	31.6	7.5	1.8	5.4
64	050	18°16'N 131°46'W	5,210	Scripps Jyn V-50PG	Corer		Cronan and Tooms, 1969		Emission spectrography	1.09	0.74	0.22	9.58	24.26			2.5
65	050	11°24'N 132°07'W	4,843	Lamont V20-36	Corer	Nodule	Lamont (unpublished)		Wet chemical	1.34	1.32	0.24	0.50	28.5		0.7	57.0
66	050	14°22'N 133°07'W	4,816	Scripps MP-5	Corer	Nodule	Mero, 1965	Outer 1 cm	X-ray fluorescence spectrography	1.05	0.78	0.45	9.2	22.9	7.0	1.4	2.5

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
67	050	15°54'N 133°57'W	4,606	Scripps Jyn V-48PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.66	0.20	0.32	13.57	20.52			1.5
68	050	16°15'N 137°06'W	4,553	Scripps Car-78	Snapper	Nodule 1 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.46	0.40	0.20	8.9	10.0	13.7	0.8	1.1
69	050	13°07'N 138°56'W	4,927	Scripps Msn-153PG	Corer	Nodule 1x1.2x1 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.50	1.31	0.33	5.1	25.0	6.3	1.4	5.0
70	050	10°45'N 139°24'W	4,770	Lamont V21-D13	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	1.36	0.68	0.30	7.4	20.8		1.5	2.8
71	050	11°01'N 139°58'W	4,877	Lamont RC11-D20	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	1.62	1.10	0.32	6.0	30.5		1.4	5.1
72	051	19°29'N 140°02'W	5,574	Lamont RC11-D18	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.64	0.36	0.16	9.0	13.6		0.8	1.5
73	051	14°52'N 140°02'W	4,828	Lamont RC11-D19	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	1.10	0.70	0.18	8.5	21.0		1.3	2.5
74	051	10°59'N 142°37'W	4,978	Scripps Msn-150G	Corer (gravity)	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.23	0.96	0.31	6.4	17.0	9.9	1.2	2.7
75	051	15°03'N 142°46'W	4,526	Lamont V20-44	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.38	0.20	0.27	16.4	20.6		2.2	1.3
76	051	11°55'N 144°54'W	5,539	Scripps Jyn V-31PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.52	0.37	0.18	10.61	19.45			1.8
77	051	12°19'N 145°08'W	5,550	Lamont V21-D11	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	1.28	1.36	0.27	5.4	25.6		1.5	4.7
78	051	14°26'N 145°21'W	4,640	Lamont V20-48	Corer	Nodule	Lamont (unpublished)		Wet chemical	1.18	1.08	0.27	5.6	24.0		1.5	4.3
79	051	14°25'N 145°52'W	4,618	Lamont V20-D4	Dredge (rock)	Nodule	Lamont (unpublished)		Wet chemical	0.52	0.39	0.26	9.60	13.4			1.4
80	051	13°10'N 147°45'W	5,603	Lamont V21-D10	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	1.12	0.40	0.32	9.5	16.4		1.8	1.7
81	052	13°44'N 150°00'W	5,218	Lamont V21-D9	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.69	0.75	0.18	4.25	17.5			4.1
82	052	14°19'N 152°37'W	5,480	Challenger Chal-264	Trawl	Nodule	Murray and Renard, 1891	Whole nodule	Wet chemical	~1.	~1.5	~0.5	16.15	18.4	13.2	1.5	1.1
83	052	11°51'N 152°56'W	5,221	Scripps Wah-2PG	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.72	0.46	0.26	11.98	15.44			1.3
84	052	11°17'N 154°08'W		U.S.S.R. Vit-5126		Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.64	0.35	0.26	9.32	20.19			2.2

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
85	052	10°22'N 157°08'W	5,343	Lamont RC13-58	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.74	0.45	0.27	12.4	19.6			1.6
86	053	14°11'N 161°08'W	5,652	Scripps Msn-G	Corer	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.98	0.81	0.31	9.2	23.3	5.6	1.5	2.5
87	053	13°05'N 163°10'W	5,413	Scripps Tet-27A	Corer	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.86	0.65	0.31	10.0	18.5	8.8	1.6	1.9
88	053	13°50'N 163°32'W	5,460	Lamont RC12-79	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.84	0.58	0.26	10.2	21.2			2.0
89	053	11°01'N 164°56'W	4,835	Scripps Proa-148G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.60	0.65	0.44	17.08	19.23			1.1
90	053	10°30'N 165°33'W	4,341	Scripps Proa-147V	Corer (heatprobe)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.66	0.32	0.88	16.38	14.18			0.9
91	053	16°06'N 165°45'W	2,400	Scripps Tet-22	Corer	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.25	0.04	0.73	17.2	16.0	6.0	2.0	0.9
92	053	16°05'N 165°52'W	5,295	Lamont RC12-193	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.64	0.45	0.29	11.0	16.8			1.5
93	053	15°36'N 166°40'W	5,440	Scripps Proa-169G	Corer	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.34	0.16	0.84	16.95	16.70			1.0
94	053	19°07'N 169°44'W	1,740	Scripps MP-25F1	Dredge (chain bag)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.44	0.07	1.28	12.72	13.38			1.0
95	053	19°07'N 169°44'W	1,741/ 1,786	Scripps MP-25F2	Dredge (chain bag)	Nodule 3x2x2 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.42	0.10	0.95	14.5	20.5	3.3	2.1	1.4
							Hewett et al., 1963		Emission spectrography	0.7	0.15	1.5	>10.	>10.	3.	1.5	
96	054	10°23'N 170°57'W	4,469	Scripps Proa-156G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.77	0.63	0.69	14.54	17.01			1.2
97	054	19°25'N 171°00'W	1,320/ 1,410	Scripps MP-26A-3	Dredge (chain bag)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.47	0.06	1.17	11.68	12.28			1.0
						Nodule 3x3x3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.60	0.15	0.95	13.3	22.7	2.7	2.2	1.7
						Nodule	Goldberg, 1954		Colorimetry	0.31	0.19	0.46					
						Nodule	Dietz, 1955		Colorimetry	0.52		0.8	16.8	16.9			1.7
98	054	12°59'N 171°05'W	5,546	Lamont RC13-18	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.59	0.46	0.31	13.6	19.6			1.4

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
99	054	10°20'N 172°06'W	5,106	Scripps Proa-157G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.40	0.24	0.43	13.72	20.63			1.5
100	054	11°23'N 172°47'W	5,380	Scripps Proa-159G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.49	0.27	0.43	14.80	17.12			1.2
101	054	12°16'N 172°48'W	2,708	Scripps Proa-161G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.31	<0.05	0.90	16.03	13.02			0.8
102	054	18°20'N 173°17'W	3,950	Scripps MP-32	Corer	Crust	Mero, 1965		X-ray fluorescence spectrography	0.30	0.17	0.42	14.6	13.1	7.1	1.5	0.9
103	054	17°48'N 174°22'W	1,810/ 2,290	Scripps MP-33K	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.23	0.08	0.88	14.49	11.13			0.8
						Crust 1 cm	Mero, 1965		X-ray fluorescence spectrography	0.29	0.07	0.70	14.05	14.4	4.9	6.8	1.0
							Hewett et al., 1963		Emission spectrography	0.3	0.15	1.5	>10.	>10.	3.	7.	
104	054	12°01'N 175°37'W	5,280	Lamont V24-77	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.20	0.28	0.16	15.2	17.3			1.1
105	054	12°31'N 175°51'W	5,464	Scripps Proa-162G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.53	0.43	0.72	12.88	15.85			1.2
106	054	17°10'N 177°10'W	2,016	Scripps MP-37C	Dredge	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.34	0.09	0.88	13.27	14.97			1.1
107	054	17°04'N 177°15'W	2,010 1,830	Scripps MP-37A	Dredge	Crust 2 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.47	0.19	0.45	10.7	13.0	4.1	8.5	1.2
							Goldberg, 1954		Colorimetry	0.58	0.48	0.54	13.4	21.7			1.6
							Dietz, 1955		Wet chemical	0.58		0.54	13.19	21.03			1.6
108	055	16°08'N 179°44'E	5,330	Lamont V24-100	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.28	0.35	0.16	15.8	16.8			1.1
109	056	11°57'N 164°59'E	1,500/ 2,100	Scripps MP-43D	Dredge	Crust 5 cm	Mero, 1965		Emission spectrography	0.42	0.11	1.05	11.5	19.5	1.7	1.6	1.7
111	056	12°09'N 164°44'E	1,480/ 1,880	Scripps MP-43A	Dredge		Goldberg, 1954		Colorimetry	0.61	0.47	0.61	15.6	23.6			1.5
							Cronan and Tooms, 1969		Emission spectrography	0.52	0.04	1.60	13.53	19.40			1.4

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
112	057	19°55'N 155°59'E	5,643	U.S.S.R. Vit-3631	Spoon	Nodule 4 cm diam	Skornyakova et al., 1962		Wet chemical and colorimetry	0.33		0.53	14.4	17.2	6.2	1.8	1.2
113	057	14°48'N 154°03'E	5,460	Lamont RC10-153	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.46	0.24	0.37	19.2	18.0		2.0	1.0
114	057	18°05'N 152°57'E	5,218	Lamont RC12-129	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.50	0.32	0.34	15.0	14.8			1.0
116	083	22°18'N 107°48'W	3,000	Scripps VS-B11-35	Trawl	Nodule 5x2x1 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.12	0.05	0.02	1.36	24.8	13.4	0.9	18.2
117	084	21°53'N 112°47'W	3,385	Scripps DH-10	Dredge	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.54	0.31	0.01	5.7	30.3			5.3
118	084	21°48'N 113°03'W	3,450	Scripps DH-9	Dredge	Nodule	Mero, 1965	Half nodule	X-ray fluorescence spectrography	1.10	0.47	0.04	8.3	31.0			3.7
119	084	22°30'N 113°08'W	3,604	UNK-MS	Dredge	Nodule 5x3x3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.63	0.42	0.26	4.85	28.8	7.9	1.3	5.9
120	084	24°24'N 113°16'W	1,950	Scripps MV 65-1-38	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.11	0.09	0.01	1.99	33.92			17.0
121	084	24°23'N 113°18'W	3,550	Scripps Mag Bay-A35	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.11	0.06	0.01	1.69	33.90			20.1
122	084	24°58'N 113°25'W	3,315/ 3,340	U.S.S.R. Vit-4265	Trawl (camera)	Nodule	Skornyakova et al., 1962	Outer 1 cm	Wet chemical and colorimetry	0.18		0.00	1.2	32.8	5.4	1.8	27.3
123	084	24°34'N 113°28'W	3,510	Scripps MV 65-1-41	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.07	0.05	0.01	1.18	34.12			19.0
124	084	21°40'N 113°30'W	3,420	Scripps DH-8	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.24	0.60	0.07	9.4	28.9			3.1
125	084	29°03'N 113°33'W	384/ 493	Scripps VS-78	Dredge	Nodule 8x6x5 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.04	0.01	0.01	0.86	38.9	1.2		4.8
126	084	21°33'N 113°48'W	3,660	Scripps DH-7	Dredge	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.24	0.62	0.05	7.5	24.4			3.3
127	084	21°21'N 114°06'W	3,660	Scripps DH-6	Dredge	Nodule	Mero, 1965	Half nodule	X-ray fluorescence spectrography	1.35	0.72	0.08	9.0	28.9			3.2
128	084	21°27'N 114°07'W	3,800	Scripps DH-5	Dredge	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.23	0.62	0.11	10.9	27.6			2.5
129	084	21°31'N 114°08'W	3,800	Scripps DH-4	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.46	0.77	0.05	8.1	28.2			3.5

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
130	084	21°40'N 114°11'W	3,800	Scripps DH-3	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.19	0.64	0.09	9.9	28.8			3.0
131	084	21°50'N 115°12'W	3,430	Scripps DH-2	Dredge	Nodule 1 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.02	0.50	0.11	13.0	25.1			2.0
132	084	27°20'N 116°10'W	4,030	Scripps PAS-19121	Corer	Nodule 0.5x2x2 cm	Mero, 1965	Whole nodule	Emission spectrography	1.25	0.70	0.27	9.3	21.2	6.2	1.0	2.3
133	084	22°00'N 116°14'W	3,480	Scripps DH-1	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.02	0.61	0.08	10.4	27.8			2.7
134	084	29°31'N 117°17'W	540/ 820	Scripps SOB-13D	Dredge	Crust	Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.22	0.04	0.73	15.6	21.1	1.1	2.1	1.4
135	084	20°19'N 117°29'W	4,010	Scripps Ris-5V	Corer (heat probe)	Nodule	Cronan and Tooms, 1969		Emission spectrography	1.26	0.68	0.26	10.46	24.13			2.3
136	084	23°30'N 119°35'W	440	Hend-1	Dredge	Crust	Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.36	0.04	0.62	13.5	20.5	1.2	2.1	1.5
137	084	25°15'N 119°40'W		U.S. Navy NEL-Hend	Dredge		Goldberg, 1954		Colorimetry	0.30	0.22	0.32	20.1	21.3			1.1
138	085	29°57'N 120°42'W	4,078/ 4,017	U.S.S.R. Vit-4217	Trawl	Nodule 4x2x2 cm	Skornyakova et al., 1962	X-sect.	Wet chemical and colorimetry	0.74	0.45	0.15	11.2	16.7	10.1	1.3	1.5
139	085	24°22'N 125°00'W	4,330	Scripps DWHH-4	Corer	Nodule 1x2x2 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	1.21	0.49	0.24	9.5	18.5	5.7	1.3	2.0
						Nodule 0.8x2x2 cm	Scripps-NODC (unpublished)		Emission spectrography	1.7	0.69	0.33	13.3	25.9	7.9	0.5	1.1
140	085	28°59'N 125°40'W	4,000	Wig-6	Corer	Nodule 0.3 cm diam	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.51	0.34	0.37	13.6	14.3	8.7	1.1	1.2
141	085	29°58'N 125°55'W	4,325	U.S.S.R. Vit-4221		Nodule 2x1.5x1.5 cm	Mero, 1965	Half nodule	X-ray fluorescence spectrography	0.41	0.25	0.15	7.0	8.3	16.8	0.7	1.2
142	085	21°27'N 126°43'W	4,300	Scripps DWBD-1	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.35	0.20	0.34	12.91	16.92			1.3
						Nodule 4x4x4 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.13	0.19	0.30	11.5	9.7	18.8	1.0	0.8
						Nodule 3.5 cm diam	Scripps-NODC (unpublished)		Emission spectrography	0.46	0.36	0.50	18.2	24.6	7.0	1.8	1.4
						Nodule 3.5 cm diam	Scripps-NODC (unpublished)		Emission spectrography	0.39	0.28	0.07	7.9	7.0	21.5	0.6	0.9
143	085	28°23'N 126°57'W	4,340	Harvard Alb-2	Trawl	Nodule	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.67	0.44	0.19	10.6	10.4	14.7	0.7	1.0

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
144	085	20°51'N 127°16'W	4,702	Scripps MP-3	Corer	Nodule	Mero, 1965	Outer 2 cm	X-ray fluorescence spectrography	1.10	0.76	0.36	9.2	21.2	7.9	1.4	2.3
145	086	20°00'N 130°01'W	4,895	U.S.S.R. Vit-4289	Dredge	Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	1.10	0.91	0.33	8.7	21.8	7.3	1.5	2.5
146	086	23°17'N 138°15'W	4,890	Scripps Naga-8C	Dredge		Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.35	0.20	0.52	14.1	15.9	6.5	1.4	1.1
147	086	29°10'N 139°55'W	4,890	Lamont RC11-D15	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.26	0.14	0.09	17.4	12.5		1.4	0.7
148	087	21°30'N 140°00'W	5,378	Lamont RC11-D17	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	1.00	0.54	0.23	10.5	21.0		1.0	2.0
149	087	23°17'N 141°13'W	5,540	Scripps Naga-10C	Corer	0.5x3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.44	0.45	0.14	4.7	7.0	3.	0.7	0.7
							Hewett et al., 1963		Emission spectrography	0.7	0.3	0.3	>10.	>10.	3.	3.	
150	087	22°57'N 143°58'W	4,750	Scripps Hilo-4G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.84	0.56	0.22	8.19	10.67			1.3
151	087	22°57'N 143°58'W	4,850	Scripps Hilo-5G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.87	0.53	0.16	9.31	10.81			1.2
152	087	24°50'N 144°05'W	5,190	U.S.S.R. Vit-4239	Trawl (camera)		Mero, 1965		X-ray fluorescence spectrography	0.44	0.45	0.14	4.7	7.0	18.1	0.7	1.5
							Skornyakova et al., 1964		Wet chemical and colorimetry	0.46	0.43	0.10	5.17	12.49		1.3	2.4
153	087	23°54'N 148°00'W	5,220	Scripps Naga-15	Dredge	Nodule 1x3x3 cm	Mero, 1965		X-ray fluorescence spectrography	0.49	0.43	0.20	7.2	10.9	13.8	0.6	1.5
154	088	24°16'N 157°56'W	~3,968	Lamont RC12-188	Corer	Nodule	Lamont (unpublished)		Wet chemical	0.18	0.12	0.08	6.6	6.0			0.9
155	088	27°15'N 157°00'W	5,720	Lamont V21-D6	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.52	0.49	0.32	10.0	18.8		1.3	1.9
156	088	29°15'N 157°02'W	5,830	Lamont V21-D5	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	1.36	1.10	0.22	3.9	28.0		1.5	7.1
157	088	28°20'N 158°20'W	~5,360	Lamont RC12-187	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.96	0.30	0.28	10.1	15.2			1.5
158	088	28°24'N 159°11'W	5,680	Lamont V21-D4	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.62	0.27	0.32	11.6	16.4		1.6	1.4
159	088	23°01'N 159°21'W	4,856	Lamont V21-D8	Trawl (biology)	Crust	Lamont (unpublished)		Wet chemical	0.01	0.02	0.01	3.00	0.40			0.1

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
160	089	27°36'N 161°54'W	4,947	Lamont RC13-15	Corer (piston)	Nodule	Lamont (unpublished)		Atomic absorption	0.54	0.32	0.24	10.0	16.0			1.6
161	090	20°03'N 171°38'W	3,477	U.S.S.R. Vit-4331	Spoon	Nodule	Skornyakova et al., 1962	Outer layer	Wet chemical and colorimetry	0.27		0.46	17.7	26.8	6.6	2.3	1.5
162	090	24°00'N 175°40'W	5,318	U.S.S.R. Vit-4347	Scoop	Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.76	0.53	0.42	12.38	20.16			1.6
163	091	27°42'N 175°10'E	5,750	Scripps Jyn IV-11G	Corer (gravity)	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.81	0.52	0.26	13.87	20.20			1.5
164	091	23°55'N 173°40'E		U.S.S.R. Vit-3782		Crust	Nikolayev and Yefimova, 1963			0.38			13.40	19.15		1.6	1.4
165	091	23°57'N 170°58'E	5,817	U.S.S.R. Vit-4351	Spoon	Nodule	Skornyakova et al., 1964	Outer layer	Wet chemical and colorimetry	0.53	0.38	0.46	11.91	20.22	6.0	1.8	1.7
							Skornyakova et al., 1964		Wet chemical and colorimetry	1.09		0.39	13.24	20.69		1.7	1.6
166	092	24°01'N 163°02'E	5,542	U.S.S.R. Vit-4359	Spoon	Nodule	Skornyakova et al., 1962	Core	Wet chemical and colorimetry	0.54		0.32	11.2	17.2	9.5	2.4	1.5
						Nodule	Skornyakova et al., 1964		Wet chemical and colorimetry	0.41	0.29	0.36	14.59	16.08		1.6	1.1
						Nodule	Skornyakova et al., 1964		Wet chemical and colorimetry	0.48		0.25	14.52	17.10		1.7	1.2
167	092	24°04'N 160°46'E	3,951	U.S.S.R. Vit4362	Spoon	Nodule	Skornyakova et al., 1962		Wet chemical and colorimetry	0.49		0.47	11.3	22.5	6.1	2.8	2.0
168	093	26°12'N 153°44'E	6,120	U.S.S.R. Vit-4370	Trawl	Crust	Skornyakova et al., 1962	Outer layer	Wet chemical and colorimetry	0.41		0.36	14.6	16.1	7.2	1.6	1.1
						Nodule	Mero, 1965	Whole nodule	Emission spectrography	0.41	0.27	0.14	14.0	12.2	8.2	1.5	0.9
169	093	27°20'N 150°10'E	5,286			Nodule	Goldberg, 1954		Colorimetry	0.27	0.50	0.19	17.0	14.5			0.9
170	120	30°12'N 117°38'W	1,300	Scripps SOB-10D	Dredge	Crust	Cronan and Tooms, 1969		Emission spectrography	0.20	0.03	0.56	15.15	14.23			0.9
						Crust	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.18	0.04	0.40	14.7	10.7	11.8	1.5	0.7
171	120	31°19'N 117°38'W	2,100/ 2,120	Scripps SOB-5D	Trawl	Crust	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.34	0.06	0.08	11.4	13.4	12.5	0.9	1.2
172	120	30°18'N 117°40'W	1,060	Scripps SOB-27D	Dredge	Crust	Cronan and Tooms, 1969		Emission spectrography	0.59	0.04	0.59	11.85	14.40			1.2
							Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.24	0.08	0.23	12.3	7.8	15.6	1.0	0.6

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
173	120	32°50'N 118°00'W	~2,000	S Clem	Dredge	Mn coated steel frag.	Goldberg and Arrhenius, 1958	Coating		0.02	0.05	0.01		0.1		0.2	
174	120	31°23'N 118°03'W	1,040	Scripps SOB-20D	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.45	0.06	0.58	12.92	19.40			1.5
						Crust	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.23	0.05	0.53	14.5	13.7	12.5	1.6	0.9
175	120	32°45'N 118°13'W	1,588	S Clem-SV	Dredge	15 cm diam	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.19	0.05	0.14	16.1	14.5	9.8	1.6	0.9
176	120	31°05'N 118°37'W	1,830/ 1,650	Scripps SOB-25D	Dredge		Cronan and Tooms, 1969		Emission spectrography	0.48	0.13	0.20	9.22	14.59			1.6
							Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.13	0.04	0.26	16.4	11.8	12.0	1.6	0.7
177	120	31°21'N 119°03'W	695	Scripps SOB-22D	Dredge	Crust	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.24	0.06	0.19	10.3	11.7	12.4	0.7	1.1
178	122	32°56'N 132°30'W	710	U.S. Navy NEL-667	Dredge	Crust	Dietz, 1955		Colorimetry	0.40		0.90	11.4	25.6			2.2
179	122	39°38'N 135°06'W	4,790	Lamont V20-72	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.46	0.24	0.30	16.1	17.0		0.9	1.1
180	122	35°07'N 137°53'W	5,035	U.S.S.R. Vit-4199	Dredge		Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.33	0.29	0.29	13.0	10.4	13.4	1.1	0.8
181	122	31°51'N 139°58'W	4,991	Lamont RC11-D14	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.62	0.38	0.31	18.5	17.3		1.2	0.9
182	123	39°56'N 140°02'W	~4,748	Lamont RC11-D13	Dredge (pebble)	Nodule	Lamont (unpublished)		Wet chemical	0.50	0.28	0.26	14.3	15.5		1.2	1.1
183	123	34°04'N 145°56'W	5,390	Scripps UPWD-1	Dredge		Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.67	0.45	0.34	11.8	15.7	11.3	1.1	1.3
184	123	34°08'N 145°57'W	5,300	Scripps UPWD-2	Dredge		Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.59	0.34	0.34	11.6	15.0	11.3	1.2	1.3
185	124	30°22'N 154°56'W	5,400	Challenger Chal-256	Dredge	Nodule 3x4x3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.68	0.43	0.31	10.4	13.9	14.6	1.2	1.3
						Nodule 3 cm diam	Murray and Renard, 1891		Wet chemical	-1.	-1.5	-0.5	13.7	25.0	9.3	1.4	1.8
186	124	38°09'N 156°25'W	5,720	Challenger Chal-253	Dredge		Murray and Renard, 1891		Wet chemical	-1.	-1.	-0.5	15.48	16.6	10.9	2.0	1.1

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
187	124	31°31'N 159°42'W	5,720	Lamont V21-D3	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.52	0.44	0.40	12.2	19.2		1.3	1.6
188	125	37°52'N 160°17'W	5,020	Challenger Chal-252	Trawl	Nodule 6x6x8 cm	Riley and Sinhaseni, 1958	Whole nodule	Spectrography	0.40	0.26	0.13	12.4	19.9	8.8	1.0	1.6
						Nodule	Murray and Renard, 1891		Wet chemical	~1.	~0.2		14.32	18.0	13.0	1.8	1.3
						Nodule	Murray and Renard, 1891		Wet chemical	0.4	0.5	0.25	13.10	16.05	10.0	2.0	1.2
						Nodule	Murray and Renard, 1891		Wet chemical		~0.5		12.48	16.1	12.9	2.0	1.3
189	125	34°54'N 160°19'W	5,577	Lamont V21-D2	Trawl (biology)	Nodule	Lamont (unpublished)		Wet chemical	0.07	0.05	0.04	10.6	5.00		2.1	0.5
190	125	35°02'N 166°28'W	5,902/ 5,913	U.S.S.R. Vit-4090	Trawl	Nodule	Skornyakova et al., 1962	Outer 0.8 cm	Wet chemical and colorimetry	0.61		0.36	11.2	15.9	10.7	1.6	1.4
						Nodule	Skornyakova et al., 1962		Wet chemical and colorimetry	0.41		0.33	12.13	15.77	8.7	1.6	1.3
						Nodule	Skornyakova et al., 1962		Wet chemical and colorimetry	0.64		0.31	10.57	18.69	8.5	1.4	1.8
191	126	35°00'N 172°57'W	5,971	U.S.S.R. Vit-4084	Spoon	Nodule	Skornyakova et al., 1962	Outer 0.5 cm	Wet chemical and colorimetry	0.29		0.22	10.8	13.1	12.9	1.6	1.2
192	126	36°30'N 173°16'W	4,195	Scripps Ck-16	Corer		Scripps-NODC (unpublished)		Emission spectrography	0.50	0.50	0.39	9.5	14.5	13.1	1.4	1.5
193	127	37°41'N 177°04'E	5,300	Challenger Chal-248	Trawl	Nodule	Riley and Sinhaseni, 1958	Whole nodule	Spectrography	0.28	0.43	0.09	10.3	16.5	11.2	1.2	1.6
194	128	37°03'N 166°34'E	4,978	Lamont RC11-D5	On camera frame	Nodule	Lamont (unpublished)		Wet chemical	0.26	0.14	0.09	17.4	12.5		1.4	0.7
195	128	34°47'N 160°40'E	4,226	Lamont RC10-176	Corer (piston)	Nodule	Lamont (unpublished)		Wet chemical	0.12	0.16	0.10	15.9	9.60		1.1	0.6
196	130	36°29'N 146°43'E	5,720	Scripps Jyn II-21	Corer (gravity)	Nodule 2.5x1x1 cm	Mero, 1965	Whole nodule	X-ray fluorescence spectrography	0.12	0.07	0.00	11.8	1.9	26.4	1.3	0.2
197	130	38°00'N 146°00'E	3,500	Univ. of Tokyo JEDS-5	Trawl	Crust 3 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.38	0.10	0.29	13.9	19.8	3.3	2.2	1.4
198	157	40°23'N 127°59'W	1,260	Scripps Fan-BD-25	Dredge	Crust 1 cm	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.61	0.04	0.43	8.8	23.5	7.1	1.2	2.7
							Ahrens et al., 1967		Emission spectrography	0.42	0.02	0.50	14.1	21.0		2.4	1.5
							Hewett et al., 1963		Emission spectrography	0.3	0.07	0.3	>10.	>10.		3.	

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
199	157	42°45'N 128°03'W	2,520	Cas D-5	Dredge		Scripps-NODC (unpublished)		Emission spectrography	0.16	0.06	0.17	21.7	15.2	13.5	1.8	0.7
							Scripps-NODC (unpublished)		Emission spectrography	0.15	0.05	0.16	21.7	17.5	13.	2.1	0.8
							Scripps-NODC (unpublished)		X-ray fluorescence spectrography	0.11	0.04	0.12	15.7	12.8	9.4	1.5	0.8
						Nodule 3x2x2 cm	Ahrens et al., 1967		Emission spectrography	0.32	0.03	0.45	19.6	22.8		2.2	1.2
200	157	40°16'N 128°28'W	4,060/ 4,400	Scripps Fan-BD-20	Dredge	Nodule	Cronan and Tooms, 1969		Emission spectrography	0.44	0.37	0.10	10.12	11.76			1.2
						Nodule	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.56	0.37	0.07	8.4	18.8	12.6	1.1	2.2
						Nodule	Ahrens et al., 1967	Pieces	Emission spectrography	0.55	0.45	0.12	8.75	20.3		1.3	2.3
201	158	40°20'N 135°47'W	4,471/ 4,477	U.S.S.R. Vit-4191	Corer, Trawl	Nodule 3 cm diam	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.58	0.22	0.36	9.5	16.5	13.3	1.4	1.7
						Nodule	Skornyakova et al., 1964		Wet chemical and colorimetry	0.48	0.21	0.29	14.05	16.06		1.7	1.1
						Nodule	Skornyakova et al., 1968		Wet chemical and colorimetry	0.47	0.21	0.29	11.51	16.65			1.5
202	158	42°02'N 139°57'W	~ 4,116	Lamont RC11-D12	Dredge (pebble)	Nodules 2x2x1 cm	Lamont (unpublished)		Wet chemical	0.24	0.08	0.24	23.0	19.0		1.6	0.8
203	159	43°58'N 140°38'W	4,350	Scripps Cusp-8P	Corer	Nodule 1.2 cm diam	Mero, 1965	X-sect.	X-ray fluorescence spectrography	0.72	0.42	0.23	9.4	17.7	11.8	1.7	1.9
204	160	40°14'N 155°55'W	4,938			Nodule from crust	Ahrens et al., 1967	Half nodule	Emission spectrography	0.28	0.29	0.35	12.0	14.3		1.5	1.2
205	160	40°14'N 155°55'W	5,029	Scripps NH-C10	Caught in core wire	Crust ("Horizon")	Mero, 1965	Outer 2 cm	X-ray fluorescence spectrography	0.45	0.47	0.23	6.9	11.9	13.9	1.0	1.7
							Goldberg, 1954		Colorimetry	0.63		0.25	11.6	13.2			1.1
206	160	41°08'N 159°54'W	5,435/ 5,456	U.S.S.R. Vit-4104	Trawl	Nodule	Skornyakova et al., 1962	Outer layer	Wet chemical and colorimetry	0.43		0.31	8.92	13.25	14.7	1.9	1.5
207	162	40°24'N 175°42'W	6,065	U.S.S.R. Vit-4074	Trawl	Nodule	Skornyakova et al., 1962	Outer layer	Wet chemical and colorimetry	0.22	0.16	0.13	10.7	12.0	14.4	1.9	1.1

TABLE 2. CHEMICAL ANALYSES OF FERROMANGANESE NODULES AND CRUSTS - NORTH PACIFIC

Map no.	Mrsdn. Sq.	Location Lat. Long.	Depth m	Institution Number	Method of sampling	Description of FeMn	Publication or source	Portion analyzed	Analytical method	Results of Chemical Analyses in Weight Percent							
										Ni	Cu	Co	Fe	Mn	Si	Ca	Mn/Fe
208	163	40°30'N 170°48'E	5,460	Scripps Jyn II-9G	Corer		Cronan and Tooms, 1969		Emission spectrography	0.22	0.12	0.15	12.77	6.97			0.5
209	163	44°28N 170°15'E	1,258	U.S.S.R. Vit-3150	Trawl	Nodule	Skornyakova et al., 1962	Outer 1 cm	Wet chemical and colorimetry	0.12		0.41	7.8	33.9	2.8	1.9	4.3
210	195	56°10'N 145°15'W	1,370/ 1,800	Scripps NH-D7	Dredge (chain bag)	Crust	Goldberg, 1954		Colorimetry	0.45	0.40	0.26	13.1	20.9			1.6
211	196	52°47'N 150°05'W	1,500	Scripps NH-D1	Dredge (chain bag)	Crust	Goldberg, 1954		Colorimetry	0.32	0.21	0.31	14.8	19.4			1.3

TABLE 3

PHYSICAL PROPERTIES OF THE SUBSTRATE

AS DETERMINED BY ANALYSIS OF SAMPLES

FROM THE TOPS OF PISTON CORES

NORTH PACIFIC

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
1	010	06°19'N	90°37'W	3,647	V24-38	1.14	2.22	401.94	90	9.05					
2	010	04°45'N	90°56'W	3,032	RC13-139	1.37	2.62	133.84	78	3.56					
3	010	08°27'N	91°33'W	3,493	RC10-248	1.23	2.31	216.19	83	5.06					
4	010	06°37'N	91°52'W	3,579	RC13-135	1.19	2.95	342.12	91	10.24					
5	010	04°21'N	93°16'W	3,338	RC10-57	1.40	2.52	114.37	74	2.92					
6	010	04°53'N	93°34'W	3,413	V24-39	1.29	2.64	183.55	83	4.90					
7	010	01°49'N	94°08'W	2,655	RC13-138	1.31	2.43	159.28	79	3.92					
8	010	06°08'N	94°47'W	3,660	RC10-58	1.18	2.19	276.33	86	6.14					
9	010	09°39'N	95°23'W	4,098	RC13-134	1.13	2.76	522.84	93	14.63					
10	010	00°06'N	95°39'W	3,231	RC13-110	1.30	2.28	149.98	77	3.47					
11	010	00°51'N	96°02'W	3,436	RC13-137	1.20	2.11	239.73	83	5.12					
12	010	05°34'N	96°19'W	3,662	RC10-59	1.26	2.77	218.85	86	6.15					
13	010	03°04'N	97°08'W	3,204	V24-40	1.38	2.98	144.42	81	4.36					
14	010	00°50'N	97°28'W	3,446	V21-208	1.40	2.72	123.69	77	3.41					
15	010	07°52'N	97°39'W	3,484	RC13-132	1.15	2.62	427.93	91	11.38					
16	011	03°20'N	101°43'W	3,120	RC10-62	1.35	2.40	129.50	75	3.14					
17	011	02°19'N	104°27'W	3,468	RC10-63	1.41	2.56	111.84	74	2.89					
18	011	01°49'N	105°41'W	3,499	RC10-64	1.40	2.51	116.26	74	2.95					
19	011	03°11'N	106°23'W	3,667	V21-205	1.46	2.56	96.55	71	2.50					
20	011	00°58'N	106°54'W	3,687	RC13-118	1.27	2.21	164.37	78	3.68					
21	011	05°25'N	106°54'W	3,821	RC13-121	1.36	2.70	145.30	79	3.97					
22	011	02°32'N	107°13'W	3,792	RC13-119	1.41	2.62	114.42	75	3.03					
23	011	03°51'N	107°14'W	3,753	RC13-120	1.39	2.78	131.94	78	3.72					
24	011	00°41'N	108°37'W	3,588	RC10-65	1.32	2.57	160.69	80	4.18					
25	011	01°43'N	109°20'W	3,720	V24-48	1.39	2.55	122.57	75	3.16					
26	012	06°50'N	110°28'W	3,696	RC10-75	1.42	2.82	122.53	77	3.50					
27	012	04°23'N	110°53'W	3,928	V21-203	1.44	2.78	113.16	76	3.19					
28	012	05°42'N	111°37'W	4,100	RC10-74	1.28	2.89	211.70	86	6.20					
29	012	00°49'N	112°44'W	3,878	V24-49	1.33	2.30	132.84	75	3.09					
30	012	02°48'N	113°37'W	3,780	RC10-72	1.32	2.34	141.02	76	3.34					
31	012	05°03'N	113°49'W	4,039	V21-202	1.42	2.49	105.85	72	2.67					
32	012	01°48'N	114°32'W	3,856	V24-50	1.35	2.40	129.01	75	3.13					
33	012	01°27'N	114°42'W	3,860	RC10-71	1.36	2.43	125.76	75	3.10					
34	012	01°20'N	114°54'W	3,891	RC10-70	1.37	2.66	137.89	78	3.71					
35	013	01°40'N	120°20'W	4,409	V24-51	1.30	2.58	176.65	82	4.62					
36	013	07°18'N	125°20'W	4,610	RC10-93	1.24	2.69	240.87	86	6.57					

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
37	013	01°51'N	129°01'W	4,473	V24-53	1.43	2.38	94.89	69	2.29					
38	014	08°38'N	130°11'W	4,890	V21-197	1.18	2.26	300.27	87	6.88					
39	014	09°48'N	136°11'W	4,819	V21-196	1.20	2.50	281.03	87	7.11					
40	014	02°14'N	136°15'W	4,341	V24-56	1.43	2.39	97.71	70	2.37					
41	014	08°47'N	139°53'W	5,086	RC11-206*	1.20	2.57	299.86	88	7.81					
42	015	01°41'N	140°03'W	4,420	RC11-210	1.37	2.35	115.86	73	2.76					
43	015	03°39'N	140°04'W	4,400	RC11-209	1.43	2.51	101.55	72	2.58					
44	015	02°16'N	141°40'W	4,490	V24-58	1.35	2.53	138.66	78	3.55					
45	015	04°39'N	144°58'W	4,868	RC12-65						0.00	1.71	45.31	52.98	2.90
46	015	02°34'N	145°32'W	4,662	V24-59	1.31	2.72	173.56	82	4.78					
47	015	02°37'N	148°13'W	4,755	RC12-66						0.00	2.13	40.38	57.59	2.45
48	015	02°48'N	149°00'W	4,859	V24-60	1.17	2.76	368.95	91	10.33	0.00	0.59	32.15	67.26	1.72
49	016	01°21'N	153°04'W	4,420	RC13-63	1.38	2.44	118.58	74	2.92					
50	016	03°06'N	153°09'W	4,846	RC13-62	1.40	2.50	113.80	74	2.88					
51	016	05°22'N	153°11'W	4,786	RC13-61	1.24	2.24	201.63	82	4.57					
52	016	06°52'N	153°19'W	5,017	RC13-60	1.11	1.58	305.03	83	4.89					
53	016	03°04'N	153°35'W	4,834	V24-62	1.54	2.89	89.29	72	2.61	0.00	10.75	33.12	56.13	3.06
54	016	09°37'N	153°42'W	5,203	RC13-59	1.16	1.87	257.38	83	4.89					
55	016	04°10'N	159°04'W	3,933	V24-64	1.66	2.69	59.29	61	1.61					
56	017	09°31'N	160°50'W	4,868	RC13-57	1.26	2.25	184.69	80	4.21					
57	017	08°53'N	164°26'W	4,925	RC13-56	1.47	2.97	109.08	76	3.27					
58	017	07°31'N	164°60'W	4,982	RC12-81	1.28	2.48	184.66	82	4.63					
59	017	04°32'N	165°01'W	4,854	RC12-82	1.34	3.01	170.73	83	5.21					
60	017	08°32'N	166°58'W	5,161	RC13-51	1.16	2.13	316.99	87	6.83					
61	017	00°22'N	167°10'W	5,393	RC13-48	1.24	2.64	239.42	86	6.41					
62	017	09°41'N	168°42'W	5,222	RC12-195*	1.22	2.92	278.42	89	8.23					
63	018	05°43'N	170°55'W	5,901	RC13-20	1.13	2.88	561.21	94	16.37					
64	018	08°33'N	170°59'W	5,169	RC13-19*	1.21	2.30	250.26	85	5.84					
65	018	02°28'N	171°08'W	5,298	RC13-21	1.14	2.16	387.80	89	8.49					
66	018	00°02'N	175°04'W	5,218	RC13-23	1.26	2.47	201.97	83	5.06					
67	018	04°57'N	175°04'W	5,316	RC13-24	1.16	2.58	382.13	90	10.01					
68	019	01°28'N	174°52'E	4,691	RC12-200*	1.32	2.78	174.30	83	4.91					
69	019	06°41'N	177°14'E	5,482	RC13-32	1.23	2.80	262.65	88	7.46					
70	019	07°35'N	178°25'E	~5,565	RC12-199	1.15	2.19	357.33	88	7.94					
71	021	06°46'N	150°23'E	4,451	RC10-149	1.26	2.32	183.58	81	4.32					
72	023	03°04'N	135°33'E	4,464	V24-140	1.33	2.62	155.85	80	4.14					

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
73	024	09°10'N	124°12'E	1,524	RC12-358	1.35	3.18	169.24	84	5.46					
74	024	07°21'N	120°31'E	4,276	V24-135	1.30	2.73	182.94	83	5.06					
75	024	08°58'N	120°14'E	2,049	RC12-357	1.30	2.62	179.18	82	4.75					
76	025	07°27'N	114°33'E	525	RC12-353	1.41	3.43	146.88	83	5.10					
77	025	07°30'N	114°30'E	1,344	RC12-355	1.33	2.58	155.58	80	4.07					
78	025	07°30'N	114°13'E	1,390	RC12-356	1.36	2.96	158.01	82	4.73					
79	025	07°30'N	114°13'E	1,161	RC12-354	1.38	2.73	135.09	78	3.73					
80	025	06°00'N	114°01'E	2,303	RC12-352	1.23	2.65	252.96	87	6.79					
81	025	05°02'N	113°35'E	1,229	RC12-351	1.39	2.43	115.53	74	2.85					
82	025	06°33'N	111°13'E	1,950	RC12-350	1.28	2.73	205.13	85	5.68					
83	027	08°44'N	94°12'E	3,797	RC12-348	1.21	2.85	297.87	89	8.61					
84	027	09°08'N	90°02'E	3,010	RC12-339	1.43	2.78	114.63	76	3.22					
85	046	10°26'N	91°16'W	3,716	RC12-30	1.19	2.33	276.07	86	6.52					
86	046	12°60'N	92°39'W	4,034	RC12-32	1.30	2.48	168.28	80	4.23					
87	046	14°50'N	93°57'W	412	RC12-33	1.44	2.97	118.85	78	3.57					
88	046	10°01'N	94°02'W	3,797	RC12-133	1.17	2.46	343.95	89	8.57					
89	046	11°34'N	96°45'W	4,330	RC13-131	1.15	2.32	372.01	89	8.73					
90	046	11°08'N	98°44'W	3,680	RC10-245	1.19	2.36	277.50	86	6.63					
91	046	12°27'N	99°02'W	3,451	RC13-130	1.21	2.76	298.11	89	8.34					
92	046	16°09'N	99°39'W	5,365	RC13-128	1.42	2.85	124.15	78	3.58					
93	047	13°55'N	100°14'W	3,649	RC13-129	1.15	2.02	329.42	87	6.76					
94	047	12°50'N	100°32'W	3,455	RC13-124	1.18	2.51	323.26	89	8.23					
95	047	12°45'N	101°12'W	3,382	RC13-125	1.17	3.11	412.58	92	13.01					
96	047	12°08'N	101°30'W	3,288	RC13-127	1.19	3.32	380.87	92	12.83					
97	047	12°09'N	102°12'W	3,147	RC13-126	1.14	2.60	465.50	92	12.27					
98	047	12°50'N	103°19'W	3,012	RC13-123	1.23	2.60	245.84	86	6.49					
99	048	15°08'N	113°28'W	3,919	RC10-89	1.15	2.22	370.36	89	8.35					
100	051	19°29'N	140°02'W	5,574	RC11-199	1.33	2.59	151.47	79	3.97					
101	051	14°52'N	140°02'W	4,828	RC11-200	1.39	2.46	116.14	74	2.89					
102	051	12°32'N	140°05'W	4,996	RC11-202	1.21	2.31	251.53	85	5.88					
103	051	11°42'N	142°48'W	5,099	V21-194	1.15	2.20	373.83	89	8.33					
104	051	10°02'N	143°38'W	5,253	RC10-103	1.18	2.06	253.41	84	5.28					
105	052	13°44'N	150°00'W	5,218	V21-191	1.26	2.41	191.30	82	4.67					
106	052	16°49'N	154°11'W	4,947	V21-189	1.27	2.42	183.54	81	4.50					
107	052	10°22'N	157°08'W	5,343	RC13-58	1.23	2.26	215.23	83	4.92					
108	053	19°20'N	160°17'W	4,826	RC12-191	1.21	2.42	253.69	86	6.22					

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Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
109	053	13°57'N	160°58'W	5,737	RC13-55	1.28	2.75	201.23	84	5.60					
110	053	16°28'N	161°43'W	5,590	RC12-78	1.38	2.57	128.52	77	3.35					
111	053	16°57'N	163°00'W	5,773	RC12-192	1.30	2.77	186.59	83	5.24					
112	053	13°50'N	163°32'W	5,460	RC12-79 *	1.29	2.48	172.60	81	4.34					
113	053	13°58'N	163°46'W	5,546	RC13-54	1.25	2.69	226.87	86	6.17					
114	053	17°31'N	164°41'W	5,473	V24-72	1.36	2.80	147.97	80	4.20					
115	053	16°05'N	165°52'W	5,295	RC12-193 *	1.40	2.47	112.40	73	2.81					
116	053	19°34'N	166°39'W	5,242	RC13-16	1.17	2.93	386.20	91	11.48					
117	053	16°29'N	166°47'W	5,234	V24-73	1.38	2.98	145.79	81	4.41					
118	053	13°57'N	167°00'W	5,442	RC13-53	1.45	2.60	101.16	72	2.66					
119	053	11°59'N	167°02'W	5,176	RC13-52	1.26	2.61	208.76	84	5.51					
120	053	13°49'N	167°18'W	5,152	RC12-194	1.40	3.05	138.07	81	4.27					
121	053	14°53'N	169°51'W	5,669	V24-74	1.38	2.61	126.58	77	3.35					
122	054	14°20'N	170°55'W	4,429	V24-75	1.35	2.75	153.47	81	4.28					
123	054	10°51'N	175°03'W	4,605	RC13-25	1.44	2.49	99.53	71	2.51					
124	054	13°51'N	175°14'W	4,217	RC13-26	1.52	2.74	88.67	71	2.46					
125	054	13°52'N	175°18'W	4,488	RC13-28	1.29	2.78	199.42	84	5.62					
126	055	13°10'N	178°53'E	~3,336	V24-101	1.66	2.72	60.04	62	1.65					
127	055	13°55'N	178°20'E	5,506	RC13-30	1.27	2.62	207.02	84	5.50					
128	055	12°18'N	177°11'E	5,638	RC13-31	1.28	3.43	236.06	89	8.20					
129	055	10°53'N	173°00'E	5,374	V24-80	1.19	2.29	280.93	86	6.52					
130	056	19°52'N	162°58'E	4,808	V24-88	1.44	2.46	96.82	70	2.41					
131	056	19°04'N	161°23'E	~4,879	V24-87	1.35	2.87	158.68	82	4.61					
132	056	19°03'N	161°19'E	~3,985	V24-86	1.63	2.93	72.25	68	2.14					
133	056	16°48'N	161°04'E	5,603	V24-84	1.30	2.90	194.36	85	5.70					
134	057	17°51'N	158°52'E	5,510	V24-85	1.35	2.94	164.07	83	4.89					
135	057	18°05'N	152°57'E	5,218	RC12-129 *	1.36	2.56	136.01	77	3.53					
136	057	11°19'N	152°05'E	5,861	V24-113	1.27	2.52	195.05	83	4.99					
137	057	14°42'N	150°33'E	5,993	V24-114						0.00	1.92	20.36	77.72	1.08
138	059	15°32'N	136°24'E	4,184	V21-119	1.36	2.79	148.22	80	4.19					
139	059	15°16'N	135°22'E	4,987	V21-120	1.41	2.88	129.82	79	3.79					
140	059	19°34'N	134°30'E	5,826	V21-116	1.41	2.60	114.00	75	3.00					
141	059	15°07'N	133°20'E	4,746	V21-122	1.42	2.44	101.28	71	2.50					
142	060	13°00'N	127°03'E	5,075	V21-126	1.40	2.66	122.22	76	3.29					
143	060	15°06'N	124°08'E	3,528	RC12-361	1.59	2.94	79.65	70	2.37					
144	060	18°11'N	120°04'E	3,189	V24-128	1.63	2.50	56.57	58	1.43					

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
145	061	14°14'N	119°50'E	2,518	V24-126	1.81	2.60	37.74	49	.99					
146	063	11°12'N	95°08'E	2,692	RC12-345	2.69	3.24	9.95	24	.32					
147	063	15°10'N	90°34'E	2,666	RC12-343	1.41	2.62	116.42	75	3.08					
148	063	12°42'N	90°01'E	3,012	RC12-340	1.38	2.55	124.78	76	3.22					
149	085	21°15'N	125°07'W	4,468	RC10-237	1.52	2.89	92.31	72	2.70	0.00	0.01	21.27	78.72	1.00
150	085	22°58'N	128°17'W	4,491	RC10-236	1.54	2.85	86.06	71	2.49	0.00	0.00	12.49	87.51	0.83
151	085	28°38'N	129°06'W	4,281	RC10-234	1.54	2.95	89.90	72	2.68	0.00	0.17	18.08	81.75	0.96
152	085	25°50'N	129°25'W	4,737	RC10-235	1.48	2.54	89.42	69	2.30	0.00	0.00	17.67	82.33	0.94
153	086	29°11'N	139°55'W	4,927	RC11-196						0.00	0.00	15.50	84.50	0.85
154	087	21°31'N	140°00'W	5,378	RC11-198						0.00	0.15	13.81	86.04	0.97
155	088	28°00'N	151°10'W	5,338	V20-66						0.00	0.01	15.05	84.94	0.83
156	088	25°51'N	153°12'W	5,363	V20-65						0.00	0.04	18.76	81.20	0.98
157	088	23°21'N	155°52'W	4,205	V20-64						0.00	0.66	31.35	67.99	1.50
158	088	27°15'N	157°00'W	5,711	V21-183	1.47	2.47	89.90	69	2.25	0.00	0.00	20.13	79.87	1.09
159	088	29°51'N	157°02'W	5,824	V21-182	1.44	2.79	112.48	76	3.18	0.00	0.03	15.59	84.38	0.93
160	088	27°36'N	157°30'W	5,506	RC13-10						0.00	0.01	16.00	83.99	.92
161	088	27°44'N	157°44'W	5,583	RC13-8						0.00	0.02	16.28	83.72	.94
162	088	27°33'N	157°50'W	5,504	RC13-9						0.00	0.01	15.43	84.56	.90
163	088	23°53'N	157°52'W	4,431	RC12-189	1.42	2.66	116.28	75	3.13					
164	088	25°03'N	157°54'W	4,804	V21-184	1.51	2.82	94.33	72	2.69	0.00	0.05	22.17	77.78	1.06
165	088	20°47'N	157°56'W	1,476	RC12-173	1.51	2.98	98.66	74	2.98					
166	088	24°16'N	157°56'W	~3,968	RC12-188*	1.34	2.41	137.51	77	3.36					
167	088	20°55'N	158°06'W	2,992	V21-59						0.00	1.96	43.82	54.22	2.13
168	088	28°12'N	158°07'W	5,544	RC12-437	1.53	2.77	85.38	70	2.40					
169	088	20°51'N	158°09'W	3,751	V21-60	1.52	2.57	80.66	67	2.10	0.00	1.52	51.14	47.34	3.05
170	088	20°52'N	158°09'W	3,762	V21-187	1.48	2.50	88.17	69	2.23	0.00	1.58	50.84	47.58	2.84
171	088	28°20'N	158°20'W	~5,360	RC12-187*	1.38	2.29	108.97	71	2.52					
172	088	28°51'N	158°21'W	5,302	V21-181	1.45	2.68	104.39	73	2.83	3.97	0.06	15.00	80.97	0.93
173	088	22°27'N	158°23'W	4,927	RC12-190	1.33	2.55	152.38	79	3.93					
174	088	28°24'N	159°11'W	5,676	V21-180						0.00	0.01	15.46	84.47	0.79
175	088	23°01'N	159°21'W	4,857	V21-185	1.51	2.94	96.73	74	2.88	0.00	1.46	74.11	24.44	9.24
176	089	21°36'N	161°26'W	4,583	V21-61	1.49	2.80	96.68	73	2.74	0.00	0.39	37.24	62.37	1.92
177	089	22°14'N	165°14'W	4,625	V21-62	1.60	2.77	72.40	67	2.03	0.00	0.02	48.56	51.42	2.08
178	089	22°51'N	169°41'W	4,674	V21-63	1.69	2.53	48.34	55	1.24	0.00	0.02	16.91	83.07	0.99
179	090	23°27'N	173°13'W	4,867	V21-64	1.59	2.60	67.71	64	1.78	0.00	0.00	20.61	79.39	1.17
180	090	29°05'N	174°35'W	5,340	V20-100						0.00	0.01	22.00	77.99	1.07

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181	090	23°58'N	176°51'W	5365	V21-65						0.00	0.00	16.57	83.43	0.88
182	090	28°18'N	176°57'W	4460	V20-101						0.00	0.16	42.95	56.89	2.58
183	090	24°48'N	178°04'W	5447	V24-97	1.45	2.52	97.05	71	2.48					
184	091	24°31'N	179°21'E	5601	V21-66	1.63	2.86	69.12	66	2.00	0.00	0.02	19.12	80.86	0.95
185	091	26°34'N	177°46'E	5700	V24-94	1.28	2.46	182.82	82	4.56					
186	091	27°36'N	177°46'E	5287	V24-95	1.48	2.64	93.99	71	2.51					
187	091	24°58'N	176°16'E	5879	V21-67	1.64	2.72	62.34	63	1.71	0.00	0.00	11.28	88.72	0.84
188	091	25°48'N	176°13'E	5782	V24-93	1.48	2.86	104.44	75	3.02					
189	091	24°57'N	174°00'E	5909	V24-92	1.42	2.65	114.69	75	3.08					
190	091	25°31'N	172°45'E	5964	V21-68						0.00	0.00	19.05	80.95	0.97
191	091	23°39'N	170°52'E	5936	V24-91	1.46	2.77	105.45	74	2.95					
192	092	26°26'N	169°02'E	5982	V21-69	1.51	2.54	80.88	67	2.08	0.00	0.00	23.72	76.28	1.13
193	092	27°05'N	166°04'E	5954	V21-70						0.00	0.00	20.36	79.64	1.05
194	092	20°52'N	165°07'E	5544	V24-89	1.25	2.41	203.77	83	4.97					
195	092	27°54'N	162°31'E	5954	V21-71	1.65	2.48	52.73	57	1.32	0.43	0.03	25.10	74.44	1.22
196	092	28°07'N	160°36'E	5892	RC10-158	1.51	2.62	84.78	69	2.25	0.00	0.05	20.77	79.18	1.09
197	093	24°46'N	159°08'E	5682	RC10-157	1.46	2.61	97.59	72	2.57	0.00	0.08	25.27	74.65	1.27
198	093	28°47'N	158°50'E	5369	V21-72	1.45	2.61	101.90	72	2.70	0.00	0.29	17.35	82.36	0.89
199	093	22°20'N	157°49'E	5402	RC10-156	1.37	2.39	118.73	74	2.88	0.00	0.04	38.57	61.39	1.17
200	093	28°19'N	156°53'E	6190	RC12-405	1.43	2.86	121.41	77	3.51					
201	093	27°30'N	156°36'E	6128	RC12-408	1.36	2.82	151.72	81	4.34					
202	093	25°44'N	154°58'E	5768	RC12-407	1.22	2.36	238.16	85	5.70					
203	093	25°35'N	154°37'E	5801	RC12-406	1.22	2.64	258.61	87	6.93					
204	093	29°28'N	154°36'E	5872	V21-73	1.38	2.47	118.95	74	2.97	0.00	0.21	25.51	74.28	1.20
205	093	20°25'N	151°34'E	5801	RC12-130	1.17	2.41	336.18	89	8.21					
206	093	29°51'N	150°50'E	6015	V21-74						0.00	0.44	27.26	72.30	1.34
207	094	20°55'N	149°55'E	3177	RC11-158						0.00	1.78	63.70	34.52	5.90
208	094	26°48'N	142°54'E	4025	RC 11-160						0.00	2.17	43.77	54.06	2.54
209	094	23°26'N	149°17'E	5804	RC12-131	1.51	2.68	87.86	70	2.38					
210	094	26°40'N	146°47'E	5431	RC12-132	1.47	2.62	95.33	71	2.52					
211	094	29°06'N	144°25'E	5854	RC 12-133	1.27	2.47	193.48	82	4.84					
212	094	27°54'N	140°03'E	3702	V21-83	1.64	2.31	45.39	51	1.06					
213	094	27°57'N	141°22'E	4116	V21-84						0.00	1.60	23.06	75.34	1.19
214	094	27°58'N	142°30'E	1684	V21-85	1.60	2.39	56.84	57	1.37	0.00	73.16	15.41	11.43	87.70
215	094	27°53'N	145°03'E	5717	V21-86	1.41	2.49	107.92	73	2.72	0.00	2.28	26.36	71.36	2.11
216	094	27°53'N	146°35'E	5879	V21-87	1.53	2.43	72.14	64	1.78	0.00	2.87	36.55	60.58	2.16

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217	094	23°35'N	145°39'E	5821	V21-89	1.52	2.61	82.68	68	2.18	0.00	0.96	57.57	41.47	6.91
218	094	23°57'N	144°23'E	5841	V21-90	2.00	2.99	33.38	50	1.01	0.00	21.33	42.85	35.82	9.82
219	094	23°25'N	143°23'E	5128	V21-91	1.44	2.51	101.19	72	2.57	0.00	0.88	73.51	25.61	8.33
220	094	23°00'N	143°10'E	4283	V21-92	1.55	2.79	83.37	70	2.35	0.00	1.93	61.49	36.58	5.44
221	094	24°37'N	142°28'E	2878	V21-93	1.38	2.53	125.86	76	3.23	0.00	42.11	52.13	5.76	56.30
222	094	28°33'N	146°53'E	5949	V21-140						0.00	0.70	34.62	64.68	1.78
223	095	27°56'N	138°13'E	4565	V21-82	1.46	2.90	111.07	76	3.26					
224	095	24°38'N	136°56'E	4971	V21-137	1.36	2.45	129.53	76	3.21					
225	095	29°02'N	136°30'E	4352	V21-81	1.75	2.58	43.68	53	1.14					
226	095	23°41'N	136°05'E	4868	V21-97	1.44	2.96	121.16	78	3.63					
227	095	29°41'N	134°47'E	4799	RC12-142	1.39	2.90	139.15	80	4.09	0.00	0.77	47.10	52.13	2.93
228	095	23°06'N	134°26'E	2135	V21-98	1.62	2.81	68.74	66	1.95					
229	095	23°27'N	134°04'E	5042	V21-136	1.44	3.12	125.85	79	3.97					
230	095	29°46'N	133°17'E	~2350	RC12-143	1.46	2.55	95.77	71	2.47					
231	095	23°32'N	132°14'E	5148	V21-99	1.42	2.44	104.09	72	2.57					
232	095	29°07'N	132°14'E	4931	RC12-144	1.39	2.39	109.60	72	2.65					
233	095	29°20'N	131°58'E	5620	RC12-145	1.34	2.25	124.98	74	2.84					
234	095	23°35'N	131°26'E	5233	V21-100	1.34	2.48	144.07	78	3.62					
235	095	29°33'N	131°25'E	3922	RC12-146	1.45	2.35	88.78	67	2.11					
236	095	21°28'N	130°03'E	5929	V21-135	1.40	2.68	124.54	77	3.38					
237	096	23°55'N	127°58'E	5960	V21-112	1.43	2.43	100.32	71	2.47					
238	096	20°43'N	126°23'E	5298	V21-134	1.69	2.68	54.94	59	1.49					
239	096	26°35'N	126°20'E	1644	RC12-366	1.48	2.97	107.49	76	3.24					
240	096	23°57'N	126°11'E	2787	RC12-365	1.54	2.60	77.31	67	2.04					
241	096	21°45'N	125°35'E	4936	RC12-364	1.46	2.77	106.23	74	2.98					
242	121	37°58'N	128°34'W	4726	RC10-231	1.42	3.16	134.77	81	4.31	0.00	0.00	33.19	66.81	1.32
243	121	35°35'N	128°39'W	4674	RC10-232	1.40	2.54	114.18	74	2.93	0.00	0.25	13.33	86.42	0.73
244	122	39°38'N	133°41'W	4773	V20-73						0.00	1.45	14.64	83.91	0.83
245	122	39°38'N	135°06'W	4790	V20-72 *						0.00	0.14	16.38	83.48	0.90
246	122	37°42'N	137°51'W	5302	V20-71						0.00	0.01	17.16	82.83	0.85
247	122	35°00'N	139°57'W	5303	RC11-194	1.44	2.50	98.06	71	2.48	0.00	0.00	15.14	84.86	0.87
248	122	31°51'N	139°58'W	4934	RC11-195	1.42	2.42	99.80	70	2.44	0.00	0.00	14.59	85.41	0.86
249	123	39°56'N	140°02'W	4748	RC11-193	1.44	2.63	105.55	73	2.81	0.00	0.01	16.86	83.13	0.92
250	123	35°42'N	140°51'W	5207	V20-70						0.00	1.00	17.75	81.25	0.89
251	123	30°58'N	146°48'W	5788	V20-68						0.00	0.00	19.49	80.51	0.92
252	123	30°33'N	148°12'W	5042	V20-67						0.00	1.55	15.63	82.82	0.94

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253	124	39°12'N	153°25'W	5706	V20-89						0.00	0.12	17.32	82.56	0.87
254	124	38°48'N	155°37'W	5991	V20-90						0.00	0.05	19.57	80.38	0.97
255	124	37°18'N	157°42'W	5863	V20-91						0.00	0.01	20.44	79.55	0.99
256	124	38°00'N	158°57'W	5576	RC12-184	1.34	2.44	139.00	77	3.43					
257	124	32°25'N	158°58'W	5993	RC12-186	1.36	2.49	132.39	76	3.34					
258	124	35°16'N	159°00'W	5929	RC12-185	1.37	2.87	145.18	80	4.22					
259	124	30°43'N	159°34'W	5771	V21-179						0.00	0.03	16.59	83.38	0.87
260	124	36°18'N	159°38'W	5764	V20-92						0.00	0.27	19.63	88.10	0.98
261	124	31°31'N	159°42'W	5720	V21-178	1.49	2.88	100.79	74	2.94	0.00	0.27	24.85	74.88	1.25
262	124	31°12'N	159°45'W	5885	RC12-436	1.32	2.58	163.14	81	4.26					
263	125	33°52'N	160°08'W	6022	V21-177	1.41	2.51	110.90	73	2.81	0.00	0.00	16.44	83.56	0.97
264	125	34°54'N	160°19'W	6521	V21-176						0.00	0.03	18.03	81.94	0.96
265	125	32°43'N	160°34'W	5781	RC12-435	1.45	2.78	110.71	75	3.12					
266	125	38°22'N	161°06'W	5654	V21-175	1.39	2.52	118.89	75	3.03	0.00	0.01	21.96	78.03	1.14
267	125	35°27'N	161°28'W	5797	V20-93						0.00	0.03	21.95	78.02	1.03
268	125	36°13'N	162°40'W	5900	RC12-434	1.43	3.05	127.22	79	3.93					
269	125	36°13'N	162°40'W	5900	RC12-433	1.39	2.98	142.26	81	4.29					
270	125	34°36'N	163°14'W	5993	V20-94						0.00	0.09	24.12	75.79	1.05
271	125	38°51'N	164°02'W	5097	RC12-432	1.39	2.80	135.26	79	3.84					
272	125	33°56'N	164°47'W	5804	V20-95						0.00	0.05	16.61	83.34	0.81
273	125	33°02'N	166°42'W	5771	V20-96						0.00	0.05	31.62	68.33	1.72
274	125	32°04'N	168°44'W	5841	V20-97						0.00	0.04	17.87	82.09	0.95
275	126	31°10'N	170°35'W	5673	V20-98						0.00	0.03	20.45	79.52	0.99
276	126	30°21'N	172°17'W	5486	V20-99						0.00	0.02	19.91	80.07	0.99
277	126	31°11'N	177°49'W	5216	V20-102						0.00	0.02	26.65	73.33	4.57
278	126	33°58'N	177°50'W	3442	V20-103						0.00	1.37	41.13	57.50	2.37
280	126	37°18'N	178°10'W	5449	V20-104						0.00	0.02	77.44	22.54	7.77
281	126	39°00'N	178°17'W	5336	V20-105						0.00	0.86	37.89	61.25	1.33
282	127	39°38'N	173°43'E	4312	RC10-179						0.00	0.11	31.08	68.81	1.47
283	127	37°48'N	172°20'E	5808	RC10-178	1.23	2.32	221.80	83	5.22	0.00	0.00	25.87	74.13	0.67
284	127	37°12'N	170°51'E	5302	RC10-177	1.25	2.67	226.39	85	6.13	0.00	0.00	27.16	72.84	1.22
285	127	38°06'N	170°01'E	3849	RC12-417	1.50	2.60	85.64	69	2.25					
286	128	36°24'N	166°44'E	5319	RC12-416	1.32	2.79	175.96	83	4.97					
287	128	37°03'N	166°34'E	4978	RC11-165	1.22	2.31	230.17	84	5.38					
288	128	34°03'N	164°50'E	6088	V21-145						0.18	0.06	30.27	69.49	1.68

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
289	128	35°48'N	163°43'E	5550	RC12-411	1.36	2.95	157.53	82	4.71					
290	128	37°41'N	163°02'E	3968	V21-146	1.36	2.42	126.56	75	3.10	0.00	0.95	33.93	65.12	1.98
291	128	35°20'N	162°38'E	5158	RC11-164	1.29	2.35	163.83	79	3.90	0.00	0.04	29.79	70.17	1.24
292	128	31°13'N	162°18'E	5894	RC10-159	1.45	2.51	96.22	71	2.45	0.00	0.12	26.04	73.84	1.22
293	128	39°33'N	162°05'E	5256	V21-147	1.20	2.27	254.71	85	5.86	0.00	0.08	32.10	69.82	1.42
294	128	32°23'N	161°19'E	5693	RC12-410	1.36	2.72	144.89	79	3.99					
295	128	34°47'N	160°40'E	4226	RC10-176 *	1.40	2.32	104.11	71	2.45	0.00	1.36	36.70	61.94	2.00
296	128	32°41'N	160°01'E	4931	V21-144	1.36	2.85	152.05	81	4.38	0.00	0.05	23.37	76.58	1.26
297	129	32°28'N	159°50'E	4621	RC10-160	1.36	2.47	129.65	76	3.24	0.00	0.43	28.98	70.59	1.37
298	129	30°18'N	159°15'E	5742	RC12-409	1.40	2.88	133.49	79	3.89					
299	129	34°35'N	159°10'E	4014	RC10-175	1.40	2.49	113.99	74	2.87	0.00	1.47	35.03	63.50	1.65
300	129	31°25'N	158°48'E	3913	RC10-162	1.46	2.52	92.75	70	2.37	0.00	1.66	39.36	58.98	2.33
301	129	33°05'N	158°00'E	3587	RC10-161	1.59	2.83	76.32	68	2.18	0.00	0.58	36.23	63.19	2.23
302	129	32°35'N	157°35'E	3191	RC10-174	1.62	2.72	65.62	64	1.80	0.00	1.98	34.90	63.12	1.91
303	129	31°44'N	157°30'E	3766	RC10-164						0.00	1.58	44.31	54.11	2.73
304	129	32°43'N	157°30'E	3550	RC10-163	1.75	2.70	48.18	56	1.32	0.00	1.70	51.63	46.67	4.16
305	129	38°47'N	157°24'E	5612	V20-128						0.00	0.16	28.96	70.88	1.43
306	129	35°51'N	157°20'E	3592	V21-143						0.39	29.01	36.39	34.21	12.28
307	129	31°50'N	157°20'E	3792	RC10-166						0.00	1.00	46.62	52.38	2.99
308	129	37°41'N	156°35'E	5766	V20-129						0.00	0.24	38.46	61.30	1.73
309	129	37°41'N	156°27'E	4056	RC10-173	1.34	1.98	97.19	66	1.95	0.00	2.47	35.86	61.67	1.89
310	129	31°35'N	156°25'E	4241	V21-142	1.44	2.88	117.31	77	3.42	0.00	0.63	34.44	64.93	1.58
311	129	31°16'N	155°30'E	5068	RC12-404	1.32	2.86	178.87	83	5.19					
312	129	32°08'N	154°38'E	4387	RC10-172	1.58	2.82	77.97	69	2.22	0.00	2.91	32.41	64.68	1.86
313	129	30°48'N	154°04'E	5821	V21-141	1.42	2.78	118.77	77	3.35	0.00	1.97	44.18	53.85	3.62
314	129	32°28'N	153°02'E	5544	RC10-171	1.60	2.76	71.51	66	2.00	0.00	1.11	33.64	65.25	1.74
315	129	39°32'N	152°42'E	5559	RC11-163	1.33	2.63	156.13	80	4.16	0.00	1.44	31.09	67.47	1.55
316	129	36°52'N	152°33'E	5912	RC12-403	1.24	2.44	225.32	84	5.57					
317	129	32°29'N	152°14'E	5621	RC10-170	1.53	2.82	87.87	71	2.51	0.00	0.76	33.54	65.70	1.71
318	129	32°31'N	151°04'E	5740	RC10-169	1.38	2.64	130.02	77	3.48	0.00	1.43	45.24	53.33	2.30
319	129	33°24'N	150°23'E	6092	RC10-167	1.52	2.78	88.16	71	2.48	0.00	1.57	46.66	51.77	2.97
320	130	30°04'N	147°41'E	6119	V21-75						0.00	0.62	30.21	69.17	1.55
321	130	38°49'N	145°45'E	5243	RC12-166	1.26	2.39	197.30	82	4.79					
322	130	30°25'N	144°30'E	5916	V21-76	1.46	2.50	92.87	70	2.35	0.00	1.26	45.66	53.08	2.66
323	130	37°04'N	143°51'E	~6485	RC12-165	1.53	2.63	81.61	68	2.17					
324	130	32°55'N	142°32'E	6306	V20-136						0.00	10.40	41.60	48.00	3.68

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
325	130	36°27'N	141°53'E	2319	RC12-164	1.28	2.48	184.26	82	4.64					
326	130	32°39'N	141°50'E	6736	RC12-135	1.34	2.64	153.27	80	4.09					
327	130	32°58'N	140°34'E	1503	V20-133						0.00	44.25	36.15	19.60	40.50
328	130	33°05'N	140°25'E	1106	V21-78						0.66	88.07	7.47	3.80	571.00
329	131	34°43'N	139°55'E	2598	V20-135						0.00	0.62	53.63	45.75	3.65
330	131	33°12'N	139°02'E	1763	RC11-162	1.45	2.51	95.12	70	2.41					
331	131	34°02'N	138°23'E	4400	V21-80	1.47	2.43	85.04	67	2.09					
332	131	32°15'N	138°17'E	3782	RC12-161	1.22	2.18	211.41	82	4.67					
334	131	33°00'N	138°02'E	4030	RC12-162	1.34	2.68	153.82	80	4.17					
335	131	33°14'N	137°54'E	~3673	RC12-136	1.37	2.71	137.29	79	3.77					
336	131	33°30'N	137°52'E	4001	RC12-163	1.35	2.55	142.65	78	3.69					
337	131	31°31'N	137°47'E	4091	RC12-160	1.31	2.71	176.39	82	4.84					
338	131	30°52'N	137°44'E	4189	RC12-154	1.38	2.42	117.23	74	2.88					
339	131	39°47'N	137°36'E	2840	RC12-397	1.29	2.33	158.72	78	3.75					
340	131	31°44'N	137°08'E	4228	RC12-155	1.40	2.54	114.95	74	2.96					
341	131	31°38'N	137°07'E	4281	RC12-159	1.41	2.77	123.70	77	3.47					
342	131	30°10'N	137°04'E	4486	RC12-153	1.34	2.55	144.05	78	3.72					
343	131	32°28'N	136°35'E	4318	RC12-156	1.40	2.55	114.75	74	2.96					
344	131	38°55'N	136°30'E	2650	RC12-389	1.20	2.26	264.07	85	6.06					
345	131	31°06'N	136°27'E	4449	RC11-161	1.44	2.39	92.05	69	2.22					
346	131	39°07'N	136°08'E	2496	RC12-388	1.19	2.34	274.84	86	6.52					
347	131	39°42'N	136°02'E	1103	RC12-390	1.40	2.39	107.60	72	2.61					
348	131	39°59'N	135°43'E	898	RC12-391	1.50	2.51	83.59	68	2.13					
349	131	39°59'N	135°43'E	1008	RC12-392	1.45	2.59	101.64	72	2.67					
350	131	37°15'N	135°42'E	1622	RC12-380	1.23	2.24	215.64	83	4.90					
351	131	31°54'N	135°36'E	4449	RC12-158	1.38	2.71	135.04	78	3.70					
352	131	30°44'N	135°23'E	4259	RC12-152	1.38	2.45	117.56	74	2.92					
353	131	32°32'N	135°16'E	4784	RC12-157	1.37	2.62	132.29	77	3.51					
354	131	36°54'N	134°33'E	1010	RC12-379	1.21	2.13	229.44	83	4.96					
355	131	36°57'N	134°32'E	1401	RC12-378	1.24	2.38	210.32	83	5.08					
356	131	30°36'N	134°13'E	4515	RC12-141	1.37	2.90	146.12	81	4.30	0.00	3.10	42.66	54.24	2.81
357	131	31°50'N	134°12'E	4876	RC12-140	1.34	2.63	149.40	79	3.97					
358	131	32°18'N	134°09'E	3153	RC12-139	1.29	2.74	191.91	84	5.33					
359	131	33°00'N	134°09'E	605	RC12-138	1.63	2.49	55.03	58	1.39					
360	131	30°44'N	134°04'E	4464	RC12-151	1.42	2.74	119.59	76	3.31	0.00	4.60	45.04	50.36	3.41

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
361	131	38°55'N	133°48'E	1437	RC12-381	1.28	2.37	170.99	80	4.10					
362	131	39°43'N	133°07'E	2113	RC12-383	1.23	2.36	219.27	83	5.24					
363	131	31°03'N	132°50'E	4854	RC12-150	1.46	2.59	98.24	72	2.58					
364	131	39°55'N	132°40'E	3027	RC12-382	1.23	2.94	269.95	88	8.05					
365	131	37°35'N	132°15'E	2226	RC12-377	1.22	2.48	253.40	86	6.37					
366	157	45°35'N	126°09'W	2582	RC10-229	1.30	2.48	166.32	80	4.18	0.00	0.53	20.67	78.80	0.96
367	157	48°12'N	126°10'W	1657	V20-75						0.00	0.37	38.87	60.76	1.81
368	157	45°56'N	127°00'W	2765	RC10-228	1.32	2.98	184.17	84	5.56	0.00	0.12	22.51	77.37	1.20
369	157	47°54'N	127°12'W	2582	RC11-186	1.24	2.07	182.31	79	3.83	0.00	0.13	22.18	77.69	1.06
370	157	47°27'N	127°16'W	2534	RC10-226	1.28	2.49	183.79	82	4.63	0.00	0.11	29.18	70.71	1.22
371	157	47°54'N	127°39'W	2628	V20-76						0.00	0.01	24.82	75.17	1.13
372	157	48°45'N	127°45'W	2536	RC10-225	1.26	2.40	198.44	82	4.82	0.00	0.20	24.13	75.67	1.16
373	157	46°18'N	128°00'W	2774	RC10-227	1.19	2.13	255.07	84	5.52	0.00	0.08	15.57	84.35	0.89
374	157	40°28'N	128°25'W	3200	RC10-230	1.51	2.73	88.98	71	2.45	0.00	1.90	37.29	62.52	1.67
375	157	47°42'N	128°40'W	2659	V20-77						0.00	2.32	24.68	73.00	1.38
376	158	47°09'N	130°07'W	~2670	RC11-187	1.35	2.47	133.82	77	3.35	0.00	0.30	22.72	66.98	1.53
377	158	49°04'N	130°57'W	1159	RC10-224						63.09	32.82	2.36	1.73	3249.00
378	158	47°15'N	131°02'W	2983	V20-78						0.00	0.17	33.06	66.77	1.67
379	158	46°44'N	131°35'W	3319	RC11-188						0.00	0.36	26.27	73.37	1.48
380	158	41°04'N	132°22'W	3749	V20-74						0.00	0.12	27.85	72.03	1.21
381	158	46°50'N	133°18'W	3711	V20-79						0.00	0.10	29.33	70.57	1.41
382	158	45°58'N	134°25'W	3922	RC11-189	1.44	2.78	111.81	75	3.15	0.00	0.00	50.95	49.05	2.36
383	158	49°18'N	134°39'W	3645	RC10-223	1.34	2.26	123.98	73	2.83	0.00	0.00	32.53	67.47	1.31
384	158	43°30'N	135°00'W	3801	V20-80						0.00	0.83	48.64	50.53	3.18
385	158	49°57'N	135°14'W	3559	RC10-222	1.44	2.66	106.59	74	2.87	0.00	0.07	38.37	61.56	1.88
386	158	45°56'N	138°14'W	4294	V20-82						0.00	2.52	30.87	66.61	1.30
387	158	44°57'N	138°22'W	4254	RC11-190						0.00	0.00	21.58	78.42	1.00
388	158	45°45'N	139°24'W	4345	V20-83						0.00	0.32	23.28	76.40	1.01
389	158	42°02'N	139°57'W	4116	RC11-192	1.48	2.70	95.21	72	2.60	0.00	1.38	34.83	63.79	1.73
390	158	44°31'N	139°57'W	4387	RC11-191						0.00	0.00	16.75	83.27	0.82
391	159	49°43'N	140°31'W	3959	RC11-184						0.00	1.50	32.98	65.52	1.46
392	159	45°27'N	141°11'W	4457	V20-84						0.00	0.17	27.30	72.53	1.15
393	159	48°00'N	143°25'W	4438	RC11-185						0.00	1.11	34.68	64.21	1.58
394	159	44°54'N	143°37'W	3817	V20-85						0.00	0.71	22.01	77.28	1.05
395	159	43°37'N	148°06'W	5138	V20-86						0.00	0.07	15.91	84.02	0.81
396	159	41°48'N	149°55'W	4819	V20-87						0.00	0.08	20.83	79.09	0.98

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397	160	40°11'N	151°39'W	5081	V20-88						0.00	0.44	23.63	75.93	1.20
398	160	45°43'N	157°14'W	4929	RC12-175	1.24	2.54	227.13	85	5.85					
399	160	46°07'N	157°48'W	~5267	RC12-182	1.41	2.64	118.03	75	3.15					
400	160	43°00'N	157°50'W	5365	RC12-176	1.33	2.32	135.28	76	3.17					
401	160	47°09'N	158°57'W	5141	RC12-181	1.35	2.69	149.86	80	4.09					
402	160	44°00'N	159°02'W	5449	RC12-183	1.33	2.42	142.48	77	3.49					
403	160	46°36'N	159°40'W	5167	RC11-171						8.87	1.58	39.57	49.98	3.76
404	161	40°08'N	162°30'W	5691	V21-174	1.36	2.35	120.20	74	2.86	0.00	0.09	20.23	79.68	0.95
405	161	44°29'N	163°21'W	5451	RC11-170						0.00	0.56	24.61	74.83	1.21
406	161	44°22'N	163°33'W	5493	V21-173						0.00	1.40	25.51	73.09	2.50
407	161	49°53'N	164°57'W	5013	V21-171	1.75	2.40	36.76	47	0.89	0.00	0.71	72.78	26.51	7.84
408	161	48°38'N	167°49'W	5749	RC12-431	1.43	2.39	97.19	70	2.35					
409	162	44°37'N	170°03'W	6081	RC10-205	1.34	2.74	155.18	81	4.30	6.18	0.63	24.97	68.22	1.50
410	162	42°10'N	170°14'W	5665	RC11-169	1.34	2.88	163.25	82	4.75	0.00	0.04	22.59	77.37	1.23
411	162	47°13'N	170°26'W	5497	RC10-206	1.33	2.29	134.74	75	3.12	0.00	1.97	34.07	63.96	1.84
412	162	47°24'N	171°30'W	5638	RC12-430	1.42	2.89	123.62	78	3.61					
413	162	41°42'N	171°57'W	5883	RC10-203	1.30	2.67	177.96	82	4.81	0.00	0.07	22.92	77.01	1.05
414	162	45°37'N	173°00'W	5523	RC10-202	1.33	2.69	163.40	81	4.45	0.00	1.02	29.76	69.22	1.49
415	162	48°32'N	173°13'W	5158	RC10-201	1.42	2.59	112.66	74	2.96	4.89	3.84	31.92	59.35	2.27
416	162	43°24'N	178°52'W	5872	V20-107						0.00	1.15	27.20	71.65	1.24
417	162	45°27'N	179°15'W	5625	V20-108						16.99	0.16	23.31	59.54	6.83
418	162	47°19'N	179°39'W	5629	V20-109						0.00	1.26	34.52	64.22	1.96
419	163	49°31'N	179°04'E	4986	RC10-184	1.32	2.45	153.43	79	3.81	0.00	0.69	37.97	61.34	1.98
420	163	45°37'N	177°52'E	5561	RC10-182						0.00	1.97	31.11	66.92	1.50
421	163	44°05'N	176°50'E	5698	RC10-181	1.37	2.61	131.63	77	3.48	3.19	0.24	29.58	66.99	1.53
422	163	43°46'N	171°14'E	5841	RC11-166	1.32	2.54	154.72	79	3.98	0.00	0.74	45.51	53.75	2.71
423	164	47°57'N	168°47'E	2739	V20-119						0.00	2.54	67.37	30.09	9.35
424	164	47°24'N	167°45'E	6216	V20-120						0.00	0.93	38.37	60.70	2.15
425	164	40°41'N	166°59'E	5656	RC12-412	1.31	2.69	172.70	82	4.71					
426	164	43°17'N	166°54'E	5015	RC12-413	1.38	2.72	136.78	79	3.77					
427	164	46°58'N	164°16'E	5859	V20-121						0.00	1.08	42.59	57.33	2.52
428	164	41°17'N	164°09'E	4872	RC12-415	1.33	2.78	167.08	82	4.70					
429	164	44°17'N	163°18'E	5291	RC12-414	1.43	2.64	109.47	74	2.93					
430	164	48°00'N	162°01'E	5416	V21-150						0.00	1.88	34.77	63.35	2.16
431	164	46°34'N	161°41'E	5563	V20-122						0.00	0.24	40.58	59.18	2.19
432	164	42°05'N	160°36'E	5477	V21-148						0.00	2.25	33.79	63.96	1.80

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
433	164	45°08'N	160°28'E	5665	V21-149						0.00	2.81	58.49	38.70	6.17
434	165	46°15'N	157°55'E	4903	V20-123						0.00	0.74	44.57	54.69	2.55
435	165	40°17'N	156°55'E	5583	V20-127						0.00	0.36	38.28	61.36	1.84
436	165	42°09'N	155°52'E	5515	V20-126						0.00	0.57	37.30	62.13	2.03
437	165	45°50'N	154°30'E	5534	V20-124						0.00	2.38	45.43	52.19	2.77
438	165	43°29'N	154°22'E	5545	V20-125						0.00	0.14	43.75	56.11	2.50
439	165	42°07'N	151°37'E	5097	RC12-172	1.19	2.51	296.14	88	7.55					
440	165	40°11'N	150°44'E	5332	RC12-402	1.23	2.58	243.40	86	6.37					
441	166	42°21'N	149°58'E	4940	RC12-171	1.43	2.14	78.51	62	1.70					
442	166	42°39'N	148°12'E	7240	RC12-170	1.36	2.31	119.50	73	2.80					
443	166	40°50'N	148°08'E	5415	RC12-401	1.16	2.20	318.56	87	7.10					
444	166	43°00'N	146°04'E	1845	RC12-169	1.51	2.53	81.04	67	2.08					
445	166	40°57'N	144°56'E	~3862	RC12-168	1.42	2.84	122.98	77	3.53					
446	166	40°55'N	144°51'E	3900	RC12-400	1.22	2.22	225.45	83	5.07					
447	167	40°31'N	137°31'E	2664	RC12-398	1.29	2.79	196.12	84	5.54					
448	167	40°19'N	136°14'E	2338	RC12-394	1.37	2.84	148.01	81	4.26					
449	167	40°46'N	135°39'E	3048	RC12-393	1.18	2.81	365.67	91	10.43					
450	167	40°06'N	135°12'E	838	RC12-387	1.59	2.67	69.04	65	1.86					
451	167	40°48'N	134°36'E	3497	RC12-386	1.29	2.86	201.11	85	5.82					
452	167	40°50'N	134°26'E	3532	RC12-385	1.20	2.31	263.89	86	6.18					
453	167	40°00'N	133°17'E	2677	RC12-384	1.36	2.49	130.88	76	3.29					
454	194	51°03'N	139°33'W	3786	RC10-219	1.37	2.62	135.76	78	3.60	0.00	2.34	44.99	52.67	2.46
455	194	57°00'N	138°09'W	2957	RC11-177						0.00	0.31	30.88	68.81	1.39
456	194	51°29'N	136°59'W	3636	RC11-183						0.00	0.22	30.28	69.50	1.28
457	194	53°18'N	135°41'W	1289	RC11-181						1.38	90.83	6.17	3.00	351.00
458	194	51°03'N	133°44'W	3157	RC10-220	1.24	2.26	205.52	82	4.71	0.00	1.03	29.70	69.27	1.33
459	194	50°33'N	131°37'W	2834	RC10-221	1.40	2.71	123.48	77	3.38	0.00	0.10	33.20	66.70	1.57
460	195	50°57'N	146°05'W	4338	RC10-217	1.44	2.84	116.81	77	3.36	2.75	5.33	36.59	55.33	2.96
461	195	53°30'N	145°39'W	4067	RC11-179	1.42	2.61	113.96	75	3.01	0.00	2.51	36.07	61.42	2.32
462	195	56°57'N	144°44'W	3819	RC11-176	1.54	2.92	88.85	72	2.63	0.00	0.62	38.12	61.26	1.84
463	195	50°55'N	143°15'W	909	RC10-218						4.67	86.63	5.89	2.81	264.00
464	195	53°09'N	142°54'W	3860	RC11-180						14.52	1.45	29.48	54.55	7.07
465	195	55°11'N	140°15'W	1547	RC11-178						0.72	71.15	20.16	7.97	97.60
466	196	50°58'N	151°10'W	4989	RC10-216	1.56	2.65	75.44	66	2.02					
467	196	52°35'N	151°21'W	1618	RC11-174	1.83	2.76	41.06	53	1.14	50.75	31.89	12.42	4.94	2214.00
468	196	54°30'N	155°52'W	5517	RC12-180	1.52	2.54	79.41	67	2.04					

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
469	196	52°29'N	157°03'W	4601	RC12-179	1.33	2.75	166.54	82	4.65					
470	196	50°06'N	157°14'W	4903	RC12-174	1.42	2.51	106.04	72	2.69					
471	196	51°01'N	158°06'W	4887	RC10-215	1.55	2.44	67.36	62	1.67	17.00	0.30	47.14	35.56	17.33
472	196	53°54'N	158°24'W	6384	RC12-178	1.43	2.48	101.47	71	2.55					
473	197	52°52'N	163°45'W	6909	V21-167						0.00	27.08	63.79	9.13	35.60
474	197	50°59'N	164°08'W	4731	RC10-214	1.54	2.33	64.58	60	1.52	0.19	19.18	30.62	50.01	4.30
475	197	51°15'N	164°53'W	4808	RC11-172						0.00	2.16	38.81	59.03	2.06
476	197	53°12'N	164°58'W	3607	RC11-173	1.43	2.42	98.38	70	2.41	0.00	2.25	34.22	63.53	1.85
477	197	52°21'N	165°35'W	7011	V21-170						0.00	1.54	42.45	56.01	2.05
478	197	54°55'N	166°45'W	165	V21-168						0.33	47.47	44.43	7.77	59.50
479	197	51°49'N	167°45'W	7196	RC10-213						0.00	0.81	54.23	44.96	3.72
480	197	54°16'N	168°19'W	1858	V21-169						0.00	3.95	58.23	37.82	4.84
481	197	51°25'N	169°12'W	7103	V21-166						0.00	0.24	37.87	61.89	1.70
482	198	51°06'N	170°08'W	7231	RC10-212	1.27	2.27	175.38	80	4.03	0.00	0.21	35.43	64.36	1.78
483	198	50°55'N	171°33'W	7264	RC10-207	1.43	2.88	120.54	77	3.52	0.00	1.14	40.45	58.41	2.40
484	198	50°03'N	171°45'W	5137	RC10-211	1.42	2.52	107.09	73	2.73	0.00	2.00	46.38	51.62	3.98
485	198	51°38'N	171°46'W	3737	RC10-208	1.51	2.48	79.67	66	2.00	0.00	1.45	52.47	46.08	5.00
486	198	56°24'N	172°26'W	1919	V21-164	1.54	2.37	66.31	61	1.59	0.00	0.73	47.00	52.27	2.11
487	198	56°01'N	172°27'W	2576	V21-165						0.00	2.44	45.91	51.65	4.09
488	198	50°48'N	172°38'W	7284	RC10-210	1.44	2.38	92.53	69	2.23	0.00	1.68	38.57	59.75	2.17
489	198	53°04'N	173°18'W	2774	RC10-209						0.00	1.18	54.08	44.74	3.83
490	198	50°44'N	173°56'W	7317	RC10-200						0.00	0.09	33.93	65.98	1.37
491	198	51°19'N	174°01'W	4698	RC10-199	1.36	2.22	111.48	71	2.51	0.00	2.37	50.11	47.52	3.92
492	198	58°02'N	176°07'W	3270	V21-163						0.00	0.53	44.03	55.44	2.32
493	198	53°22'N	176°11'W	3731	V21-158						0.00	2.35	52.61	45.04	4.56
494	198	50°50'N	176°15'W	4874	RC11-167						0.00	2.17	60.41	37.42	5.37
495	198	58°33'N	177°13'W	2317	V21-162	1.52	2.74	87.97	70	2.44	0.00	2.28	66.50	31.22	7.88
496	198	53°12'N	177°41'W	3733	RC10-190	1.19	1.87	212.59	80	4.02	0.00	1.68	50.55	47.77	3.15
497	198	52°15'N	178°03'W	3422	RC10-189	1.39	2.29	102.98	70	2.39	0.00	22.62	54.08	23.30	16.63
498	198	53°54'N	178°30'W	3801	V20-113						0.00	0.76	43.90	55.34	2.55
499	198	52°48'N	178°42'W	3592	V20-112						0.00	1.49	54.83	43.68	4.54
500	198	55°01'N	179°01'W	3801	RC10-194	1.22	2.39	237.45	85	5.76	0.00	0.00	31.65	68.35	1.30
501	198	54°54'N	179°42'W	3810	V20-114						0.00	0.25	39.84	59.91	1.94
502	198	51°01'N	179°58'W	3851	V20-111						0.00	0.83	53.98	45.19	3.96
503	198	55°23'N	179°43'W	3813	V20-115						0.00	0.10	35.61	64.29	1.68
504	199	54°28'N	179°55'E	3414	RC12-420	1.34	2.74	155.07	81	4.31					

TABLE 3. PHYSICAL PROPERTIES OF THE SUBSTRATE AS DETERMINED BY ANALYSIS OF SAMPLES FROM THE TOPS OF PISTON CORES - NORTH PACIFIC

Map no.	Marsden Square	Location Lat.	Location Long.	Depth in meters	Lamont Core No.	Wet Density g/cc	Dry Density g/cc	Moisture Content % dry wt.	Porosity %	Void Ratio	Texture gravel %	Texture sand %	Texture silt %	Texture clay %	Mean Size μ
505	199	54°26'N	179°51'E	1853	RC12-421	1.39	2.43	112.05	73	2.75					
506	199	57°30'N	179°50'E	3779	V21-160	1.24	2.36	217.58	83	5.21	0.00	1.68	45.31	53.01	2.54
507	199	53°37'N	179°42'E	1628	RC12-429	1.18	2.50	321.41	89	8.16					
508	199	54°24'N	179°37'E	252	RC12-422	2.01	2.79	27.99	44	0.79					
509	199	59°34'N	179°15'E	3237	V21-161	1.20	2.08	229.19	82	4.83	0.00	4.65	43.73	51.62	2.55
510	199	53°15'N	179°12'E	3025	RC10-191	1.18	2.26	287.92	86	6.60	0.00	1.49	51.52	46.99	3.18
511	199	54°54'N	178°34'E	397	RC10-197	1.84	2.57	34.14	47	0.88	0.40	95.33	2.42	1.85	175.90
512	199	53°38'N	178°27'E	3684	RC10-192	1.18	2.01	255.44	83	5.20	0.00	1.09	46.57	52.34	2.53
513	199	53°47'N	177°24'E	3895	V20-116						0.00	1.23	41.52	57.25	2.28
514	199	50°12'N	177°11'E	6591	RC10-186	1.39	2.84	137.59	79	3.95	0.00	1.30	33.99	64.71	1.74
515	199	54°42'N	177°05'E	1007	RC10-196	1.33	2.66	156.53	80	4.22	0.00	17.88	53.09	29.03	12.09
516	199	54°39'N	177°00'E	1135	V21-157						0.00	13.31	46.06	40.63	5.25
517	199	55°58'N	176°56'E	3835	RC10-195	1.27	2.52	198.88	83	5.09	0.00	0.16	31.61	68.23	1.30
518	199	52°33'N	176°54'E	3673	RC10-188	1.43	2.57	106.36	73	2.77	0.00	1.59	40.41	58.00	2.52
519	199	53°01'N	176°23'E	3904	V20-117						0.00	1.35	47.28	51.37	3.18
520	199	55°05'N	176°20'E	3418	V21-156						0.00	0.86	52.44	46.70	4.00
521	199	54°36'N	175°46'E	2261	RC12-423	1.64	2.73	64.06	63	1.77					
522	199	50°40'N	175°40'E	6216	RC10-187	1.47	2.55	93.65	70	2.42	0.00	2.92	38.36	58.72	2.53
523	199	56°01'N	172°57'E	3826	RC12-424	1.28	2.47	180.82	81	4.52					
524	199	50°22'N	172°43'E	5360	V20-118						0.00	1.27	38.25	60.48	2.10
525	199	57°47'N	172°08'E	2999	V21-155	1.20	2.10	227.12	82	4.84	0.00	0.89	34.71	64.40	1.94
526	199	56°27'N	170°28'E	1531	RC12-425	1.42	2.77	118.70	76	3.33					
527	200	58°06'N	169°37'E	3338	V21-154	1.20	2.54	279.94	87	7.20	0.00	0.37	34.11	65.52	1.51
528	200	57°21'N	168°19'E	3532	V21-153	1.26	2.19	172.54	79	3.83	0.00	3.02	33.12	63.86	1.52
529	200	55°47'N	165°39'E	3279	V21-152	1.99	2.62	24.70	39	0.65	0.00	50.36	36.07	13.57	37.10
530	200	57°36'N	163°59'E	3160	RC12-426	1.28	2.68	194.73	84	5.28					
531	200	52°16'N	163°38'E	5055	V21-151						0.00	2.06	47.58	50.36	3.24

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