LAMONT GEOLOGICAL OBSERVATORY of COLUMBIA UNIVERSITY
Palisades, New York

ACOUSTIC PROVINCES of the NORTH PACIFIC BASED ON DEEP-SEA CORES

A Preliminary Survey

by

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

Technical Report No. 3
CU-3-67 NAVSHIPS N00024-67-C-1186

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INTRODUCTION

This report is a preliminary survey of 261 sediment cores collected north of 20 degrees latitude in the Pacific Ocean (see fig. 1 for location of coring stations). An additional 50 cores will be incorporated into the study prior to its completion in late 1968. The object of the investigation is to provide data which can be employed in the prediction of sound reflection and/or absorption by the sea floor of the North Pacific.

It is known that certain bulk and textural properties of marine sediments have a direct bearing on the speed at which sound travels through these materials (Hamilton, 1956; Hamilton and others, 1956; Shumway, 1956, 1960a, 1960b; Sutton and others, 1957; Nafe and Drake, 1957, 1961, 1963; Schreiber, 1966, 1967a, 1967b, 1967c, 1968; Horn, 1967; Horn and others, 1967a, 1967b, 1968). In turn, sediment layers which have high velocity characteristics are good reflectors, whereas those with low velocity properties absorb rather than reflect sound. The problem at hand then is to delineate the areas of the sea floor where reflectors or "absorbers" exist. In this survey the reflectors most commonly encountered are either turbidites (sand or coarse-grained silt deposited in deep water by turbidity currents) or ash (coarse-grained silt consisting of volcanic glass). These reflectors are restricted to a zone which follows the continental borders and extends 200 to 600 miles seaward. Beyond the regions where reflectors occur are vast areas where only deep-sea clays have been accumulating on the sea floor. Sound travels through these deposits at lower speeds than through the overlying water; there is little velocity contrast at the sediment - water interface, and the sound is absorbed rather than reflected at the sea floor.

An inspection of the cores reveals that the North Pacific can be divided into regions with distinct acoustic properties. First, areas can be distinguished where sub-bottom reflectors are either present or absent. Second, in those areas where reflectors do occur, it is possible to identify provinces in which a common set of properties occurs.

In this report, the large area where sub-bottom reflectors are extremely rare is named the CENTRAL NORTH PACIFIC ACOUSTIC PROVINCE. East of Japan, the Kuril Islands, and the Kamchatka Peninsula, the cores contain multiple sub-bottom reflectors composed of ash. The latter is confined to a zone that parallels the coastlines and is referred to as the JAPAN ACOUSTIC PROVINCE. Off the Aleutians, Alaska, and British Columbia, there is another belt where reflectors are common.

FIGURE I SUBMARINE PHYSIOGRAPHIC PROVINCES OF THE NORTHERN PACIFIC AND LOCATION OF CORING STATIONS.

This area of the sea floor is tentatively named the ALEUTIAN-ALASKA ACOUSTIC PROVINCE. Near the Aleutian Islands, turbidites and ash offer good reflectors, whereas south of the Gulf of Alaska and west of British Columbia turbidites dominate. In subsequent reports it will be necessary to break down the Aleutian-Alaska Acoustic Province into subprovinces, because the sub-bottom reflectors have different properties and are restricted in aerial extent.

METHODS

At sea, the cores are extruded and shipboard geologists describe their lithology. Shear strengths are taken down the length of the cores using a fall-cone penetrometer (Hansbo, 1957), the number of readings depending upon the complexity of layering, texture, etc. Bulk property samples are collected from the freshly extruded cores using a plastic syringe which contains a small rubber-headed piston. These samples are placed in plastic vials, tightly sealed, and shipped to the laboratory. At Lamont, the following raw data are determined from the bulk property samples: 1) wet weight, 2) wet volume, 3) dry weight, and 4) dry volume. From this information the porosity, moisture content, wet and dry densities, and void ratio of each sample are calculated.

When the oceanographic vessels return to Lamont, sound velocities are measured on those cores which are well preserved. The speeds at which sound travels through the cores are determined using a sediment velocimeter (Underwater Systems, Inc., Velocimeter Model No. 201A). The cores are split into halves, tagged, and photographed. Geologists redescribe the cores with emphasis placed on defining acoustic reflectors. Samples representative of the various layers in the cores are taken and analyzed for texture according to the procedure outlined by Folk (1965).

In this preliminary report the results of textural analysis of the tops of the cores are given along with maps showing the location and thickness of acoustic reflectors. In later reports, the results of detailed core analyses will be given.

SURFICIAL SEDIMENT DISTRIBUTION IN THE NORTH PACIFIC AND ITS BEARING ON THE ACOUSTIC PROPERTIES OF THE SEA FLOOR

The tops of all cores from the North Pacific have been analyzed for texture. The results are presented in two ways: 1) mean grain size has been plotted on figure 2 and contoured at a 1 micron interval; and 2) mean grain size, standard deviation

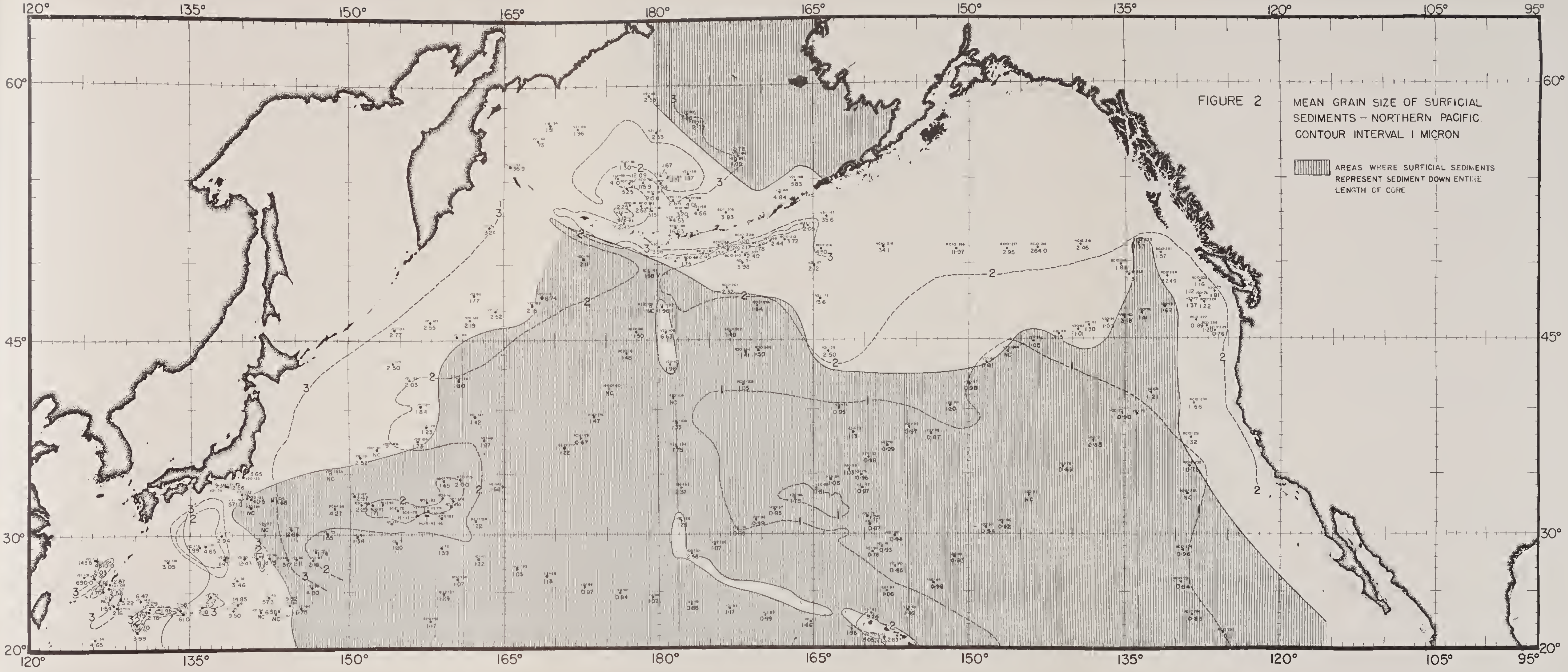


FIGURE 2 MEAN GRAIN SIZE OF SURFICIAL SEDIMENTS – NORTHERN PACIFIC. CONTOUR INTERVAL 1 MICRON

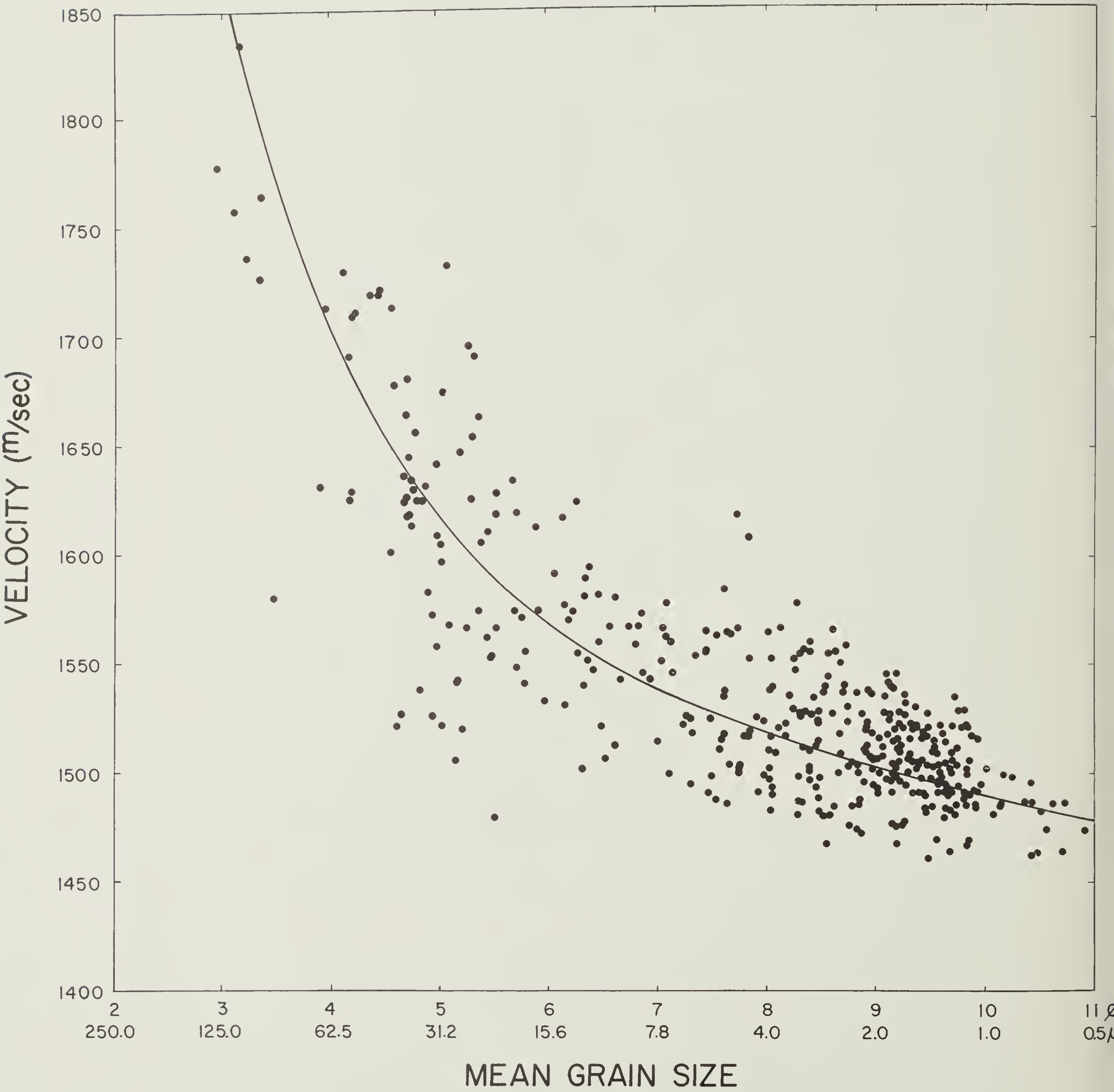
(sorting), skewness, and transformed kurtosis are listed in the Appendix.

Mean grain size is the most important textural parameter of the four presented. There is a strong correlation between this property and the speed at which sound travels through a sediment (fig. 3). Therefore, mean grain size has an important bearing on the degree of absorption and/or reflection of sound at or near the sea floor. Figure 2 serves two important purposes: 1) It provides a quick picture of the average size of surficial sediments in the North Pacific; and 2) it illustrates the shortcomings of interpreting the acoustic properties of the sea floor which might come from analyses of short cores and surface grab samples.

The analyses reveal that the normal deep-sea sediments of the North Pacific are extremely fine-grained. Most are pelagic clays with mean grain sizes that range from 1 to 2 microns. Only in areas within 100 miles of the continents does the average size increase slightly, reflecting contributions of terrigenous materials.

It appears that the bulk of coarse detritus transported seaward is being very effectively trapped in the circum-Pacific trenches and ponded behind the seamounts off Alaska and California. The result is that only the finest of particulate matter is reaching the

FIGURE 3


VELOCITY (m/sec)
1850
1800
1750
1700
1650
1600
1550
1500
1450
1400
2
250.0
3
125.0
4
62.5
5
31.2
6
15.6
7
7.8
8
4.0
9
2.0
10
1.0
MEAN GRAIN SIZE

deep areas of the North Pacific. In northern latitudes (north of 40 degrees) there are a few cores with anomalously high mean grain sizes. The tops of these cores contain ice-rafted pebbles or sand. The erratic distribution of such material in the cores precludes the use of ice-rafted sediment in studies of the acoustic nature of the sea floor.

The surface sediments of the North Pacific are characterized by low sound velocities. Based on the data presented in figure 3, the area within the 1 micron contour in figure 2 has a velocity of 1500 m/sec, that between the 1 and 2 micron contours 1510 to 1515 m/sec, and those sediments with average sizes of the order of 3 microns should have velocities of approximately 1520 m/sec. Therefore, the majority of surficial sediments in the North Pacific are characterized by sediment velocities lower than that of the overlying sea water.

If only the tops of the cores are considered, it would seem that the majority of the sea floor should have low velocity characteristics, high absorption values, and the reflectivity of the bottom would be minimal. However, these are erroneous conclusions as the tops of the cores are only representative of the entire sediment section in a restricted portion of the North Pacific. In those cores that are uniform throughout, sediment at the top of the core is representative of the entire sediment section. In figure 2, the areas of the Pacific where this situation exists are shown by shading. These areas are characterized by deep-sea clay sedimentation; the deposits have low velocities, and the sea floor should show high absorption values and low reflectivity. Beyond the limits of these regions, the tops of the cores are not an index of the acoustic nature of the sea floor.

DISTRIBUTION OF SUB-BOTTOM REFLECTORS AND THE ACOUSTIC PROVINCES OF THE NORTH PACIFIC

The occurrence of sub-bottom reflectors in the North Pacific is principally a function of proximity to land. Reflectors most frequently encountered are of two types: 1) ash horizons and 2) turbidites. Both require that land be in the vicinity to serve as a source of large amounts of sedimentary material. Therefore, the major sub-bottom reflectors of the North Pacific are located along the edges of the continental masses (fig. 4). Thin ash layers are common in the cores collected off the east coast of Japan, the Kurils, the Kamchatka Peninsula, and the Aleutians. In the eastern Pacific (off the coasts of Alaska, British Columbia, and California), turbidite sequences are the rule. Ash is dis-

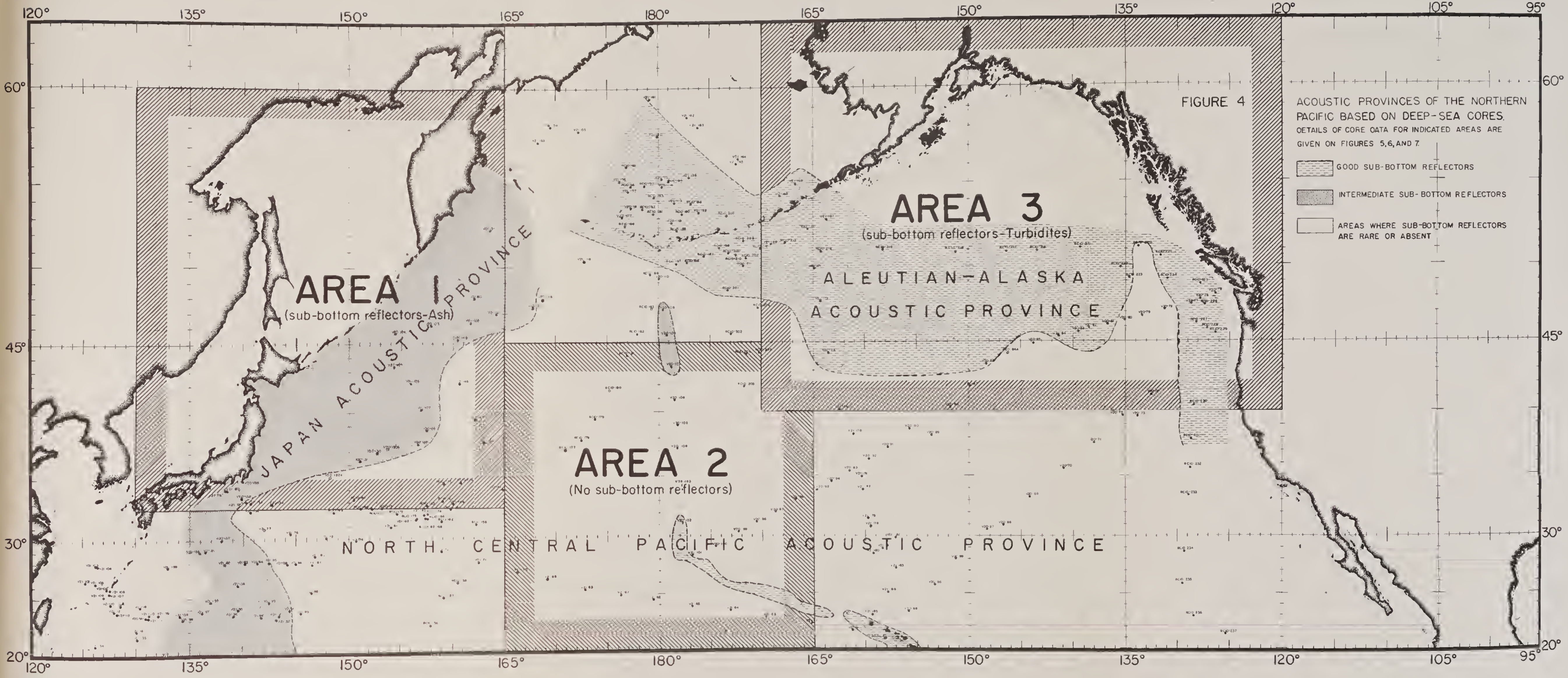


FIGURE 4
ACOUSTIC PROVINCES OF THE NORTHERN PACIFIC BASED ON DEEP-SEA CORES.
DETAILS OF CORE DATA FOR INDICATED AREAS ARE GIVEN ON FIGURES 5,6, AND 7.
GOOD SUB-BOTTOM REFLECTORS
INTERMEDIATE SUB-BOTTOM REFLECTORS
AREAS WHERE SUB-BOTTOM REFLECTORS ARE RARE OR ABSENT
AREA 1
(sub-bottom reflectors-Ash)
JAPAN ACOUSTIC PROVINCE
AREA 2
(No sub-bottom reflectors)
AREA 3
(sub-bottom reflectors-Turbidites)
ALEUTIAN-ALASKA ACOUSTIC PROVINCE
NORTH CENTRAL PACIFIC ACOUSTIC PROVINCE
120°
135°
150°
165°
180°
165°
150°
135°
120°
105°
95°
60°
45°
30°
20°

tributed along the east coast of Asia, whereas turbidites occur off the west coast of the American continent. As would be expected, there is an area of overlap of the two types of reflectors. Both are found in cores taken in the region of the Aleutians.

JAPAN ACOUSTIC PROVINCE

Cores taken from the waters east of Japan, the Kurils, and the southern half of the Kamchatka Peninsula consist of deep-sea mud and clay interlayered with thin horizons of white ash. They occur within a zone of irregular width which ranges from 100 miles to 600 miles from shore (figs. 4 and 5). The ash layers that are greater than 5 cm thick are shown in figure 5. Although the ash horizons are relatively thin, they are coarser than the sediments with which they are associated and occur as distinct layers with sharp boundaries. They are characterized by higher velocities and higher wet densities than the sediments with which they are intercalated. Therefore, they provide a series of velocity contrasts close to the sediment-water interface. Reflectivity in the Japan Acoustic Province should be higher than that of the Central North Pacific Acoustic Province, but lower than that of the Aleutian-Alaska Acoustic Province.

No cores have been recovered from the waters within 100 to

200 miles of the Asian shoreline. Presumably, if cores were available, they would contain a far greater number of ash layers and the ashes would be slightly coarser in texture. As a consequence, bottom reflectivity should increase as land is approached.

CENTRAL NORTH PACIFIC ACOUSTIC PROVINCE

Sub-bottom reflectors are rare in the north central Pacific (figs. 4 and 6). The majority of cores from this area are uniform throughout and consist of monotonous sequences of deep-sea clay. Such sediments are characterized by very low compressional velocity, low wet density, and are extremely fine-grained. Reflection should be minimal within this province, whereas absorption values should be correspondingly high.

There are two areas of the sea floor within the province where sub-bottom reflectors exist but are limited in aerial extent. Within 100 miles of the shores of the Midway and Hawaiian Islands good sub-bottom reflectors occur. They consist of sand and gravel layers. The sands are generally carbonate detritus which has moved downslope from shallow waters through turbidity current activity. The layers of gravel are made up of basalt pebbles. Presumably these coarse volcanic ejecta represent periods of explosive volcanism on the Hawaiin Islands.

Cores taken in the vicinity of the Emperor Seamount Chain contain layers of volcanic silt. They are brown in color, generally thicker, and coarser-grained than the ashes within the Japan Acoustic Province. They offer good sub-bottom reflectors and will be described in detail in future reports.

ALEUTIAN - ALASKA ACOUSTIC PROVINCE

The Aleutian-Alaska Acoustic Province is shown in figure 7. It is the most complex area of the North Pacific. In subsequent reports it will be necessary to sub-divide this region into three separate acoustic areas: 1) Aleutian Province, 2) Alaska Province, and 3) British Columbia Province.

Only a brief description of the Aleutian-Alaska Province is given at this time. Sub-bottom reflectors include turbidites, brown ash layers, current winnowed sands, and possibly diatom ooze. In figure 7, all turbidites and ash layers which are greater than 10 cm in thickness are shown as solid black sections within the cores. The writers consider the Aleutian-Alaska Province to be characterized by high bottom reflectivity within the area designated. The turbidite and ash layers are thick and considerably coarser than any sediments elsewhere in the Pacific. These high velocity layers provide excellent sub-bottom reflection of sound.

The most recent cruise of the R/V Robert D. Conrad included a series of traverses and coring stations within the Aleutian-Alaska Acoustic Province. The cores collected during this cruise will add greatly to the information on sub-bottom reflectors south of the Aleutian Islands and within the Gulf of Alaska.

CONCLUSIONS

The North Pacific contains distinct acoustic provinces which can be effectively delineated and described by studies of deep-sea cores. The central North Pacific has been an area of clay deposition for several million years. Sub-bottom reflectors within this province are rare and occur only in areas within 100 miles of the Midway and Hawaiian Islands. They are turbidites and coarse volcanic detritus derived from the Islands.

East of Japan, the Kuril Islands, and the Kamchatka Peninsula, airborne ash has been blown seaward during periods of volcanism and now forms distinct, thin, white layers of silt-sized ash. The cores reveal that the frequency of ash layers increases toward the Asian coastline. Bottom reflectivity in this region should be higher than in the more central areas of the North Pacific and presumably will increase in a landward direction.

North and south of the Aleutian Islands, at the southern limit of the Gulf of Alaska, and off British Columbia, reflectivity should be greater than other areas of the North Pacific. Here thick turbidite sequences and coarse-grained brown ash layers are common. Sound reflection at the sea floor should be maximum within this province.

Acknowledgment

We gratefully acknowledge the U. S. Naval Ship Systems Command for providing financial support for the investigation (Contract N00024-67-C-1186). Laboratory and technical assistance was given by S. Jones, S. Walker, B. Bush, D. Liebesberger, D. Ultsch, L. Murphy, M. Parsons, V. Jones, and D. Hogge. Drafting and typing of the manuscript were done by M. Seely and B. Brown, respectively. Thanks are also due members of the Core Laboratory at Lamont for their cooperation.

APPENDIX

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES
GRAIN SIZE DATA

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 20

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz Ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
64	4205	0	-	.66	31.35	67.99	.32	9.39	1.49	2.61	+.09	.45
65	5363	0	-	.04	18.76	81.20	.19	9.99	0.98	2.17	+.17	.46
66	5338	0	-	.01	15.05	84.94	.15	10.22	0.83	2.15	+.15	.45
67	5042	0	-	1.55	15.63	82.82	.16	10.05	0.94	2.30	+.11	.49
68	5788	0	-	-	19.49	80.51	.19	10.09	0.92	2.20	+.15	.45
69	5351	36	0.27	0.95	43.35	55.93	.44	8.39	2.98	2.41	+.14	.55
70	5207	0	-	1.00	17.75	81.25	.18	10.13	0.89	2.31	+.09	.47
71	5302	0	-	.01	17.16	82.83	.17	10.20	0.35	2.45	-.01	.49
72	4790	0	-	.14	16.38	83.48	.16	10.11	0.90	2.18	+.14	.46
73	4773	0	-	1.45	14.64	83.91	.15	10.22	0.83	2.14	-.02	.44
74	3749	0	-	.12	27.85	72.03	.28	9.69	1.21	2.40	+.14	.45
75	1657	0	-	.37	38.87	60.76	.39	9.11	1.81	2.66	+.16	.44
76	2628	0	-	.01	24.82	75.17	.25	9.80	1.12	2.43	+.10	.47
77	2659	0	-	2.32	24.68	73.00	.25	9.51	1.37	2.73	+.07	.51
78	2983	15	-	.17	33.06	66.77	.33	9.22	1.67	2.36	+.19	.50
79	3711	0	-	.10	29.33	70.57	.29	9.46	1.41	2.46	+.14	.48
80	3801	0	-	.13	49.34	50.53	.49	8.29	3.18	2.73	+.14	.52

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 20

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz Ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
81	4232	0	-	1.15	36.70	62.15	.37	9.33	1.55	2.61	+.13	.43
82	4294	0	-	2.52	30.87	66.61	.32	9.59	1.30	2.58	+.14	.45
83	4345	0	-	.32	23.28	76.40	.23	9.95	1.01	2.46	+.05	.46
84	4457	0	-	.17	27.30	72.53	.27	9.76	1.15	2.34	+.15	.43
85	3817	0	-	.71	22.01	77.28	.22	9.89	1.05	2.40	+.07	.47
86		0	-	.07	15.91	84.02	.16	10.26	0.81	2.23	+.08	.45
87	4319	0	-	.08	20.83	79.09	.21	10.00	0.98	2.21	+.14	.45
88	5081	0	-	.06	24.01	75.93	.24	9.70	1.20	2.54	+.06	.51
89	5706	0	-	.12	17.32	82.56	.17	10.16	0.87	2.17	+.16	.43
90	5991	0	-	.05	19.57	80.38	.20	10.01	0.97	2.32	+.10	.48
91	5863	0	-	.01	20.44	79.55	.20	9.97	0.99	2.25	+.15	.46
92	5764	0	-	.27	19.63	80.10	.20	9.99	0.98	2.27	+.14	.46
93	5797	0	-	.03	21.95	78.02	.22	9.92	1.03	2.33	+.10	.46
94	5993	0	-	.09	24.12	75.79	.24	9.86	1.08	2.33	+.12	.45
95	5804	0	-	.05	16.61	83.34	.17	10.27	0.81	2.33	+.03	.46
96	5771	0	-	.01	31.66	68.33	.32	9.16	1.75	2.68	+.07	.54

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 20

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
97	5841	0	-	.04	17.87	82.09	.18	10.04	0.95	2.38	+.07	.51
98	5673	0	-	.03	20.45	79.52	.20	9.98	0.99	2.32	+.10	.47
99	5486	0	-	.02	19.91	80.07	.20	9.97	0.99	2.30	+.14	.47
100	5340	0	-	.01	22.00	77.99	.22	9.86	1.07	2.37	+.10	.46
101	4460	0	-	.16	42.95	56.89	.43	8.59	2.58	3.05	+.02	.43
102	5216	10	-	.02	26.65	73.33	.27	9.63	1.26	2.70	+.19	.48
103	3442	0	-	1.37	41.13	57.50	.42	8.71	2.37	2.86	+.11	.48
104	5449	0	-	0.00	77.46	22.54	.77	7.00	7.79	1.75	+.37	.58
105	5336	0	-	.86	37.89	61.25	.38	9.55	1.33	2.17	+.27	.44
106		NO CORE										
107	5872	0	-	.16	28.20	71.65	.28	8.99	1.96	3.00	-.07	.46
108	5625	0	16.99	.16	23.31	59.54	.28	7.23	6.63	5.36	-.43	.61
109	5629	0	-	1.26	34.52	64.22	.35	8.99	1.96	2.52	+.10	.54
110	4334	0	5.83	12.14	34.14	47.79	.42	7.61	5.10	4.41	-.21	.55
111	3851	0	-	.83	53.98	45.19	.54	7.98	3.96	2.45	+.24	.49
112	3592	0	-	1.49	54.83	43.68	.56	7.78	4.53	2.30	+.13	.55
113	3801	0	-	.09	44.57	55.34	.45	8.56	2.64	2.46	+.22	.53

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 20

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz Ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
114	3810	0	-	.25	39.84	59.91	.40	9.01	1.94	2.40	+.30	.53
115	3813	0	-	.10	35.61	64.29	.36	9.22	1.67	2.45	+.21	.49
116	3895	0	-	1.23	41.52	57.25	.42	8.77	2.28	2.45	+.24	.51
117	3904	0	-	1.35	47.28	51.37	.48	8.31	3.15	2.65	+.12	.54
118	5360	0	-	1.27	38.25	60.48	.39	8.88	2.11	2.71	+.10	.53
119	2739	0	-	2.54	67.37	30.09	.69	6.83	8.74	2.43	+.46	.43
120	6216	0	-	0.93	38.37	60.70	.39	8.85	2.15	2.64	+.16	.49
121	5859	0	-	1.08	42.59	57.33	.43	8.62	2.52	2.63	+.15	.49
122	5563	0	-	.24	40.58	59.18	.41	8.83	2.19	2.58	+.12	.56
123	4903	0	-	.74	44.57	54.69	.45	8.61	2.55	2.52	+.15	.52
124	5534	0	-	2.38	45.43	52.19	.47	8.49	2.77	2.79	+.17	.49
125	5545	0	-	.14	43.75	56.11	.44	8.64	2.50	2.35	+.19	.54
126	5515	0	-	.57	37.30	62.13	.38	8.94	2.03	2.46	+.17	.51
127	5583	0	-	.36	38.28	61.36	.38	9.08	1.84	2.61	+.12	.52
128	5612	0	-	.16	28.96	70.88	.29	9.44	1.43	2.47	+.20	.45
129	5766	0	-	.24	38.46	61.30	.39	9.17	1.73	2.46	+.19	.48
130	NO CORE											

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 20

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz Ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
131	5858	0	-	6.88	35.45	57.67	.38	8.62	2.52	3.13	.00	.48
132	229	NO CORE										
133	1503	0	--	44.25	36.15	19.60	.65	4.62	40.5	2.98	+.31	.52
134	2352	NO CORE										
135	2598	0	-	0.62	53.63	45.75	.54	8.09	3.65	2.86	+.32	.46
136	6306	0	-	10.40	41.60	48.00	.46	8.08	3.68	3.06	+.08	.51
137	3919	0	-	0.98	48.69	50.33	.49	8.40	2.94	2.77	+.19	.48
138	4244	0	-	1.70	38.51	59.79	.39	8.97	1.99	2.70	+.16	.50
139	3782	0	-	2.06	47.48	50.46	.49	8.35	3.05	2.72	+.18	.48
140	4477	0	5.08	8.40	47.46	39.06	.55	7.27	6.47	3.97	-.04	.60
141	4987	0	-	1.39	38.12	60.49	.39	8.97	1.99	2.73	+.13	.47

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 21

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	% SILT / SILT + CLAY	MEAN-Mz Ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
59	2992	0	-	1.96	43.82	54.22	.45	8.87	2.13	2.89	+.10	.42
60	3751	0	-	1.52	51.14	47.34	.52	8.35	3.05	2.84	+.25	.46
61	4583	0	-	0.39	37.24	62.37	.37	9.02	1.92	2.70	+.13	.45
62	4625	0	-	0.02	48.56	51.42	.49	9.23	1.66	2.74	+.17	.45
63	4674	0	-	0.02	16.91	83.07	.17	9.98	0.99	2.20	+.22	.47
64	4867	0	-	-	20.61	79.39	.21	9.73	1.17	2.03	+.30	.48
65	5365	10	-	-	16.57	83.43	.17	10.15	0.88	2.20	+.15	.45
66	5601	0	-	0.02	19.12	80.86	.19	9.87	1.07	2.24	+.01	.47
67	5879	0	-	-	11.28	88.72	.11	10.21	.84	2.36	+.14	.53
68	5953	0	-	-	19.05	80.95	.19	10.00	.97	2.29	+.11	.45
69	5982	0	-	-	23.72	76.28	.24	9.78	1.13	2.41	+.12	.48
70	5954	0	-	0	20.36	79.64	.20	9.89	1.05	2.35	+.11	.45
71	5954	0	0.43	0.03	25.10	74.44	.25	9.67	1.22	2.49	+.10	.48
72	5369	12	0.38	0.31	30.24	69.07	.31	9.49	1.39	2.77	-.02	.47
73	5872	0	-	0.21	25.51	74.28	.26	9.70	1.20	2.39	+.16	.46
74	6015	0	-	0.44	27.26	72.30	.27	9.54	1.34	2.42	+.13	.47
75	6119	0	-	0.62	30.21	69.17	.30	9.33	1.55	2.53	+.18	.49

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 21

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz ϕ	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT.K_G'
76	5916	0	-	1.26	45.66	53.08	.46	8.55	2.66	2.84	+.16	.48
78	1106	0	0.66	88.07	7.47	3.80	.66	0.80	5.71	1.62	+.49	.74
79	3550	0	-	7.54	63.28	29.18	.68	6.73	9.39	2.58	+.46	.50
80	4400	0	0.03	23.56	49.51	26.90	.65	6.30	12.66	2.99	+.27	.49
81	4352	0	-	22.16	35.88	41.96	.46	7.74	4.65	2.84	+.14	.49
82	4565	0	-	0.83	42.67	56.50	.43	9.02	1.93	2.66	+.13	.47
83	3702	0	-	17.92	55.50	26.58	.68	6.33	12.43	2.61	+.27	.47
84	4116	0	-	1.60	23.06	75.34	.23	9.72	1.18	2.38	+.14	.47
85	1684	17	-	73.16	15.41	11.43	.57	3.51	87.5	2.37	+.61	.63
86	5717	0	-	2.28	26.36	71.36	.27	8.88	2.11	2.83	+.14	.49
87	5879	0	-	2.87	36.55	60.58	.38	8.85	2.16	2.64	+.09	.50
88	5757	0	-	0.14	58.15	41.71	.58	7.79	4.50	2.86	+.34	.48
89	5821	0	-	0.96	57.57	41.47	.58	7.21	6.75	2.33	+.50	.49
90	5841	0	-	21.33	42.85	35.82	.55	6.67	9.82	3.26	+.04	.47
91	5128	0	-	0.88	73.51	25.61	.74	7.24	6.58	2.38	+.47	.48
92		NO CORE										
93	2878	0	-	42.11	52.13	5.76	.90	4.12	57.3	1.37	+.36	.71
94	1252	MANGANESE PAVEMENT, NO SAMPLE										

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 21

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz ϕ	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
95	4698	0	0.16	9.94	72.43	17.47	.81	6.07	14.85	2.08	+.31	.55
96	5475	0	-	1.01	74.55	24.44	.75	6.71	9.50	2.18	+.43	.55
97	4868	0	-	1.25	39.19	59.56	.40	8.84	2.18	2.62	+.13	.50
98	2134	0	-	56.84	30.73	12.43	.71	4.03	61.0	2.79	+.45	.60
99	5148	0	-	0.55	34.86	64.59	.35	9.41	1.46	2.49	+.15	.49
100	5233	0	-	1.39	40.93	57.68	.42	8.77	2.29	2.72	+.16	.50
101	5293	0	-	2.12	42.36	55.52	.43	8.49	2.76	2.67	+.17	.42
102	139	0	39.89	39.05	17.02	4.04	.81	0.53	690.	4.11	-.44	.42
103	132	0	0.11	96.25	1.28	2.36	.35	2.80	143.5	0.42	0.00	.59
104	143	0	67.87	18.95	9.66	3.52	.73	-2.20	4610.	4.00	+.95	.39
105	1902	0	-	0.32	38.64	61.04	.39	8.94	2.03	2.60	+.22	.47
106		NO CORE										
107	2217	0	-	2.07	44.68	53.25	.46	8.59	2.58	2.90	+.16	.44
108	1900	0	-	2.54	44.74	52.72	.46	8.44	2.87	3.06	+.11	.43
109	1964	0	-	1.30	44.76	53.94	.45	9.20	1.70	2.70	+.11	.46
110		NO CORE										
111	5616	0	-	1.23	56.99	41.78	.58	7.58	5.22	2.29	+.21	.50
112	5960	0	-	1.32	34.16	64.52	.35	9.08	1.84	2.47	+.18	.50

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 21

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz ϕ	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
113	5687	0	-	1.59	38.55	59.86	.39	8.85	2.16	2.60	+.15	.55
114	5618	0	0.72	0.47	35.05	63.76	.35	9.20	1.70	2.71	+.11	.46
134	5298	0	-	2.14	53.01	44.85	.54	7.74	4.65	2.86	+.18	.48
135	5929	0	-	1.79	54.42	43.79	.55	7.96	3.99	3.00	+.23	.47
136	5042	0	-	0.90	32.19	66.91	.32	9.32	1.56	2.62	+.10	.48
137	4971	0	-	1.21	43.82	54.97	.44	8.84	2.17	2.85	+.15	.47
138	4418	0	-	0.79	58.55	40.66	.59	8.17	3.46	2.85	+.37	.45
139	6009	0	-	0.60	50.76	48.64	.51	8.30	3.17	2.57	+.29	.44
140	5949	0	-	0.70	34.62	64.68	.35	9.13	1.78	2.70	+.12	.47
141	5821	0	-	1.97	44.18	53.85	.45	8.13	3.55	3.29	+.03	.50
142	4241	0	-	0.63	34.44	64.93	.35	9.31	1.58	2.69	+.11	.46
143	3592	INDURATED NO SAMPLE										
144	4931	0	-	0.05	23.37	76.58	.23	9.62	1.26	2.51	+.18	.48
145	6088	0	0.18	0.06	30.27	69.49	.30	9.21	1.68	2.42	+.16	.54
146	3968	0	-	0.95	33.93	65.12	.34	8.98	1.97	2.67	+.03	.54
147	5256	0	-	0.08	32.10	69.82	.32	9.45	1.42	2.43	+.16	.49
148	5477	0	-	2.25	33.79	63.96	.35	9.12	1.80	2.76	+.09	.48

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 21

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz ϕ	MEAN-Mz μ	STAND. DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
149	5665	0	-	2.81	58.49	38.70	.60	7.33	6.18	2.57	+.28	.49
150	5416	0	-	1.88	34.77	63.35	.70	9.14	1.77	2.75	+.18	.45
151	5055	0	-	2.06	47.58	50.36	.49	8.26	3.24	3.05	+.13	.45
152	3279	0	-	50.36	36.07	13.57	.73	4.75	36.9	2.27	+.66	.66
153	3532	0	-	3.02	33.12	63.86	.34	9.15	1.75	2.77	+.06	.48
154	3338	0	-	0.37	34.11	65.52	.34	9.37	1.51	2.57	+.10	.45
155	2999	0	-	0.89	34.71	64.40	.35	8.99	1.96	2.78	+.05	.48
156	3418	0	-	0.07	53.23	46.70	.55	7.96	4.00	2.72	+.18	.51
157	1135	0	-	13.31	46.06	40.63	.53	7.57	5.25	3.44	+.21	.43
158	3731	0	-	2.35	52.61	45.04	.54	7.77	4.56	2.41	+.11	.53
159	3760	0	-	-	29.05	70.95	.29	9.51	1.37	2.61	+.06	.42
160	3779	0	-	1.68	45.31	53.01	.46	8.62	2.53	2.65	+.20	.54
161	3237	0	-	4.65	43.73	51.62	.46	8.61	2.55	2.91	+.19	.55
162	2317	0	-	0.24	68.55	31.21	.69	6.98	7.88	2.68	+.33	.48
163	3270	0	-	0.53	44.03	55.44	.44	8.74	2.32	2.76	+.21	.46
164	1919	0	-	0.73	47.00	52.27	.47	8.52	2.72	2.91	+.14	.46
165	2576	0	-	2.44	45.91	51.65	.47	7.93	4.09	2.57	-.02	.51

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 21

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz Ø	MEAN-Mz µ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
166	7103	0	-	0.24	37.87	61.89	.38	8.67	2.44	2.85	+.17	.44
167	6909	0	-	27.03	63.79	9.13	.87	4.81	35.6	1.73	+.70	.73
168	165	0	0.33	47.47	44.43	7.77	.85	4.10	58.3	1.72	+.22	.61
169	1858	0	-	3.95	58.23	37.82	.39	7.69	4.84	2.90	+.36	.51
170	7011	0	-	1.54	42.45	56.01	.43	8.93	2.05	2.79	+.13	.48
171	5013	0	-	0.71	72.78	26.51	.73	6.99	7.84	2.12	+.47	.57
172	5198	0	-	12.24	66.40	21.36	.26	6.20	13.6	2.18	+.28	.49
173	5493	0	-	1.40	25.51	73.09	.26	8.64	2.50	2.51	+.14	.46
174	5691	0	-	0.09	20.23	79.68	.20	10.03	0.95	2.35	+.09	.45
175	5654	10	-	.01	21.96	78.03	.22	9.79	1.13	2.28	+.14	.48
176	5621	0	-	0.03	18.03	81.94	.19	10.03	.96	2.34	+.11	.48
177	6022	5	-	-	16.43	83.57	.16	10.00	.97	2.11	+.27	.45
178	5720	0	-	0.27	24.85	74.88	.25	9.64	1.25	2.41	+.17	.46
179	5771	0	-	0.03	16.59	83.38	.17	10.16	0.87	2.35	+.08	.48
180	5676	0	-	0.01	15.52	84.47	.16	10.36	0.76	2.18	+.12	.44
181	5302	0	3.97	0.06	15.00	80.97	.16	10.07	.93	2.37	+.06	.47
182	5824	4	-	0.03	15.59	84.38	.16	10.05	.94	2.14	+.20	.45

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

VEMA 21

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT / SILT + CLAY	MEAN-Mz Ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G
183	5711	0	-	0.01	14.40	85.59	.14	10.20	0.85	2.10	+.22	.43
184	4804	0	-	0.05	22.17	77.78	.22	9.88	1.06	2.34	+.13	.46
185	4857	0	-	1.46	74.10	24.44	.75	6.75	9.24	2.14	+.50	.55
187	3762	0	-	1.58	50.84	47.58	.52	8.46	2.83	2.91	+.27	.45

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

RC-10

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz Ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
156	5402	0	-	0.04	38.57	61.39	.39	9.74	1.17	2.39	+.10	.49
157	5682	0	-	0.08	25.27	74.65	.25	9.60	1.29	2.38	+.21	.48
158	5892	0	-	0.05	20.77	79.17	.21	9.84	1.09	2.29	+.15	.45
159	5894	0	-	0.12	26.04	73.84	.26	9.68	1.22	2.38	+.19	.45
160	4621	0	-	0.43	28.98	70.59	.29	9.51	1.37	2.57	+.10	.47
161	3587	0	-	0.58	36.23	36.19	.36	8.80	2.23	2.83	+.11	.49
162	3913	0	-	1.66	39.36	58.98	.40	8.71	2.38	2.78	+.07	.52
163	3550	0	-	1.70	51.63	46.67	.53	7.90	4.16	3.01	+.14	.44
164	3766	0	-	1.58	44.31	54.11	.45	8.51	2.73	2.92	+.09	.50
165	3638	MANGANESE PAVEMENT NO SAMPLE										
166	3729	0	-	1.00	46.62	52.38	.47	8.38	2.99	3.00	+.12	.45
167	6092	0	-	1.57	46.66	51.77	.47	8.39	2.97	2.49	+.19	.53
168	5751	0	-	2.69	48.81	48.50	.50	7.86	4.27	2.81	+.06	.50
169	5740	0	-	1.43	45.24	53.33	.46	8.77	2.29	2.74	+.19	.47
170	5621	0	-	0.76	33.54	65.70	.34	9.19	1.71	2.79	+.03	.47
171	5544	0	-	1.11	33.64	65.25	.34	9.20	1.69	2.71	+.10	.45
172	4387	0	-	2.91	32.41	64.68	.33	9.07	1.86	2.82	+.13	.47
173	4056	0	-	2.47	35.86	61.67	.37	9.01	1.94	2.77	+.15	.48

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

RC-10

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz ϕ	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
174	3191	0	-	1.98	34.90	63.12	.36	9.03	1.90	2.85	+.05	.49
175	4014	0	-	1.47	35.03	63.50	.36	9.23	1.65	2.76	+.04	.40
176	4226	0	-	1.36	36.70	61.94	.37	8.96	2.00	2.82	+.01	.52
177	5302	0	-	.00	27.16	72.84	.27	9.68	1.22	2.42	+.17	.46
178	5808	0	-	-	25.87	74.13	.26	10.54	0.67	2.15	+.12	.44
179	4312	0	-	0.11	31.08	68.81	.31	9.41	1.47	2.57	+.14	.43
181	5698	0	3.19	0.25	29.57	66.99	.31	9.40	1.48	2.73	+.01	.49
182	5561	0	-	1.97	31.11	66.92	.32	9.38	1.50	2.69	+.08	.47
184	4986	0	-	0.69	37.97	61.34	.38	8.98	1.98	2.82	+.14	.43
185		NO CORE										
186	6591	0	-	1.30	33.99	64.71	.34	9.16	1.74	2.63	+.12	.51
187	6216	0	-	3.01	36.50	60.49	.38	8.85	2.15	2.83	+.09	.47
188	3673	0	-	1.59	40.41	58.00	.41	8.68	2.43	2.92	+.04	.47
189	3422	0	-	22.62	54.08	23.30	.70	5.91	16.63	3.22	+.05	.54
190	3733	0	-	1.68	50.55	47.77	.51	8.28	3.20	2.78	+.23	.52
191	3025	0	-	1.49	51.52	46.99	.52	8.29	3.18	2.59	+.31	.50
192	3684	0	-	1.09	46.57	52.34	.47	8.62	2.53	2.45	+.29	.51

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

RC-10

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz Ø	MEAN-Mz μ	STAND. DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
193	137	0	0.24	95.89	2.72	1.15	.70	2.21	215.6	0.79	-.12	.55
194	3801	0	-	0	31.65	68.35	.32	9.58	1.31	2.43	+.25	.43
195	3835	0	-	0.16	31.61	68.23	.32	9.58	1.30	2.48	+.20	.45
196	1007	0	-	17.88	53.09	29.03	.65	6.36	12.09	2.98	+.26	.50
197	397	0	0.40	95.33	2.42	1.85	.57	2.50	175.9	0.57	-.01	.57
198	3728	0	-	3.33	54.34	42.33	.56	7.96	4.01	2.72	+.23	.55
199	4698	0	-	2.37	50.11	47.52	.51	7.99	3.92	2.79	+.14	.51
200	7317	0	-	.09	33.95	65.96	.34	9.53	1.35	2.64	+.11	.45
201	5158	0	4.89	3.84	31.92	59.35	.35	8.74	2.32	3.66	-.12	.61
202	5523	0	-	1.02	29.76	69.22	.30	9.39	1.49	2.50	+.12	.48
203	5883	0	-	.07	22.92	77.01	.23	9.89	1.05	2.21	+.12	.45
204	5618	0	-	.88	30.93	68.19	.31	9.47	1.41	2.54	+.12	.46
205	6081	0	6.18	0.63	24.97	68.22	.27	9.37	1.50	3.91	-.19	.64
206	5497	0	-	1.97	34.07	63.96	.35	9.09	1.84	2.82	+.02	.47
207	7264	0	-	1.14	40.45	58.41	.41	8.70	2.40	2.81	+.04	.50
208	3737	0	-	1.45	52.47	46.08	.53	7.64	5.00	3.03	+.13	.42
209	2774	0	-	1.18	54.08	44.74	.55	8.02	3.83	2.60	+.25	.51

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

RC-10

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz Ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
210	7284	0	-	1.68	38.57	59.75	.39	8.84	2.17	2.85	+.10	.48
211	5137	0	-	2.00	46.33	51.62	.47	7.96	3.98	2.81	+.03	.49
212	7231	0	-	.21	35.43	64.36	.36	9.13	1.78	2.56	+.15	.47
213	7196	0	-	0.81	54.23	44.96	.55	8.07	3.72	2.97	+.24	.45
214	4731	0	-	19.37	30.62	50.01	.38	7.86	4.30	3.97	-.06	.43
215	4887	0	17.00	0.30	47.14	35.56	.57	4.87	34.1	6.06	-.31	.59
216	4989	0	-	2.25	71.01	26.74	.73	6.38	11.97	2.38	+.44	.50
217	4338	0	2.75	5.33	36.59	55.33	.40	8.40	2.95	3.60	-.09	.55
218	909	0	4.67	86.63	5.89	2.81	.51	1.92	264.0	1.62	-.03	.60
219	3786	0	-	2.34	44.99	52.67	.46	8.66	2.46	2.76	+.19	.50
220	3157	0	-	1.03	29.70	69.27	.30	9.55	1.33	2.62	+.07	.46
221	2834	0	-	0.10	33.20	66.70	.33	9.31	1.57	2.74	+.03	.45
222	3559	0	-	0.07	38.37	61.56	.38	9.05	1.88	2.78	+.18	.42
223	3645	0	-	0	32.53	67.47	.33	9.57	1.31	2.62	+.03	.44
224	1159	0	63.09	32.82	2.36	1.73	.58	-1.70	3249.	2.92	+.40	.37
225	2536	0	-	0.20	24.13	75.67	.24	9.75	1.16	2.48	+.10	.45
226	2534	0	-	0.11	29.18	70.71	.48	9.68	1.22	2.61	+.01	.46

SURFACE SEDIMENT SAMPLES FROM NORTH PACIFIC CORES

GRAIN SIZE DATA

RC-10

CORE NO.	DEPTH IN METERS	DEPTH IN CORE (Cm)	% GRAVEL	% SAND	% SILT	% CLAY	%-SILT SILT + CLAY	MEAN-Mz ø	MEAN-Mz μ	STAND.DEV. σ_I	SKEW Sk_I	TRANS. KURT. K_G'
227	2774	0	-	0.08	15.57	84.35	.16	10.13	0.89	2.14	+.19	.46
228	2765	0	-	0.12	22.51	77.37	.23	9.70	1.20	2.47	+.13	.48
229	2582	0	-	0.53	20.67	78.80	.21	10.36	0.76	2.29	-.23	.45
230	3200	0	-	.19	37.29	62.52	.37	9.23	1.66	2.70	+.10	.46
231	4726	0	-	-	33.19	66.81	.33	9.57	1.32	2.53	+.14	.43
232	4674	0	-	.25	13.33	86.42	.13	10.41	0.73	2.17	+.06	.46
233		NO CORE										
234	4281	0	-	.17	18.08	81.75	.18	10.02	0.96	2.23	+.15	.46
235	4737	3	-	-	17.67	82.33	.18	10.06	0.94	2.26	+.14	.45
236	4491	0	-	-	12.49	87.51	.12	10.20	0.85	2.17	+.21	.46
237	4468	0	-	.01	21.27	78.72	.21	9.96	1.00	2.26	+.15	.45

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A preliminary survey of sub-bottom reflectors contained in 261 sediment cores from the North Pacific reveals that they are restricted to certain areas of the sea floor. Their distribution is given. Because they are of limited extent and possess different sonic properties, they are considered acoustic provinces. The sea floor of the North Pacific includes 3 such regions: 1) the Japan Acoustic Province, 2) the Aleutian-Alaska Acoustic Province and 3) the Central North Pacific Acoustic Province

Off Japan and the Kurils, sub-bottom reflectors are ash layers; south and west of the Aleutians and Alaska they are silts and sands deposited by turbidity currents; whereas in the central North Pacific reflectors are rare. Surficial sediment is only useful as an index to the relectivity of the bottom within the Central North Pacific Acoustic Province.

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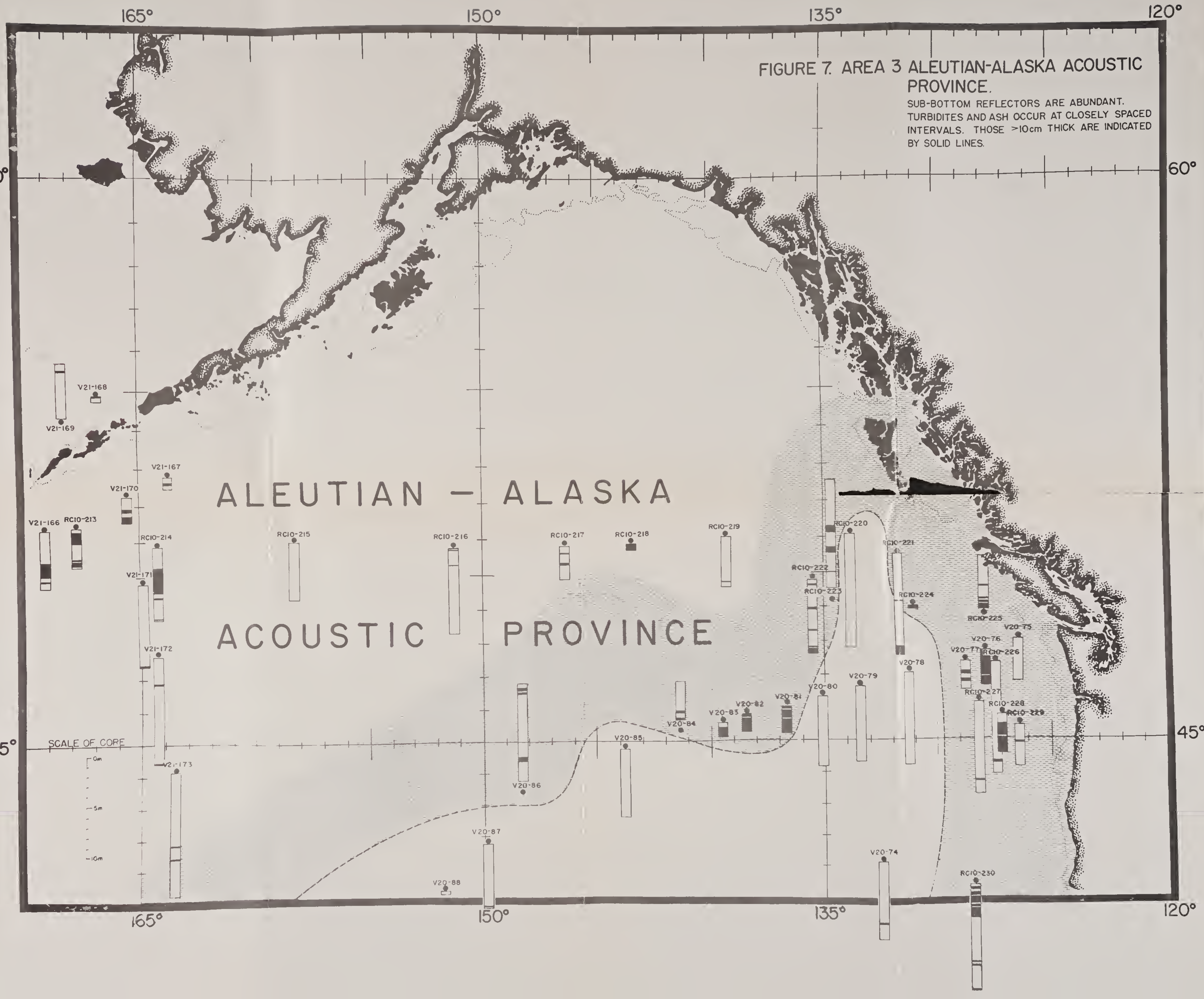

FIGURE 7. AREA 3 ALEUTIAN-ALASKA ACOUSTIC PROVINCE.
SUB-BOTTOM REFLECTORS ARE ABUNDANT. TURBIDITES AND ASH OCCUR AT CLOSELY SPACED INTERVALS. THOSE >10cm THICK ARE INDICATED BY SOLID LINES.
ALEUTIAN — ALASKA
ACOUSTIC PROVINCE
165°
150°
135°
120°
60°
45°
SCALE OF CORE
0m
5m
10m
V21-166
V21-167
V21-168
V21-169
V21-170
V21-171
V21-172
V21-173
RC10-213
RC10-214
RC10-215
RC10-216
RC10-217
RC10-218
RC10-219
RC10-220
RC10-221
RC10-222
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RC10-225
RC10-226
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RC10-228
RC10-229
RC10-230
V20-74
V20-75
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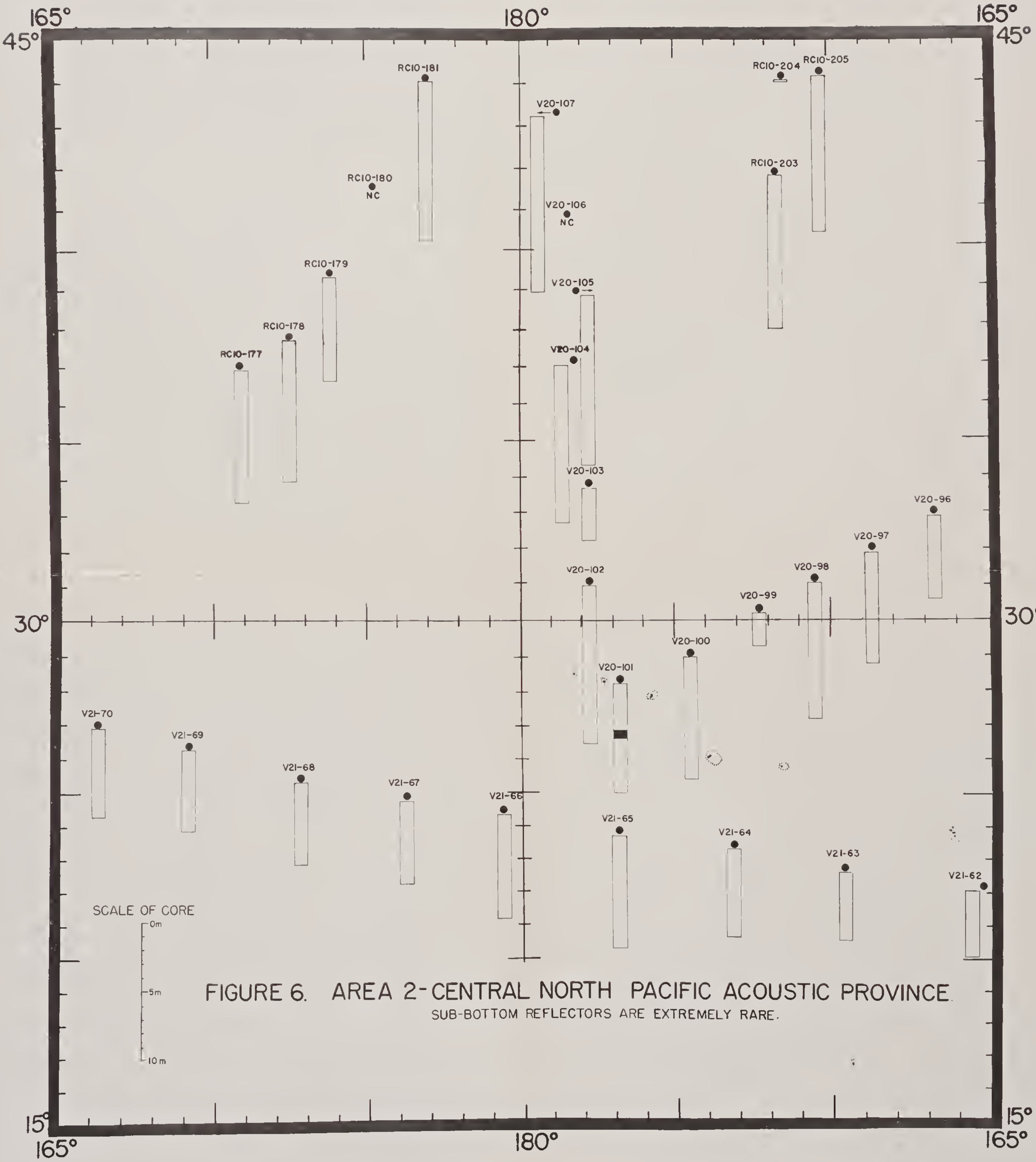

FIGURE 6. AREA 2-CENTRAL NORTH PACIFIC ACOUSTIC PROVINCE

SUB-BOTTOM REFLECTORS ARE EXTREMELY RARE.

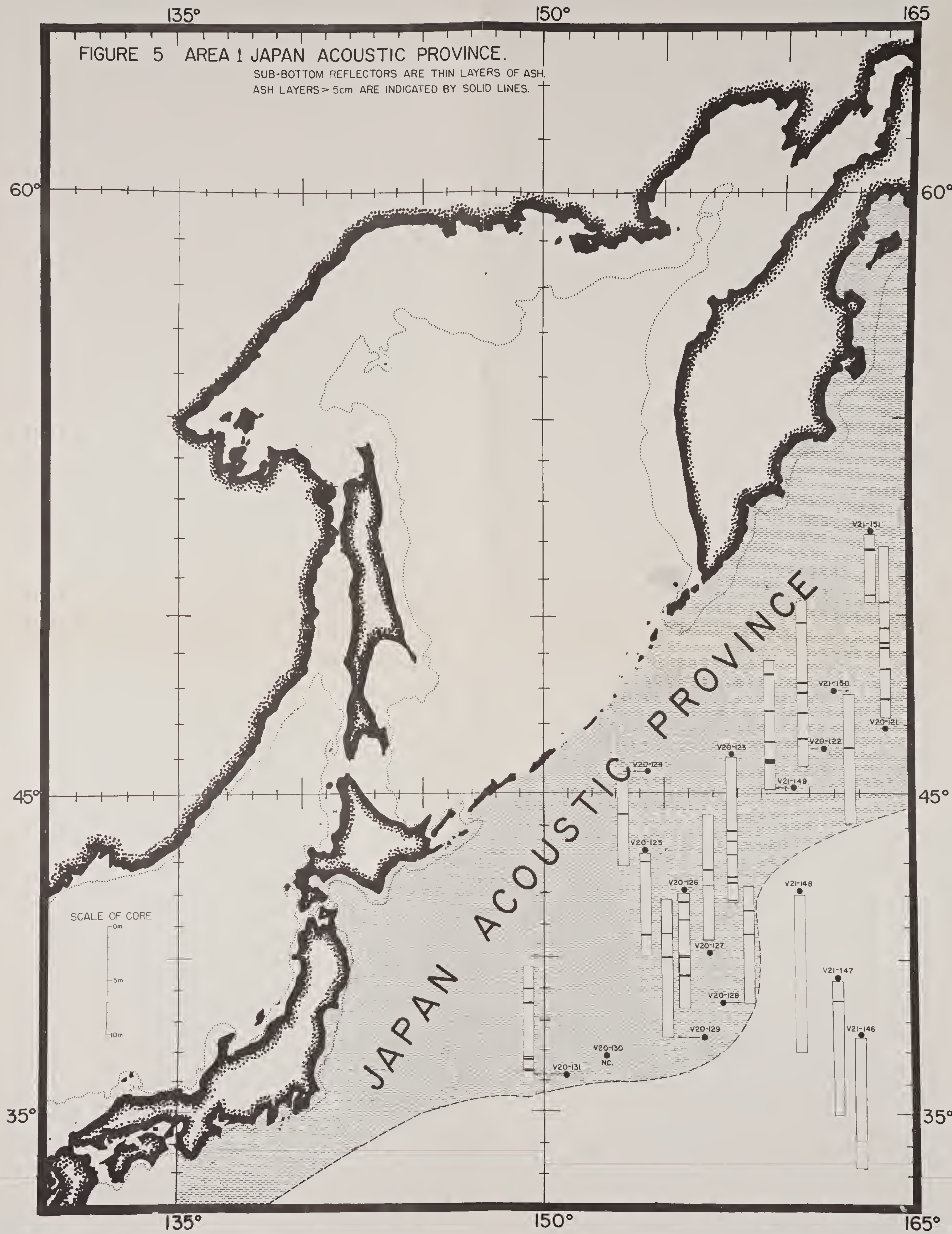

FIGURE 5 AREA 1 JAPAN ACOUSTIC PROVINCE.
SUB-BOTTOM REFLECTORS ARE THIN LAYERS OF ASH.
ASH LAYERS > 5cm ARE INDICATED BY SOLID LINES.