XI. RELATION BETWEEN MANGANESE NODULE ABUNDANCE AND ACOUSTIC STRATIGRAPHY IN THE GH78-1 AREA

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The problem of relation between the manganese nodule abundance and the thickness of acustic transparent layer both on seismic and 3.5 kHz PDR or SBP (subbottom profiling) records has been received attention especially in connection with the possibility of establishing a rapid prospecting method as well as obtaining the data for the feature of sedimentation and its bearing on the nodule growth.

As described in Chap. VI (NISHIMURA *et al.*, in this report), following the classification by TAMAKI *et al.* (1977), the acoustical stratigraphic sequence on seismic record of the GH78-1 area is divisible into Unit I (Type A, A′ and Type C), Unit II, and acoustic basement in descending order, and this is roughly correlative to that on the 3.5 kHz record.

Unit I ranges in thickness from within 10 m to 210 m, and is probably of Neogene to Quaternary age. Type A is acoustically transparent and seems to be oozy and clayey sediment, and Type A′ is characterized by the strong sea bottom reflection, though it has the similar transparent nature within inside of the layer as that of Type A. Type C is an acoustically highly stratified layer, but it appears as an opaque layer on 3.5 kHz record, and supposedly of turbidites beds. The distribution of Type C is restricted only to the southern deep sea basin areas, which corresponds to the northwestward extension of that neighboring to Magellan Rise in GH77-1 area. Unit II is an acoustically semi-opaque layer with reflector probably of Middle Eocene to Oligocene chert bed at its uppermost part, and with minor intra-folding structure, ranging in thickness from 50 m–210 m. Acoustic basement is thought as the Mesozoic basalt.

The results of our study on the relationship between the manganese nodule abundance and the thickness of transparent layer both on 3.5 kHz and seismic records are shown in Table XI-1 and Fig. XI-1. In addition, Fig. XI-2, a distribution map of the thickness of transparent layer on 3.5 kHz record, was tentatively made to show the areal change of relationship between the nodule abundance and the thickness of 3.5 kHz transparent layer, taking the topography into consideration. Also, the isopach map of Unit I (See Fig. VI-2 of Chap. VI, NISHIMURA *et al.*, in this report) serves as one of the important data for interpretation of this relationship.

These results are agreeable as a whole with the tendency recognized in the previously surveyed areas (MORITANI and MURAKAMI, 1979 etc.). Namely the general tendency that higher nodule abundance is confined to thin transparent layer of Type A of Unit I less than 40 m–50 m and that thicker layer more than 100 m relates to scarce nosule abundance is applicable here. However, it

Table XI-1 Relationship between the manganese nodule abundance and the thickness of transparent layer both on 3.5 kHz and seismic records

Station No.	Thickness of transparent layer		Type of Unit I	Abundance of manganese nodules (kg/m²)	
	3.5 kHz (m)	seismic (m)		wired grab	freefall grab
1036	10	?	(A)	32.5	32.0
1036-A	10	20	A	nd	nd
1037	15	10	A	nd	26.0
1037-1	—	—	—	10.6	nd
1038	0?	0?	(A)	nd	13.0
1038-A	0?	—	—	16.7	20.7
1039	0?	0	(A)	nd	2.2
1039-A	0	0	(A)	13.5	15.1
1040	0?	0	(A)	7.5	nd
1041	5	0	(A)	trace	trace
1042	5	0	(A)	trace	trace
1043	0	0	(A)	1.8	0.9
1044	2	0	(A)	nd	2.9
1044-1	—	—	—	3.9	nd
1045	0	0	(A)	20.2	trace
1046	0	0	—	2.2	7.7
1047	35	25	A	2.9	4.3
1048	0	0	(A)	8.1	6.9
1048-1	—	—	—	25.5	nd
1049	10	0	(A)	3.5	9.5
1050	0	0	(A)	6.2	12.1
1051	0	0	(A)	14.9	13.8
1052	5	0	(A)	3.1	0.9
1053	0	0	(A)	1.8	2.6
1054	0	0	(A)	23.9	5.2
1055	15	0	(A)	0.6	0.9
1056	0	?	(A)	9.4	17.3
1057	15	0	(A)	nd	19.0
1058	5	10*	C	0	0
1059	0	0	A	1.8	0.8
1060	15	20	A	10.3	4.3
1061	5	10	A	3.1	6.1
1064	0	0	(A)	nd	33.7
1065	45	45	A	0.3	trace
1066	25	25	A	17.3	15.5
1067	35	20	A	18.6	33.7
1068	20	20	A	nd	32.9
1069	0	—	—	nd	38.1
1070	0	0	(A)	49.2	16.4
1071	0	0	(A)	31.0	20.7
1072	15	0?	(A)	nd	38.1
1073	0	0	(A)	nd	32.8
1074	25	20	A	nd	25.9
1075	0?	0	(A)	0	0
1076	15	35	A	nd	2.9

(1) * Thickness of transparent layer in seismic reflection record is equal to that of whole Unit I except at St. 1058, where that of Unit I is about 180 m and the transparent part is 10 m thick.

(2) (A) means that the corresponding stations are definitely in the area of Type A distribution, though the transparent layer is too thin to be recognized.

(3) Abundance of manganese nodules listed in the column of freefall grab is the maximum one at each station. Nd stands for no data.

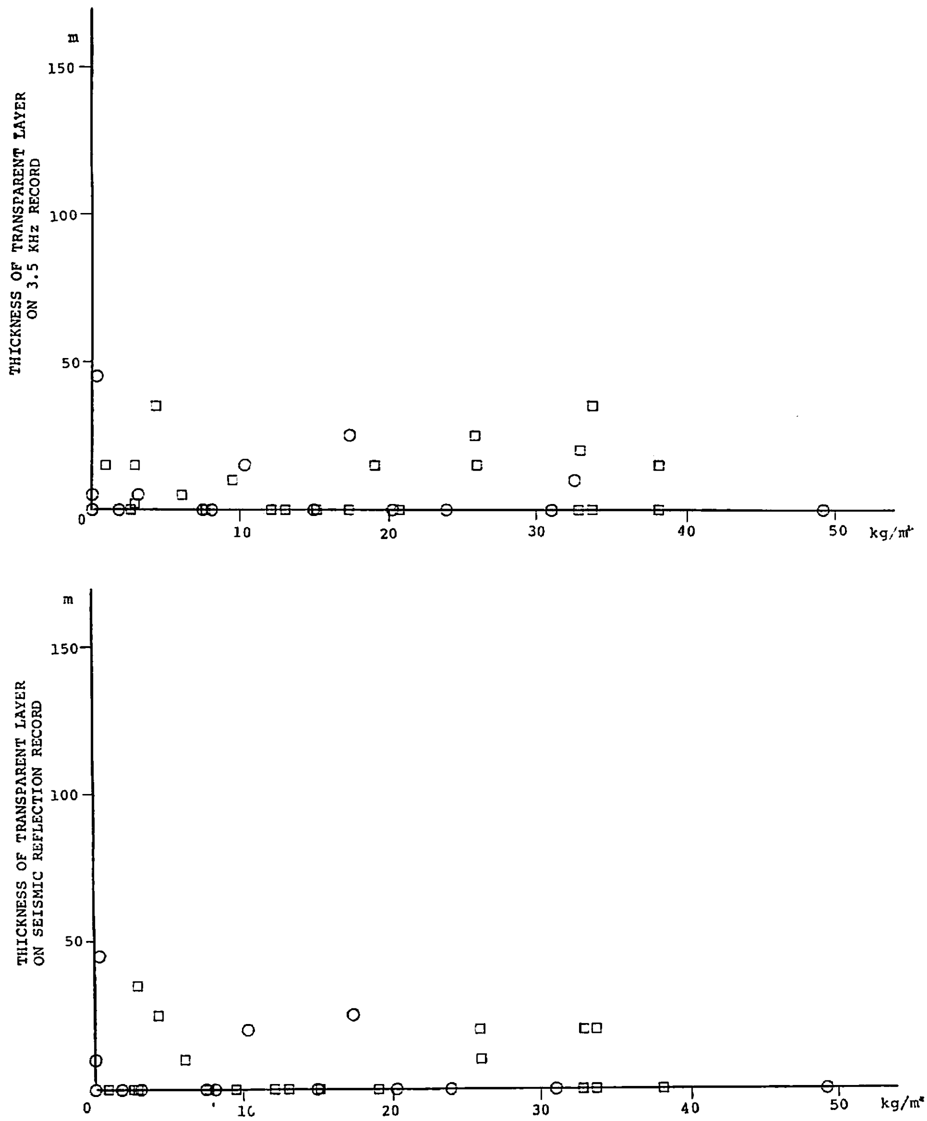

Fig. XI-1 Relation between manganese nodule abundance and thickness of acoustic layers at each sampling station. The data of manganese nodule abundance were obtained from Okean-70 grab or double box corer (circle) and freefall grab (square).

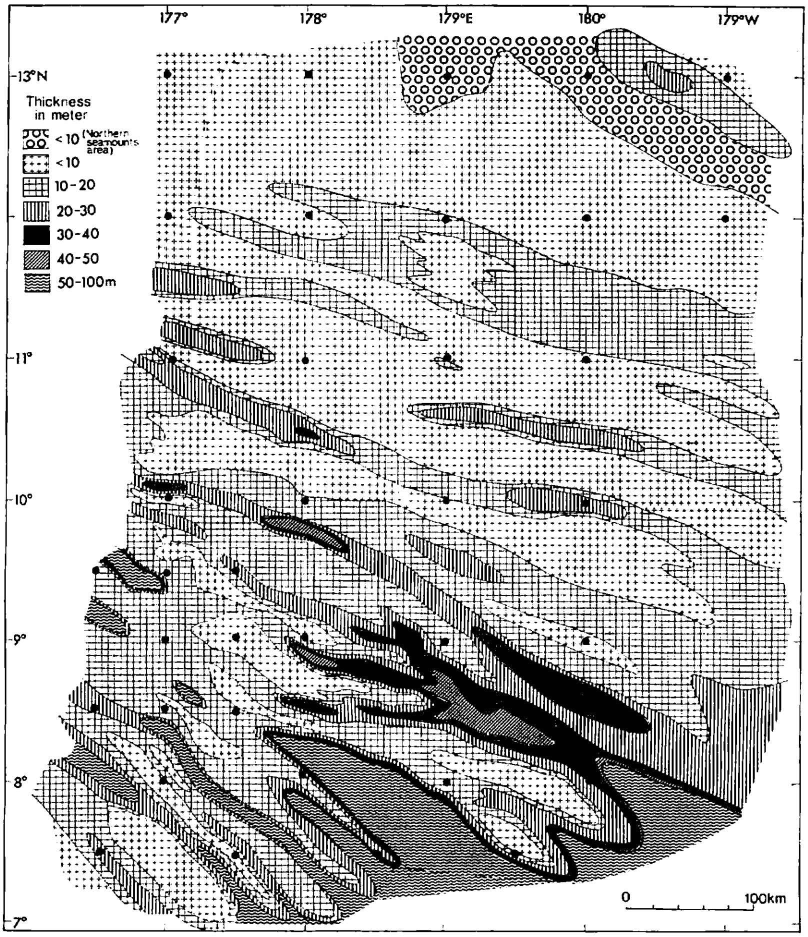

Fig. XI-2 Distribution map of the thickness of transparent layer on 3.5 kHz record.

is noted that the present GH78-1 area is characterized by very thin transparent layer less than 10 m especially in northward half part from the latitude around 10°N. Towards south from the above said latitude around 10°N, the thickness of transparent layer gradually increases. But the thickest part of Unit I more than 150 m with Type C on seismic record around St. 1058 is represented as thinner transparent layer on 3.5 kHz, because of the opaque nature of Type C on 3.5 kHz. It may be quite natural that the thicker layer part in southern deep sea basin has scarce nodule abundance, just in case of St. 1058 with zero nodule abundance, probably related to the supply of the turbidites material from Magellan Rise area. On the contrary, in the northwestern abyssal plain, although the Unit I layer is very thin the nodule abundance is very low.

These facts may, as mentioned previously (MORITANI and MURAKAMI, 1979), suggest that thinner transparent layer or, in other words, low sedimentation rate since Middle Eocence to Oligocene time had relation to the higher manganese nodule growth, and that the mode of sedimentation represented by the Type C or acoustic turbidites affected negatively to the growth of manganese nodules. Nevertheless, it must be noticed that the thickness less than 40 or 50 m relates to both higher and less abundances. This suggests that the thinner transparent layer less than 40 m–50 m is not necessarily connected with higher nodule abundance, and there must be still some other local factors controlling the distribution of manganese nodules. This remains as problem to be checked in further studies.

References

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