

NODULE ANALYSIS DATA

These data are arranged in four sections: station listing, transition metal analyses section, non-transition element analyses section, and bibliography. Data records in the analyses sections are keyed to the station listing by sequence number, and to the bibliography by reference number.

Station Listing

Latitude, Longitude - expressed in degrees and decimal parts of a degree.

Institution (no column heading) - refer to the following code:

FSU - Florida State University

HIG - Hawaii Institute of Geophysics

LDGO - Lamont-Doherty Geological Observatory

OSU - Oregon State University

USSR - Akademiia Nauk, U.S.S.R.

SIO - Scripps Institution of Oceanography

WHOI - Woods Hole Oceanographic Institution

DES and NAR - no function at present.

Transition Metal Analyses

Information on sample type, section of nodule sampled, dimensions, and nodule core material is provided where available.

Analytical method (2-column field immediately following REF column)

Refer to the following code:

WC - Wet chemical

XF - X-ray fluorescence spectrometry

XE - X-ray energy spectrometry

EM - Electron microprobe analysis.

AA - Atomic absorption analysis

NA - Neutron activation analysis.

ES - Emission spectroscopy

Data fields containing all zeros indicate "not known".

Non-Transition Element Analyses

"Z" is the atomic number of the element, which is followed by the weight percent of that element in the sample.

DOCUMENTATION for SIO Original Manganese Nodule FileSTA Records Format on SIO File

<u>Item</u>	<u>Beginning Column</u>	<u>Format</u>
Sequence No.	1	A7
-----	8	1X
Ship/Cruise/Station	9	A12
-----	21	1X
Latitude	22	F6.3
Latitude direction	28	A1 (N or S)
-----	29	1X
Longitude	30	F7.3
Longitude direction	37	A1 (E or W)
-----	38	1X
Sample Device	39	A12
-----	51	1X
Water Depth (m)	52	I5
-----	57	1X
Core Length (cm)	58	I5
-----	63	1X
Institution Code	64	A4
-----	68	1X
Reference Code	69	A4
-----	73-75	3X
Surface Lithology Code	76	A2
-----	78	1X
Nodule Occurrence	79	A3 (Yes, No, Nar)
-----	82	1X
Surface Nodules	83	A1 (S)
Buried Nodules	84	A1 (B)
-----	85	1X
Nodule coverage	86	A5
-----	91	1X
Estimate derivation	92	A5
-----	97	1X
Mn Concentration kg/m ²	98	F5.2

XTRA Records Format on SIO File

<u>Item</u>	<u>Beginning Column</u>	<u>Format</u>
Sequence No.	1	A7
Analysis No.	8	A2
-----	10	1X
Depth in Core	11	I5
Z1	16	I3
Z1 Concentration	19	F7.4
Z2	26	I3
Z2 Concentration	29	F7.4
Z3	36	I3
Z3 Concentration	39	F7.4
Z4	46	I3
Z4 Concentration	49	F7.4
Z5	56	I3
Z5 Concentration	59	F7.4
Z6	66	I3
Z6 Concentration	69	F7.4
Z7	76	I3
Z7 Concentration	79	F7.4
Z8	86	I3
Z8 Concentration	89	F7.4
Z9	96	I3
Z9 Concentration	99	F7.4
Z10	106	I3
Z10 Concentration	109	F7.4
Z11	116	I3
Z11 Concentration	119	F7.4

NAR Records Format on SIO File

<u>Item</u>	<u>Beginning Column</u>	<u>Format</u>
Sequence No.	1	A7
Analysis No.	8	A2
-----	10	1X
Sample Type Code	11	I2
Section Type Code	13	A2
-----	15	21X
Largest dimension	36	I3
-----	39	1X
Next largest dimension	40	I3
-----	43	1X
Smallest dimension	44	I3
-----	47	1X
Nucleus	48	A7
-----	55	1X
Morphology Code	56	A5
-----	61	1X
SIO Reference Code	62	A4
-----	66	1X
Analytical Method Code	67	A3
-----	70	1X
Mn concentration	71	F5.2
-----	76	1X
Fe concentrations	77	F5.2
CO "	82	F5.2
Ni "	87	F5.2
Cu "	92	F5.2
Zn "	97	F6.3
P6 "	103	F6.2
Al "	109	F6.2
Si "	115	F6.2
Ca "	121	F6.2
H ₂ O "	127	F6.2

NODULE ANALYSIS DATA

These data are arranged in four sections: station listing, transition metal analyses section, non-transition element analyses section, and bibliography. Data records in the analyses sections are keyed to the station listing by sequence number, and to the bibliography by reference number.

Station Listing

Latitude, Longitude - expressed in degrees and decimal parts of a degree.

Institution (no column heading) - refer to the following code:

FSU - Florida State University

HIG - Hawaii Institute of Geophysics

LDGO - Lamont-Doherty Geological Observatory

OSU - Oregon State University

USSR - Akademiia Nauk, U.S.S.R.

SIO - Scripps Institution of Oceanography

WHOI - Woods Hole Oceanographic Institution

DES and NAR - no function at present.

Transition Metal Analyses

Information on sample type, section of nodule sampled, dimensions, and nodule core material is provided where available.

Analytical method (2-column field immediately following REF column)

Refer to the following code:

WC - Wet chemical

XF - X-ray fluorescence spectrometry

XE - X-ray energy spectrometry

EM - Electron microprobe analysis.

AA - Atomic absorption analysis

NA - Neutron activation analysis.

ES - Emission spectroscopy

Data fields containing all zeros indicate "not known".

Non-Transition Element Analyses

"Z" is the atomic number of the element, which is followed by the weight percent of that element in the sample.

SEQUENCE NUMBER	SHIP/CRUISE + STATION NO	LATI- TUDE	LONGI- TUDE	SAMPLING DEVICE	WATER DEPTH (M)	CORE LENGTH (M)	REF NO.	RECORD NUMBER	DES	NAR
770031	ET7 R07	61.167S	45.167W	ROCK	DREDGE	232	0.00 FSU	A226	1	000190
790086	ET5 -R06	61.233S	67.717W	ROCK	DREDGE	3804	0.00 FSU	A227	2	000191
790089	ET5 -MT1	61.150S	67.833W	IRAWL	DREDGE	4084	0.00 FSU	A227	3	000192
790090	ET5 -R07	62.292S	67.850W	ROCK	DREDGE	3795	0.00 FSU	A227	4	000193
800024	ET10-R09	62.850S	74.758W	ROCK	DREDGE	4005	0.00 FSU	A227	5	000194
800030	VEMA17-SBI40	60.125S	74.917W	SEDMNT	DREDGE	4616	0.00 LDGO	A130	6	000195
800039	ET10-R011	61.033S	75.067W	ROCK	DREDGE	4471	0.00 FSU	A227	7	000196
800041	ET10 -MT10	62.037S	75.172W	IRAWL	DREDGE	4389	0.00 FSU	B568	8	000197
800062	ET10 -MT19	61.367S	78.933W	IRAWL	DREDGE	4544	0.00 FSU	B568	9	000198
820013	ET17-RD101	62.200S	94.767W	ROCK	DREDGE	4898	0.00 FSU	A227	10	000199
820014	ET23-RS2	61.450S	94.967W	ROCK	DREDGE	4691	0.00 FSU	A227	11	000200
820017	ET15 -BT1	61.033S	95.033W	IRAWL	DREDGE	4993	0.00 FSU	B574	12	000202
820027	ET15-RD4	61.033S	99.950W	ROCK	DREDGE	4938	0.00 FSU	A227	13	000203
830007	ET15 -BT5	61.100S	104.967W	IRAWL	DREDGE	4883	0.00 FSU	B574	14	000204
840013	ET11-MI4	60.360S	114.872W	IRAWL	DREDGE	4700	0.00 FSU	A227	15	000206
840015	ET23-RS5	60.400S	115.017W	ROCK	DREDGE	5033	0.00 FSU	A227	16	000207
850005	ET13 -BT7	65.617S	123.923W		DREDGE	4706	0.00 FSU	B571	17	000209
850015	ET13 -BT8	63.603S	129.897W		DREDGE	4813	0.00 FSU	B571	18	000210
860006	ET17-PC7-2	61.083S	134.350W	PISTON CORE		4435	0.00 FSU	A227	19	000211
860007	ET17-RS5	65.067S	134.883W	ROCK	DREDGE	4298	0.00 FSU	A226	20	000212
860009	ET17-PC6-1	60.950S	134.917W	PISTON CORE		3804	0.00 FSU	A227	21	000213
860010	ET17-RD4	64.050S	135.000W	ROCK	DREDGE	4334	0.00 FSU	A227	22	000215
860013	ET20-RS5	60.333S	137.767W	ROCK	DREDGE	4243	0.00 FSU	A227	23	000217
870004	ET25-PC15	64.517S	145.983W	PISTON CORE		3775	0.00 FSU	A227	24	000218
890002	ET14-RD5	62.433S	160.117W	ROCK	DREDGE	2926	0.00 FSU	A227	25	000219
890009	MSN-916	64.183S	165.933W	GRAVITY CORE		2932	1.00 SIO	M001	26	000220
910002	MSN-906	63.067S	173.483E	GRAVITY CORE		3583	0.37 SIO	M001	27	000222
910005	ET27-RS2	63.100S	177.617E	ROCK	DREDGE	3383	0.00 FSU	A227	28	000223
990053	03 12-993	60.025S	99.225E	IRAWL	DREDGE	4560	0.00 USSR	A246	29	001678
990006	03 12-873	61.075S	98.233E	SEDMNT	DREDGE	4415	0.00 USSR	A185	30	001499
1110004	VEHA 22-102	50.183S	22.400W	PISTON CORE		4319	3.96 LDGO	A109	31	000226
1110056	ET3 -MT2	54.183S	27.363W	IRAWL	DREDGE	5185	0.00 FSU	B566	32	000227
1120034	VEMA17-SBI84	50.253S	35.883W	IRAWL	DREDGE	4702	0.00 LDGO	A130	33	000228
1130027	ET7 -BT1	55.033S	44.475W		DREDGE	3727	0.00 FSU	B565	34	000229
1130062	ET7 -R016	59.142S	48.883W	ROCK	DREDGE	3850	0.00 FSU	A227	35	000231
1130061	ET7 -PC18	53.042S	43.433W	PISTON CORE		3113	4.20 FSU	B565	36	000230
1130063	ET7 -RD17	53.058S	48.950W		DREDGE	3255	0.00 FSU	B565	37	000232
1130068	VE15 -136	52.213S	49.082W	PISTON CORE		2514	7.35 LDGO	B630	38	000233
1140005	ET22-PC6	55.900S	51.833W	PISTON CORE		3950	0.00 FSU	A227	39	000236
1140009	ET22-RS2	57.650S	52.033W	ROCK	DREDGE	3985	0.00 FSU	A227	40	000237
1140013	ET22-PC34	53.383S	52.900W	PISTON CORE		3584	0.00 FSU	A227	41	000240
1140011	VEMA18-RD11	53.000S	52.900W		DREDGE	3101	0.00 LDGO	A130	42	000238
1140021	VEMA18-RD10	54.283S	54.217W		DREDGE	2355	0.00 LDGO	A130	43	000243
1140029	VEMA15SB120	57.533S	55.139W	IRAWL	DREDGE	4075	0.00 LDGO	A130	44	000244
1140040	ET6 -RD10	55.100S	55.833W	ROCK	DREDGE	2871	0.00 FSU	A227	45	000245
1140044	ET6 -BT2	53.942S	55.917W	IRAWL	DREDGE	1887	0.00 FSU	A227	46	000250
1140045	ET6 -BT4	57.950S	55.950W	IRAWL	DREDGE	4005	0.00 FSU	A227	47	000252
1140046	ET6 -RD13	57.767S	55.967W	ROCK	DREDGE	4064	0.00 FSU	A227	48	000253
1140052	ELIANIN-6-11	55.733S	56.050W	TRIP CORE		3914	0.22 FSU	B559	49	001365
1140051	ET6 -PC11	55.733S	56.050W	PISTON CORE		3914	5.42 FSU	B564	50	000254
1140056	ET6 -RD9	54.050S	56.083W	ROCK	DREDGE	1719	0.00 FSU	A227	51	000257
1140054	ET6 -RD11	55.975S	56.083W	ROCK	DREDGE	4144	0.00 FSU	A227	52	000255
1140061	ET6 -BT3	56.933S	56.483W	IRAWL	DREDGE	3365	0.00 FSU	A227	53	000260
1140062	ET6 -RD12	56.950S	56.517W	ROCK	DREDGE	3127	0.00 FSU	A227	54	000261
1140067	ET22-RS1	57.833S	56.850W	ROCK	DREDGE	3919	0.00 FSU	A227	55	000263
1140081	ET6 R05	56.267S	58.275W	ROCK	DREDGE	4087	0.00 FSU	A226	56	000264
1140089	ET6 -MT3	56.233S	58.700W	IRAWL	DREDGE	4133	0.00 FSU	A227	57	000268

0 indicates 'not known'
↓

FILE 2

SEQ NO.	SAMP. TYPE	SECT	SAMPLED DIMENSIONS	CORE	MORPH	REF	MN	FE	CO	NI	CU	ZN	FB	AL	SI	CA	H2O
4840006	NH- 10	40.235N 155.917W	CORE	5033			0.00	SIO	A077	851		001350					
4840015	VITYAZ 4104	40.883N 159.898W	TRAWL	5435			0.00	USSR	N687	852		001353					
4860012	VITYAZ 4074	40.402N 175.697W	TRAWL	6065			0.00	USSR	N637	853		001354					
4870010	JYN-II-86	40.483N 172.550E	GRAVITY CORE	4250			1.65	SIO	M015	854		001356					
4870013	JYNII-96	40.500N 170.800E	GRAVITY CORE	5460			0.00	SIO	M015	855		001358					
SEQUENCE SHIP/CRUISE																	
NUMBER	+ STATION	NO	LA	LONGI-	WATER	DEPTH	LENGTH	CORE	REF	RECORD	NO.	NUMBER	DES	NAR			
4870019	OKADA-K-1	44.500N 170.417E	DREDGE	1280			0.00		A249	856		001526					
4870020	OKADA-K-2	44.617N 170.300E		1365			0.00		A249	857		001527					
4870016	VITYAZ 3151	44.157N 170.117E	TRAWL	5110			0.00	USSR	A148	858		001360					
4870018	VITYAZ 3150	44.467N 170.116E	TRAWL	1258			0.00	USSR	A178	859		001361					
5190054	GA-3	56.167N 145.250W	DREDGE	0			0.00		A165	860		001362					
5200002	GILBERT SMT.	52.783N 150.083W	DREDGE	0			0.00		A165	861		001363					
SEQUENCE SHIP/CRUISE																	
770031	0						A227	1.00	7.10	0.10	0.14	0.10	0.030	0.00	0.00	0.00	3.60
790086	0						A227	1.00	11.20	0.13	0.05	0.11	0.040	0.00	0.00	0.00	5.00
790089	0						A227	1.00	8.30	0.12	0.06	0.12	0.030	0.00	0.00	0.00	1.90
800024	0						A227	1.00	10.00	0.08	0.06	0.13	0.039	0.00	0.00	0.00	4.80
800030	0						A227	1.00	8.90	0.11	0.07	0.10	0.033	0.00	0.00	0.00	3.60
800039	0						A179 WC	6.30	10.90	0.11	0.12	0.07	0.000	0.00	0.00	0.00	0.00
800041	0						A227	2.30	13.50	0.24	0.18	0.12	0.040	0.00	0.00	0.00	8.50
800062	0						A227	7.50	14.80	0.23	0.30	0.13	0.050	0.00	0.00	0.00	10.20
820013	0						A227	4.30	14.80	0.30	0.18	0.08	0.040	0.00	0.00	0.00	11.20
820014	0						A227	11.90	9.10	0.15	0.56	0.34	0.045	0.00	0.00	0.00	9.50
820014	0						A227	13.10	18.00	0.33	0.22	0.15	0.040	0.00	0.00	0.00	14.60
820017	0						A227	12.20	18.30	0.32	0.22	0.14	0.040	0.00	0.00	0.00	15.10
920027	0						A227	1.00	8.20	0.10	0.20	0.17	0.039	0.00	0.00	0.00	6.30
830007	0						A227	4.90	10.50	0.11	0.37	0.21	0.039	0.00	0.00	0.00	10.10
830007	0						A227	11.90	15.80	0.22	0.33	0.15	0.044	0.00	0.00	0.00	17.60
830007	1						A227	12.80	20.80	0.22	0.27	0.07	0.059	0.00	0.00	0.00	22.00
840013	0						A227	10.20	16.90	0.23	0.22	0.16	0.043	0.00	0.00	0.00	16.40
840015	0						A227	16.40	17.60	0.31	0.29	0.13	0.040	0.00	0.00	0.00	18.60
840015	1						A227	13.60	19.50	0.39	0.21	0.11	0.030	0.00	0.00	0.00	17.80
850005	0						A227	4.20	9.90	0.15	0.39	0.23	0.044	0.00	0.00	0.00	9.30
850015	0						A227	11.40	14.20	0.20	0.44	0.19	0.051	0.00	0.00	0.00	14.80
860006	0						A227	22.40	10.60	0.11	0.86	0.56	0.100	0.00	0.00	0.00	18.10
860007	0						A227	10.80	16.60	0.25	0.46	0.25	0.050	0.00	0.00	0.00	7.70
860009	0						A227	11.70	23.80	0.28	0.13	0.21	0.050	0.00	0.00	0.00	18.90
860009	1						A227	12.60	23.60	0.28	0.12	0.17	0.060	0.00	0.00	0.00	19.60
860010	0						A227	9.80	16.60	0.27	0.29	0.19	0.052	0.00	0.00	0.00	7.30
860010	1						A227	11.30	16.00	0.27	0.41	0.20	0.056	0.00	0.00	0.00	7.70
860013	0						A227	18.90	10.40	0.08	1.00	0.58	0.110	0.00	0.00	0.00	14.10
870004	0						A227	18.10	17.30	0.57	0.29	0.09	0.040	0.00	0.00	0.00	17.10
890002	0						A227	6.30	18.20	0.14	0.27	0.10	0.065	0.00	0.00	0.00	12.60
890009	0						A197	14.80	11.00	0.17	0.70	0.29	0.100	0.15	2.40	11.30	1.52
890009	1						A197	14.20	10.80	0.15	0.68	0.36	0.120	0.15	2.50	13.00	1.44
910002	0						A197	8.80	12.40	0.14	0.27	0.13	0.058	0.14	3.90	15.50	1.79
910005	0						A227	18.40	15.50	0.27	0.64	0.24	0.100	0.00	0.00	0.00	19.80
910005	1						A227	13.50	22.40	0.33	0.20	0.08	0.060	0.00	0.00	0.00	19.10
910005	2						A227	12.10	23.00	0.35	0.13	0.08	0.050	0.00	0.00	0.00	20.40
990053	0						A246	2.20	12.22	0.00	0.00	0.00	0.000	0.00	0.00	0.00	0.00
990006	0						A246	3.93	5.65	0.00	0.04	0.02	0.000	0.00	0.00	0.00	0.00
1110004	0						A179 WC	12.00	5.30	0.03	0.38	0.27	0.000	0.00	0.00	0.00	0.00
1110056	0						A227	1.00	5.80	0.08	0.52	0.35	0.052	0.00	0.00	0.00	6.60

- UNIVERSITY PROGRAM OF RESEARCH ON FERROMANGANESE DEPOSITS OF THE OCEAN FLOOR, PHASE 1 REPORT, SEABED ASSESSMENT PROGRAM, IOOE, NATIONAL SCIENCE FOUNDATION, PP 137-169, APRIL 1973.
- A251 ANDREWS, J. E., C. W. LANDMESSER AND M. MORGENSEIN, HAWAII INSTITUTE OF GEOPHYSICS DATA BANKS FOR MANGANESE COLLECTIONS AND HYDRATION-RIND DATING. SEABED ASSESSMENT PROGRAM, IOOE, NATIONAL SCIENCE FOUNDATION, IOOE TECH REP NO 5, HIG-73-5, DATA REPORT NO 23, MARCH 1973.
- A255 DIETZ, R. W., MANGANESE DEPOSITS ON THE NORTHEAST PACIFIC SEA FLOOR. CALIFORNIA JOURNAL OF MINES AND GEOLOGY, VOL 51, PP 209-220, 1955.
- A256 YABUKI, H. AND M. SHIMA, URANIUM AND OTHER HEAVY ELEMENTS IN DEEP SEA SEDIMENTS COEXISTING WITH MANGANESE NODULES. SCIENTIFIC PAPERS, INSTITUTE OF PHYSICAL AND CHEMICAL RESEARCH, VOL 67, NO 3, PP 155-56, 1973.
- A260 SUMMERHAYES, C. P., MANGANESE NODULES FROM THE SOUTHWESTERN PACIFIC. NZOI JOURNAL OF GEOLOGY AND GEOPHYSICS, VOL 10, NO 6, PP 1372-81, 1967.
- A261 MENARD, H. W., E. D. GOLDBERG AND H. E. HAWKES, COMPOSITION OF PACIFIC SEA-FLOOR MANGANESE NODULES. SIO UNPUBLISHED DATA.
- A262 HEWITT, D. F., M. FLEISHER AND N. CONKLIN, DEPOSITS OF THE MANGANESE OXIDES. ECON GEOL (SUPPLEMENT) 58, PP 1-51, 1963.
- A268 LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, MEGASCOPIC CORE DESCRIPTIONS CONRAD 14, 29 JAN 1971 - 21 SEPT 1971. UNPUBLISHED.
- A275 SMITH, R. E., J. D. GASSAWAY AND H. N. GILES, IRON-MANGANESE NODULES FROM NARES ABYSSAL PLAIN. GEOCHEMISTRY AND MINERALOGY, SCIENCE, VOL 161, NOS 3843 & 3848, PP 780-781, AUG 23, 1968.
- A277 HUBBARD, G. L., RELATIONSHIP OF MORPHOLOGY AND TRANSITION METAL CONTENT OF MANGANESE NODULES TO AN ABYSSAL HILL. HAWAII INSTITUTE OF GEOPHYSICS, HIG-70-18, SEA GRANT 70-5, SEPT 1970.
- A281 MEVLAN, M. A., H. BACKER AND G. P. GLASBY, MANGANESE NODULE INVESTIGATIONS IN THE SOUTHWESTERN PACIFIC BASIN, 1974. NEW ZEALAND OCEANOGRAPHIC INSTITUTION FIELD REPORT NO 4, JAN 1975. (TANGAROA).
- N344 KALINENKO, V. O., O. B. BELOKORYTOVA AND G. G. NIKOLAYEVA, BAKTERIOGENNOYE EOPPOBPAHIE ZHELEZO-MAGNANISOVYKH KONKRETSII V INDIISKOM OKEANE (THE BACTERIOGENIC FORMATION OF FERROMANGANESE CONCRETIONS IN THE INDIAN OCEAN). OKEANOLOGIYA, TOM 11, VYP 6, PP 1050-59, 1962. (VITYAZ CRUISE 33).
- N626 NIINO, H., ON A MANGANESE NODULE AND PETROCHUS DREDGED FROM THE BANKS NEAR THE IZU ISLANDS, JAPAN. RECORDS OF OCEANOGRAPHIC WORKS IN JAPAN, VOL 2, NO 2, PP 120-126, OCT 1955.
- A812 MURRAY, JOHN AND A. F. RENARD, REPORT ON DEEP-SEA DEPOSITS BASED ON THE SPECIMENS COLLECTED IN THE YEARS 1872 TO 1876, IN REPORT ON THE SCIENTIFIC RESULTS OF THE VOYAGE OF HMS CHALLENGER DURING THE YEARS 1873-1876. LONGMANS & CO., LONDON, 1891. (HMS CHALLENGER 1873-1876).
- A056 CONFIDENTIAL REFERENCE
- A077 YOUNG, EDWARD J., SPECTROGRAPHIC DATA ON CORES FROM THE PACIFIC OCEAN AND THE GULF OF MEXICO. GEOCHIMICA ET COSMOCHEMICA ACTA.

FILE 5 ↓

This document provides a guide
to field contexts/codes.

The format in which data
appear on your tape is
entirely different.

This documentation applies to
files:

MG65995012-15

not all files contain all data
types - please see individual
file descriptions.

SIO REFERENCE SERIES

SEDIMENT DATA BANK CODING INSTRUCTIONS

J.Z. Frazer
N.A. Freeland
D.L. Hawkins

University of California

17 April 1978

Scripps Institution of Oceanography

Reference Number 78-9

SEDIMENT DATA BANK CODING INSTRUCTIONS

by

J. Z. Frazer, N. A. Freeland¹ and D. L. Hawkins¹

Geological Research Division
Scripps Institution of Oceanography
University of California, San Diego
La Jolla, California

¹Deep Sea Drilling Project, SIO

17 April 1978

SIO Reference No. 78-9

PREFACE

This report explains how to code information for input to the SIO Sediment Data Bank. The Sediment Data Bank Users' Handbook, SIO Reference 78-10, describes the data bank and available types of output and includes instructions for data retrieval.

TABLE OF CONTENTS

A. Station Records.	1
B. Manganese Nodule Analyses Records.	5
C. Sediment Description Records	10
1. Notes on Sediment Classification Schemes	10
2. Coding Instructions.	18
D. References	27

A. STATION RECORDS

One Station Record is to be coded for each core, dredge or other sample. If seafloor photographs were taken in conjunction with other sampling, they are not coded as separate stations but information from the photographs is entered in Columns 52-53. If seafloor photographs were taken where no other sampling occurred, they are coded as separate stations.

Station Records are identified by the numeral "0" in the first column. The information is coded as follows:

<u>Columns</u>	<u>Item</u>	<u>Explanation</u>
1	0	Card number; identifies Stations record
2-8		Leave blank
9-14 15-21	Latitude Longitude	Latitude and longitude are expressed as degrees, minutes and tenths of minutes, right justified with decimal point omitted, followed by N, S, E or W.
22-23	Sampler Type	Coded as in Table 1. Omit if unknown.
24-28	Bathymetry	Water depth in meters, as reported in the data source (may be corrected or uncorrected). Enter as a right-justified integer.
29	Institution	Data collected from one of the institutions listed below is coded as indicated. For other institutions leave column blank. F = Florida State University H = Hawaii Institute of Geophysics L = Lamont-Doherty Geological Observatory O = Oregon State University R = Akademiia Nauk, USSR S = Scripps Institution of Oceanography W = Woods Hole Oceanographic Institution
30-41	Station Name and Number	Identifies the station. Enter the cruise or ship name or an appropriate abbreviation and the station number or sample number, starting in Col. 30. May be up to 12 alphanumeric characters.
42-45	Reference	A letter followed by three digits to indicate the source of the information which is being coded. Each reference number is keyed to an item for which an entry has been made in the Bibliography File.

TABLE 1: SAMPLER TYPES

<u>Sampler (Col. 22)</u>	<u>Type (Col. 23)</u>	
C		Core
	A	Heat Probe (pre-1971)
	B	Box
	C	Camera
	D	Dart
	E	Triple (pre-1971)
	F	Free-fall
	G	Gravity
	H	Gravity with Heat Flow Thermistors
	I	5-inch Gravity
	J	Multiple core, up to 5 gravity corers
	L	Phleger
	M	Miscellaneous
	O	Gravity Oriented
	P	Piston
	R	Piston Oriented
	T	Trip (with piston core)
	V	Von Herzen
	W	Biological Box
D		Dredge or Drag Haul
	A	Box
	B	Bucket
	C	Chainbag
	M	Miscellaneous
	P	Pipe
	R	Rock
	T	Trawl
F		Photograph (Camera Station)
	D	Deeptow
	M	Multiple (more than one frame at same spot)
	O	One photo
	S	Survey (more than one frame, different spots)
	T	Television
G		Grab Sampler
	A	Sounding
	B	Box
	C	Catcher (on camera or core)
	F	Free-fall
	K	Shipek
	M	Miscellaneous
	O	Orange Peel
	P	Petterson
	S	Snapper
	W	Biological
H		Deep Sea Drilling Project Hole
	D	Drill Core
	S	Side Wall Core

46-50	Length of Core	In meters. If decimal point is not entered, it is assumed to be at the right of Col. 50. For example, 140 m is coded as 140 or 140.; 231 cm is coded as 2.31.
51	Manganese Nodule Occurrence	Refers only to nodules collected by the sampler described in Cols. 22-23. If nodules were observed in seafloor photographs associated with the station, the information should be entered in Cols. 52-53, not here. Use the following codes: 0 or blank = unknown; no information 1 = nodules absent 2 = nodules present
52	Manganese Nodule Coverage	Code as follows: 0 or blank = no information 1 = no nodules 2 = sparse (<20% coverage) 3 = moderate (estimated 20-50% coverage) 4 = abundance (coverage estimated >50%)
53	Sampler Type From Which Coverage and/or Concentration Estimate Was Determined	Code as follows: 0 or blank = unknown 1 = box core or box grab 2 = photographs 3 = miscellaneous; other 4 = sonar 5 = television 6 = grab sampler 7 = coverage from photographs, concentration most likely from major sampler (Cols. 22-23)
54-58	Manganese Nodule Concentration	Seafloor concentration in kg/m ² . Enter as a real number to two decimal places; decimal point must be included.
59	Surface Nodules	Enter a "1" in this column if manganese nodules occurred within 10 cm of the sediment surface.
60	Buried Nodules	Enter a "1" in this column if manganese nodules occurred below 10 cm in the sediment. Both Cols. 59 and 60 may be filled if both buried and surface nodules were observed.
61-62	Surface Lithology	These codes are to give a general indication of the lithology of the surface sediment. They are not intended to constitute a comprehensive system of sediment classification such as described in Section C. If a sample does not fit into a category, do not code. Code as follows:

VA = volcanic ash (includes volcanic mud,
volcanic sand)
RO = rock
MP = manganese pavement
PC = pelagic clay
SC = siliceous clay
CC = calcareous clay
SO = siliceous ooze
CO = calcareous ooze
CS = calcareous-siliceous ooze
TM = terrigenous material (sand, silt,
mud, gravel)
CT = calcareous terrigenous material
ST = siliceous mud

See Section C-1 for definitions of these terms.

63-80

These columns are not read by the update
program; leave blank or use for notes.

B. MANGANESE NODULE ANALYSES RECORDS

Manganese nodule records are identified by the digit "3" in column 1. Depending on the number of elements analyzed, there may be 3 or 4 cards for a single sample. Each subsequent card will be identified by the digits "4" and "5". Card number 5 may be used repeatedly as many times as necessary.

Card 3 is coded as follows:

<u>Columns</u>	<u>Item</u>	<u>Explanation</u>
1	3	Card number
2-4	Square number	Square and sequence numbers are the same as on the Station Record which corresponds to the station from which the manganese sample was taken. Columns 2-3 should be completely filled; use leading zeroes.
5-8	Sequence number	
9-10	Analysis number	Number analysis from 0-99 sequentially using a new number for each analysis.
11-12	Sample type	<p>Enter the sample type according to the following code:</p> <p>0 = unknown 1 = Mn nodule or nodules 2 = Mn nodule in sediment 3 = micronodules 4 = micronodules in sediment 5 = nodules and micronodules 6 = Mn-encrusted sediment 7 = Mn-coated rock 8 = crust, pavement 9 = Mn-coated organic material 10 = several crusts</p>
13-27	Sample dimensions	<p>Enter dimensions in millimeters (1 cm = 10 mm, 0.1 cm = 1 mm) as follows:</p> <p>13-17 largest dimension or diameter 18-22 next largest dimension 23-27 smallest dimension</p> <p>You must right justify the number or include a decimal point in the dimension. If a range is given, enter the largest dimension in columns 13-17 and the smallest dimension in columns 23-27. If dimensions are in microns, you enter a minus sign (-) before the number in cols. 13-17.</p>

28-29 Section analyzed

Enter the description of the section analyzed according to the following code:

- 0 = unknown
- 1 = whole
- 2 = half
- 3 = quarter
- 4 = fragments or pieces
- 5 = core or nucleus
- 6 = without core
- 7 = cross-section
- 8 = layer adjacent to core
- 9 = middle layer
- 10 = outer layer or outer crust
- 11 = inner part, without outer layer
- 12 = topside
- 13 = underside
- 14 = bulk composition (representative of total material on seafloor at the location)
- 15 = average analysis of a number of nodules
- 16 = composite 2-5 nodules or micronodules analyzed together
- 17 = composite 6-12 nodules or micronodules analyzed together
- 18 = composite more than 12 nodules or micronodules analyzed together

30-31 Analytical method

Enter the method according to the following code:

- 0 = unknown
- 1 = wet chemical (colorimetry, volumetry, gravimetry)
- 2 = x-ray fluorescence spectrometry
- 3 = x-ray energy spectrometry
- 4 = electron microprobe
- 5 = atomic absorption
- 6 = neutron activation
- 7 = emission spectrometry
- 8 = other - see reference (use for combination of methods)

If a single method was used for a majority of the elements analyzed including Mn, Fe, Co, Ni, Cu, then code that method; if not, code as "8".

32-33 Nucleus

If given, enter the description of the nucleus according to the following code:

- 01 C210
1 = present but not described or undetermined
- 2 = none apparent
- 3 = tooth

4 = earbone
 5 = pumice
 6 = chert
 7 = palagonite
 8 = clay
 9 = altered basalt
 10 = volcanic
 11 = nodule fragment
 12 = metallic object
 13 = sediment, unspecified
 14 = rock, unspecified

34-37 Reference

A letter followed by three digits to indicate the source of the information being coded. Each reference number is keyed to an item for which an entry has been made in the Bibliography File.

38-72 Element
 concentrations
 (weight %)

Enter the concentrations for the following elements in the columns indicated:

38-42 Manganese (Mn)
 43-47 Iron (Fe)
 48-52 Cobalt (Co)
 53-57 Nickel (Ni)
 58-62 Copper (Cu)
 63-67 Zinc (Zn)
 68-72 Molybdenum (Mo)

If the concentration is more than 4 digits, there is an implied decimal point just before the left most column in the field. If you enter a number without a decimal point, it must be left justified. If you enter a number with a decimal point, it may be entered anywhere in the field.

73-80 These columns are to be left blank.

Card 4 is coded as follows:

<u>Column</u>	<u>Item</u>	<u>Explanation</u>
1	4	Card number. This card may be omitted if none of the information given below is given in the source.
2-4	Square Number	
5-8	Sequence number	Same as on Card 3
9-10	Analysis number	

- 11-35 Element concentration (weight %) Enter concentrations for the following elements in the columns indicated:
- 11-15 Silicon (Si)
 16-20 Calcium (Ca)
 21-25 Titanium (Ti)
 26-30 Lead (Pb)
 31-35 Aluminum (Al)
- 36-40 % weight lost Weight lost indicates the amount of water lost when drying the sample at 110°C.
- 41-44 Morphology Morphology is coded according to a simplified version of the Hawaii Institute of Geophysics classification system.¹ Enter the primary morphology as a number 1 through 7 right justified or in Col. 42. If a second primary morphology is described enter it in 42 and the first in Col. 41.

41-42		43-44	
<u>Primary Morphology</u>		<u>Surface Texture</u>	
<u>Code</u>	<u>Shape</u>	<u>Code</u>	<u>Texture</u>
1	Spherical	1	Smooth
2	Ellipsoidal	2	Rough (granular or micro-botryoidal)
3	Discoidal	3	Botryoidal
4	Poly (coaspheroidal)		
5	Biological		
6	Tabular		
7	Faceted		

For example, if you were given a discoidal nodule with a rough to smooth surface, you would enter it as 0321 in the four column field.

- 45-72 Additional element concentrations (weight %) On this and the next card, additional elements must be entered in order of increasing atomic number. For each additional element there are 7 columns, enter the atomic number of the element followed by the concentration.
- For example, if you were given 1.08% Na, you would enter it as 111.080 in the 7-column field.

- 73-80 These columns are to be left blank.

Card 5 is coded as follows:

1	5	Card number
2-4	Square number	
5-8	Sequence number	Same as on cards 3 and 4.
9-10	Analysis number	
11-66	Additional element concentrations (weight %)	Enter concentrations in the same way as on Card 4 under Additional element concentrations. Atomic number fields begin in Cols. 11,18,25,32,39,46,53 and 60. If you have more element concentrations than the space provided on these three forms, card 5 may be used repeatedly until all elements are recorded.

DEPTH IN CORE. The depth below the seawater-sediment interface at which the sample analyzed was found is to be entered as a pseudo element concentration on either Card 4 or Card 5. The "atomic number" indicating depth is 93, and the depth in cm is entered as a right-justified integer under "element concentration." For a surface sample the depth is entered as zero (0).

67-80 These columns are to be left blank.

C. SEDIMENT DESCRIPTION RECORDS

1. Notes on Sediment Classification Schemes

More than a century of sediment data collecting is represented in the Sediment Data Bank DESCRIPTIONS File. Schemes of sediment classification have evolved from the first systematic scheme which was proposed by Murray and Renard in 1884. The most recent system in wide use today was proposed in 1973 by an ad hoc group of the JOIDES Advisory Panel on Sedimentary Petrology and Physical Properties.

These changes have presented some difficulties to data bank coders. The Murray and Renard system was "primarily from a geographical point of view although subdivisions were made according to grain size, the preponderance of different groups of organisms and different kinds of inorganic materials, and color and calcium carbonate content."² For JOIDES, "Sediment names are. . . based solely upon parameters determined in smear slides aided by compositional and textural properties apparent to the naked eye or under the hand lens."³

The various schemes all use the same terms to specify major lithological divisions, although the definitions of these terms sometimes differ. Some schemes subdivide the categories, using different terms to describe somewhat different sediments that would be included in a single category by other schemes.

In order to encompass sediment descriptions prepared by all observers, the data bank has adopted a very general lithological classification system. It is based on the JOIDES system, but we have had to combine some JOIDES categories. Our system divides sediments into ten major lithological categories as listed in the Table, below.

TABLE 2: SEDIMENT DATA BANK LITHOLOGIES

<u>Lithology</u>	<u>Definition</u>
0 Undetermined	
1 Rock or Gravel	All indurated sediments as well as sediments with grain size > 2 mm. Includes shells, coral, or pumice if they are the major constituent, and DSDP's "indurated chalk."
2 Manganese nodules	Manganese nodules, crusts or pavement.
3 Sand or silt	Terrigenous sediment of which at least 90% of the clasts have grain size of 39 - 2000 μ m.
4 Mud	Terrigenous sediments of mixed grain size. See Fig. 1, page 22.

- 5 Calcareous ooze $\text{CaCO}_3 > 30\%$, $< 25\%$ siliceous remains. Calcareous material is biogenous debris from foraminifera, pteropods, or nannofossils. Includes: globigerina ooze, foram ooze, pteropod ooze, foram marl ooze, foram marl, foram chalk, globigerina and foram mud.
- 6 Siliceous ooze Pelagic sediments containing $> 30\%$ skeletal remains of siliceous organisms (radiolaria, diatoms, silico-flagellates, sponge spicules and echinoid spines).
- 7 Clay Pelagic clay, having $< 30\% \text{CaCO}_3$, $< 30\%$ siliceous skeletons, $\geq 10\%$ slow sedimentation indicators (zeolites, Fe and Mn micronodules, fish debris); Terrigenous clay, having $< 50\%$ volcanic particles, $< 30\% \text{CaCO}_3$, $\geq 90\%$ clay-sized particles, $< 10\%$ slow sedimentation indicators.
- 8 Volcanic ash Grain size $< 4 \text{ mm}$, and 50% or more of the sample is of pyroclastic origin.
- 9 Siliceous-calcareous ooze Biogenous sediments in which siliceous and calcareous biogenous material are each $> 25\%$. (Most sediments within this category contain enough CaCO_3 to be considered calcareous ooze, but many researchers find the indication of a large siliceous component useful).
- 10 Zeolitite Sediment containing $> 50\%$ zeolites.

Our system was designed to facilitate digital coding of sediment descriptions from a variety of sources and to serve the needs of specific research groups. It is not meant to replace schemes in current use for classifying marine sediments. In most cases data included in the DESCRIPTIONS records allow the user to reclassify the sediments according to any system using our Program SEARCH (see SIO Reference No. 78-10). Such reclassification is, of course, impossible if the original source contained only the lithological category with no additional descriptive information.

Several classification systems are summarized below along with the Sediment Data Bank lithological name which corresponds to each major category in the other systems.

The scheme devised by Murray and Renard² includes ten major sediment categories as follows:

<u>Term used by</u> <u>Murray & Renard</u>	<u>Definition</u>	<u>Data Bank</u> <u>Classification</u>
Blue mud	Characteristically bluish gray; moderately coherent and granular; made up of land detritus, mainly quartz. Frequently found in deeper water surrounding continents.	Mud (may sometimes be classified as calcareous ooze if $\text{CaCO}_3 > 30\%$)

Coral mud and Sand	Calcareous sediment found near coral reefs and islands, consisting largely of neritic and benthic organisms. Usually white.	Mud or sand (may be calcareous ooze if organisms have lost identity from wave action and/or other forces)
Diatom ooze	Characteristically yellowish or cream colored, found in cold waters of the Southern Ocean and along the northern border of the Pacific. Diatom frustules exceptionally abundant (>20%) and $\text{CaCO}_3 < 30\%$.	Siliceous ooze
Globigerina ooze	Structure usually pulverulent - granular to coherent, fine-grained and homogenous; $\text{CaCO}_3 > 30\%$; abundant remains of foraminifera (15 - 95%).	Calcareous ooze
Green mud	Resembles blue mud but contains glauconite.	Mud (may sometimes be classified as calcareous ooze if $\text{CaCO}_3 > 30\%$)
Pteropod ooze	Warm water deposits at moderate depths resembling globigerina ooze but with abundant molluscs, notably pteropods.	Calcareous ooze
Radiolarian ooze	Deposits found in the central Pacific and Indian Ocean which, "While resembling red clays in most respects, differ. . . in containing a much larger number of radiolarian shells, skeletons and spicules, together with sponge spicules and the frustules of diatoms" (more than 30% siliceous organisms).	Siliceous ooze
Red clay	Color brick red or chocolate brown, or may be gray. Plastic when wet, very coherent when dry; found in the deep ocean far from land; $\text{CaCO}_3 < 30\%$.	Clay
Red mud	A variety of blue mud found in the Yellow Sea and off the coast of Brazil; similar in mineral composition to other terrigenous deposits near the continents.	Mud (may be classified as calcareous ooze if $\text{CaCO}_3 > 30\%$)
Volcanic muds and sands	Muds and sands found around volcanic islands which contain large amounts of volcanic material; brownish gray or grayish brown; structure only slightly coherent; $\text{CaCO}_3 < 30\%$.	Volcanic ash if 50% of material is of volcanic origin; otherwise, mud or sand

Noting several weaknesses in the above system, in 1944 Revelle⁴ proposed a new system of sediment classifications as follows:

<u>Term used by Revelle</u>	<u>Definition</u>	<u>Data Bank Classification</u>
I. Pelagic Deposits	Sediments of red, brown, yellow or white color which have below a certain amount of allogenic mineral and rock particles > 5 μ m and which contain only small amounts of neritic organism remains	
A. Oozes	Skeletal remains of organisms >30% in amount	
Globigerina } Pteropod } ooze Coccolith } Calcareous }	CaCO_3 >30%; skeletal remains of calcareous organisms >30%	Calcareous ooze
Siliceous Globigerina ooze	CaCO_3 >30%; abundant siliceous remains	Siliceous-calcareous ooze
Siliceous } Diatom } ooze Radiolarian }	CaCO_3 <30%; skeletal remains of siliceous organism >30%	Siliceous ooze
B. Red Clay	Skeletal remains of organisms <30%	Clay
II. Terrigenous deposits, called muds	Distinguished by a bluish, green, gray or black color, or presence of appreciable neritic organic remains or allogenic minerals	
A. Organic muds	Skeletal remains of organisms >30%	
Calcareous mud and sand	CaCO_3 >30%; calcareous organisms or neritic type	Calcareous ooze
Globigerina } pteropod } mud	CaCO_3 >30%; calcareous organisms of pelagic type	Calcareous ooze
Siliceous } Diatom } mud Radiolarian }	CaCO_3 <30%; remains of siliceous organisms >30%	Siliceous ooze

B. Inorganic muds Skeletal remains of organisms <30%.

Clayey muds	Median diameter <0.005 mm	Clay or mud, according to Fig. 1, page 22
Silty or Sandy muds	Median diameter >0.005 mm	Silt, sand or mud according to Fig. 1, page 22

Olausson⁵ proposed a classification system which is essentially the same as Revelle's but with the following modifications:

- 1) Calcareous oozes and muds are divided into two categories, marl oozes or muds which contain 30-60% CaCO_3 , and chalk oozes or muds which contain >60% CaCO_3 .
- 2) If CaCO_3 >30% and skeletal remains are >30%, the term foraminiferal (pteropod) marl or chalk ooze or mud is used; if CaCO_3 >30% but skeletal remains are <30%, the sediment is still classified as an ooze or an organic mud but the qualifier foraminiferal (pteropod) is omitted.

Until recently most authors and institutional core labs used either the Revelle or the Olausson system, or modifications of them without specifying which scheme they were using. Thus the data bank has had to adopt the most general classification scheme, omitting Olausson's distinction between marl and chalk oozes. For many samples the data bank user can separate the calcareous oozes with >60% CaCO_3 content. This parameter is given in percent if it was reported as such, or it is expressed as "high" (>60% for most sources, >50% for data from the USSR) or "moderate" (30-60% for most sources, 30-50% for USSR data). Of course, if the original author used the Revelle classification system or an unspecified system and did not measure CaCO_3 , it is impossible for our coders to deduce such information.

The JOIDES system is the most recent attempt to construct a general classification system for marine sediments. It has been followed in the Deep Sea Drilling Project reports since 1974 and is used in computer processing of DSDP data⁶. A growing number of authors seem to be adopting the JOIDES system, although it is by no means followed universally. Some DSDP authors continue to use individual variations. This scheme is as follows:

<u>Term Used by DSDP</u>	<u>Definition</u>	<u>Data Bank Classification</u>
Igneous or metamorphic rock		Rock or gravel

Pelagic Sediments

Pelagic clay	<30% CaCO_3 , <30% siliceous skeletons; slow sedimentation indicators (zeolites, Fe and Mn micronodules, fish bones, etc.) >10%.	Clay
Zeolite clay	Zeolites are dominant constituent	Zeolitite
Siliceous Radiolarian Diatomaceous } ooze	Soft; >30% siliceous skeletons <30% CaCO_3 , <30% silt and clay	Siliceous ooze
Radiolarite Diatomite Chert Porcelanite }	Same as siliceous ooze but hard	Rock or gravel
Calcareous ooze	Soft; >30% CaCO_3 , <30% silt and clay	Calcareous ooze
Chalk Indurated chalk } Limestone	Same as calcareous ooze but firm or hard	Rock or gravel

Transitional sediments

Muddy diatom ooze	Soft; >50% diatoms; >30% silt and clay; <30% CaCO_3 .	Siliceous ooze
Muddy diatomite	Same as above but hard	Rock and gravel
Diatomaceous } mud Siliceous	Soft; 10-50% diatoms; >30% silt and clay; <30% CaCO_3 .	Siliceous ooze if diatoms >30%; otherwise, mud
Marly calcareous ooze	Soft, >30% CaCO_3 , >30% silt and clay.	Calcareous ooze
Marly chalk } Marly limestone	Same as above but hard	Rock and gravel

Terrigenous and volcanic detrital sediments

Clay } Mud } Silt } Sand }	Soft; <80% volcanic particles; <10% diatoms; <30% CaCO_3 ; slow sediment indicators <10%. Sediments subdivided into textural groups according to the diagram in Fig. 1, page 22.	Clay, mud or sand and silt
-------------------------------------	--	----------------------------

Claystone Mudstone Shale Siltstone Sandstone	Same as above but hard	Rock or gravel
Volcanic Ash	Soft; >80% volcanic particles; grain size <4 mm.	Volcanic ash
Tuff	Same as above, but hard	Rock or gravel

Like most other classification schemes, this one allows for the inclusion of various qualifiers to indicate secondary and minor sediment constituents. These are coded as described in Section C-1.

The core curators of the various oceanographic institutions may or may not classify their sediment samples according to one of the systems described above. Further, the system used by any institution may vary over the years, or among different core describers. Recent reports from Scripps Institution of Oceanography describing cores collected on some recent cruises use an adaptation of the JOIDES system, for example, whereas visual shipboard descriptions seem to follow the Revelle scheme.

Lamont-Doherty Geological Observatory uses a unique system in which the major division is based on the percentage of the sample contained in the coarse fraction (>62 microns). This system was described by Ansis Kaneps in an unpublished report⁷ and is as follows:

<u>Term used by</u> <u>LDGO</u>	<u>Definition</u>	<u>Data Bank</u> <u>Classification</u>
Coarse fraction <5%:		
Chalk	>67% calcareous nannofossils; remainder is clay and silt	Calcareous ooze
Marl	33-67% calcareous nannofossils; remainder is clay and silt	Calcareous ooze
Clay	<33% calcareous nannofossils; >67% clay and silt	Clay
Coarse fraction 5-30%:		
Foraminiferal chalk	5-30% foraminifera; remainder is chalk	Calcareous ooze
Foraminiferal marl	5-30% foraminifera; remainder is marl	Calcareous ooze
Foraminiferal clay	5-30% foraminifera; remainder is clay and silt	Clay

Radiolarian (diatom) chalk	5-30% siliceous microfossils; remainder is chalk	Calcareous ooze or siliceous-calcareous ooze depending on detailed description
Radiolarian (diatom) marl	5-30% siliceous microfossils, remainder is clay and silt	Clay
Coarse fraction 30-80%:		
Foraminiferal (pteropod) chalk ooze	30-80% coarse calcareous micro- fossils; remainder is chalk	Calcareous ooze
Foraminiferal (pteropod) marl ooze	30-80% coarse calcareous microfossils; remainder is marl	Calcareous ooze
Foraminiferal (pteropod) clay ooze	30-80% calcareous microfossils; remainder is clay and silt	Calcareous ooze
Radiolarian (diatom) chalk ooze	30-80% coarse siliceous microfossils; remainder is chalk	Siliceous or siliceous-calcareous ooze depending on detailed description
Radiolarian (diatom) marl ooze	30-80% coarse siliceous microfossils; remainder is marl	Siliceous or siliceous-calcareous ooze
Radiolarian (diatom) clay ooze	30-80% coarse siliceous micro- fossils; remainder is clay and silt	Siliceous ooze
Coarse fraction >80%:		
Foraminiferal (pteropod) ooze	>80% coarse microfossils, pre- dominantly foraminifera or pteropods	Calcareous ooze
Radiolarian (diatom) ooze	>80% coarse microfossils, predominantly radiolaria or diatoms	Siliceous ooze

The Kaneps report does not mention the classification of terrigenous sediments, but Lamont-Doherty uses the usual terms sand, silt and mud; we presume they have the same meaning here as in other systems.

2. Coding Instructions

A description record is coded for each grab or dredge sample or for each layer of a core. As many layers may be described as are in the core. Since most data sources do not give complete sediment descriptions, some items will be blank.

Description Records can occupy two cards (identified by the digits "1" or "2" in Column 1). Either card or both may be used to code the description, depending upon what information is available.

Card No. 1 is coded as follows:

<u>Columns</u>	<u>Item</u>	<u>Explanation</u>
1	1	Card number
2-4 5-8	Square Number Sequence Number	Square and sequence numbers are those which have been assigned to the Station Record which corresponds to the station at which the sediment sample was collected.
9-10	Layer Number	The topmost layer (which may include the entire sample) is Layer 00. Going downward in the core, layers are numbered successively 01, 02, etc. If more than 99 layers are coded, begin numbering again from 01 (e.g., 98, 99, 01, 02, etc.).
12	Foraminifera	Includes skeletal remains of Globigerina.
13	Pteropods	
14	Calcareous Nannofossils	Includes coccoliths, discoasters
15	Diatoms	
16	Radiolaria	

The amounts of the above microfossils (Cols. 12-16) are specified by the code shown below. It should be noted that most analyses have been determined by smear slide observations. Data that has been produced through chemical analyses may show a lower concentration than that arrived at by a visual core description. Allowance for this distinction has been made in the coding instructions.

0 or blank = no information

1 = probably absent. This classification can imply two different situations: a) the observer recorded the microfossil as "absent" or b) the microfossil was not specified as absent, but additional information found by the coder implied that the microfossils were absent, although this was not explicitly stated.

2 = definitely present. This code is used only for incomplete descriptions in which the actual quantity of microfossils is either not supplied or cannot be understood.

3 = rare or trace amounts, probably <10%. Includes such categories as "few" (usually 5-15%) and "negligible" and DSDP categories "trace" (<2%) and "bearing" (2-10%).

4 = low, probably 10-30%. Usually the abundances of the constituents have been estimated and listed in the description. Includes samples described as "Foraminiferal" or "Radiolarian" clay.

DSDP core describers may add the prefix "rich" to the sediment name if constituents are present in amounts of 10-25%.⁸ Although DSDP descriptions always list the estimated percentages or abundance, the coder may encounter descriptions from other sources where the sediment was described as, for example, a foram-rich clay, which would be included in this category. At SIO a sediment name is prefixed by the term "bearing" for a comparable range of 5-25% (personal communication, Carolyn Glockhoff).

For DSDP and SIO, major constituents present in quantities greater than 25% provide the sediment name. Constituents are listed in order of increasing abundance from left to right. The coder can use the number of sediment names to estimate abundances. For example, a sample may have the assigned lithology "Foram, clayey, nanno ooze." The first item of three is probably less abundant than 30%; thus Forams would be in the 10-30% range. The second constituent would be likely to fall in the 30-50% range, but probably toward the lower boundary of this category. The nannofossils could also be assumed to be present in the 30-50% range, though being present in the greatest abundance they could be assumed to be in the higher end of the range.

Occasionally specimen abundances are given in terms of individuals per gram of sediment. In order to determine the percentage equivalent one must have specific knowledge of both the specimens and the region. An example would be diatoms in the Bering Sea, where 100,000 to 200,000 diatoms per gram sediment would constitute between 10 and 30%, but this cannot necessarily be applied to other regions because of variance in specimen size (personal communication, Edith Vincent, SIO).

5 = moderate, probably 30-60%. This category would include those samples described as foraminiferal or pteropod marl ooze in the Olausson or Kaneps classification systems. SIO observers require that more than 50% of the sediment consist of biogenous remains before the sediment is called an "ooze" (personal communication, Carolyn Glockhoff). A "biogenous ooze" may be dominated by one skeletal type, or it may be a composite. In the latter case, the abundance of any one organism is likely to be in the low or moderate range.

6 = probably >30% and possibly >60%. This category is used when the sample is classified as "ooze" according to a system where ooze is defined as a sediment containing >30% microfossils and no further information is available.

7 = dominant, >50%. Oozes modified by the name of only one microfossil type are usually assigned to this category.

Other skeletal or plant debris present is to be indicated by entering the numeral "1" in the appropriate column:

<u>Column</u>	<u>Item</u>	<u>Explanation</u>
17	Sponge spicules or echinoid spines	
18	Macrofauna Shells	Includes shell fragments as well as pelecypods, gastropods, brachiopods, balanus, ostracods, scaphopods and ostrea.
19	Other Animal Debris	Fish scales or teeth, Bryozoa, tunicates, polychaetes, ophiuroidea, stylaster.
20	Plant Debris	Includes algae
21-22	CaCO ₃ Content	<p>Enter the percentage as an integer, or if given qualitatively use L (low), M (moderate) or H (high) in Col. 22. If CaCO₃ is less than 0.5%, code as 0 (zero).</p> <p>CaCO₃ content analyzed at intervals down a core is entered as follows: If only a few analyses are available for the core and there is no indication that the analyses represent a larger interval, delimit one-cm layers where the analyses were done. If the CaCO₃ was measured at regular intervals, assume that the level in the core for which there is an analysis represents the midpoint of an interval; for example, if the core is sampled at 0, 10 and 20 cm, the layers encoded would be 0-5, 5-15, and 15-25 cm.</p> <p>Adjacent CaCO₃ values which are within about 10% of each other can be averaged. If the carbonate value reported determines a layer to be in a different lithological class from the adjacent layers, then code separately.</p> <p>If a sample is described as "marl" and CaCO₃ is not measured, enter "M" for moderate.</p>
23	Organic Carbon	<p>Code as follows:</p> <p>0 or blank = not specified 1 = <0.5% 2 = 0.5-1.5% 3 = >1.5%</p>
24	Disturbance	If the layer had a flow-in, was stretched, contaminated or disturbed in any other way, enter a "1" in this column.

25 Consolidation

Code as follows:

- 0 or blank = soft or not specified, un-consolidated
 1 = soupy, semi-liquid
 2 = firm, stiff, or partially indurated
 3 = hard, indurated

The presence of minerals and other features in the sample is indicated by the numeral "1" and their absence by a blank or "0" in the appropriate column:

26	Turbidite	
27	Bedded	Laminated, stratified, varved, evidence of cross-bedding
28	Graded	
29	Worm Burrows	
30	Mottling	Cannot be specifically identified as burrows
31	Volcanic Ash Layer	Ash layer within the layer of core being described
32	Dispersed Volcanic Ash	Accumulations of glass shards constitute volcanic ash.
33	H ₂ S	Hydrogen sulfide gas
34	Manganese Pavement or Crusts	
35	Manganese Nodules	Includes samples described as concretions
36	Manganese Micronodules	Generally silt or sand-sized. Do not place a "1" in this column if the description reports merely "manganese test positive."
37	Quartz	
38	Feldspar	Includes plagioclase and orthoclase
39	Pyroxene	Includes hypersthene and augite
40	Chlorite	
41	Mica	Includes muscovite and biotite. Mica is usually a terrigenous sediment component; however, muscovite can be authigenic.
42	Glass	
43	Palagonite	
44	Glauconite	A component of "green mud" or "green sand." It is an indicator of very slow sedimentation.

45	Barite	
46	Phillipsite	When SiO visual core descriptions indicate the presence of zeolites, phillipsite is being described.
47	Other Zeolites	Includes harmotome, clinoptilolite, etc.
48	Pyrite	
49	Other Sulfides	Includes marcasite and hydrotroilite
50	Other Dark Minerals	FeMg minerals, amphiboles (hornblende), olivine
51	Transfer?	If coded from original source, leave blank; if recoded from the old system, place a "1" in this column.
53-54	Lithology	Indicate the dominant lithology of the sample according to the codes shown below. In most cases, the lithology is that specified in the original source. However, the coder should read the full description in the source and see Table 2 before assigning the lithology.

0 = undetermined. Used for dredge samples in which no sediment was collected and for badly disturbed samples.

1 = rock or gravel

2 = manganese nodules or pavement. This is used only if the layer consists primarily of nodules or pavement.

3 = sand or silt. Must be $\geq 90\%$ sand and/or silt (see Fig. 1). Samples described as "pteropod sand" or "foram silt" are coded as calcareous ooze. Card 2 of their coded descriptions should include indication of grain size and relevant adjectives.

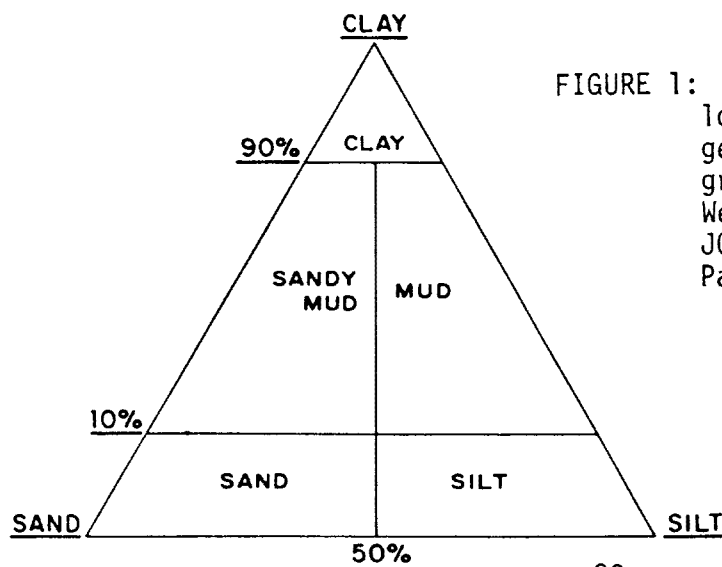


FIGURE 1: Diagram indicating lithological categories of terrigenous sediments based on grain size. Modified from Wentworth, 1922, by the JOIDES Sedimentary Petrology Panel.

4 = mud. See classification schemes in Section C-1 for various definitions of this term. It is always a terrigenous sediment, generally of mixed grain size. Data bank coders should follow DSDP definition (Fig. 1) if possible.

5 = calcareous ooze

6 = siliceous ooze

7 = clay. May be pelagic or terrigenous. Pelagic clay is fine-grained with indicators of slow sedimentation $\geq 10\%$, $< 20\%$ terrigenous detrital material in the coarse fraction or $< 30\%$ in the total sample, CaCO_3 or siliceous microfossils $< 30\%$; includes sediments described as lutite. Terrigenous clay is a terrigenous sediment with $\geq 90\%$ clay-sized fraction.

8 = volcanic ash

9 = siliceous-calcareous ooze. Includes samples with $> 30\%$ CaCO_3 and "appreciable" amounts of radiolaria or diatoms.

10 = zeolitite

Part 2 of the Description Record is identified by the numeral "2" in Column 1 and is coded as follows:

<u>Columns</u>	<u>Item</u>	<u>Explanation</u>
1	2	Card number; identifies second part of Description Record
2-10	Square Number Sequence Number Layer Number }	Same as for Card 1
11-16	Top of Layer	The depth below the sediment-water interface, in centimeters, at which the layer being described begins. The top layer may or may not begin at zero.
17-21	Layer Length	The depth of the top of the layer, in centimeters, subtracted from the depth of the bottom of the layer
22-24 25-27	Predominant Color Secondary Color }	Colors are expressed by a 3-character code condensed from the Munsell system. The first character of each color code represents the <u>hue</u> : R = red (R in Munsell code) O = orange or yellow-red (YR 1/ to YR 5/) Y = yellow (2.5Y) G = green, yellow-green or olive (7.5Y, 10Y, GY, B, BG) B = blue or purple (B, PB, P, RP) N = neutral (black, white or gray: N) T = tan or light yellow-brown (2.5Y6/ to 9/ or YR6/ to 9/)

The second character of each color code represents the value:

W = whitish, very light, very pale (9/ or 8/ in Munsell code)
 L = light (6/ or 7/)
 M = moderate or unspecified (4/ or 5/)
 D = dark (2/ or 3/)
 B = black or very dark (1/ or 0/)

The third character indicates the saturation:

0 = little or no gray or saturation unspecified (/4 or greater in Munsell code)
 1 = grayish (/2 or /3)
 2 = mostly or entirely gray (/1 or N)

When the color is not given in the source according to the Munsell code, it can still be expressed by the method described above. If hue alone is given, value should be expressed as "moderate" and the saturation as zero. Various shades can be expressed as follows (where X = color):

XW0 = very light X	XD0 = dark X
XW1 = very pale X	XD1 = dusky X
XW2 = X-ish white	XD2 = dark X-ish gray
XL0 = light X	XB0 = very dark X
XL1 = pale X	XB1 = very dusky X
XL2 = light x-ish gray	XB2 = X-ish black

Some frequently used color names may seem difficult to translate into a code. For example, "cream colored" could be yellowish white (YW2) or very light tan (TW0), whereas beige could be light tannish gray (TL2) or pale tan (TL1). Either coding would be acceptable. Fine distinctions are unimportant, as the code is merely a scheme to accommodate general perceptions of color.

The remainder of Card 2 records information about the grain size of the layer and information about the sediment or rock types. It is coded as follows:

<u>Column</u>	<u>Item</u>	<u>Explanation</u>
28	Amount of Rock	Blank = not present or not reported M = present in minor or trace amounts, <10% S = secondary constituent, 10-50% D = dominant or only constituent, >50%
29	Amount of Gravel, Pebbles	
30-32 33-35 36-38 39-41	Modifiers for Rock or Pebbles	Rock and pebbles are considered together, and may have as many as four modifiers taken from Table 3. The most important modifier goes in Cols. 30-32, the next most important in Cols. 33-35, etc.

TABLE 3: MODIFIERS FOR ROCK AND PEBBLES

Code	Modifier
IGN	Igneous, unspecified
BAS	Basalt, pillow basalt, basalt glass
GAB	Gabbro, diabase
PUM	Pumice
BRE	Breccia, volcanic
VOL	Volcanic, unspecified
TUF	Tuff
AND	Andesite
GRA	Granite
PER	Periodotite
MET	Schist, or unspecified metamorphic
GRE	Greenstone
SER	Serpentine
SED	Sedimentary, unspecified
SAN	Sandstone, graywacke
MUD	Mudstone, siltstone, claystone, shale
CON	Conglomerate
LIM	Limestone
CHA	Chalk
CHE	Chert, porcelanite
EVA	Evaporite -- gypsum, salt
MNN	Mn nodules
MNP	Mn pavement or crust
MNC	Mn-coated
COR	Coral
PHO	Phosphorite nodules
ZEO	Zeolite nodules
GLA	Glacial transport material
SHE	Macrofauna shells
ALT	Altered
FER	Ferruginous
SIL	Siliceous

42-43	Amount of Sand }	These are size fractions and do not imply terrigenous origin. Code same as Amount of Rock, right justified, or express as a percentage. In general, do not code "trace," "negligible" or "<2%" amounts.
44-45	Amount of Silt }	
46-48 }	Modifiers for	Up to two modifiers from Table 4 may be used.
49-51 }	Sand and Silt	

TABLE 4: MODIFIERS FOR CLAY, SAND AND SILT

Code	Modifier
FIN	Fine
COA	Coarse
PEL	Pelagic
TER	Terrigenous
CAL	Calcareous
SIL	Siliceous
SHE	Shell
COR	Coral
VOL	Volcanic
FER	Ferruginous
ZEO	Zeolitic

52-53	Amount of Clay	Code same as Amount of Sand or Silt
54-56 }	Modifiers for	Up to two modifiers from Table 4 may be used.
57-59 }	Clay	
60-80		These columns are to be left blank or used for notes.