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=           DEEP SEA DRILLING PROJECT                 =
=    CLAY MINERALOGY, ADDITIONAL DATA CODED BY WHOI   =
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I. INTRODUCTION

A. BACKGROUND AND METHODS

This data set consists of results from analyses made by a large number of scientists from various countries who applied a total of 60 different methods to clay mineral analyses.

These data were encoded at the Woods Hole Oceanographic Institution, under the direction of Dr. J. Mienert from the Initial Reports, and are intended as an extension of the x-ray mineralogy data compiled by the DSDP data management staff for Legs 1-37 of the DSDP. The data compiled at DSDP were from x-ray diffraction analyses made by the University of Califoria at Riverside X-Ray Mineralogy Laboratory, and are contained in separate data sets.

Legs 38 through 96 data were digitized by WHOI completely from published articles of DSDP volumes, ie. from a variety of different tables, bar logs, and columnar logs. The files contain both shipboard measurements and measurements made at onshore laboratories. The x-ray mineralogy data are usually presented with the relative proportions of of clay minerals (%) normalized to 100%. Purely descriptive data analyses such as a division of the relative amount of clay components into traces, rare, and common are excluded from this study because of any lack of quality control of the data. The unevenness in quality and quantity of past measurements is due to the use of different size fractions, the inadequate treatment of samples, and the inconsistency in converting XRD peak intensities to absolute or relative concentrations of clay minerals. This results in a somewhat limited treatment of deep-sea clay mineralogy. However, the data are certainly of value for studies of areas where the same method has been applied and for regional compilations of clay mineralogy data in areas of similar sediment facies.

The analysis of clay minerals is organized according to grain size, in particular in three main size fractions as follows:

Bulk grain sizes:	> 20 microns
Silt grain sizes:	< 5 , < 10, 1-10, 2-20, 2-37 microns
Clay grain sizes:	< 1, < 2 microns

The data set contains the clay minerals (%) organized in three files:

xrw_bulk.dat
xrw_silt.dat
xrw_clay.dat

The format follows the general guidelines established by the University of California at Riverside X-Ray Mineralogy Laboratory which operated from Leg 1 through Leg 37 under DSDP contract, with the following exceptions:

1. A section depth (top and bottom) is given for some samples.
2. A BSF depth is given for some samples.
3. Depth to top and bottom of sample interval are omitted.
4. The fraction field may contain micron ranges rather than the original "B", "S", or "C" for Bulk, Silt, or Clay.
5. Mineral mnemonic/Weight % couplets for one sample are all on one record, rather than using multiple records combined with a record position field.

II. FORMAT AND FIELD DESCRIPTIONS

A. RECORD FORMATS

The data files have a logical record length of 191 characters. The data files are sorted in the following sequence by:

Position	Format	Field Contents
1-2	I2	Leg ID
3-5	I3	Site
6	A1	Hole
7-9	*A3	Core
10-11	*A2	Section
12-14	**I3	Top Section Depth
15	A1	"-"
16-18	**I3	Bottom Section Depth
19-25	**F7.2	BSF Depth
26-29	A4	Fraction
30-31	I2	Number of Minerals in Sample
32-191	20(A4,**F4.1)	Couplets of mineral mnemonic followed by weight percent

*For some holes, no core or section is given, only BSF depth.
**These formats are >90% correct. In some cases, Top Section Depth may contain a decimal number. In some cases, weight percentages may be F4.0.

The couplets of mineral mnemonic identify the clay mineral followed by percentages. The percentages attached to the actual minerals are weight percents relative to the particular sample and fraction, but for some analyses these values have not been normalized to 100%. Despite the fact that percentages are sometimes written to 1/10 of 1 percent, the data must be viewed as semiquantative.

C. REFERENCES

For an overview of the clay mineralogy data of DSDP Volume 1-44 see G. Ross Heath, 1984. X-ray Mineralogy Studies. In G. Ross Heath (ed.), Sedimentology, Physical Properties, and Geochemistry in the Initial Reports of the Deep Sea Drilling Project Volumes 1-44: An Overview,

World Data Center A for Marine Geology and Geophysics Report MGG-1, pp. 71-91.

E. X-RAY MINERAL MNEMONIC LIST:

Mineral	Four Character Mnemonic
'diffuse scattering' measure	DIFF
'amorphous material' measure	AMOR
QUARTZ	QUAR
MICA & MONTMORILLONITE	MICA
MONTMORILLONITE	MONT
CHLORITE	CHLO
CALCITE	CALC
KAOLINITE	KAOL
K-FELDSPAR	K-FE
CLINOPTILOLITE	CLIN
PYRITE	PYRI
BARITE	BARI
PALYGORSKITE (Atapulgite; Palygorskite & Sepiolite)	PALY
AMPHIBOLE	AMPH
PHILLIPSITE	PHIL
CRISTOBALITE	CRIS
DOLOMITE	DOLO
GOETHITE	GOET
MAGNETITE	MAGN
GYPSUM	GYPS
HALITE	HALI
ANALCITE	ANAL
HEMATITE	HEMA
ARAGONITE	ARAG
SIDERITE	SIDE
FELDSPAR (undifferentiated)	FELD
APATITE	APAT
SEPIOLITE	SEPI
RHODOCHROSITE	RHOD
MAGNESIAN CALCITE	MGCA
MIXED LAYER CLAY	MIXL
ANHYDRITE	ANHY
"variety of MONTMORILLONITE"	2-MO
ILLITE (Itmontmorillonite; Itmontmorillonite & Mica; Itmontmorillonite & Smectite)	ILLI
ALKALINE FELDSPARS (K Feldspars; Sanidine)	AK-F
CLAY MINERALS	CMIN
ZEOLITE	ZEOL
WAIRAKITE	WAIK
SEPENTINE	SERP
PYROXENE	PYRO
PYRO-PHYLLITE	PYPH
OPAT-CT	OPAT
NATRO-JARO	NJAR
MARCASITE	MARC

MAGHEMITE	MAGH
LEPIDOCROSITE	LEPI
HORNBLENDE	HORN

Table 1. Summary of X-ray Mineralogical Studies Reported in DSDP Volumes 1 to 9 (Including the table from Heath, 1984)

LEG (SITES)	LOCATION	FRACT (MICRONS) BULK	<2	2-20	DATA FORMAT IN IR TABLE	BARLOG	COLLOG	METH	REFERENCES	DEVICE	SITES	NOTES
01 1- 7	Gulf Mexico	X			X			M1	Rex, 1969			Brief defn of methods at Riverside lab
02 8- 12	N. Atlantic	X			X			M1	Rex, 1970			
03 13- 22	S. Atlantic	X		X	X	X		M1	Rex, 1970			
04	Atl, Carib.	X		X	X	X		M2	Rex and Murray, 1970			Riverside meth in Appendix
05 32- 43	E N. Pacific	X			X	X		M2	Rex and Murray, 1970			
06 44- 60	W N. Pacific	X		X	X	X		M2	Rex et al., 1971			
			<1		X			M3	Lisitzin, 1971			
07 61- 67	W. Pacific	X	X		X	X		M2	Balshaw, K.M., 1981			
			X			X		M4	Drever, J.I., 1971			Site 66 only
08 68- 75	E. Pacific	X	X	X	X	X		M2	Balshaw, K.M., 1982			Semiquatitative for 2-20 microns
09 76- 84	E. Pacific	X	X	X	X	X		M2	Basov et al., 1979			As Leg 8
10 85- 97	Gulf Mexico	X	X	X	X	X		M2	Beiersdorf et al., 1983			As Leg 8; lists

revised peak intensity vs. conc. factors												
11	98-108	E N.Atlantic	X	X	X	X	X			M2	Zemmels, 1972	As Leg 8; no data site 107; no methods for Hathaway samps (bulk & <2) *
12	109-119	N N.Atlantic	X	X	X	X	X			M5	Fan and Zemmels, 1972	no data sites 109-110; quant. all fractions
13	120-134	Mediterranean	X	X	X	X	X			M5	Zemmels and Cook, 1973	Site 121 only**
14	135-144	N. Atlantic	X	X	X	X	X			M5	Fan and Rex, 1972	No data Site143 new chl factor; no data 139, 142, 143.

Table 1. Summary of X-ray Mineralogical Studies Reported in DSDP Volumes 1 to 9 (continued)

		FRACT (MICRONS)			DATA FORMAT IN IR					
LEG (SITES)	LOCATION	BULK	<2	2-20	TABLE	BARLOG	COLLOG	METH	REFERENCES	DEVICE	SITES	NOTES

60 452-461 W. Pacific X M39
Desprairies, 1982 453-454

456,460-461
X X M37 Balshaw,
1982 452-454

61 462 W.Eq.Pacific X X X X M32 Nagel &
Muller, 1981 462
X X X X M40
Kurnosov&Shevchenko,1981 462

62 463-466 N.Ce.Pacific X X X X M40 Nagel &
Schumann, 1981 463-466 Dev XRD-DRON-1.
<1 <10 M41 Rateev
et al., 1981 XRD-DRON-1 463-466 CuK alpha rad.

@2deg/min scan

speed. Verbal

list relative

dominance.
X X,<1 X M32,42 Hein &
Vanek, 1981 XRD-NORELCO 463-466 ditto except

verbal list.

63 467-473 <1 X X M41 Rateev
et al., 1981 XRD-DRON-1 467-473 ditto including

verbal list.

64 474-481 E. Pacific X X X M40
Schumann&Nagel, 1982 477,481,

477-479

65 482-485 E. Pacific/ ?X ---- Timofeev
et al., 1983 482-485 Verbal list rel.
Gulf of
dominance.
California X X,<0.5,<1 X M43 Rangin
et al., 1983 483,485
X X X X X M32
Schumann, 1983 482-485
>20 X X M32 Kurnosov
et al., 1983 482-485

66 486-493 E. Pacific X X X M32
Schumann&Nagel, 1982 486-493

67 494-500 E. Pacific/ X X M32
Heinemann & Fuchtbauer, 494-496,
Trench off 1982
499-500
Guatemala X X X X M40 Kurnosov
et al., 1982 494-496,

499-500
X X X M38 Latouche
& Maillet, XRD-Philips 494-500 Verbal list rel.

1310 dominance.
X <1 1-10 X --- Kurnosov&Shevchenko, 495,499- CuK alpha rad. 1982
500

Table 1. Summary of X-ray Mineralogical Studies Reported in DSDP Volumes 1 to 9 (continued)

LEG (SITES)	LOCATION	FRACT (MICRONS) BULK	<2	2-20	DATA FORMAT IN IR TABLE	BARLOG	COLLOG	METH	REFERENCES	DEVICE	SITES	NOTES
68	502-503	E. Eq.		X	2-37		X	M44	Zimmermann, 1982	XRD-7 G.E.	502	CuK alpha rad.
	Pacific											@2 deg/min scan
												speed
		X		X		X		X	M32	Schumann&Nagel, 1982	502,503	CuK alpha rad.
												@1.8deg/min
												scan speed
69	501,	E. Eq.	>20	X	X		X	M45	Beirsdorf&Rosch,1983	XRD-Philips	504,505	
	504-505	Pacific/							ADP 10			
		Panama Basin										
70	506-510	E. Eq.		X	X			M46	Honnorez et al.,1983	XRD-Philips	506,507	Verbal list rel.
		Pacific							Norelco			abundance
												CuK alpha rad.
												1deg 2theta/min
												scan speed
		X,>20	X		X			M47	Kurnosov et al.,1983	XRD-DRON-	506,507,	CuK alpha rad.
1,5	509											

71 511-514 S W Atlantic X X X X M48
Robert&Maillet, 1983 XRD-CGR 327,329, CuK alpha rad.

theta60 330,511, @1deg 2theta/

512,513, min scan speed

514

<1 X M49
Varentsov et al,1983 XRD-DRON-2 511,513, CuK alpha rad.

514 @2deg/min &

@1deg/min

scan speed

Verbal list rel.

dominance

<1 <10 X M49 Timofeev
et al.,1983 XRD-DRON-1 511,513 CuK alpha rad.

@2deg/min &

@1deg/min

scan speed

Verbal list rel.

dominance

72 515-518 S W Atlantic X 2-37 M44
Zimmermann, 1983 XRD-7 G.E. 515,516, CuK alpha rad.

355,357 @2deg/min

scan speed

X X M50
Coulbourn, 1983 XRD-RIGAKu 515,516, CuK alpha rad.

Miniflex 517 @2.4deg 2theta/

2005 scan speed

Verbal list rel.

dominance

73 519-524 Ce. S. X X M33 Karpoff,
1984 519,520, CuK alpha rad.
Atlantic
521,522, @1deg/min

523 scan speed

74 525 S E Atlantic X X M48
Maillet&Robert,1984 XRD-CGR 525,526, CuK alpha rad.

theta60 527,528, @1deg 2theta/

529 min scan speed

Table 1. Summary of X-ray Mineralogical Studies Reported in DSDP Volumes 1 to 9 (continued)

LEG (SITES)	LOCATION	FRACT (MICRONS) BULK	<2	2-20	DATA FORMAT IN IR TABLE	BARLOG	COLLOG	METH	REFERENCES	DEVICE	SITES	NOTES
75 530-532	S E Atlantic		X				X	M48	Maillot&Robert, 1984	XRD-CGR	530,532	CuK alpha rad. theta60 @1deg 2theta/ min scan speed
			X				X	M48	Chamley et al., 1984		525,527, 528,523	
			X				X	M51	Stow & Miller, 1984		530	CuK alpha rad. @1deg 2theta/ min scan speed
76 533-534	Western N Atlantic/ Blake Bahama Outer Ridge		X				X	M52	Kagami et al., 1983		534	Only Cretaceous sections
			X			X	X	M48	Chamley et al.,1983	XRD-Philips	534	CuK alpha rad. 1730 @2deg 2theata/ min scan speed
77 535-543	Gulf of Mexico		X			X	X	M48	Debrabant et al,1984	XRD-Philips	535,536, 537,538, 1730	CuK alpha rad. @2deg 2theta/ 540 min scan speed
78 541-543	E Caribbean/ Lesser Antilles			X				M53	Wright, 1984	XRD-Norelco	---	CuK alpha rad. Only surface sed. samples

intraoceanic
from piston
island arc
cores

X X X X M54 Pudsey,
1984 541,542, CuK alpha rad.

543 @2deg theta/

min scan speed
X X <5 X X M38
Latouche&Maillet, XRD-Philips 541,542, CuK alpha rad.
1984
1130 543

79 544-547 E N Atlantic/ X X M51
Stein&Sarnthein, XRD-Philips 544
N W African 1984
1050
Margin
X X X M32
Schumann, 1984 544,545,

546,547

X X X M48
Chamley&Debrabant, XRD-Philips 544,546,
1984
1730 547

80 548-551 E N Atlantic X X X X M38 Chennaux
et al.,1985 XRD-Philips 548,549, CuK alpha rad.

1130 550

X X X X M55 Thiry &
Pascal, 1985 548,549,

550

81 552-555 E N Atlantic/ X X X X M38 Latouche
& Maillet, XRD-Philips 552,553, CuK alpha rad.
Rockall 1984
1310 554,555
Plateau
X X M44
Zimmerman, 1984 XRD-7 G.E. 552,553, CuK alpha rad.

554,555 @2deg 2theata/

min scan speed

Table 1. Summary of X-ray Mineralogical Studies Reported in DSDP Volumes 1 to 9 (continued)

LEG (SITES)	LOCATION	FRACT (MICRONS) BULK	<2	2-20	DATA FORMAT IN IR TABLE	BARLOG	COLLOG	METH	REFERENCES	DEVICE	SITES	NOTES
82 556-564	Ce. N Atlantic	X	X		X	X		M38	Latouche & Maillet, 1985	XRD-Philips	558,563	CuK alpha rad.
83 504B	E Eq. Pacific/ Panama Basin	X				X		---	Alt et al., 1985	XRD-Philips	504	CuK alpha rad.
84 565-570	E Eq. Pacific/off Guatemala		X		X			M56	Helm, 1985		565,567, 568,569, 570	CuK alpha rad.
85 571-575	Ce. Eq. Pacific				NO MINERALOGY!							
86 576-581	N W Pacific	X	X	X	X		X	M57	Schoonmaker et al., 1985		576,578, 581	CuK alpha rad. @2deg 2theata/ min scan speed
87 582-584	N W Pacific		X				X	M28,M48	Chamley et al., 1986		582,583, 584	Device XRD- Philips Norelco
89 585-	W Eq. Pacific	X	X		X		X	M48	Chamley et al., 1986		585	
90 587-594	S W Pacific	<63	X		X			M53	Gardner et al., 1986		591	
			X				X	M48	Robert et al., 1986	XRD-CGR	592,593, 594	CuK alpha rad. theta60 @1deg 2theta/ min scan speed
			X				X	M48	Stein & Robert, 1986	XRD-CGR	588,590,	

theta60 591

91 ?

92 597-602 S E Pacific X X M58 Kastner, 1986 597 Verbal list rel.

dominance

Table 1. Summary of X-ray Mineralogical Studies Reported in DSDP Volumes 1 to 9 (continued)

LEG (SITES)	LOCATION	FRACT (MICRONS) BULK	<2	2-20	DATA FORMAT IN IR TABLE	BARLOG	COLLOG	METH	REFERENCES	DEVICE	SITES	NOTES
96 614-624	Gulf of Mexico		<4				X	M59	Stow et al., 1986		615,620, 621,622	CuK alpha rad. @1deg 2theta/ min scan speed
			X	X		X		M60	Thayer et al., 1986		618,619	Verbal list rel. dominance
			X				X	M52	Ishizuka et al.,1986		615,617, 618,619	
			<4		X			M59	Pickering et al.,1986		614,619	CuK alpha rad. @1deg 2theta/ min scan speed

A Stoffers and Muller, 1978, Zemmels et al., 1972. the Hathaway samples were analyzed at Woods Hole Oceanographic Institution.

There is no information on sample preparation. Layer silicates are not differentiated in the bulk analyses. Clays (<2um) treated with ethylene glycol. Intensity vs. abundance factors not stated.

B Nesteroff (1972) refers to X-ray mineralogy done at the University of Paris, but includes no methology or data plots or listings.
Composition ranges are reported in the text, but their origin (Riverside of Paris) is unclear.

C Connelly and Nalli, 1973. No methology or data listings given. Qualitative results discussed in text.

D Emelyanov et al., 1979. Carbonates, quartz, and feldspars determined for bulk sediment (using CaF2 interal standard?).

E Kossovakaya and Drits, 1978, Rateev et al., 1979, Renngarten et al., 1979, Timofeev et al., 1979, Varentsov, 1979. None of Leg
38 Russian mineralogy includes adequate methodology. All sites are assumed to have used M16 treatments.

Table 2. X-ray mineralogy: Synopsis of treatments for Legs 1-96
(refers to Table 1)

M1 - Rex, 1969. Rex's initial paper summarizes the sample treatment, intensity to concentration conversion factors, and concept of data reduction used at Riverside. The Appendix (M5) is a direct descendent of M1.

M2 - Rex reviews the data-processing scheme at Riverside. Includes filter description, intensity to concentration conversion factors, and interference corrections. The Appendix (M5) describes the Riverside procedure that eventually evolved from M2.

M3 - Lisitzin et al., 1971. Grind to <1 micron (sic), add CaF2 standard. Compare to standards for quartz and carbonate estimates. Stokes-separate < 1 micron fraction, remove carbonate with 0.1N HCl, remove oxyhydroxides with dithionite-citrate-bicarbonate (DCB), saturate with 1N MgCl2, expand with glycerine. Also use Li saturation (Greene-Kelly, 1953). Use Biscaye (1965) peak-area ratios (M11).

M4 - Drever, 1971. No information on sample treatment. M1 factors used

for abundance estimates.

M5 - Cook et al., 1974. This is the "polished" Riverside Lab methodology (see Appendix).

M6 - de Segozac, 1973. Remove carbonate by 0.1N HCl, Stokes-separate (settle and centrifuge) <2 micron, Mg-saturate. Ethylene glycol solvate? Plots of peak character and montmorillonite/illite and chlorite/illite (4.7/5A) peak ratios.

M7 - von Rad and Rosch, 1972. Bulk samples, formic-acid-treated fractions run if carbonate rich. Abundance estimates as "main", "abundant", "common", and "tract": (>40, 20-50, 10-20, 3-10%). Columnar logs with abundance symbols.

M8 - Roberson, 1973. Wash out salt, disaggregate ultrasonically, Stokes-separate <2 micron by centrifuge, pipette on glass. Use "similar to" Johns, et al. (1954) abundance estimates.

M9 - Hayes, 1973. Stokes-separate <2 microns (centrifuge), Mg-saturate, ethylene glycol solvate. Intensity to conversion ratios - mica/ montmorillonite:illite:chlorite = 1:3:3. Separate chlorite from vermiculite by 7A/14A ratio (2 to 0.2, respectively).

M10- Okada and Tomita, 1973. Air-dry aggregates on glass, expand with ethylene glycol. Intensity to conversion factors for montmorillonite:-illite:kaolinite = 1/2.6:1:1/1.2 (based on matching standards to unknowns). Size fraction not stated, probably bulk.

M11- Venkatarathnam, 1974. Biscaye (1965) methodology and intensity to abundance factors. Sodium acetate (pH=5) carbonate removal, DCB oxyhydroxide removal, sodium carbonate disaggregation, then size separate. Paste smear <2 micron fraction on glass, ethylene glycol solvate. Conversion factors - montmorillonite:illite:kaolinite: chlorite = 1:4:2:2.
Gerbuneva, 1976. Uses < 1 micron, no DCB.
Zimmerman, 1977. Uses <4 micron.

M12- Gostin and Moriarity, 1975. Carbonate removal by glacial acetic acid, Stokes-separate < 2 micron fraction, NaOH remove opal, DCB remove oxyhydroxides, Mg saturate, glycerine solvate. Conversion factors - montmorillonite:illite:kaolinite:chlorite = 1:4:2:4. Also uses CEC (Ba) to cross check montmorillonite.

M13- Perry et al., 1976. Stokes-separate < 1 micron, < 1 micron, pipette on glass. Ethylene glycol solvate? Use relative peak intensities (no abundance conversion).

M14- Eslinger and Savin, 1976. Stokes-separate <0.3, 0.3-0.7, and >0.7 microns. Ethylene glycol solvate. Illite/smectite:illite:kaolinite:-chlorite abundances given by I/S 003/005-1/2 I 001:I 001:K 002:C 004.

M15- Kastner, 1976. Stokes-separate <2 micron, >2 micron. Use Drever's (1973) technique. Data shown as relative peak intensities (illite 10A:chlorite 7A:illite/smectite 17A).

M16- Kessovskaya and Drits, 1978. Stokes-separate <1 and 1-10 micron. Other methodology not stated. Mentions glycerine saturation. Description and rough estimates of clay mineralogy. (Method is also described in Rateev et al., 1979, McCoy et al., 1977, Timofeev et al., 1979, and Varentsov, 1979).

M17- Perry et al., 1979. Stokes-separate <1 micron, pipette on glass,

ethylene glycol solvate. Use Biscaye (1965) intensity to concentration factors (M11).

M18- White, 1976. Grind dry, then wet. Stokes-separate <5 micron. Ethylene glycol solvate. Use Biscaye (1965) factors (M11). Sites 338, 340, 341, 343, 344, 345.

M19- White, 1976. Bulk: wash, dry crush, report as "present", "abundant", "major". Clays: Stokes-separate <2 micron, vacuum mount on tile, ethylene glycol solvate. Use Biscaye (1965) factors (M11). Sites 346 to 349.

M20- Matsumoto, 1978. Bulk: dry grind. No intensity to concentration conversion factors. Clays: <2 micron, ethylene glycol solvate, hydrazine hydrate expand kaolinite. Intensity to abundance conversion factors - smectite:mica:kaolinite:chlorite + 1:1.7:1:1.5.

M21- Siesser and Bremner, 1978. Dialyse 24 hr. Bulk: dry, crush, press, tabulate peak intensities above background. Clays: remove carbonate with 25% acetic acid, Mg-saturate, pipette on glass (warm to dry), ethylene glycol solvate. Use Johns, et al. (1954) factors (kaolinite and chlorite undifferentiated).

M22- Couture, 1978. Glass mount. Remove carbonate by pH=5 acetate buffer, ethylene glycol solvate. Data listed as "present", "abundant", "dominant".

M23- Melieres, 1978. Bulk samples. Use NaF internal standard, ethylene glycol solvate. Abundances estimated by comparison with standards. For clays, remove carbonte with 10% HCl, pipette on glass, ethylene glycol solvate. Montmorillonite:illite:kaolinite:chlorite = 1 (14A):1(10A):1:1 (7A divided by 003:006 ratio).

M24- Trimonis et al., 1978. For clays, Stokes-separate <2 micron, remove carbonate with 1N HCl, Mg-saturate, glycerine solvate. Abundance from Biscaye (1965) factors (M11).

M25- Koch and Rothe, 1979. Bulk plus <2 micron. Carbonate removed from clays with 10% HCl, pipette on glass (checked against smear mount). Clay ratios from Biscaye (1965) factors (M11). Bulk results comparable to Hathaway's (see footnote a, Table 1).

M26- Pastouret et al., 1978. No methodology or accessible reference. Qualitative data (abundant, common, present?) for 20-63 microns. Percentages (conversion factors not stated) for clay minerals.

M27- Timofeev et al., 1979. Carbonate removal by acetic acid. Clay minerals were studied in the fraction <10 microns. Treatment with glycerine solvate. Verbal listing of clay minerals.

M28- Chamley and d'Argoud, 1979. Carbonate removal by 5N hydrochloric acid. Decantation of <2 micron fraction by using Stokes law. Semiquantitative evaluations are based on the peak heights and areas (after Chamley, 1971). Relative error +/- 5%. Heights of 001 illite and chlorite peaks are taken as references.

M29- Latouche, G. and Maillet, 1979. Carbonate removal by N/10 hydrochloric acid. Ethylene glycol treatment before analysis. Semiquantitative estimates from the height (? and areas) in the diagrams of glycolated slides. The height of 001 peaks was used to determine the percentage of smectite (17A), illite (10A), and kaolinite + chlorite (7.1A).

M30- Timofeev et al., 1979. Carbonate removal by N/10 hydrochloric acid. Samples were measured natural, saturated with glycerine, and heated at 550 degrees C for identifying mixed-layer minerals of the Ch-M type.

M31- CEPM Laboratory, 1980. Carbonate-free fraction of < (?) 5mm. The 1 day mineral content were estimated in relative percentages from the heights and the areas of the x-ray diffraction peaks. No further details.

M32- Mann and Muller, 1980. Clay minerals in the <2 micron fraction were x-rayed in an untreated state, glycolated state, and when necessary, after heating. Biscaye's method (1965) was used to determine the clay minerals by multiplying the peak (peak 2 ?? (in degrees):smectite + 5.2 (17A), chlorite = 12.3 (7.2A), illite = 8.8 (10A) kaolinite + 12.3 (7.2A), polygorskite = 8.4 (10.5A), talc = 3.4 (9.3A), sepiolite = 7.4 (12.0A) area by factors (smectite = 1, chlorite = 2, illite = 4, kaolinite = 2, polygorskite = 1, talc = 1, sepiolite = 1). The sum of the clay minerals was 100 percent. The kaolinite/chlorite peak at 2 ?? = 12.3 degrees was divided by peak splitting.

For the bulk mineralogy the peak heights are multiplied by factors (REF.101). When multiplied they add up to 100%. However, if the amount of amorphous material, i.e., volcanic glass, opal, and amorphous clay minerals, vary, the factors have to be redetermined. These factors apply only for minerals which are very similar to those from Site 502 and 503.

M33- Karpoff et al., 1980. Identification of clay minerals was made on three types of oriented aggregates: untreated, ethylene-glycol-treated, and heated (Mise au point collective, 1975).

M34- Mann and Muller, 1980c. Method of M11 slightly modified because of the high amount of amorphous constituents in the sediments. The amorphous constituents influence the (020) peak in such a way that its base line cannot be exactly traced. Thus, it is impossible to quatify the percentage of clay minerals by direct peak measurements. The method applied is to subtract all other consituents that can be determined by x-ray methods. The margin of the error of this method is all the larger the greater the amount of amorphous constituents.

M35- Kurnosov et al., 1980. Carbonate removal by N/10 hydrochloric acid. Decantation of <1 micron and 1-10 micron fraction. Samples were dried, treated with ethylene glycol, and heated at 500 to 550 degrees C. Some samples were K-saturated to test the nature of expanding minerals (Weaver, 1968). Relative proportions of clay minerals were analyzed by using Biscaye's method (1965). Ref. 125, 126, 127, 129.

M36- Aoyagi and Kazama, 1980. Method of analysis is explained in detail by Oinuma and Kobayashi (1966) and Aoyagi (1967). X-ray diffraction peaks of each mineral of powdered sample measured are 001 for montmorillonite, illite, and kaolinite, 002 for chlorite and plagioclase, 020 for clinoptilolite and gypsum, 101 for quartz, 104 for calcite, dolomite, and siderite, 110 for hornblende, and 200 for pyrite and halite. Existence of illite-montmorillonite mixed-layer minerals is inferred from the width of the 17A peak of glycolated samples.

M37- Balshaw, 1981. Carbonate removal by 0.1N (pH 5) sodium acetate and acetic acid. 0.2M ammonium oxalate and 0.2M oxalic acid were used to dissolve amorphous Fe-hydroxides and oxyhydroxides. The <2 micron fraction was separated by settling using Stoke's law. Deionized water and Calgon were used to minimize flocculation of the clay particles.

The resulting clay was treated with a 1.0M solution of Mg Cl to

saturate the clay exchanges with Mg ions and finally washed. The slides were x-rayed after air drying and again after treatment with ethylene glycol. The glycolation caused a shift of the smectite peak from 12-14.0A to 18.0A. The illite peak at 10.0A, and the chlorite and kaolinite peaks which are coincident at 7.0A are not affected by glycolation. The relative percentages of the clay minerals were calculated by using techniques outlined by Biscaye (1965).

M38- Latouche et al., 1982. Pulverized sediments of bulk samples were analyzed according to the powder diffractogram method. Semiquantitative analysis of the content of quartz, calcite, and feldspars is based on their diffraction peak height which is compared with peaks of mixed synthetic reference samples. Carbonate removal of the clay fraction (<2 micron) by N/10 HCl. The <2 micron fractions were separated by gravity settling. The slides were x-rayed after air drying and then after heating at 550 degrees C for one hour. The second was scanned after treatment with ethylene glycol. Identification of clay minerals after Brown (1961) and Thores (1975). Ref. 167 slightly changed method by: (A) using 10N HCl. The clay fraction abundance, evaluated on the basis of peak heights, has an estimated experimental error of +/- 10%.

M39- Desprairies, 1982. Clay minerals in the carbonate free <2 micron fraction were determined by various treatments (heating, glycol, hydrazine). The relative abundances of the principal clay minerals were estimated by the percentage of the basal peak intensities rather than by the percentage of the basal peak areas.

M40- Kurnosov and Shevchenko, 1981. Identification of clay minerals in the wire fraction <2 micron and 2-20 micron using the method of Biscaye (1964) (see also M11). Conversion factors montmorillonite:illite: kaolinite:chlorite = 1:4:2:2.

M41- Rateev et al., 1981. Samples (? carbonate free) were prepared for the <1 micron and partly for the <10 micron fraction in three states: air dried, ethylene-glycol-treated, and heated at 550 degrees C. Kaolinite is identified by standard peaks at 7.15 and 3.57A, which are disappearing after heating at 550 degrees C and preserved after treatment with 10% HCl. Montmorillonite has peaks from 14.1 to 14.7A in an air dried state which expand to 17.9A after saturation with glycerine. Montmorillonite-illite mineral mixed layer clay is characterized by an asymmetrical peak at 14.7A in an air dried state, and at 18.8 to 19.6A after saturation with glycerine.

M42- Hein and Vanek, 1981. Carbonate and organic matter removal by sodium acetate and acetic acid. The <2 micron fraction was separated by centrifugation. The fraction was x-rayed after Mg saturation and glycolation. Peak areas were used to calculate relative amounts of clay minerals (after Biscaye, 1965).

M43- Rangin et al., 1983. The <2 micron, <0.5 micron, and <0.1 micron fractions were separated by centrifugation. The ratio of the areas under the main phyllosilicate peaks indicate the clay mineralogy (? no abundance conversion).

M44- Zimmerman, 1982. Carbonate removal by 0.6N acetic acid. Separation of the 2-37 micron and <2 micron by calculated settling times. Slides were x-rayed before and after glycol solvation. Chlorite and kaolinite abundance is indicated by the area under the 7.1A peak. The separation of these two minerals is based on the slow-scan method of Biscaye (1964). Illite has a well defined peak at 10A that was unaffected by ethylene glycol solvation. A broad peak at 17A after solvation is assigned to smectite (montmorillonite). The conversion factors of Biscaye (1965) (see M11) are used: montmorillonite:illite:kaolinite:

chlorite = 1:4:2:2.

M45- Beiersdorf and Rosch, 1983. Clay minerals of the non-CaCO3 components in the grain size fraction <2 microns, 2 to 20 microns, and >20 microns were determined qualitatively from glycolated powder samples. The concentration was estimated from peak height measurements which were compared with those of pure standards.

The concentration of all other components - especially feldspar and smectite, together with the amorphous scatter - were empirically estimated and balanced to 100%.

M46- Honnorez et al., 1983. Samples of air dried, ethylene-glycol treated, and heated smear slides of the <2 micron and bulk sediment fraction were x-rayed. Some samples were analyzed by subdividing the <2 micron fraction in arbitrary fractions between 2 and 0.4 microns. The XRD measurements did not indicate any difference and their clay mineralogies were similar to that of the bulk sample.

M47- Kurnosov et al., 1983. Samples of air dried, ethylene-glycol treated, and heated (500 to 550 degrees C for 1 hour) smear slides of the <2 micron, 2-20 micron, and bulk sediment fraction were x-rayed.

M48- Robert and Maillot, 1983. Carbonate removal by 0.2N hydrochloric acid in the <63 micron sediment fraction. The <2 micron fraction was separated by settling using Stoke's law. Oriented aggregates were made on glass slides. The untreated sample, the glycolated sample, and the sample heated for 2 hours at 490 degrees C were x-rayed. Semiquantitative evaluations were based on the peak heights and areas (after Chamley, 1971). The height of the 001 illite peak of the glycolated sample was taken as a reference. Compared to this value, smectite, attapulgite, and irregular mixed-layer clays were corrected by multiplying their peak height by a factor of 1.5 to 2.5. Well-crystallized kaolinite was corrected using a factor of 0.5. The relative error is +/- 5%. (comparable to M28).

M49- Varentsov et al., 1983. The fraction < ? 1 micron had been air dried, treated with glycerine, and heated at 550 degrees C. The interpretation of these x-rayed samples are based on comparison of the experimental data with corresponding models of Drits and Sakharov (1976).

M50- Coulbourn, 1983. Bulk samples have been x-rayed. Diffractograms of standards were compared with diffractograms of core samples. Samples were not treated with ethylene-glycol and run a second time to distinguish chlorite from montmorillonite. The quantification of diffractograms attempted is an approximate version of a method of mutual standards (Rex, 1970).

M51- Stow and Miller, 1984. The <2 micron fraction was separated by ultrasonic treatment and settling and x-rayed for untreated and glycolated samples. Semiquantitative analysis of the clay mineral diffractograms are based on the peak areas of glycolated samples (after Biscaye, 1965). The weighting factors are: 2 (kaolinite-chlorite), 4 (illite), 1 (smectite), and 1 (mixed layers). REF. 168: Carbonate free <2 micron fraction was analyzed (Lenge, 1982).

M52- Kagami et al., 1983. The <2 micron fraction was collected by sedimentation (no further details) and x-rayed. Quantitative and qualitative estimations are based on the method by Sudo et al. (1961) and Oinuma (1968).

M53- Chamley et al., 1983. Preparation and analysis of the samples after the method by Hein et al. (1976). Clay percentages were determined on the diffractogram of the glycolated samples by the peak area method and

weighted by the conversion factors after Biscaye (1965).

M54- Pudsey, 1984. Bulk samples and the <2 micron sediment fraction have been x-rayed. The <2 micron fraction was settled in sodium hexametaphosphate suspension to prevent flocculation of sediments. Each sample of the <2 micron fraction was x-rayed after (1) saturation with ethylene glycol and (2) after heating to 500 degrees C. Peak heights and areas are measured in diffractograms and are used to obtain a semiquantitative estimate of the mineralogy. The estimation of the mineralogy in percent is based on the measured peak heights and areas times a combination of weighting factors given by Rex and Murray (1970), Biscaye (1965), and Mann and Muller (1980).

M55- Thiry and Pascal, 1985. Bulk samples were treated with 1/10N HCl. The <2 micron fraction was separated by settling, dried, saturated with ethylene glycol and hydrazine hydrate, and later heated at 490 degrees C. Clay minerals and mixed layers (%) were determined by their peak areas in the diffractogram of the samples treated with ethylene glycol.

M56- Helin, 1985. No carbonate removal. The fraction <63 microns was washed several times using 0.01N NH4OH. The fractions <2 microns, 2 to 6.3 microns, 6.3 to 20 microns, and 20 to 63 microns were collected by Atterberg separation after Stoke's law (Muller, 1964). The <2 micron fraction of the air dried samples, the heated samples at 500 degrees C, and the glycolated samples were analyzed. The clay mineral distribution in percent (<2 micron) was determined by using Biscaye's method (1965). The percentages of nonexpandable layers in smectites were calculated by using Reynolds and Hower (1970) and Brindley and Brown's (1980) methods. The partial destruction of the 7-A peak after heating was interpreted as indicating the presence of chlorite. The crystallinity of smectites was investigated in untreated and glycolated samples by measuring the peak height/width at half height ratio.

M57- Schoonmaker et al., 1985. Organic matter was removed by treatement of bulk samples with 5% sodium hypochlorite buffered to pH 9.5 with HCl (after Anderson, 1963). The <2 micron fraction was then separated by centrifugation. Samples were dried at room temperature, treated with ethylene glycol, and an additional aliquot of the <2 micron fraction was treated with Na citrate-Na dithionite to remove amorphous Fe-oxyhdroxides (after Mehra and Jackson, 1960). Clay-mineral abundances were calculated from peak areas by using the "triangle method" (Mann and Fischer, 1982). The percentages of the clay minerals were determined by using weighting factors (Biscaye, 1965), Mann and Muller (1980) for the peak areas. In contrast, the abundance of mixed layers is determined by using peak heights instead of areas (after Hoffman, 1976).

M58- Kastner, 1986. The <2 micron fraction of the bulk sample and that of the >2 micron fraction of the insoluble residue were determined by the Stoke's law settling method. XRD analyses were used to establish a crystallinity index for goethite.

M59- Stow, 1986. The <4 micron fraction was separated by settling. Peak heights were measured for all minerals and normalized to 100% without any application of weighting factors.

M60- Thayer et al., 1986. The bulk sample and the <2 micron fraction were x-rayed. XRD measurements for bulk sediments utilized the technique of Roberts (1982), while the <2 micron fraction was analyzed in a commercial laboratory (without further details).

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NGDC Notes:

This data set was received from the Woods Hole Oceanographic Institution combined with a copy of the x-ray mineralogy data set compiled by the DSDP for Legs 1-37. The two sets of data contained too many differences to be left as a combined set, and so were split into the original DSDP files and into the new WHOI files.

Some differences included:
1) Original DSDP data contain relative terms rather than percentages in some cases (trace, abundant, etc.), 2) The fields giving depth to sample, section, or BSF did not overlap between the two data sets, 3) The DSDP data were generated under fairly uniform conditions, all by the University of California at Riverside X-Ray Mineralogy Laboratory, and retain more of their uniform value when separable from the additional analyses (Note that some data prior to Leg 38 were encoded by WHOI).

Some modifications were made to the WHOI data by NGDC:
1) Leg ID was shortened from 3 to 2 digits to provide uniformity with all of the other DSDP sediment and hardrock data sets.
2) Duplicate 4-digit site and hole fields were reduced to a single 3-digit site and 1-digit hole (blank, A, B, etc.) to provide uniformity with all of the other DSDP sediment and hardrock data sets.
3) An alpha 7-digit Section Depth was justified into 2 separate depth fields separated by a "-" to allow numeric searching on the field.
4) When "CC" was found in the Section Depth field sporadically, it was moved to the section field to be consistent with labelling in other parts of the WHOI data set and with other DSDP data sets.
5) Hole assignments conflicting with the DSDP Coredepths file were checked against the Initial Reports and changed where neccessary. We advise caution, however, in assuming that all holes cited are now correct, because only those conditions (i.e. out of range core # for a hole) which caused a mis-match with the Coredepths file were corrected. Other errors which did not cause a mis-match may still exist. These data have not undergone the thorough quality control that data sets compiled by the DSDP data group have been through.