9. X-RAY MINERALOGY OF CORES FROM LEG 40, DEEP SEA DRILLING PROJECT

W.G. Siesser, Department of Geology, University of Cape Town
and
J.M. Bremner, National Research Institute for Oceanology, Stellenbosch

INTRODUCTION

Sedimentologists on Leg 40 selected representative samples from each hole for X-ray diffraction analysis. The purpose of this X-ray study is to provide basic data on the bulk mineralogy and to identify certain components not readily identifiable by optical methods (e.g., zeolites and clays). Certain mineralogic trends noted in the cores are discussed in a later section.

The X-ray mineralogy laboratory at Riverside, California, has developed a "minlog" program which produces semiquantitative values for various mineral components in DSDP sediments. We have thus presented the data in Tables 1-6 in a manner which can be modified and used for minlog computation. The tables also list the lithologic unit assigned to the sediments in Chapters 2-4 of this volume and the type of sediment analyzed.

ANALYTICAL METHODS

Samples were first dialysed for 24 hr in fresh water to remove interstitial salt. Each sample was then split into two halves, one portion being used for a briquette mount (for bulk analysis), the other for a glass-slide mount (for clay analysis).

The split intended for bulk analysis was dried, then crushed in an automatic pestle and mortar. Two grams of the crushed sediment were pressed into a bakelite-backed briquette in order to obtain X-ray results with maximum reproducibility. Each briquette was pressed for 1 min at 2100 bars pressure.

Splits destined for clay-mineral analysis were pre-treated prior to slide preparation. The carbonate was first removed with 25% CH_3COOH. The clays were then saturated with magnesium for 4 hr in a 1N $MgCl_2$ solution to ensure uniform expansion after glycolation. Preferred-orientation mounts (glass slides) were made from this suspension, then dried immediately in a warm oven to minimize differential settling. The slides were next fumed with ethylene glycol for 48 hr in a desiccator at a constant temperature of 70°C, then X-rayed. If the diffractogram suggested that chlorite might be present, a second, unglycolated, slide was prepared. These slides were heated at 550°C for 1 hr in an electric furnace and X-rayed as soon as they were cool.

Samples were run on a Phillips PW 1540 X-ray diffractometer using Ni-filtered CuKα radiation. Briquettes were scanned from 3° to 58° 2Θ and glass slides from 3° to 13° 2Θ at a speed of 1° 2Θ per minute. Instrument settings were as follows:

Kv/mA—48/20
Rate meter—4 × 10^2(briquettes), 1 × 10^3(glass slides)
Time constant—4 Window—250-100-1
Slits—1°/.1/1°
Attenuation—2(briquettes), 3(glass slides).
Proportional counter—455

All mineral identifications were made visually, after which a baseline was constructed by manually drawing a line tangent to the background trace. A numerical value is given for each mineral detected (Tables 1-6). This number represents the peak-height intensity for maxima centered at the following d-spacings:

Mineral	d-spacing (Å)
Calcite	3.035
Dolomite	2.886
Quartz	3.343
K-feldspar	3.24
Plagioclase	3.18
Pyrite	1.633
Phillipsite	4.97
Harmotome	3.12
Clinoptilolite	9.00
Kaolinite	7.15
"Illite"	10.00
Montmorillonite	17.0-18.0
Chlorite	14.0

It should be noted that the relative intensities reported for clay minerals cannot be directly compared with the intensities of the other minerals. The clay intensities were measured on carbonate-free preparations whereas the other intensities were measured on bulk-analysis preparations.

DRILLING MUD USAGE

Unweighted drilling mud was used at all sites other than 361. Nevertheless, barite was not detectable by X-ray in any samples from Site 361, indicating that contamination is unlikely. Bentonitic drilling mud was used in flushes at Sites 361, 363, 364, and 365. Samples from core intervals which could conceivably have been contaminated contain only normal amounts of montmorillonite, or in some cases, no montmorillonite at all, again suggesting that contamination is unlikely.

CLAY MINERALOGY

Clay minerals detected belong to four groups: kaolinite, mica ("illite"), montmorillonite, and chlorite. In addition, mixed-layer clay minerals were noted in almost all the samples investigated. No palygorskite was detected.

TABLE 1
Mineralogical Results From Site 360

Sample (Interval in cm)	Unit	Sediment Type	Peak-Height Intensities									Peak-Height Intensities				Relative %			Unidentified Peaks
			Calc	Dolo	Qz	K-Feld	Plag	Pyr	Phil	Harm	Clino	Kao	Ill	Mont	Chl	Kao	Ill	Mont	
1-3, 68-70	1	Foram-nanno ooze	240	0	15	0	2	0	t	0	0	7	22	8	0	10	84	6	
3-3, 68-70	1	Nannofossil ooze	194	0	16	3	0	0	2	0	0	10	22	8	0	20	74	6	
6-3, 68-70	1	Nannofossil ooze	220	0	16	0	3	0	t	0	0	7	23	0	10	7	93	0	
11-3, 68-70	1	Nannofossil ooze	208	0	22	0	3	0	t	0	0	10	23	10	11	15	79	6	
14-3, 68-70	2	Nannofossil chalk	140	0	40	9	0	0	t	0	0	4	19	10	0	4	88	8	
17-3, 68-70	2	Nannofossil chalk	200	0	23	0	3	0	t	0	0	7	35	9	11	11	83	6	
20-3, 68-70	2	Nannofossil chalk	203	0	13	0	2	0	3	0	0	8	22	9	0	16	75	9	
23-3, 68-70	2	Nannofossil chalk	190	0	23	0	48	0	t	0	0	6	15	8	0	11	82	7	
25-1, 68-70	2	Nannofossil chalk	190	0	6	0	9	0	t	0	0	7	21	15	12	9	77	14	
27-3, 65-67	3	Nannofossil chalk	197	0	9	0	0	0	t	0	0	8	19	12	8	11	76	13	
30-3, 68-70	3	Nannofossil chalk	207	0	15	0	3	0	1	0	0	6	11	17	0	13	42	45	
33-3, 68-70	3	Marly nanno-fossil chalk	190	0	24	0	4	0	t	0	0	6	15	18	0	9	60	31	
36-3, 68-70	4	Marly nanno-fossil chalk	175	0	23	0	3	0	t	0	0	5	15	20	0	7	58	35	
40-2, 65-68	4	Marly nanno-fossil chalk	90	0	25	6	6	0	0	0	0	0	12	13	0	0	79	21	
43-2, 68-70	4	Marly nanno-fossil chalk	81	0	22	3	6	0	0	0	0	0	14	22	0	0	81	19	4.11Å
46-3, 68-70	4	Calcareous claystone	45	0	33	5	6	0	t	0	0	3	13	21	0	2	70	28	3.52Å
50-1, 68-70	4	Calcareous claystone	53	0	30	4	4	0	t	0	0	3	16	18	0	2	70	28	

TABLE 2
Mineralogical Results From Site 361

Sample (Interval in cm)	Unit	Sediment Type	Peak-Height Intensities									Peak-Height Intensities				Relative %			Unidentified Peaks
			Calc	Dolo	Qz	K-Feld	Plag	Pyr	Phil	Harm	Clino	Kao	Ill	Mont	Chl	Kao	Ill	Mont	
1-2, 68-72	4A	Mud	5	0	71	20	22	0	0	3	0	3	3	4	8	21	63	3	
2-2, 68-70	4A	Mud	0	0	77	23	26	0	0	0	0	2	15	8	0	2	88	10	
3-1, 63-65	4A	Mud	0	0	95	15	35	0	0	0	0	2	24	8	10	2	88	10	
5-4, 68-70	4A	Marly nanno-fossil ooze	48	0	63	11	10	0	0	0	0	4	8	13	15	7	62	31	
6-2, 68-70	4A	Marly nanno-fossil ooze	18	0	115	15	26	0	0	0	0	0	32	22	0	0	85	15	
8-6, 73-75	4A	Marly nanno-fossil chalk	98	0	7	0	2	0	t	0	0	8	20	51	0	4	31	65	
10-3, 68-70	5	Brown pelagic clay	0	2	36	11	8	0	t	0	0	8	16	23	0	12	44	44	
11-3, 68-70	5	Brown pelagic clay	0	2	46	11	10	0	1	0	0	6	24	19	18	6	74	20	
15-2, 48-50	6	Grayish sandy mudstone	0	0	98	48	40	2	0	0	0	0	12	5	0	0	96	4	
19-3, 67-70	6	Grayish sandy mudstone	0	0	52	8	84	0	t	0	0	6	9	15	15	13	52	35	
26-3, 125-127	6	Dusky red claystone	35	0	71	8	12	0	7	0	0	2	15	9	0	3	80	17	
30-3, 98-100	7	Carbonaceous sandy mudstone	0	0	133	11	17	4	7	0	0	3	3	0	0	39	61	0	
32-3, 68-70	7	Carbonaceous sandy mudstone	0	0	126	25	19	1	8	0	0	8	15	0	0	11	89	0	
34-3, 104-106	7	Carbonaceous shale	13	0	135	21	33	5	t	0	0	7	3	0	0	52	48	0	
38-3, 77-79	7	Carbonaceous sandy siltstone	0	125	114	29	19	0	0	0	0	7	10	0	4	18	82	0	
40-3, 70-72	7	Carbonaceous silty shale	0	3	131	16	19	3	t	0	0	14	16	0	0	16	84	0	
42-1, 67-70	7	Carbonaceous Shale	15	0	72	0	5	9	t	9	0	5	5	0	3	36	64	0	
44-3, 68-70	7	Carbonaceous sandy mudstone	0	0	135	49	27	0	5	0	0	24	10	0	0	56	44	0	
46-2, 86-88	7	Carbonaceous sandy mudstone	0	0	129	23	29	0	5	0	0	15	12	0	0	28	72	0	
48-1, 81-83	7	Carbonaceous calcite-cemented sandstone	263	0	144	12	16	0	4	0	0	7	12	3	0	13	85	2	

TABLE 3
Mineralogical Results From Site 362

Sample (Interval in cm)	Unit	Sediment Type	Peak-Height Intensities									Peak-Height Intensities				Relative %			Unidentified Peaks
			Calc	Dolo	Qz	K-Feld	Plag	Pyr	Phil	Harm	Clino	Kao	Ill	Mont	Chl	Kao	Ill	Mont	
1-4, 69-71	1A	Siliceous nanno-fossil ooze	152	1	22	0	7	0	3	0	t	7	20	8	14	14	78	8	
3-3, 68-70	1A	Marly nanno-fossil ooze	158	0	27	0	6	0	t	0	0	3	14	0	8	7	93	0	
5-3, 68-70	1A	Diatomaceous mud	85	0	24	3	5	2	t	0	0	3	7	0	0	18	82	0	
18-3, 68-70	2A	Siliceous nanno-fossil chalk	145	0	22	0	4	0	t	2	0	7	23	9	11	9	81	9	
25-3, 68-70	2A	Marly nanno-fossil chalk	200	6	12	0	1	0	t	0	0	7	22	11	12	14	71	14	
35-3, 68-70	2B	Marly nanno-fossil chalk	160	0	19	3	0	0	t	0	0	8	27	19	22	6	77	17	
38-3, 88-90	2C	Marly nanno-fossil chalk	170	0	13	0	0	0	0	0	0	10	23	15	26	12	72	15	
3A-3, 68-70	2C	Marly nanno-fossil chalk	137	0	27	3	5	0	3	0	0	8	22	13	17	8	79	13	
4A-3, 63-65	3	Marly nanno-fossil chalk	145	0	21	0	7	0	0	0	0	5	20	16	26	5	76	19	
5A-3, 64-66	3	Braarudosphaera chalk	425	7	10	0	0	0	0	0	0	8	23	20	22	18	82	0	
8A-3, 99-101	4	Marly limestone	200	0	11	0	2	0	2	0	0	4	19	12	10	9	68	23	
9A-3, 103-105	4	Marly limestone	228	0	9	0	0	0	2	0	t	5	19	21	0	4	63	33	
10A-3, 118-120	4	Marly limestone	125	0	12	0	0	0	2	2	0	3	19	17	0	2	77	21	

TABLE 4
Mineralogical Results From Site 363

Sample (Interval in cm)	Unit	Sediment Type	Peak-Height Intensities									Peak-Height Intensities				Relative %			Unidentified Peaks
			Calc	Dolo	Qz	K-Feld	Plag	Pyr	Phil	Harm	Clino	Kao	Ill	Mont	Chl	Kao	Ill	Mont	
1-3, 68-70	1A	Foram-nanno ooze	190	0	7	0	0	0	t	0	0	8	28	10	9	8	83	9	
5-3, 68-70	1B	Foram-nanno chalk	158	0	20	0	5	0	3	2	0	8	29	0	15	10	90	0	
6-3, 68-70	1B	Nannofossil chalk	275	0	9	0	0	0	1	0	0	10	23	21	0	12	70	18	
9-3, 68-70	1C	Nannofossil chalk	225	0	9	0	0	0	t	0	0	7	22	12	0	11	74	15	
11-3, 68-70	1C	Foram-nanno chalk	240	0	6	0	1	0	t	0	t	7	29	15	16	4	84	12	
13-3, 68-70	1C	Foram-nanno chalk	253	0	6	0	0	0	t	0	0	10	35	19	0	5	82	13	
15-3, 68-70	1C	Nannofossil chalk	260	0	4	0	2	0	t	0	5	0	19	15	0	0	82	18	
17-2, 68-70	1C	Foram-nanno chalk	250	0	5	0	0	0	t	0	5	2	29	21	0	2	81	17	
19-3, 68-70	1D	Foram-nanno chalk	236	0	5	0	2	0	2	0	1	4	18	13	15	6	77	17	
23-2, 68-70	2A	Marly nanno-fossil chalk	175	0	7	0	10	0	0	0	7	0	10	9	0	0	82	16	
25-2, 68-70	2A	Marly nanno-fossil chalk	222	0	16	4	5	0	t	0	2	3	19	7	0	3	90	7	
26-3, 85-87	2B	Calcareous mudstone	113	6	51	9	20	0	4	0	5	3	12	10	0	7	61	32	
27-1, 68-70	2B	Marly nanno-fossil chalk	172	3	13	4	7	0	t	0	1	0	4	5	0	0	73	27	
29-3, 46-48	2C	Marly limestone	172	0	8	0	0	3	t	4	6	1	11	7	0	2	85	13	
31-3, 41-43	2C	Marly limestone	158	0	22	4	6	0	0	0	t	1	10	0	0	3	97	0	4.33Å, 4.10Å 2.81Å, 2.71Å
32-3, 80-82	2C	Marly limestone	172	6	15	8	0	0	2	0	1	4	15	8	0	8	79	13	4.10Å
33-3, 102-104	2C	Marly limestone	235	50	21	7	6	0	2	3	0	7	13	6	7	14	76	10	
34-3, 22-24	2C	Dolomitic limestone	128	150	29	37	10	0	3	0	0	4	6	8	8	16	60	24	
37-3, 83-85	2D	Dolomitic limestone	130	68	24	0	6	0	3	0	0	5	4	4	0	31	53	16	
39-3, 58-60	3	Limestone	158	35	30	5	7	0	0	2	0	15	5	9	0	40	40	20	

TABLE 5
Mineralogical Results From Site 364

Sample (Interval in cm)	Unit	Sediment Types	Peak-Height Intensities									Peak-Height Intensities				Relative %			Unidentified Peaks
			Calc	Dolo	Qz	K-Feld	Plag	Pyr	Phil	Harm	Clino	Kao	Ill	Mont	Chl	Kao	Ill	Mont	
1-3, 68-70	1	Calcareous mud	19	0	37	7	8	0	4	0	0	38	23	21	0	43	34	23	
3-3, 68-70	2	Marly nannofossil ooze	94	0	28	0	6	0	t	0	0	57	24	22	0	42	42	16	
4-3, 68-70	2	Zeolitic mud	29	0	40	8	10	0	4	0	0	63	28	20	0	46	42	12	
5-3, 68-70	3	Pelagic clay	0	3	47	12	10	0	4	0	0	31	25	21	18	31	52	17	
7-1, 68-70	3	Zeolitic mud	0	0	49	16	16	0	0	0	13	1	13	4	0	1	94	3	
8-3, 68-70	4	Nannofossil chalk	168	0	44	15	8	0	3	3	5	3	21	7	7	4	89	7	
15-3, 68-70	5	Marly nannofossil chalk	235	0	23	6	18	0	0	0	0	5	30	0	11	5	95	0	
21-3, 68-70	5	Marly nannofossil chalk	125	0	16	7	7	0	2	0	0	6	22	14	8	6	76	18	
25-3, 70-71	5	Carbonaceous shale	0	0	125	15	6	6	4	17	0	3	11	8	0	3	88	9	
27-3, 32-33	6	Marly nannofossil chalk	175	0	46	5	5	0	3	0	0	4	12	6	0	6	84	10	
29-3, 22-23	6	Marly nannofossil chalk	140	17	63	9	10	0	2	0	0	6	17	7	0	6	88	6	
31-3, 114-115	6	Limestone	237	0	31	6	5	0	t	2	0	7	20	10	7	8	81	11	
34-3, 22-23	6	Limestone	235	4	8	1	0	0	0	0	0	3	11	4	6	6	88	6	
37-3, 27-28	6	Limestone	275	13	17	5	7	0	3	0	0	4	20	11	8	4	84	12	
39-3, 66-67	7	Calcareous carbonaceous shale	120	46	34	12	9	2	t	2	0	5	9	0	0	21	79	0	
41-3, 75-77	7	Calcareous carbonaceous shale	185	19	52	12	2	0	5	0	0	27	12	0	0	50	50	0	
42-3, 57-58	7	Carbonaceous shale	15	4	128	32	0	6	8	0	0	7	8	0	0	20	80	0	
43-3, 108-109	7	Carbonaceous marly dolomitic limestone	60	285	19	0	3	0	0	0	0	11	2	0	0	73	27	0	
45-3, 23-25	7	Carbonaceous dolomitic limestone	0	425	40	5	2	3	0	2	0	4	9	0	0	9	91	0	
46-1, 145-146	7	Dolomitic limestone	0	397	38	5	0	2	0	0	0	14	10	0	0	30	70	0	

TABLE 6
Mineralogical Results From Site 365

Sample (Interval in cm)	Unit	Sediment Type	Peak-Height Intensities Calc	Dolo	Qz	K-Feld	Plag	Pyr	Phil	Harm	Clino	Peak-Height Intensities Kao	Ill	Mont	Chl	Relative % Kao	Ill	Mont	Unidentified Peaks
1-3, 68-70	1	Carbonaceous mud (Pleistocene)	26	0	33	7	0	0	3	3	0	35	27	22	0	33	52	15	
3-3, 69-71	4	Carbonaceous mudstone (Cretaceous)	3	0	78	19	30	0	6	0	0	5	16	8	8	6	86	8	
4-1, 44-46	5	Gray mudstone (Tertiary)	4	0	40	14	24	0	4	0	0	17	21	19	0	25	55	20	
5-3, 106-108	5	Gray mudstone (Tertiary)	0	0	46	21	17	0	4	0	0	14	11	20	0	25	43	32	
6-2, 105-107	5	Gray mudstone (Tertiary)	0	0	55	18	22	0	6	0	0	15	27	19	0	15	70	15	
7-1, 67-69	5	Gray mudstone (Tertiary)	0	0	85	113	73	0	4	7	0	1	10	7	0	1	85	14	

"Illite" is the term commonly used for 1 Md mica found in sediments. Glauconite also has a 1 Md or 1 M structure and is very difficult to distinguish from illite by X-ray diffraction, especially in a mixture of minerals. Thus, the "illite" category listed in Tables 1-6 may also include amounts of mica and glauconite.

The relative abundance of each mineral in a three-component clay system (viz., kaolinite, "illite," and montmorillonite equal 100%) may be expressed as a percentage following the method of Johns et al. (1954). The relative percentage of chlorite cannot be calculated in this manner without investigation at higher 2θ angles. The 17Å area measured for montmorillonite is taken as read, the 10Å area of illite multiplied by a factor of four, and the 7Å represented by kaolinite multiplied by a factor of two (Johns et al., 1954). These values are then converted to percentages (Tables 1-6).

RESULTS

Site 360 (Table 1)

The X-ray diffraction analyses of Site 360 sediments confirm the smear slide descriptions. Calcite is the overwhelmingly predominant mineral throughout (all the calcite at this and the other sites is the stable variety, low-magnesian calcite). Its relative abundance decreases towards the bottom of the hole (Cores 40-50), with a corresponding relative increase in terrigenous quartz and feldspar. Traces of phillipsite were noted throughout the cores (a trace [t] listed in Tables 1-6 means that the mineral was detected in the noncarbonate analysis, but not in the bulk analysis).

"Illite" predominates in the clays, with little significant variation in relative abundance down the hole. Kaolinite predominates over montmorillonite in the uppermost cores, but montmorillonite is more abundant than kaolinite in Cores 25 to 50.

Site 361 (Table 2)

This site shows considerable variation in mineralogy. The terrigenous and calcareous muds and pelagic clays in the upper regions of the hole were chosen for X-ray analysis, and a variety of shales, sandy mudstones, and sandstones in the lower layers. Thus calcite varies from absent throughout much of the hole to abundant in Core 48, where a calcite-cemented sandstone was X-rayed. Dolomite was noted only in Core 38. Pyrite is present in most of the cores from Cores 30-44. Phillipsite is detectable from Core 8 downward, and significant amounts occur in Cores 26-32 and 44-48. Cores 1 and 42 also contain harmotome.

Illite again dominates in the clays. Montmorillonite predominates over kaolinite from Cores 2-26, but montmorillonite is virtually absent in the lower cores, with only illite and kaolinite remaining. Montmorillonite is especially abundant in Cores 8 and 10, being equal to or greater than illite in relative abundance.

Site 362 (Table 3)

These cores are predominantly calcite with minor amounts of dolomite and terrigenous material.

Phillipsite is present in trace or minor amounts, as to a much lesser extent are harmotome and clinoptilolite. All three clay minerals are present throughout, with little recognizable variation in relative abundance.

Site 363 (Table 4)

As at Site 362, this site is also dominated by carbonate minerals—chiefly calcite, but with dolomite increasing markedly from Cores 32-39. Clinoptilolite is common in Cores 15-29, and phillipsite and harmotome occur in minor quantities throughout, with phillipsite slightly more abundant in the lower half of the hole.

Dolomite encountered at this hole is best termed protodolomite (the "nonideal" dolomite of some authors). A protodolomite does not possess the ideal dolomite structure of a 1:1 molar $CaCO_3$-$MgCO_3$ ratio (see Goldsmith and Graf, 1958). Protodolomites differ from ideal dolomites by containing mole excess $CaCO_3$ and by not having perfect ordering of the Ca and Mg atoms in the crystal structure. The ordered array of Ca and Mg atoms in dolomite produces X-ray "order reflections." The presence or absence of these reflection peaks and their relative intensities and sharpness enable a qualitative statement to be made concerning the ordering state.

Dolomites in this hole have a *d*-spacing of 2.896Å-2.900Å for the (211) maximum, compared with 2.886Å for an ideal dolomite. Excess $CaCO_3$ has caused an expansion of the crystal lattice, because Ca atoms are larger than the Mg atoms that they replace. The larger *d*-spacings correspond to approximately 54-56 mole % $CaCO_3$. The (100), (221), and (111) order-reflection maxima are absent, indicative of a poorly ordered protodolomite.

The clay mineralogy is also similar to Site 362; illite predominates, but all three clay groups are present throughout with little variation in abundance. Both kaolinite and montmorillonite appear to increase towards the bottom of the hole, while illite decreases.

Site 364 (Table 5)

A significant feature at Site 364 is the abundance of dolomite from Cores 29 to 46. Dolomite intensities increase dramatically in Cores 43-46, and calcite, which is associated with dolomite in the upper cores, suddenly becomes absent in Cores 45-46.

Dolomite in the upper cores (29-41) is protodolomite (about 56 mole % $CaCO_3$) similar to that at Site 363. However, Core 43 contains more nearly ideal dolomite with about 53 mole % $CaCO_3$ and the appearance, albeit weak and diffuse, of ordering peaks. Cores 45 and 46 contain stoichiometric dolomite ($Ca_{50}Mg_{50}$) and fairly sharp ordering peaks. Thus dolomite in this hole becomes more ideal, i.e., stoichiometric, with depth. It is well established that dolomites formed at higher salinities contain less excess $CaCO_3$ in their lattices and are better ordered (Goldsmith and Graf, 1958; Füchtbauer and Goldschmidt, 1965; Marschner, 1968; and Supko et al., 1974). Supko et al. (1974) also found a progressive trend towards more ideal dolomite with depth in their Red Sea cores (DSDP Leg 23) as evaporite sequences were approached. Thus, the similar increase in better ordered, more stoichiometric dolomite in the lowest cores at Site 364 lends additional evidence for the inferred presence of an evaporite body in the Angola Basin.

Pyrite is slightly more common towards the bottom of this hole. Phillipsite is the dominant zeolite and is present throughout most of the hole; harmotome and clinoptilolite are scattered sporadically throughout.

Illite is dominant in the clays, although kaolinite is very abundant in Cores 1-5 and again in Cores 39-46. Montmorillonite is subordinate throughout, and is not detectable in Cores 39-46.

Climate may account for the greater abundance of kaolinite in these cores in contrast to the relatively lower abundance in sites to the south. Kaolinite is known to be produced more abundantly in regions of tropical weathering—moist climate and good drainage favor the formation of kaolinite (Carroll, 1970). The Angolan sourceland today is certainly more humid and better drained than the South and South West African sourcelands, and this may explain the greater relative abundance of kaolinite in the upper cores.

Site 365 (Table 6)

These cores have a consistently greater terrigenous component than in those sites to the south. Phillipsite is common, and harmotome is noted in two cores. Clinoptilolite was not detected. Illite is the most abundant clay, with kaolinite predominating over montmorillonite, again probably reflecting tropical weathering.

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W.G. Siesser is presently a member of the C.S.I.R. National Research Institute for Oceanology; J.M. Bremner is a member of the Geological Survey.

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