27. X-RAY MINERALOGY FROM HOLES 399, 400, 400A, 401, 402 AND 402A OF BAY OF BISCAY

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INTRODUCTION

Routine X-ray mineralogy analysis of 279 samples from Holes 399, 400, 400A, 401, 402, and 402A in the Bay of Biscay have been performed in order to ascertain shipboard lithological determinations.

Methodology

Quartz, calcite, and dolomite have been analyzed automatically in percentages versus total rock (see Figures 1, 2, and 3). (Figure 1 is in back pocket, this volume.)

The presence of siderite, Mg-calcite, and aragonite has been verified (see Tables 1 and 2). In these tables of X-ray mineralogy results, the aragonite fraction has been quantitatively dosed as follows: 1 signifies zero to 10 per cent of the total rock; 2 = 10 to 50 per cent; 3 = 50 to 80 per cent; and 4 = greater than 80 per cent. The occurrence of these carbonates and the poor crystallinity of calcite (particularly in the Hole 402A samples of Albian-Aptian sediment) probably explains the large differences between our data and the carbonate content analysis of the shipboard party.

We have determined the clay mineral composition (kaolinite, illite, illite-smectite, smectite, and chlorite) of the carbonate-free, fine-grained fraction (<5 μm). In addition, we frequently have found zeolites from the late Aptian up to the Eocene, and opal-CT from the late Aptian up to the late Albian. These minerals are analyzed on the carbonate-free fine-fraction, together with the clay minerals. The major part of the zeolites seems to be clinoptilolite, but some diagrams are different, e.g., Sample 402A-23-3, 104 cm. We always measured the highest peak, which is generally located at $2\Theta = 10°$.

We did not definitely prove the presence of fibrous clays, which are mentioned by Chamley (this volume); this can be explained by their low content ($<5\%$). Nevertheless, we have mentioned the samples whose diagrams remained uncertain. These samples are indicated by the notation "1" in the columns "attapulgite" and "sepiolite." (See Tables 1 and 2.)

Finally, we have recorded the presence of fine-grained quartz and feldspars, with the same notation as for the carbonates in the total rock.

SUMMARY OF RESULTS

Holes 399, 400, and 400A

The following three major sedimentary sequences can be defined for these holes: Lower Cretaceous, Upper Cretaceous and lower Tertiary, and upper Tertiary and Quaternary.

Lower Cretaceous

These sediments are generally beige to dark gray, slightly silty, calcareous clays or marls with ligneous remains. Smectite largely prevails, with illite and illite-smectite. Zeolites and opal-CT are intermittent and locally abundant (see Plate 1, Figures 1 and 2).

The samples are alternately more silty and less carbonated, especially during the lower to middle Albian. In contrast, the upper Albian is generally more carbonated and contains a larger amount of opal-CT.

Upper Cretaceous-Lower Tertiary

These deposits are generally ochre to beige, silty calcareous clays. These samples are more silty and calcareous than those of the Lower Cretaceous. Smectite is still largely dominant, with some illite and kaolinite, and a low amount of chlorite. Illite-smectite has disappeared. The zeolite content is still high during the Upper Cretaceous, and it becomes intermittent above this horizon. Opal-CT has completely disappeared.

Upper Tertiary and Quaternary

This sequence is composed of gray-white to white, slightly silty marls up to the middle of the upper Pliocene: The sediments are much more silty and locally much less carbonated above this horizon. A slight occurrence of siderite can be noted.

Smectite decreases regularly, with an increase of illite during the Oligocene and an increase of illite-smectite and chlorite during the Pliocene.

Samples 400A-12-2, 106 cm and 400A-44-1, 107 cm are particularly rich in fine-grained silica. For the former, this could be a silt (38% of quartz); for the latter, a beginning of silicification.

Site 401 (Plates 1 and 2)

These samples are much more carbonated and less silty in Site 401.

Lower Cenomanian

Only one sample, with ochre argillaceous micrite, is identified as being lower Cenomanian. Smectite is largely predominant with illite-smectite and minor chlorite and kaolinite.

Maestrichtian-Campanian

This sediment is characterized by white argillaceous micrite. Smectite is dominant with illite, and there are occurrences of zeolite.

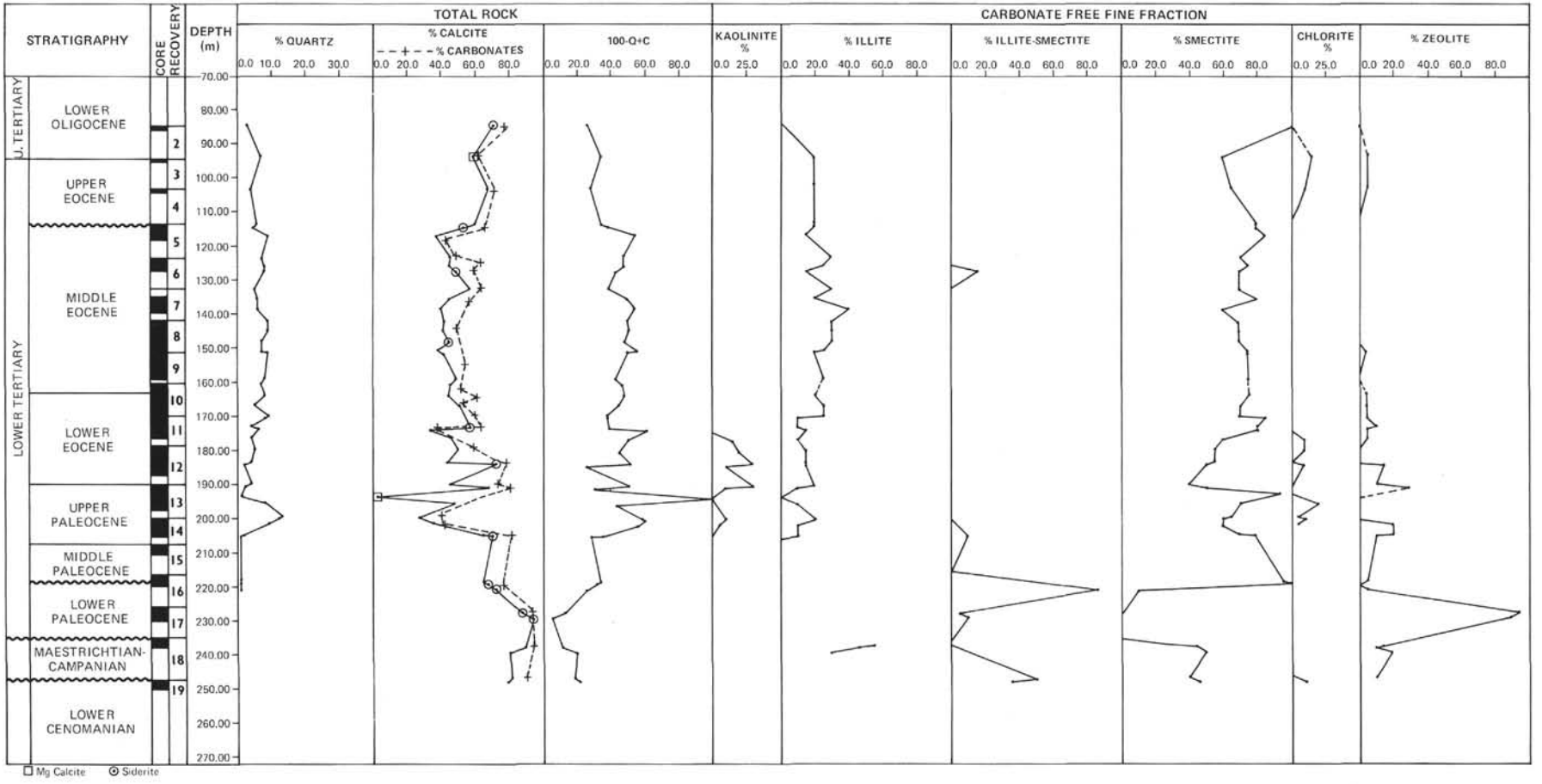


Figure 2. *X-ray mineralogy for IPOD Leg 48, Site 401.*

Lower Tertiary

A regular decrease in the calcite content can be noted up to the upper Eocene, with an increase of the silt fraction.

Smectite is definitely dominant, with a slight increase in illite, and occurrences of kaolinite and chlorite in the upper Paleocene and lower Eocene.

The zeolites are very common up to the lower part of the middle Eocene.

An increase in carbonate content is noticeable in the upper Eocene and lower Oligocene. Smectite is the only clay mineral in the lower Oligocene.

Quaternary

The samples are composed of gray, gray-beige, and beige to dark gray silty calcareous marls, with illite dominant, and with illite-smectite, kaolinite, and chlorite.

Holes 402 and 402A (Plate 2)

Three intervals can be distinguished (with clearcut breaks of sedimentation) between Lower Cretaceous, middle to upper Eocene, and Quaternary.

Lower Cretaceous

This interval is composed of gray or beige to dark gray, silty shales, with abundant ligneous debris.

The presence of white micrite (Sample 402-6-1, 43 cm) and siderite concretion (Samples 402-19-4, 106 cm and 402A-21-4, 111 cm) can be noted. Siderite is locally abundant in the Gargasian and the Bedoulian. Aragonite principally occurs from the base of the upper Gargasian up to the base of the upper Albian.

Some horizons rich in Mg-calcite (Samples 402A-31-3, 68 cm and 402A-34-1, 82 cm) have been observed. These concentrations are probably linked with the presence of numerous shell debris.

Smectite is largely predominant, with some kaolinite and illite; there are slightly chlorite occurrences at the base of the Gargasian. From the uppermost Aptian and above, the zeolite and opal-CT contents increase.

Middle to Upper Eocene

Gray-beige silty marls, with largely predominant silica and badly crystallized illite, occurred at the base of this unit, up to Sample 402A-3-2, 68 cm; no illite was found until Sample 402-5-3, 63 cm. There is no kaolinite, chlorite, nor zeolite.

Quaternary

The sediments of this age have the same appearance as their equivalents in the other sites.

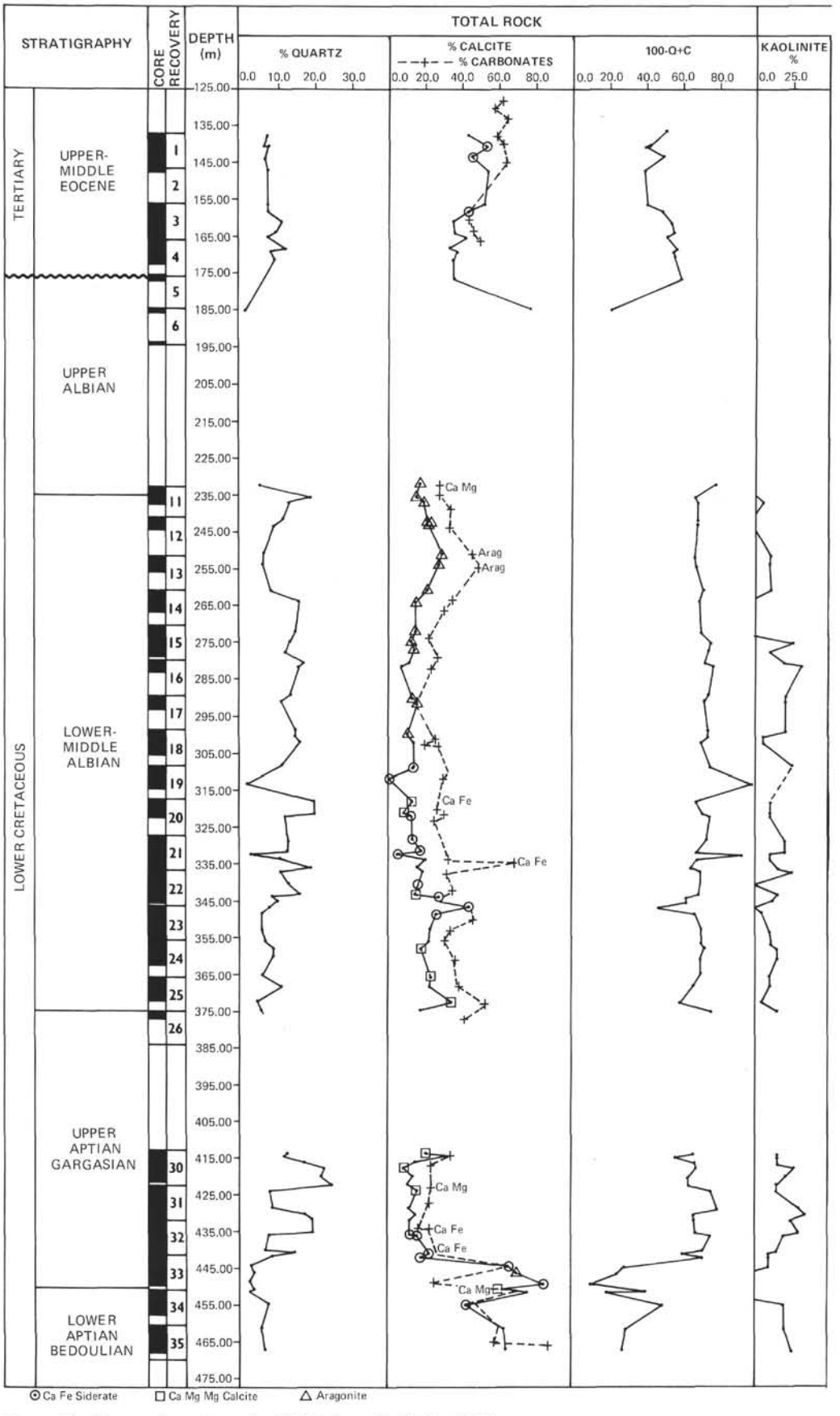


Figure 3. *X-ray mineralogy for IPOD Leg 48, Hole 402A.*

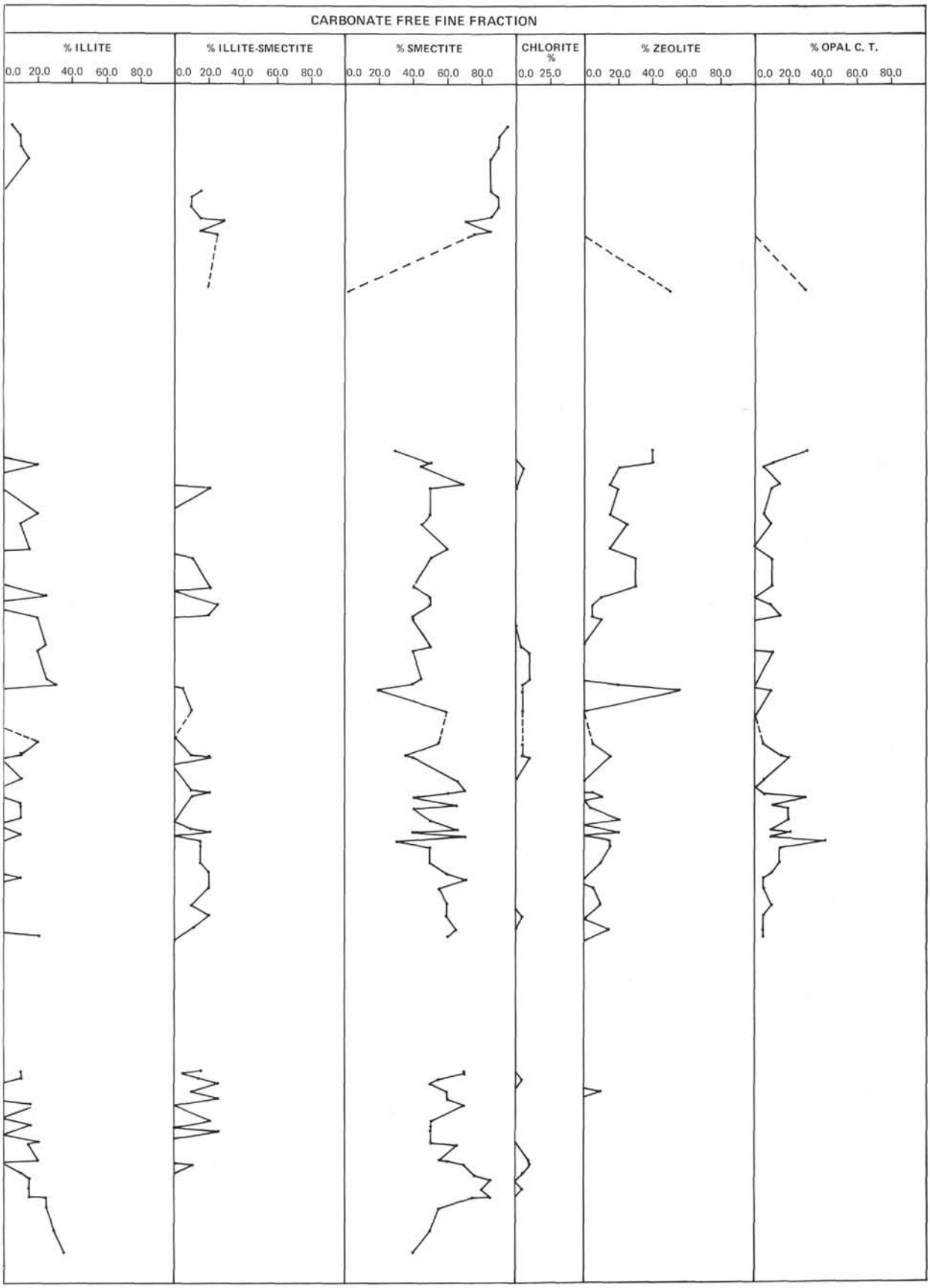


Figure 3. *(Continued).*

TABLE 1
X-Ray Mineralogy Main Results

Holes 399, 400, and 400A

Stratigraphy	Sample	Total Rock: Quartz (%)	Total Rock: Calcite (%)	Total Rock: Intens. x Aragon. + Sider. . Mg. Cal.	Carbonate-Free Fraction: Kaolinite (%)	Illite (%)	Illite Smectite (%)	Smectite (%)	Chlorite (%)	Zeolite (%)	Opal (%)
Pleistocene Quaternary		14	31	+2	15	35	17	13	20		
Upper Pliocene		14 7	34 52	+3	16 18	32 33	28 27	6 6	18 16		
Lower Pliocene		8	57		14	34	7	28	17		
Upper Miocene		7	55								
Middle Miocene	25-6, 115 36	3	66	+3	16	57		41	6		
Lower Miocene	37 41	4	52	+1	14	31		50	5		
Upper-Middle Oligocene	43 45-4, 74	4	53	+1	21	21		54	4		
Lower Eocene	45, CC 46	7	53		16	18		65	1		
Upper Eocene											
Middle Eocene	47 52-1, 64	4 10	9 22		12 6	25 33		55 57	5 3		
Lower Eocene	3-57 56	6	18	.02 +	8 24	15 17	12	50 42	3	9 8	
Upper Paleocene	57 58	15	20		11	29		49	11		
Middle Paleocene	59 59	13 2	34 61		8 –	18 –	– –	57 –	7 –	10 –	
Lower Paleocene											
Maestrichtian Campanian	60 61	3	65		5	10		50		30	
Lower Cenoman.											
Upper Albian	62 64-3, 28	3	43			10	6	38		20	26
Lower-middle Albian	3-14 67	9	10	+2		21	4	37		33	5
Upper Aptian	68	7	25	.01		26		63		7	3
Lower Aptian											

Site 401

Sample	Total Rock: Quartz (%)	Total Rock: Calcite (%)	Total Rock: Intens. x Aragon + Sider. . Mg. Cal.	Carbonate-Free Fraction: Kaolinite (%)	Illite (%)	Illite Smectite (%)	Smectite (%)	Chlorite (%)	Zeolite (%)	Opal (%)
	23	20	+	10	40	25		25		
2-1, 7	3	71	+1				99			
3-1, 15 4, CC	5	63	+1		20		62	13	5	
5 11-1, 42	8	46			24		75		2	
3-9 12	5 4	45 53		25	14		55	8	7 5	
13 14	7 1	37 66		7	13 5	5	73 75	6	8 15	
16 16-1, 146	1	67	.01				97		2	
17	1 0	74 90	+5			85 7	10		5 93	
18 19-1, 6	0 0	89 83			55 24	16	30 45		15 13	
	0	79		10		35	45	10		

no sample

no sample

Site 402

Sample	Total Rock: Quartz (%)	Total Rock: Calcite (%)	Total Rock: Intens. x Aragon + Sider. . Mg. Cal.	Carbonate-Free Fraction: Kaolinite (%)	Illite (%)	Illite Smectite (%)	Smectite (%)	Chlorite (%)	Zeolite (%)	Opal (%)
	28	25	do1.1	16	39	20	10	15		
5-1, 65	7	52			9	2	89			
402A4	9	38				17	83			
5 6-1, 43 cm	7 1	35 79		–	–	– 20	–	–	– 50	30
11-3, 91 cm	12	15	x 10				40		40	20
4-57 14-1, 62 cm	9	23	x 10 .05	6	11	3	55	18	18	7
3-42 22-5, 75 cm	14	13	x 9 + 10 .01	14	9	7	50		9	8
6-14 24	8	26	x 9	10	2	13	43		8	13
25 26	7	25	x 12 .02	10	5	10	62		5	8
30 33-1, 78 cm	15	17	x 2 + 3 .03	20	8	10	60	2	1	
3-38 34 34-1, 82 cm	3 4 7	75 65 57	+ 1 .03 + 5 .05	3 20	16 20 30		80 80 50	3		

TABLE 2
X-Ray Mineralogy Comprehensive Results, IPOD Leg 48A

Stratigraphy	Sample (Interval in cm)	Depth (m)	Total Rock (%) Quartz	Calcite	Dolomite	Intensity Siderite	Aragonite	Mg Calcite	Carbonate-Free Fraction (%) Kaolinite	Illite	Illite-montmo.	Montmorillonite	Chlorite	Intensity Attapulgite	Sepiolite	Silica	(%) Clinop.	Opal	Int. Feldspar
Hole 399																			
Pleistocene	1-1, 43	0.43	10	43					16	32	12	20	20						
	1-2, 45	1.95	18	11	4				17	43	10	13	17						
	2-1, 18	63.18	20	19	1				18	38	04	20	20						
	2-3, 96	68.46	19	16					16	37	07	20	20						
Hole 400																			
Pleistocene Holocene	1-1, 59	0.59	8	50					16	14	52		16						
	1-4, 74	6.43	18	9					16	43	24		17						
Hole 400A																			
Quaternary	1-1, 73	75.23	12	42					16	36	32		16						
	2-1, 108	85.06	24	4					20	40		20	20			1			
	2-3, 108	88.08	10	50					05	35		35	25			1			
	2-6, 75	92.25	10	42					15	30	15	15	25			1			
	3-1, 76	94.31	8	59					15	30	35		20						
Late Pliocene	3-3, 70	97.20	9	49						25	45		30			1			
	4-1, 20	104.20	21	9	1														
	4-4, 35	107.85	13	37					16	37	30		17			1			
	5-1, 112	113.62	10	48					24	38	18	10	10	1		1			
	6-1, 25	122.25	16	25					25	34	13	14	14			1			
	6-3, 55	125.55	8	47					20	30	15	25	10						
	7-1, 110	131.58	7	57					18	32	31		19			1			
	7-3, 40	134.89	8	47					19	32	30		19						
	8-2, 83	142.33	4	59					15	38	32		15						
Early Pliocene	8-4, 94	145.94	7	45					13	41	32		14						
	8-6, 93	149.43	6	53					20	36	20	14	10		1	1			
	9-2, 109	153.09	6	63					20	37		33	10			1			
	9-4, 20	155.20	9	39					25	33	28		14			1			
	9-5, 102	157.52	7	49					15	30	30	10	15		1	1			
	10-2, 113	162.53	6	47					16	37	31		16						
	11-1, 68	170.18	8	45					15	40	25		20	1					
	12-1, 104	180.04	5	55					18	36	29		17	1					
	12-2, 106	181.56	38	24												4			1
	12-3, 86	182.86	7	56					15	38	20	11	16			1			
	12-6, 105	187.55	7	61					16	38	31		15						1
	13-1, 86	189.36	5	51					20	33	34		13						
	13-2, 40	190.40	12	35															
	13-4, 112	194.12	7	52					15	38	20	12	15			1			
	14-2, 142	200.92	4	64					14	35	12	25	14						1
	15-3, 106	211.56	5	67					15	30	20	20	15						
	15-4, 128	213.28	5	61					20	31		39	10			1			
Late Miocene	16-1, 45	217.45	6	47					16	42	26		16						
	17-2, 57	228.57	7	64					10	29	16	25	20			1			
	17-4, 60	231.60	7	56					08	34	18	20	20						
	18-1, 26	236.26	7	58					14	35		37	14						
	18-2, 60	238.10	5	55					13	36		31	20						1
	18-5, 74	241.74	6	62					24	35	05	16	20			1			1
	19-2, 106	248.06	4	64					16	38		30	16						
	19-4, 106	251.06	3	64					14	43	09	20	14			1			
	20-2, 80	257.30	5	58					07	35		38	20			1			
	20-3, 68	258.68	6	46					20	32		39	09			1			1
	20-5, 86	261.86	8	49					15	38		33	14			1			
	21-4, 63	269.63	6	47					13	38		36	13	1					1
	22-2, 63	275.13	4	60					20	32		40	08			1			
	23-3, 139	287.89	5	50					20	33		38	09			1			
	24-6, 53	301.03	5	55					20	36	05	30	09	1	1	1			
	25-3, 115	306.65	7	48					20	24		46	10			1			1
Middle Miocene	25-6, 115	311.15	4	56					19	29		47	05		1				
	26-3, 89	315.89	4	61					20	37		37	06			1			
	27-1, 103	322.53	2	74					20	37		34	09						
	29-1, 132	341.82	5	48					15	42		38	05			1			1
	30-1, 36	350.36	2	75					11	39		39	11			1			1
	31-1, 66	360.16	1	85					15	45		30	10			1			
	32-2, 36	370.86	3	70					20	31		43	06			1			1
	35-3, 114	401.64	6	55					20	31		41	08			1			
	36-1, 90	407.90	2	76					15	23		54	08	1	1				
Early Miocene	37-1, 107	417.57	2	74					12	29		54	05			1			
	37-4, 37	421.37	5	55					12	29		56	03						
	38-1, 147	427.47	2	66					15	28		53	04						
	38, CC	427.60	9	38					10	33		52	05			1			
	39-1, 56	436.16	7	53					15	38		42	05						
	39-2, 87	437.87	12	19					12	39		38	11			1			
	40-1, 16	445.16	4	57					15	25		46	04			1			
	40-2, 81	447.31	4	54					15	25		57	03						
	41-1, 34	454.84	4	60					20	25		51	04			1			1
Late Middle Oligocene	43-2, 100	476.00	4	52					20	21		53	06		1				
	43-3, 88	477.38	2	66															
	43-5, 52	482.02	6	41					20	22		54	04						1
	44-1, 66	483.66	5	54					18	22		56	04		1	1			
	44-1, 47	484.77	2	77												4			
	45-1, 78	493.28	10	39					20	22		51	07			2			
	45-3, 44	495.94	7	55					20	23		57			1	1			
	45-4, 74	497.74	8	35					24	19		57			1				

TABLE 2 – *Continued*

Stratigraphy	Sample (Interval in cm)	Depth (m)	Total Rock (%)			Total Rock Intensity			Carbonate-Free Fraction (%)					Carbonate-Free Fraction Intensity			Carbonate-Free Fraction (%)		Int.
			Quartz	Calcite	Dolomite	Siderite	Aragonite	Mg Calcite	Kaolinite	Illite	Illite-montmo.	Montmorillonite	Chlorite	Attapulgite	Sepiolite	Silica	Clinop.	Opal	Feldspar
Early Oligocene	45, CC	499.50	10	36					24	24		58							
	46-4, 80	507.30	5	58					15	18		67							
	46-5, 80	508.80	5	57					15	19		66		1					
	46-6, 8	509.58	6	62					12	14		69	05						
Middle Eocene	47-1, 96	512.46	13	7					08	22		66	04						
	47-6, 75	519.75	14	6					10	34		51	05			1			1
	47-7, 52	521.02	10	14					16	28		56							
	48-2, 114	523.64	15	2					12	29		53	06			1			1
	49-1, 144	531.94	13	17					15	29		51	05			1			1
	49-2, 94	532.94	11	20					10	27		57	06			1			
	49-3, 33	533.83	13	8					10	27		58	05						1
	49, CC	536.00	13	1					12	32		50	06						
	50, CC	540.00	10	17					10	25		59	06						
	51-1, 60	549.60	9	26					07	30		59	04			1			
	51-3, 36	552.36	11	20						40		60							
	51-5, 114	556.14	9	29						45		55		1		1			
	51-7, 38	556.88	13	14					10	32		54	04						
	52-1, 64	559.64	8	28					10	26		59	05			1			
Early Eocene	52-3, 37	562.37	6	24					10	30		40	05				15		
	52-5, 42	565.42	6	15					14	31		46	09						
	53-1, 84	569.34	4	15					08		21	49	07	1	1	1	15		
	53-2, 2	571.52	6	8				1			30	65		1	1		05		
	54-1, 132	579.32	8	7		1		1	31	25		44			1	1			
	54-2, 111	580.61	6	16		1		1	25	20		41					14		
	55-1, 104	588.64	6	14				1	14	23		38	13	1	1		12		
	55-2, 46	589.46	5	32					25			44		1			06		1
	56-2, 20	598.70	5	33															1
Late Paleocene	57, CC	609.50	15	21					11	29		49	11	1					
	58, CC	614.00	14	22															
Middle Paleocene	59-1, 4	625.54	13	34					08	18		57	07			1	10		1
	59-1, 23	625.73	2	61															
Maest-Campanian	60-7, 8	644.08	2	79															
	61, CC	654.00	4	53															
Late Albian	62-1, 90	654.90	3	36								20					15	65	
	62-3, 10	657.10	4	48															
	62-5, 34	660.34	2	51						32		33					20	15	
	63-1, 68	664.18	3	50						28		35					22	15	
	63-3, 53	667.03	3	44							13	27					13		
	63, CC	669.50	3	44				1									40	60	
	64-1, 76	673.76	3	41		1					23	33		1	1		11		
	64-3, 28	676.28	4	31															
	64-3, 114	677.14	10			1		1		25		75							
	64-5, 75	697.75	7	23				1		20		70		1			10		
Early Middle Albian	65-1, 92	683.42	11	1		1		2		18		41				1	41		
	65-2, 48	684.48	6	25						20		35					45		
	66-1, 100	693.00	5	3		1					30	31			1			39	
	66-2, 84	694.34	8	17				1		40					1	1	60		
	66-4, 12	696.62	12	3				1		25		23			1	1	52		
	67-1, 75	702.25	10	5				1		22		22				1	56		
Late Aptian Gargasian	68-1, 81	711.81	6	37															
	68-2, 71	714.21	8	13						15		85							
	68-2, 106	714.46	6	35						23		54				1	23		
	69, CC	720.50	6	39						25		60		1		1	15		
	70-2, 92	730.00	7					1											
	70, CC	732.42	5	39						22		69	9	1		1			
	71-2, 38	739.50	6	24						35		65			1				
	71, CC	741.38	8	28						25		61				1	14		
	72-2, 47	750.97	7	23						15		55					10	20	
	72-4, 27	753.77	6	26						27		54			1	1	11	8	
	74, CC	768.00	10	8				2		33		49			1		8	10	
Hole 401																			
Quaternary	1-1, 33	0.35	20	32					10	40	30		20						
	1-3, 67	3.67	26	9				1	10	40	20		30			1			
Early Oligocene	2-1, 7	84.57	3	71															
Late Eocene	3-1, 15	94.15	7	59						20		60	15			1	5		
	4, CC	103.50	4	68						20		65	10			1	5		
Middle Eocene	5-1, 89	113.89	6	60						20		80				1			
	5-2, 24	114.74	5	55		1				20		80				1			
	5-3, 107	117.07	9	37						15		85			1	2			
	6-1, 116	123.66	7	46						30		70		1	1	1			
	6-3, 64	126.14	8	45						25		75		1					
	6-4, 65	127.65	8	49		1				15	15	70		1					
	7-1, 84	132.84	5	57						30		70							
	7-3, 60	135.60	6	45						20		80							
	7-5, 61	138.61	6	40						40		60				1			
	8-1, 95	142.45	9	42						30		70			1	1			
	8-3, 61	145.11	9	41						30		70							
	8-5, 84	148.34	7	45		1				30		70				1			
	8-7, 56	151.06	7	38						25		75				1			
	9-1, 51	151.51	9	41						20		75				1	5		
	9-6, 61	159.11	8	49		1				25		75				1			
	10-1, 49	160.99	7	46															
	10-3, 48	163.98	8	44						20		75				1	5		
	10-5, 50	167.00	5	51						25		70					5		
	10-7, 50	170.00	9	54						25		70			1		5		
	11-1, 42	170.42	8	54						10		85					5		
Early Eocene	11-3, 9	173.09	4	57						10		80					10		
	11-3, 91	173.91	6	33						15		80					5		
	11-5, 70	176.70	4	46					15	10		60	10		1	1	5		
	12-1, 49	179.99	5	50					20	15		55	10		1				
	12-3, 111	183.61	4	44					30	15		55			1				
	12-4, 28	184.28	2	72		1			10	15		50	10				15		

TABLE 2 – *Continued*

Stratigraphy	Sample (Interval in cm)	Depth (m)	Total Rock (%)						Carbonate-Free Fraction (%)											Intensity								Int.
			Quartz	Calcite	Dolomite	Siderite	Aragonite	Mg Calcite	Kaolinite	Illite	Illite-montmo.	Montmorillonite	Chlorite	Attapulgite	Sepiolite	Silica	Clinop.	Opal	Feldspar									
Late Paleocene	13-1, 97	189.97	4	45					30	20		40					10											
	13-2, 39	190.89	2	68					10	10		50					30											
	13-4, 121	193.71	1	1				1																				
	13-5, 54	195.54	8	49						10		70	20															
	14-1, 114	199.64	13	28					10	20		65	5			1												
	14-2, 25	200.25	12	28					10	20		60	10															
	14-3, 29	201.79	9	35					5	10		60	5			1	20											
	14-5, 37	204.87	3	63						10		70					20											
	14-5, 55	205.05	1	70		1					10	80					10											
Middle Paleocene	16-1, 77	218.27	1	65								95					5											
	16-1, 146	218.94	1	68								99																
Early Paleocene	16-3, 31	220.81	1	74		1					85	10					5											
	17-1, 39	227.39	0	88		1					5						95											
	17-2, 24	228.74	0	95		1					10						90											
Maestrichtian	18-1, 47	236.94	0	89						55		30					15											
Campanien	18-1, 107	237.54	0	89						45		45					10											
	18-2, 85	238.89	0	80						30		50			1	1	20											
	19-1, 6	246.55	1	81							50	40					10											
Early Cenomanian	19-1, 116	247.64	0	79					10		35	45	10			1												
Hole 402																												
Quaternary	1-1, 60	0.60	21	53	01				15	40	30		15			1												
	1-1, 91	2.41	37	16	01				15	40	20		25			1												
	1-2, 73	3.73	35	12	02				15	40	30		15	1		1												
	1-3, 62	5.12	1	74					10	40		40	10		1	1												
	3-1, 105	89.03	45	21					20	35	15	10	15			1												
Late Eocene	5-1, 65	128.15	6	53							40	60				1												
	5-3, 63	132.63	4	59								99				1												
	5-4, 78	134.28	5	61								99			1	1												
Hole 402A																												
Late-Middle Eocene	1-1, 51	137.49	7	43						5		95																
	1-3, 51	140.51	6	53						10		90																
	1-3, 57	140.57	7	54						10		90																
	1-5, 51	143.51	6	45						10		90			1	1												
	2-1, 61	147.11	7	54						15		85		1		1												
	3-1, 53	156.53	7	52							15	85				1												
	3-2, 68	158.18	7	44							10	90			1	2												
	3-4, 58	161.18	11	35							10	90			1	2												
	3-6, 75	164.25	9	36							15	85		1	1	2												
	3-7, 39	165.39	7	42							30	70		1		2												
	4-2, 130	168.30	11	33							15	85				2												
	4-3, 57	169.07	8	37							25	75				2												
Early-Middle Albian	5-1, 113	171.11	9	35																								
	5-2, 8	176.58	6	35																								
	6-1, 43	184.93	1	79							20				1	1	50	30										
	11-1, 41	232.41	5	17			1					30					40	30										
	11-3, 91	235.91	19	14			1					50				2	40	10										
	11-4, 57	237.07	13	19			1		5	20		45	5				20	5										
	12-1, 75	242.25	11	21			1					70					15	15										
	12-2, 43	243.43	9	23			1				20	50				1	20	10										
	13-1, 16	251.16	6	28			1		10	20		50					15	5										
	13-3, 109	254.09	6	27			1		10	10		45					25	10										
	14-1, 62	261.12	8	21			1		10	15		60					15											
	14-3, 42	263.92	16	15		1	2				10	50				2	30	10										
	15-2, 88	272.38	15	15			2				20	40					30	10										
	15-4, 87	275.37	13	12			1		25	25		50					10											
	15-6, 8	277.58	12	14		1	1		10		25	50				1	5	10										
	16-1, 12	280.71	17	11					20		20	40					5	15										
	16-2, 58	281.58	16	7					30	20		40					10											
	17-1, 80	289.80	13	13		1	1		20	25		50	5															
	17-2, 75	291.25	11	17		1	1		20	20		40	10					10										
	18-1, 91	299.41	15	11			1		20	25		45	10			1												
	18-2, 73	300.73	15	11					5	30		40	5	1			20												
	18-3, 86	302.36	16	14					5		5	20	5				55	10										
	19-1, 79	308.79	11	14		1	1		25		10		5															
	19-4, 106	313.56	2	0		4																						
	20-1, 71	318.21	20	13			1		10	20		55	5				5	5										
	20-3, 87	321.57	20	9		1			10	10	10	35	5				15	15										
	20-4, 26	322.26	12	13		1			10		20	40	10					20										
	21-2, 50	329.00	13	14		1	1		20	10		65				1		5	1									
	21-4, 58	332.02	13	19		1			20		10	70																
	21-4, 111	332.59	3	5		4			10		20	60					5	5										
	21-5, 87	333.81	11	21			1		10		10	40					10	30										
	21-7, 17	336.17	19	16					15	10		65						10										
	22-1, 68	337.18	11	19			1		25	10		40			1		5	20										
	22-3, 95	340.45	13	17		1	1			10		50					20	20										
	22-5, 75	343.25	16	15			1	1	15		10	65			1			10										
	22-6, 14	344.14	9	29		1	1				20	40				1	20	20										
	22-6, 124	345.24	10	28					10	10		70				1		10										
	23-1, 73	346.73	8	45		1					15	30					15	40										
	23-3, 104	348.54	6	27		1	1		5		15	50				1	15	15										
	23-5, 115	353.15	6	23			1		10		15	50			1		10	15										
	24-1, 95	356.45	7	22			1		10		20	60						10										
	24-2, 99	357.99	9	19			1	1	15	10		70						5										
	24-4, 46	360.46	9	21			1		15		20	55		1			5	5										
	25-1, 46	365.46	6	24			1	1	10		10	60				1	10	10										
	25-3, 48	368.42	11	23			1		10		20	60	5					5										
	25-5, 47	372.47	5	36	3		2	1	5		10	65					15	5										

TABLE 2 – *Continued*

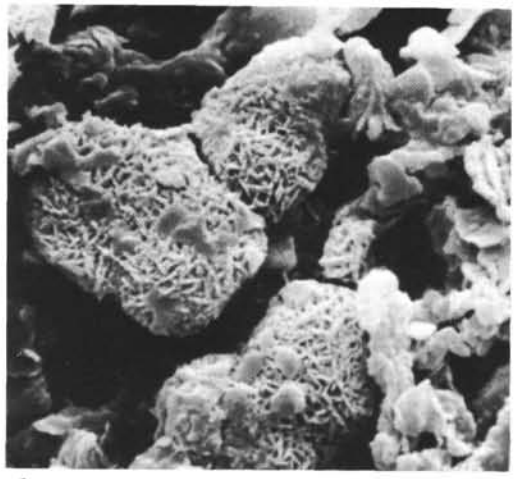
Stratigraphy	Sample (Interval in cm)	Depth (m)	Total Rock (%) Quartz	Calcite	Dolomite	Intensity Siderite	Aragonite	Mg Calcite	Carbonate-Free Fraction (%) Kaolinite	Illite	Illite-montmo.	Montmorillonite	Chlorite	Intensity Attapulgite	Sepiolite	Silice	(%) Clinop.	Opal	Int. Feldspar
Late Aptian	26-1, 23	374.73	6	18			1		15	20		60						5	
Gargasian	30-1, 142	413.92	13	20			1	1	15		15	70							1
	30-2, 66	414.66	12	31		1	1		15	10	5	70							
	30-3, 90	416.40	18	15			1		15	10	15	55	5						
	30-4, 64	417.64	23	9			1	1	25		25	50							1
	30-6, 16	420.16	22	14					20		10	60					10		
	31-1, 66	422.20	25	11			1		15		25	60		1	1	1			
	31-3, 68	424.00	8	16				3	15	15		70							
	31-5, 66	428.60	9	12			1		30		20	50				1			
	31-6, 77	430.27	18	16					35	15		50							1
	32-1, 28	431.78	20	13					25		25	50							
	32-3, 89	435.39	20	12					30	20		50				1			
	32-4, 88	435.88	8	16		2			20	15		65				1			
	32-6, 140	440.40	7	22		2			15	20		55	10	1		2			
	32-7, 22	440.72	15	24					10	20		60	10		1	1			
	33-1, 78	441.78	9	20		2			10		10	70	10						
	33-3, 38	444.38	3	68		1			10	10		75	5		1	1			
	33-4, 61	446.11	4	70		1				15		85				1			
	33-6, 35	448.85	3	85		1				15		80	5						
Early Aptian	34-1, 51	451.01	4	56		1				15		85			1	2			
Bedoulian	34-1, 82	451.32	3	77		1		2		25		75							
	34-3, 105	454.55	8	43					20	25		55							
	35-1, 67	461.17	6	64		1			20	30		50				1			
	35-5, 63	467.13	7	65					25	35		40				1			

PLATE 1

Carbonate-free fine-fraction sediments, stereoscan photographs and X-ray diagrams.

Figure 1	Opal-CT and zeolite crystallization from Sample 400A-63, CC.
Figure 2	X-ray diagram corresponding to Figure 1.
Figure 3	Bioclastics remains from Sample 401-16-1, 146 cm.
Figure 4	X-ray diagram corresponding to Figure 3.
Figure 5	Clinoptilolite crystallization from Sample 401-17-1, 39 cm.
Figure 6	X-ray diagram corresponding to Figure 5.

PLATE 1



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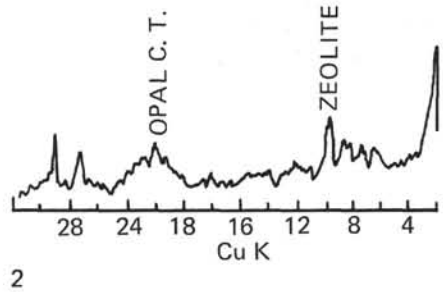

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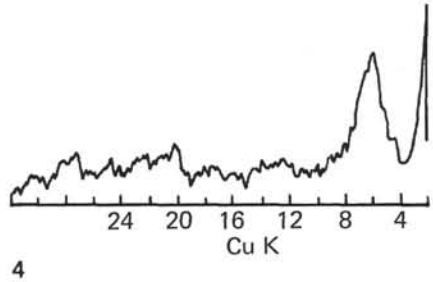

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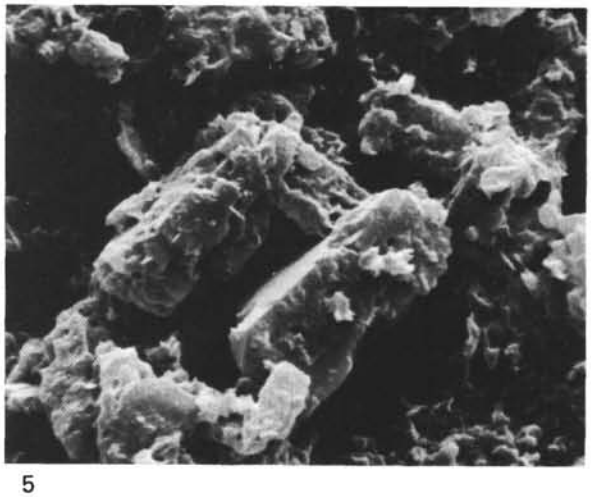

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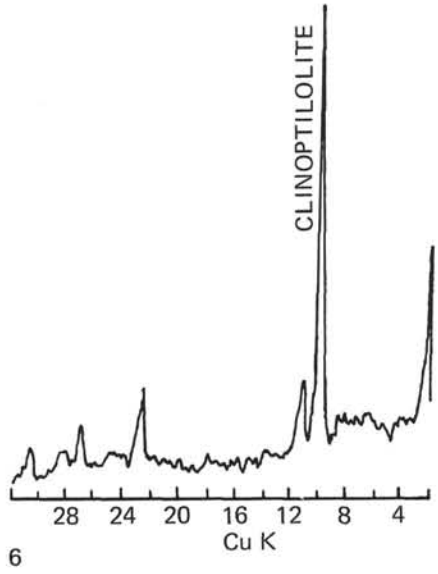
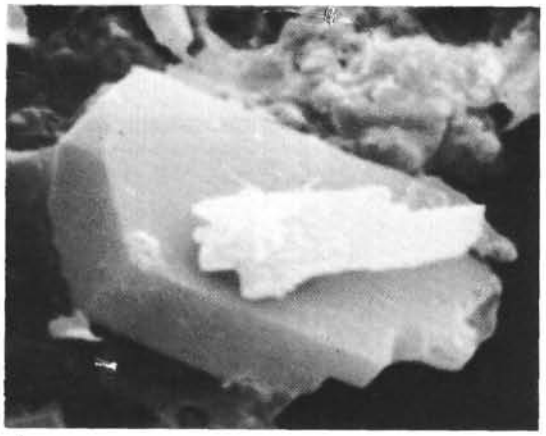


6

PLATE 2

Carbonate-free fine-fraction sediments, stereoscan photographs and X-ray diagrams.

Figure 1	Detail of zeolite crystallization from Sample 401-17-1, 39 cm.
Figure 2	Clinoptilolite crystallization from Sample 401-17-2, 24 cm.
Figure 3	Opal-CT crystallization from Sample 402A-29-3, 104 cm.
Figure 4	Detail of Figure 3.
Figure 5	X-ray diagram corresponding to Figure 2.
Figure 6	X-ray diagram corresponding to Figure 3.



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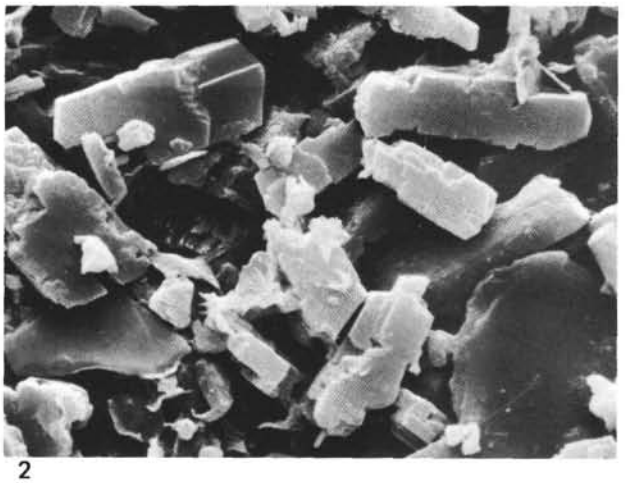

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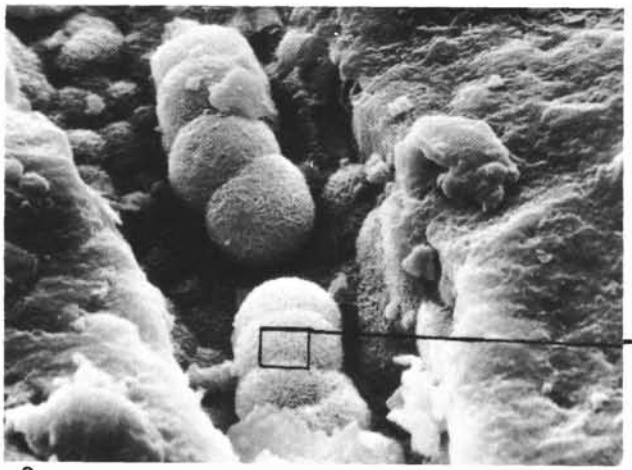

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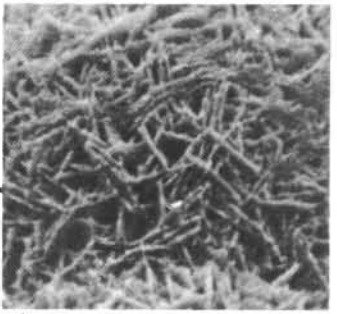

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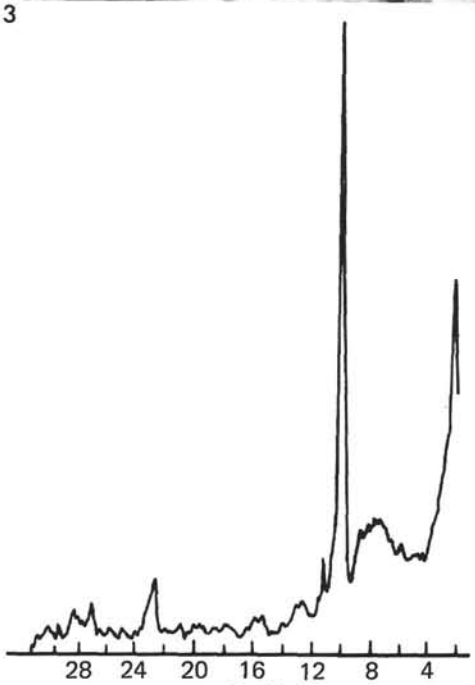

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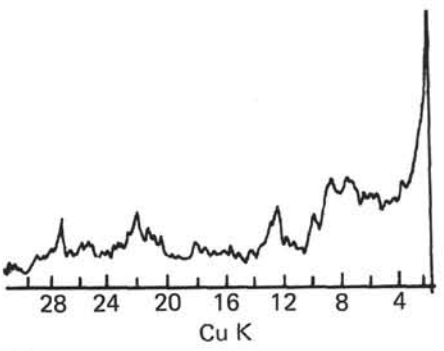

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