12. HEAVY-MINERAL COMPOSITION OF THE MEDITERRANEAN NEOGENE SEDIMENTS, DSDP LEG 42A

E. M. Emelyanov and K. M. Shimkus, The Atlantic and Southern Branches of the P. P. Shirshov Institute of Oceanology, Academy of Sciences, Kaliningrad and Gelendgik, USSR
and
Kenneth J. Hsü, Geologisches Institut, Eidg. Technische Hochschule, Zürich, Switzerland

ABSTRACT

We carried out a heavy mineral study of 150 DSDP Leg 42A samples from the Mediterranean. The results are interpreted by a comparison with the heavy-mineral provenance of the Holocene sediments. The western Mediterranean Neogene sediments, from Sites 371 and 372 in the Balearic Basin, and from Site 373 from the Tyrrhenian Basin, have a heavy-mineral composition similar to that of the Holocene sediments from nearby areas. This suggests that the sources for terrigenous clastics have remained nearly constant in the western Mediterranean. The effect of the Messinian salinity crisis has been minor, manifested only by a moderate increase of unstable species.

The Site 374 Messina Abyssal Plain sediments showed significant changes in the terrigenous component of the heavy-mineral suite. The Messinian and Quaternary suites have a large detrital component, but the heavy minerals in the early Pliocene sediments are mainly biogenic (fish teeth and bones).

The heavy-mineral composition of the sediments from the Cyprus Arc showed significant variations in response to Neogene tectonic activities and to the Messinian salinity crisis. The Taurus drainage system has always been a main source for the detritus of the Antalya Basin. However, ultramafic rocks from Troodos became a main source during Messinian time after the late Miocene deformation and uplift of Cyprus. The Nile River did not contribute much to the heavy-mineral suite except during the Messinian, when some of the Nile detritus was carried directly north and reached Sites 375 and 376.

The heavy-mineral suites of Site 377 and Site 378 sediments suggest derivation from the Peloponnesus-Crete-Rhodos drainage system; volcanogenic components in the Cretan Basin sediments did not become significant until the late Quaternary.

INTRODUCTION

Terrigenous sediments from different sources are characterized by their distinct heavy-mineral composition (Emelyanov, 1972). The purpose of the present investigation is to determine the mineralogical composition of the fine sand to coarse silt (0.1-0.05mm) fraction of the Neogene sediments from the DSDP cores obtained during Leg 42A, and to relate the mineralogy to the geologic history of the Mediterranean during the late Cenozoic.

After visual inspection of the cores onboard ship, 150 samples, representing nearly the entire Neogene, were selected from the eight sites drilled during Leg 42A by one of us (KJH). The mineralogical and textural analyses were carried out in the Atlantic and Southern branches of the Oceanology Institute (Kaliningrad and Geledgik), USSR, by the senior authors (EME and KMS).

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METHODS

The samples were boiled with pyrophosphate, or with ammonia hydrogen peroxide, to disaggregate individual grains. At the same time gypsum and the more soluble salts were dissolved. A preliminary determination of grain size, by differential settling, was made before we undertook the mineralogical investigations. Heavy minerals from the size-fraction 0.1-0.05 mm were separated with bromoform (s.g. 2.9), and were identified with the oil-immersion method. The composition of light minerals in samples from Sites 374-378 were also studied. In addition to DSDP samples, Holocene sediments samples from various Mediterranean localities near DSDP sites were analyzed to afford a means for comparison. The results of all textural and mineralogical studies are presented in Tables 1-7.

Heavy minerals are categorized into three groups: terrigenous, biogenic, and authigenic. The similarity of

TABLE 1
Grain Size (%) of the Mediterranean Cenozoic Sediments, Leg 42A

Sample (Interval in cm)	Fraction (mm) >0.1	0.1-0.05	0.05-0.01	0.01-0.005	0.005-0.001	<0.001
Site 371						
8-2, 100-102	5.55	12.00	31.92	14.15	2.67	33.70
8-2, 120-122	4.61	12.22	33.06	17.70	17.70	14.70
8-2, 135-137	6.68	17.44	42.92	13.62	13.62	5.72
8-3, 11-13	6.11	11.92	32.86	9.84	17.66	21.61
8-3, 29-31	20.89	17.38	24.18	21.48	13.37	2.70
8-3, 46-48	13.14	18.73	35.59	5.59	11.19	15.76
8-3, 68-70	27.85	16.78	21.82	2.75	16.32	14.48
8-3, 91-93	4.21	10.98	29.67	4.32	27.57	23.25
8-3, 109-111	2.56	11.19	36.25	8.35	13.67	27.97
8-3, 132-134	7.13	13.33	32.59	7.59	16.76	22.59
8-3, 147-149	5.63	7.62	39.50	13.32	11.97	21.96
Site 372						
1-4, 24-26	7.52	6.05	23.67	12.94	23.58	26.24
2-4, 16-18	17.90	3.24	23.92	17.09	20.32	17.53
3-3, 17-19	25.19	3.66	11.09	11.18	23.68	25.19
4-2, 6-8	0.09	9.15	38.96	12.07	19.43	20.28
12-6, 20-22	1.35	1.86	14.82	16.58	35.65	29.74
13-6, 20-22	0.90	2.70	12.20	18.90	36.00	29.30
14-6, 70-72	1.14	1.93	13.72	15.56	39.05	28.58
15-6, 19-21	1.44	2.21	14.19	19.73	31.15	31.26
16-6, 10-12	0.72	1.59	15.92	19.19	32.80	29.77
17-6, 47-49	1.09	2.18	13.76	19.98	35.60	27.37
18-6, 35-37	1.21	1.82	16.55	16.89	33.36	30.15
19-6, 11-13	1.41	2.62	15.74	18.36	35.61	26.24
20-6, 20-22	0.25	0.99	16.16	15.66	37.28	29.66
21-6, 38-40	1.21	2.16	15.54	17.44	34.46	29.19
22-4, 73-75	1.11	2.60	16.90	16.05	36.12	27.33
23-6, 139-141	3.76	4.85	14.65	17.43	32.67	26.63
24-6, 42-44	6.50	6.32	15.52	16.08	30.02	25.56
25-6, 77-79	4.94	4.02	15.56	12.72	26.19	36.57
26-5, 15-17	4.29	4.55	14.96	13.21	32.11	30.88
27-5, 56-58	10.59	6.78	13.13	13.88	29.02	26.59
28-6, 11-13	2.40	5.48	16.87	15.41	33.13	26.71
29-5, 118-120	3.07	8.27	25.83	18.33	26.51	17.99
30-6, 47-49	10.12	9.89	21.40	16.33	26.61	15.64
31-6, 10-12	2.60	7.24	34.63	16.99	23.12	15.41
32-6, 21-23	10.85	19.31	27.47	11.43	15.85	15.08
33-6, 65-67	2.75	4.86	26.01	15.80	35.09	15.48
34-5, 24-26	0.25	2.48	37.61	17.56	29.00	13.09
35-3, 29-31	0.13	3.70	38.90	19.26	24.49	13.52
36-6, 38-39	0.36	0.48	32.57	26.47	33.05	7.07
37-4, 19-20	0.18	1.17	36.61	21.28	25.25	15.51
38-6, 34-36	0.20	1.20	36.34	22.49	22.09	17.67
39-6, 58-60	0.46	9.81	36.60	24.40	25.77	2.96
40-6, 86-88	0.41	2.24	40.26	26.10	26.71	4.28
41-6, 3-5	0.71	5.01	43.56	17.01	21.70	12.00
42-6, 77-79	1.89	3.87	41.19	18.43	25.72	8.90
43-6, 25-27	0.58	2.52	43.44	19.45	18.23	15.78
44-6, 47-49	0.25	1.37	38.50	17.62	22.50	19.75
45-6, 35-37	0.09	3.32	49.79	12.87	16.96	16.96
46-3, 16-18	0.10	0.61	55.43	10.86	16.29	16.70
Site 373						
1-2, 64-66	4.62	5.26	26.32	12.58	37.87	13.35
1-3, 50-52	5.51	8.59	29.98		53.92	

TABLE 2
Grain Size (%) of the Mediterranean Cenozoic Sediments, Leg 42A

Sample (Interval in cm)	Fraction (mm) >0.1	0.1-0.05	0.05-0.01	<0.01
Site 374				
1-1, 123-125	1.36	28.03	49.68	20.93
2-1, 93-95	0.17	3.56	56.01	40.26
2-2, 132-134	0.13	0.19	42.67	57.01
2-3, 114-116	0.45	2.52	61.93	35.10
3-1, 135-137	4.69	2.78	18.75	73.78
4-1, 140-142	0.07	0.26	16.06	83.61
4-2, 142-144	0.06	0.06	11.57	88.31
4-3, 140-142	0.17	0.94	50.28	48.61
4-4, 123-125	0.06	0.98	61.24	37.72
5-1, 126-128	0.09	10.40	60.00	29.51
5-2, 127-129	4.09	2.55	12.61	80.75
5-3, 136-138	4.00	2.06	12.66	81.28
5-4, 127-129	4.00	3.52	15.53	76.95
5-5, 136-138	3.54	2.70	12.66	81.10
6-1, 126-128	7.07	3.65	8.87	80.41
6-2, 110-112	0.28	2.33	50.71	46.68
6-3, 119-121	3.67	2.89	10.29	83.15
6-4, 117-119	5.65	2.64	15.16	76.55
6-5, 123-125	6.73	3.50	10.62	79.15
6-6, 128-130	6.39	3.82	10.00	79.79
7-1, 112-114	7.27	3.30	9.33	80.10
7-2, 111-113	5.73	2.97	13.52	77.78
7-3, 117-119	3.35	2.47	10.73	83.45
7-4, 125-127	2.62	2.68	15.38	79.32
7-5, 125-127	4.63	3.88	12.85	78.64
7-6, 132-134	4.74	3.52	12.11	79.63
8-1, 136-138	7.37	4.05	10.43	78.15
8-2, 120-122	6.37	3.80	11.60	78.23
8-3, 143-145	3.29	2.56	6.52	87.62
8-4, 127-129	3.50	3.34	7.05	86.11
9-1, 135-137	2.07	3.26	5.57	89.10
9-2, 144-146	3.85	3.61	5.84	86.69
9-3, 4-6	2.09	2.98	4.34	90.59
9-4, 135-137	3.82	3.08	12.69	80.41
10-1, 146-148	5.14	2.71	11.74	80.40
11-2, 86-88	1.65	2.87	31.18	64.30
12-1, 120-122	1.59	0.37	6.73	91.31
13-1, 128-130	0.0	tr.	5.94	94.06
14-1, 128-130	0.0	tr.	8.06	91.94
15-1, 128-130	tr.	0.29	11.78	87.93
Site 375				
2-4, 1-3	59.60[1)]	7.07	8.41	24.92
4-4, 99-101	0.14	0.07	13.79	86.00
5-4, 98-100	0.41	0.35	11.33	87.91
6-1, 117-119	27.56[2)]	32.46	25.15	14.83
6-2, 93-95	32.24[3)]	30.08	24.06	13.62
6-3, 132-137	13.49	29.98	30.93	25.60
6-4, 62-64	28.58[4)]	35.92	21.19	14.32
7-1, 110-112	0.78	31.30	50.69	17.22
7-5, 40-42	0.06	5.98	65.56	28.40
8-3, 52-54	tr.	0.07	26.98	72.95
9-1, 98-100	0.06	0.12	13.50	86.32
10-2, 114-116	13.06	10.96	10.78	65.20
11-1, 133-135	7.36	3.85	4.67	84.12
Site 376				
1-1, 99-101	1.12	1.44	20.21	77.23
1-3, 99-101	1.34	1.64	26.94	70.08
2-1, 125-127	2.94	9.28	29.88	57.90
2-3, 118-120	9.02	3.01	13.86	74.11
3-1, 125-127	2.53	8.76	45.36	43.35
3-3, 99-101	4.85	2.70	23.05	69.40

detrital heavy-mineral suites may be masked by the great amounts and variation in the amounts of authigenic iron-sulfides which constitute more than 50% of the heavy-mineral composition in most samples. Subtle differences might indeed be obscured by the flooding of opaque minerals, but major variations are in most instances easily recognized, so that we did not recompute the heavy-mineral percentages by excluding the iron-sulfides.

HOLOCENE HEAVY MINERAL PROVINCES

Emelyanov (1972) subdivided the Mediterranean Holocene sediments into 27 provinces on the basis of

TABLE 2 – *Continued*

Sample (Interval in cm)	Fraction (mm) >0.1	0.1-0.05	0.05-0.01	<0.01
4-1, 98-100	1.42	1.26	17.35	79.97
5-1, 95-97	1.60	2.55	19.10	76.75
8-1, 128-130	4.52	3.30	52.26	39.92
8-3, 119-121	34.15	25.44	26.97	13.44
9-1, 84-86	11.59	25.25	40.40	22.76
9-3, 121-123	0.25	11.30	64.41	24.04
10-1, 124-126	1.93	9.77	51.35	36.95
11-1, 137-139	0.64	0.75	24.63	73.98
12-1, 146-148	12.89	22.41	31.30	33.40
12-3, 93-95	8.01	41.41	30.36	20.22
13-1, 100-102	12.84	26.00	26.69	34.47
13-3, 78-80	1.74	33.65	25.65	38.96
15-1, 132-134	18.64	33.56	21.69	26.11
15-2, 31-33	4.51	11.83	41.59	42.07
Site 377				
1-1, 99-101	1.63	13.17	48.41	36.79
1-2, 48-50	0.35	0.71	16.27	82.67
1-2, 101-103	37.56	9.18	13.00	40.26
3-1, 120-122	0.08	0.08	39.41	60.43
3-2, 62-64	0.11	0.11	42.75	57.03
3-2, 80-82	tr.	0.16	45.10	54.74
3-2, 101-103	1.28	0.40	42.57	55.75
3-2, 120-122	0.10	0.10	42.93	56.87
4-1, 76-78	0.78	0.54	54.85	43.83
4-1, 120-122	0.41	1.03	45.86	52.70
4-2, 40-42	1.71	0.43	43.65	54.21
4-2, 80-82	1.61	0.67	44.18	53.54
4-2, 120-122	1.66	0.68	41.30	56.36
4-3, 20-22	2.04	0.93	46.06	50.97
4-3, 40-42	1.35	1.62	42.09	54.94
4-3, 80-82	2.04	0.63	41.69	55.64
4-4, 20-22	2.18	1.26	42.68	53.88
4-4, 80-82	3.42	2.08	39.93	54.57
Site 378				
1-1, 101-103	2.37	3.28	19.87	74.48
2-2, 98-100	0.56	1.67	17.60	80.17
3-2, 98-100	0.66	1.89	17.47	79.98
5-2, 99-101	0.88	1.67	20.70	76.75
6-2, 97-99	1.0	1.92	18.24	78.84
7-2, 104-106	0.77	1.47	16.38	81.38
8-2, 100-102	1.21	3.74	37.69	57.36

[a]Note: The >0.1 fraction was dispersed giving the following contents

Sample	Total >0.1	>1.0 (% of total sample)	1.0-0.5	0.5-0.25	0.25-0
375-2-4, 1-3 cm	59.60	6.03	23.81	20.91	8.85
375-6-1, 117-119 cm	27.56	←	6.29	→	21.27
375-6-2, 93-95 cm	32.24	←	8.28	→	23.96
375-6-6, 62-64 cm	28.58	←	4.70	→	23.88

their heavy-mineral composition (Figure 1). Of those, we recognize four major types of heavy-mineral suites:

1) **Mature Suite:** The sediments of the southern Balearic Basin or of the Algerian province are characterized by a mature heavy-mineral suite (see Tables 3 and 4), as the source area is mainly an upland located in a wet and warm subtropical zone. Zircon and rutile are common and occur with lesser amounts of magnetite, epidote-zoisite, tourmaline, and apatite. Hydrous iron minerals are also abundant. Unstable heavy minerals from metamorphic terranes (micas and garnets) are present, but volcanogenic, unstable minerals, such as hornblende and pyroxenes, are rare or absent.

2) **Volcanogenic Suites:** The Holocene sediments of the eastern Tyrrhenian and of the Aegean provinces are characterized by the presence of an unstable heavy-mineral suite indicative of a Volcanogenic source (see Tables 3 and 4). Hornblende and monoclinic pyroxenes are abundant in the heavy fraction, whereas volcanic glass and ash materials are common in the light fraction. Such sediments are deposited in regions of active volcanism.

3) **Ultramafic Suites:** The Holocene sediments of the area around Cyprus are characterized by a heavy-mineral suite indicative of derivation from an ultrabasic terrane (see Tables 3 and 4). Orthorhombic pyroxene is a characteristic component; various other unstable minerals are present in varying amounts.

4) **Regional Suites:** The other heavy mineral provinces of the Mediterranean are defined by the particular suites brought down by some major rivers or some major drainage systems. The Rhone, the Nile, the rivers from Corsica, from Sardinia, or from Sicily, all of them carry an assemblage typical of their sources (see Table 3). Epidote is, for example, a common mineral in several eastern Mediterranean provinces, whereas the micas are particularly abundant in the eastern Sicily assemblage. The sediments from the Nile are derived from desert weathering, and are characterized by smectite as a clay mineral and by a heavy-mineral suite consisting of a mixture of pyroxenes, hornblendes, epidotes, zircon, and opaque iron minerals.

The mineralogy of the Holocene sediments provides the key for the interpretation of the provenance of the Neogene sediments from these DSDP cores. The results of heavy-mineral investigations will be discussed by sites.

SITE 371

This site is within the Algerian province (Figure 1). All our samples from this site are Messinian mudstones; the 0.1-0.05 mm fraction constitutes 8%-19% of the bulk. Opaque and oxidized iron minerals (ilmenite, magnetite, goethite, etc.) are the predominant heavy minerals. Epidote-zoisite and micas are present in almost all the samples and actinolite-tremolite, zircon, tourmaline, rutile, and garnets occur in some sample. The late Miocene assemblage is thus very similar to that of the Holocene, except the mature minerals are less common in our samples (cf. Tables 4 and 5). We might conclude that the Messinian detritus was derived from the same terranes in North Africa as the present detritus, but the climate was more arid then, so that a greater amount of unstable heavy minerals was preserved and sedimented.

Noteworthy is the high goethite-content in the Site 371 Messinian sediments which are similar to the Holocene sediments of the area (Emelyanov, 1968, 1972). Studies of suspension in water indicated that the hydroxides did not all come from a detrital source. Some of the goethite may have been formed as colloidal iron by biogenic activities (Emelyanov and Shim-

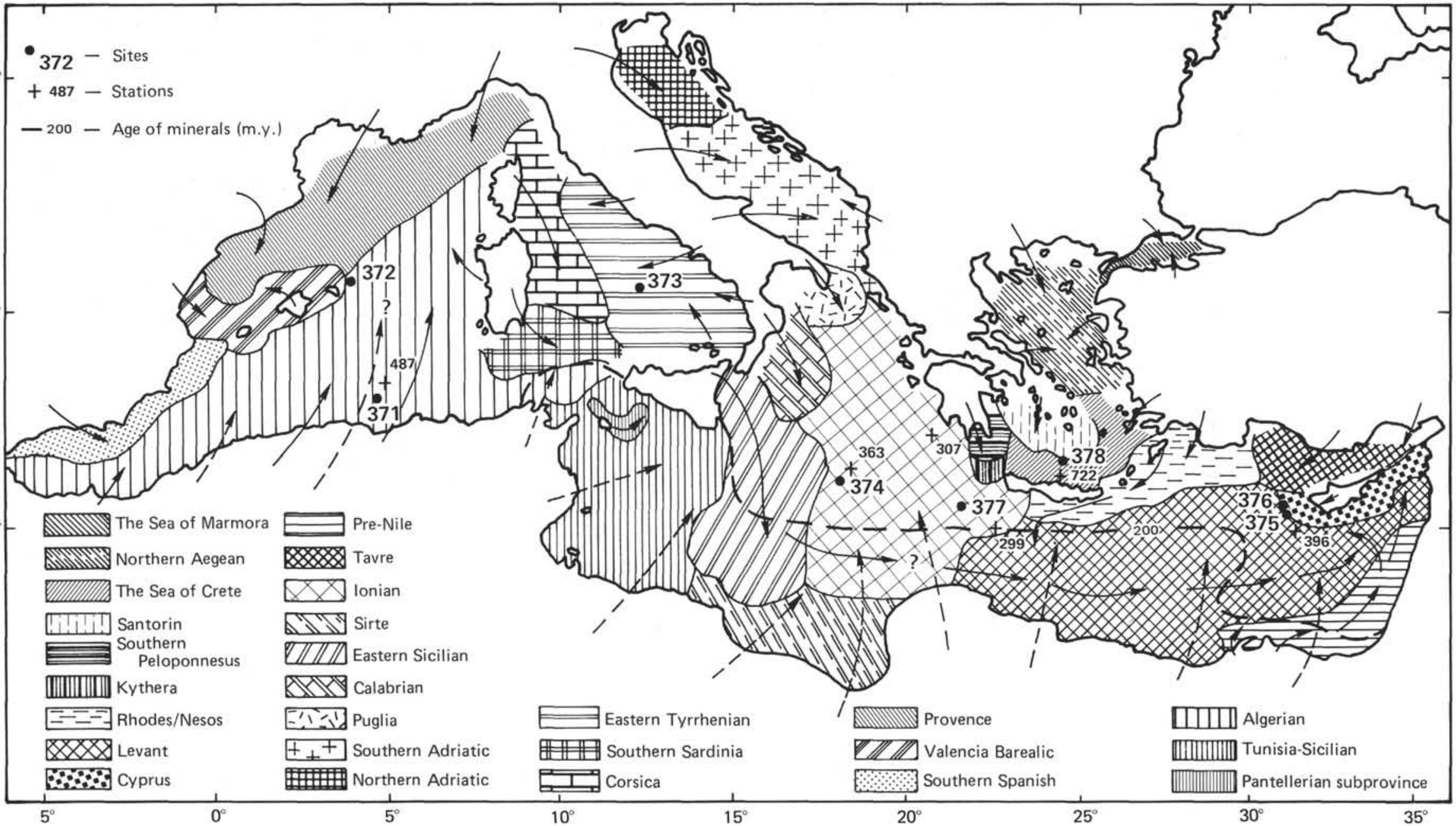

Figure 1. *Mineralogical provinces of the coarse (0.1-0.05mm) fraction of bottom sediments from the Mediterranean (Emelyonov, 1968, with some modifications). The solid arrows show the main sources and supply paths of detrital material; the dotted arrows show those of eolian material. – 200 – age of terrigenous-volcanogenic material in million/years (Emelyanov et al., 1973). Age of minerals are given after Emelyanov et al., 1973. In the southern basin the sediments are older (200-430 m.y.B.P.), in the northern part they are younger (50-200 m.y.B.P.).*

TABLE 3

Average Mineral Composition (%) of Fractions 0.1-0.05 mm of the Mediterranean Recent Sediments Terrigenous–Mineralogical Provinces (after E. M. Emelyanov, 1964, 1975)

Minerals	Provinces																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Heavy Subfraction	2.3	2.9	1.3	2.1	1.7	22.6	1.8	2.0	0.7	8.3	2.5	2.0	1.9	4.4	1.4	2.7	5.5	4.8	6.2	7.8	2.2	0.7	1.6	0.3	3.6	0.8
Opaque grains and rock fragments	6.3	3.6	4.0	6.5	6.3	16.3	9.3	9.3	15.3	0.4	3.1	6.9	0.0	1.0	27.2	8.6	4.5	20.1	14.5	1.1	2.3	1.7	0.0	2.5	1.4	3.2
Ore black	9.1	15.7	19.0	20.2	11.4	20.8	19.8	27.9	22.1	35.3	21.5	15.3	15.4	15.2	19.0	13.4	13.4	8.6	12.4	15.8	9.7	17.7	13.5	40.5	16.8	22.0
Ore red	3.4	10.7	25.0	14.8	25.5	3.1	10.3	13.2	12.8	10.0	27.7	27.1	32.3	15.7	20.0	6.3	2.4	4.5	7.9	16.2	11.8	28.3	47.9	20.2	46.7	35.5
Common hornblende	31.1	18.0	13.5	6.2	7.2	8.6	8.5	4.1	3.2	9.9	9.7	7.5	19.0	9.2	6.9	5.8	15.2	4.5	1.6	9.6	8.8	5.6	5.9	1.4	6.5	5.0
Basaltic hornblende	0.4	6.4	1.0	0.1	0.3	0.0	0.4	0.3	0.0	s.o.[a]	s.o.[a]	s.o.[a]	0.0	0.3	0.0	0.0	0.0	0.0	0.0	s.o.[a]	0.7	0.2	2.7	0.0	s.o.[a]	0.0
Fibrous amphiboles	0.7	0.5	1.5	0.1	0.7	0.0	1.9	0.6	0.4	0.9	0.6	0.4	1.3	1.2	0.9	2.5	4.7	1.1	s.o.[a]	0.2	7.2	1.5	1.6	2.9	s.o.[a]	s.o.[a]
Alkaline amphiboles	0.3	0.3	1.0	0.4	7.2	0.0	s.o.[a]	s.o.[a]	s.o.[a]	0.0	s.o.[a]	s.o.[a]	s.o.[a]	0.0	0.0	0.1	s.o.[a]	0.0	s.o.[a]	0.0	7.3	0.1	0.0	0.0	s.o.[a]	s.o.[a]
Monoclinic pyroxenes	1.2	1.9	5.8	23.9	1.1	23.8	17.6	9.2	5.7	23.3	1.7	2.7	1.2	1.2	12.3	4.6	1.1	38.6	41.4	s.o.[a]	3.8	0.6	1.6	6.2	1.1	3.2
Rhombic pyroxenes	1.3	0.4	1.5	2.1	0.2	15.2	1.3	3.0	4.8	s.o.[a]	0.2	0.8	0.0	0.3	0.3	s.o.[a]	s.o.[a]	0.0	1.0	2.5	0.4	s.o.[a]	s.o.[a]	0.6	s.o.[a]	s.o.[a]
Epidote-zoizite	23.9	19.4	12.4	13.0	14.8	4.5	10.5	13.7	10.8	11.8	12.5	13.2	10.5	10.2	8.6	20.1	18.2	5.3	4.6	33.0	27.7	15.1	8.0	5.8	7.8	10.5
Garnets	1.5	1.9	1.0	0.4	2.2	0.9	5.5	3.2	2.3	0.2	0.6	1.6	0.4	1.1	0.5	–	21.3	1.9	3.9	0.6	1.1	2.2	0.6	5.8	0.7	1.7
Yellow and brown mica	2.8	4.8	5.2	2.6	7.2	1.3	3.0	0.7	1.6	0.6	4.8	2.9	7.0	17.7	0.8	2.7	3.2	s.o.[a]	1.9	6.4	6.1	3.4	2.5	0.4	2.0	2.0
Green mica	0.9	s.o.[a]	s.o.[a]	0.0	s.o.[a]	0.0	s.o.[a]	s.o.[a]	0.0	s.o.[a]	s.o.[a]	s.o.[a]	0.0	1.1	s.o.[a]	2.7	3.2	s.o.[a]	s.o.[a]	0.0	1.4	1.5	2.2	0.0	s.o.[a]	s.o.[a]
Colorless mica	1.6	1.9	s.o.[a]	s.o.[a]	0.7	0.0	s.o.[a]	s.o.[a]	1.1	s.o.[a]	s.o.[a]	0.8	s.o.[a]	4.4	0.0	0.8	0.8	0.9	0.6	0.0	1.7	1.3	0.9	s.o.[a]	s.o.[a]	s.o.[a]
Zircon	2.6	1.8	3.0	1.0	1.8	1.7	0.9	1.6	1.5	1.7	4.1	2.4	2.4	2.6	1.2	1.6	s.o.[a]	0.3	0.8	2.8	1.4	1.6	2.7	1.7	3.5	5.5
Sphene	s.o.[a]	s.o.[a]	1.4	s.o.[a]	s.o.[a]	0.4	0.7	s.o.[a]	0.0	s.o.[a]	0.6	s.o.[a]	1.3	s.o.[a]	1.1	0.8	1.0	s.o.[a]	s.o.[a]	s.o.[a]	s.o.[a]	0.9	s.o.[a]	2.8	s.o.[a]	s.o.[a]
Ti-containing minerals	2.2	16.0	2.1	0.5	1.1	0.6	0.5	1.4	0.0	0.5	1.9	1.3	1.9	0.9	0.5	0.4	1.1	0.1	0.7	2.1	1.7	3.5	3.1	5.8	1.7	3.4
Tourmaline	s.o.[a]	0.7	0.7	s.o.[a]	s.o.[a]	0.5	s.o.[a]	s.o.[a]	0.0	s.o.[a]	0.6	s.o.[a]	0.7	1.0	s.o.[a]	0.9	s.o.[a]	s.o.[a]	s.o.[a]	s.o.[a]	0.6	0.9	0.9	1.8	0.8	0.6
Disthene	0.0	0.0	0.0	s.o.[a]	0.0	0.7	s.o.[a]	s.o.[a]	1.4	s.o.[a]	s.o.[a]	s.o.[a]	0.0	s.o.[a]	0.0	0.0	s.o.[a]	0.0	0.0	s.o.[a]	s.o.[a]	0.0	0.0	0.0	0.0	s.o.[a]
Carbonates	4.8	1.6	0.6	4.1	2.4	0.6	3.7	3.0	3.6	0.5	3.4	2.7	4.6	5.0	0.3	3.9	2.5	4.6	0.4	s.o.[a]	0.8	4.1	2.4	1.0	2.7	2.0
Light Subfraction																										
Quartz-plagioclasae	67.2	25.5	10.0	14.8	21.3	17.8	25.0	20.6	9.8	59.9	28.8	37.2	46.3	59.9	20.0	52.3	32.6	11.5	21.7	7.0	32.0	19.6	23.1	40.6	25.7	32.6
K-feldspars	1.6	s.o.[a]	s.o.[a]	0.0	0.0	4.2	s.o.[a]	s.o.[a]	1.0	0.0	s.o.[a]	2.4	1.2	1.4	s.o.[a]	0.0	s.o.[a]	s.o.[a]	s.o.[a]	0.0	s.o.[a]	0.0	s.o.[a]	0.0	s.o.[a]	s.o.[a]
Muscovite	0.0	0.5	0.5	0.5	0.0	0.0	0.5	1.2	0.5	0.0	0.5	0.5	0.5	4.3	0.5	1.6	0.7	0.5	0.5	0.0	0.0	0.5	0.0	0.0	0.5	0.5
Color mica	4.2	1.8	0.0	0.6	1.1	0.0	14.9	4.6	0.8	5.2	1.5	1.9	1.2	2.8	3.5	2.8	1.3	0.6	2.3	0.3	2.6	0.6	1.0	2.9	s.o.[a]	s.o.[a]
Volcanic glass	1.0	s.o.[a]	1.8	25.1	0.0	48.1	1.3	s.o.[a]	2.4	0.6	0.7	0.2	0.0	s.o.[a]	s.o.[a]	s.o.[a]	0.0	0.0	8.3	0.0	1.6	0.0	0.0	0.0	s.o.[a]	s.o.[a]
Volcanic ash	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	s.o.[a]	21.5	0.0	s.o.[a]	0.0	0.0	0.0	0.0	0.0
Calcite	4.7	1.9	2.2	1.3	4.9	1.9	6.4	7.4	5.3	5.2	6.4	7.6	24.2	5.4	2.1	11.5	25.1	15.9	2.9	3.6	3.1	26.1	12.7	2.0	10.9	2.9
Organogenous carbonates	13.4	65.4	83.6	54.3	67.1	3.1	28.8	55.0	69.3	6.0	53.7	45.5	21.0	22.6	63.4	24.9	29.1	54.0	37.2	85.5	56.7	47.8	60.6	39.4	39.6	52.4

Note: Principal minerals are underscored by a solid line, minerals characteristic of the province given by a dashed line. Mineralogical provinces: 1 – The Sea of Marmora, 2 – Northern Aegean, 3 – The Sea of Crete, 4 – Santorin, 5 – Southern Peloponnesus, 6 – Kythera, 7 – Rhodes, 8 – Tavre, 9 – Cyprus, 10 – Pre-Nile, 11 – Levant, 12 – Ionian, 13 – Sirte, 14 – Eastern Sicilian, 15 – Calabrian, 16 – Puglia, 17 – Southern Adriatic, 18 – Northern Adriatic, 19 – Eastern Tyrrhenian, 20 – Southern Sardinia, 21 – Corsica, 22 – Provence, 23 – Valencia Balearic, 24 – Southern Spanish, 25 – Algerian, 26 – Tunisia-Sicillian.

[a]s.o. = single occurrence

TABLE 4
Mineral Composition of Heavy (sp. weight >2.9) Subfraction 0.1-0.05 mm of the Mediterranean Recent Sediments Nearby the Sites Drilled, Leg 42A

Station	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
487	9.2	56.0	11.1	–	–	–	–	2.8	0.2	–	0.2	9.2	0.8	–	8.4	0.5	0.5	–	–
363	17.0	23.0	–	18.0	–	–	tr.	5.0	1.0	–	–	5.0	tr.	tr.	tr.	1.1	2.0	–	–
299	8.7	18.5	0.9	8.9	0.8	0.2	–	4.1	8.9	0.2	1.3	1.3	0.2	0.4	0.6	0.4	0.6	–	–
307	9.3	29.1	3.9	7.4	2.2	0.2	–	15.2	5.6	–	0.5	–	0.2	–	1.2	–	0.2	–	–
396	20.9	2.3	–	3.1	–	–	–	5.4	3.1	–	–	0.8	2.3	–	–	8.5	–	1.6	–
722	20.1	24.8	–	13.1	2.1	2.6	–	6.8	6.8	0.3	0.3	1.6	–	0.3	1.3	–	0.3	–	–

Station	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
487	–	–	–	–	0.5	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
363	–	–	–	20.0	tr.	tr.	–	–	–	–	–	–	–	tr.	–	–	–	–	–	–
299	–	0.2	–	1.1	0.4	0.2	–	–	–	–	–	–	–	40.2	–	–	–	–	–	–
307	–	0.2	–	4.2	4.7	–	–	–	–	–	–	–	–	2.2	–	–	–	–	–	–
396	1.6	3.9	–	31.8	7.0	8.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–
722	–	–	–	–	4.7	2.6	–	–	–	–	–	–	–	0.3	–	–	–	–	–	–

Note: Minerals: 1 – ore black, 2 – hydrogoethite, 3 – leucozene, 4 – common hornblende, 5 – actinolite-tremolite, 6 – alkaline amphiboles, 7 – basaltic hornblende, 8 – epidote-clinozoizite and zoizite, 9 – biotite, 10 – chlorite, 11 – muscovite, 12 – zircon, 13 – apatite, 14 – sphene, 15 – rutile, 16 – garnet, 17 – tourmaline, 18 – staurolite, 20 – disthene, 21 – monazite and other rare, 23 – weathered grains, 24 – monoclinic pyroxenes, 25 – rhombic pyroxenes, 33 – carbonates.

kus, 1974). Recall that the Messinian mudstones at Site 371 overlie a buried basement high (see Site 371 Report, this volume). If this buried hill, with a magnetic anomaly, is indeed an old seamount, the rarity of volcanogenic heavy minerals suggests that the clastics were not derived locally, but were transported to this site from a distant source.

SITE 372

This site is near the junction of three petrographic provinces: Algerian, Provencial, and Valencian-Balearic. The sediments studied range from early Miocene to Quaternary in age, and they are mainly marly oozes. The 0.1-0.05 mm fraction varies from less than 1% to 10%, except for the sample of Core 32 (19.3%).

Authigenic iron sulfides (pyrite and others) are the predominant heavy minerals. In all but a few samples, they constitute more than 80% of the heavy-mineral suite. Fish teeth and bones are present in almost all samples from Units I (Cores 1-3 and 9-33), but they are rare or absent in Unit IV (Cores 34-46) sediments, which were deposited at a considerably higher rate. Authigenic carbonates are present in small amount throughout. One notable exception is the occurrence of much (68%) barite in Sample 14-6, 7-72 cm.

Detrital heavy minerals are subordinate. Opaque and oxidized iron minerals, micas, chlorite, common hornblende are present in almost all samples. Fibrous amphiboles, epidote, garnet, zircon, sphene, and tourmaline occur in some. Other heavy minerals (pyroxenes, staurolite, kyanite) were found only in one or two of the samples studied. Only one sample of Messinian Sediment, a nannofossile ooze from Sample 4-2, 6-8 cm was studied. Its heavy-mineral composition is not significantly different from that of other Site 372 samples. The upper Burdigalian sediments (Cores 27-36) contain appreciable volcanogenic detritus, including pyroclastic debris and glasses similar to those found at Sites 122 and 123 (see Hsü, et al., 1973a,b). On the whole, the heavy-mineral composition of the Neogene sediments at this site did not vary significantly. Like those of the Holocene, the sources of the detritus could be traced to the Provence, the Pyrenace, and to the Balearic Isles (see Duplaix, 1972).

SITE 373

This site is in the eastern Tyrrhenian petrographic provence. Only two samples were studied. They are Quaternary marl oozes. The heavy minerals are characterized by a volcanogenic suite of monoclinic pyroxenes, opaque ash particles, and glass shards. The detrital heavy minerals include fibrous amphiboles, epidote, and micas; their occurrence indicates that the detritus was derived from the Corsican drainage system (see Emelyanov, 1972).

SITE 374

The site lies within the Ionian heavy mineral province. The samples studied include Pliocene-Quaternary marl oozes and Messinian mudstones. Those samples are distinctly finer grained than those from Sites 372, 375, and 376; all but one have less than 4% 0.1-0.05 mm fraction.

Authigenic sulfides are the predominant heavy minerals in the Pliocene-Quaternary sediments of Units 1a and 1b. Fish teeth and bones are dominant in the sediments of Unit 1c, which is characterized by a slow rate of sedimentation. Authigenic sulfides again predominate in the Messinian sediments (Unit IIIa).

The detrital heavy minerals are mainly micaceous; there may have been a sorting effect to exclude the more equant detrital heavy-mineral grains from the abyssal plain environment at times of pelagic sedimentation. Biotite, muscovite, and chlorite are common in practically all samples. They, especially the micas, are particularly abundant or dominant in Unit 1b and 1a samples. Oxidized iron minerals are abundant in some fine-grained or a slowly deposited sediments. Hornblende, epidote, and garnets occur in small quantities in some, and volcanogenic components are rare.

The light minerals of the 0.1-0.05 mm fraction of Site 374 samples were also studied. The Pliocene-Quaternary sediments of Units Ia, Ib, and the Messinian mudstones of Unit III are rich in quartz (up to 40%), whereas the slowly deposited Pliocene sediments of Unit 1b contain mainly foraminifers (>95%).

The abundance of micas in the heavy-mineral suite of the Site 373 samples suggests their derivation from the Sicilian drainage area; the predominance of micas are characteristic of the eastern Sicilian province (Emelyanov, 1968, 1972, 1975). However, the presence of other heavy minerals, and the high quartz/feldspar ratio of the light fraction indicate contributions from African sources; the quartz grains were transported to their abyssal plain environment either by turbidity currents or by winds (Figure 2).

To summarize, the Messina Abyssal Plain was the site of detrital sedimentation during the late Miocene, when authigenic sulfides were also formed. The environment suddenly changed at the beginning of the Pliocene to one of slow marine sedimentation with little terrigenous influx, resulting in a heavy-mineral suite made up mainly of biogenic components. The detrital components increased again toward the end of Pliocene and during the Quaternary, with addition of micas from the Sicilian source and quartz from the African source.

SITES 375 AND 376

The two sites are within the Cyprus petrographic province for the Holocene sediments. The Site 376 samples range from Quaternary to late Miocene and the Site 375 samples range from late Miocene to early Miocene in age. The samples studied include sands, muds, and oozes. The 0.1-0.05 mm fraction ranges from 25% to 35% in sandy sediments, but constitutes only 0.1% or less in the pelagic oozes (see Table 1). The mineralogical composition is influenced, to some extent, by the size-sorting effect, which may have concentrated equant grains in sandy sediments (e.g., Core 6 samples, Site 375) and micaceous flakes in fine oozes (e.g., Core 8, Site 375). However, not all the variations in mineral composition can be attributed to a sorting effect; we have detected major differences in the sources for the detritus at these two sites, particularly for sediments deposited during the late Miocene.

The Pliocene-Quaternary samples (Cores 1-5, Site 376) are marl oozes. The heavy-mineral suite consists mainly of epidotes, amphiboles, chlorite, and micas. Pyroxenes, spinel, and opaque iron minerals are present only in some of the samples studied. The suite seems to be a mixture of minerals derived from the metamorphic terranes of the Taurides province and those from the ophiolites of Cyprus.

The mineral composition of the Messinian samples (Cores 8-15, Site 376, Core 2, Site 375) differs significantly from that of the Pliocene-Quaternary Samples. Authigenic sulfides are less common, and carbonates are more abundant in the Messinian samples. The heavy-mineral suite includes significant ultrabasic elements: pyroxenes, spinels, and opaque iron minerals are present in practically all the samples; an especially large amount of brown-red spinel is present in Cores 11-15. Most of those materials are obviously derived from the ophiolites of the Troodos Massif, or those of southeastern Turkey. Also present in most samples are hornblende, sphene, garnet, and zircon. Those minerals, together with monoclinic pyroxene and ilmenite in the heavy fraction and quartz in the light fraction, are characteristic of the Nile province. Finally, the presence of epidotes, fibrous amphiboles, and other metamorphic minerals points to contribution from southern Turkey, but it seems that the Antalya Basin received far more detritus from Cyprus and from the Nile during Messinian time than it does today.

An anomalously high biotite content (70%) is present in Sample 376-9-3, 121-123 cm. Muscovite is also present, but equant heavy-mineral grains are very rare in this sample. The composition suggests that it was derived from a distant source.

The sediments from the upper Tortonian (Core 6) from Site 375 are turbidities from Unit 7 (see Site 375 Report, this volume); the size fractions greater than 0.5 mm constitute 1/3-2/3 of the bulk. Their heavy-mineral suite is significantly different from that of the Messinian sandy sediments. Several metamorphic minerals such as epidote, chlorite, chloritoid, and alkali amphiboles are either absent or less abundant in the Messinian sediments, whereas pyroxenes and spinels are less common in the Tortonian sediments. The mineralogy of the Tortonian sediments suggests their derivation from the Tauros drainage system, with little or no contribution from the Cyprus or from the Nile.

The lower Tortonian (Core 7), Serravallian, Langhian, and Burdigalian (Cores 7-11) are typical for those of pelagic or hemipelagic sediments. The predominant heavy minerals are either authigenic sulfides or biogenic teeth and bones. Chlorite and white mica are the most common micas in the detrital contribution. Since the micas probably came from the Tauride source, we interpret the difference in mineralogy between the coarse and finer sediments as being caused by size sorting.

To summarize, the heavy-mineral suites of the Site 375 and 376 sediments suggest that the Neogene detritus of the Florence Rise and Antalya Basin were derived mainly from the Tauros drainage system. The Cyprus source may have been an important contributor during the Messinian, but it became subordinate during the Pliocene-Quaternary. The sediments from the Nile rarely reached the Antalya Basin, except during the Messinian.

SITE 377

This site is in the eastern part of the Ionian petrographic province. Except for one Quaternary sandy sample (Sample 1-2, 101-103 cm), the samples studied are marls or muds. The samples are mainly Miocene and are fine grained; their 0.1-0.05 mm fraction constitutes from 0.1% to 2% of the bulk.

TABLE 5
Mineral Composition (%) of Heavy (sp. weight >2.9) Subfraction 0.1-0.05 mm of the Sites 371-378 Sediments (Leg 42A)

		Terrigenous														
Sample (Interval in cm)	Heavy Sub-fraction (%)	Ore (Black, nonmagnetic)	Magnetite	Ore (Black, Nonmagnetic), Age-oxidized	Hydrogeothite, hematite, etc.	Leucoxene	Spinel	Common Hornblende	Actinolite Tremolite	Other Fibrous Amphiboles	Alkaline Amphiboles	Basaltic Hornblende	Epidote-Clinozoizite	Zoizite	Biotite	Chlorite
Site 371																
8-2, 120-122	3.63	2.3	0.3	38.2	17.4	0.7	–	0.3	1.0	–	–	–	1.7	–	1.3	0.3
8-2, 135-137	5.46	0.7	0.7	29.3	31.2	0.7	–	0.3	0.7	–	0.3	–	2.3	–	2.3	–
8-3, 111-137	6.16	–	7.4	21.6	34.6	–	–	1.2	–	–	0.6	–	0.3	–	0.9	1.5
8-3, 29-31	5.99	–	6.7	25.0	30.7	–	–	1.0	0.3	–	–	–	1.3	0.3	0.3	3.0
8-3, 46-48	6.23	–	1.5	36.8	27.3	–	–	–	–	–	–	1.1	0.4	–	0.4	1.5
8-3, 68-70	5.45	4.5	2.3	19.7	41.4	–	–	0.6	0.6	–	–	–	0.6	–	0.6	1.1
8-3, 91-93	5.17	7.2	0.9	12.3	38.3	2.5	–	1.3	–	–	–	0.3	1.3	–	1.3	0.9
8-3, 109-111	3.11	1.9	0.5	9.7	34.0	–	–	–	–	–	–	–	1.9	–	0.5	1.9
8-3, 132-134	4.49	–	1.5	5.7	34.7	1.2	–	0.3	0.3	–	–	–	1.5	–	1.5	1.5
8-3, 147-149	0.34	2.6	2.8	6.6	35.2	–	–	0.9	0.3	0.3	–	–	2.2	–	0.6	–
Site 372																
1-4, 24-26	0.98	–	–	–	7.6	–	–	1.0	1.0	–	–	–	0.7	–	1.0	–
2-4, 15-18	3.24	8.0	0.7	0.3	11.9	0.7	–	2.0	–	0.7	0.7	–	14.0	–	1.0	11.2
3-3, 17-19	0.36	0.8	1.3	–	40.9	3.0	–	1.3	0.4	–	–	–	2.1	–	0.8	0.8
4-2, 6-8	0.43	–	–	–	1.7	–	–	0.3	–	–	0.3	–	–	–	1.7	1.1
12-6, 20-22	0.03	1.9	–	0.4	1.2	0.4	–	–	–	–	–	–	1.6	–	–	–
13-6, 20-22	1.34	–	–	–	1.0	–	–	–	–	–	–	–	–	–	0.7	1.0
14-6, 70-72	2.10	0.7	–	–	1.7	–	–	–	–	–	–	–	0.3	–	0.3	–
15-6, 19-21	4.91	–	–	0.3	1.3	0.3	–	–	–	–	–	–	0.3	–	0.3	1.0
16-6, 10-12	1.51	0.3	–	3.5	1.0	0.3	–	–	–	–	–	–	0.7	–	0.7	0.3
17-6, 47-49	11.83	–	–	–	–	–	–	–	–	–	–	–	–	–	1.0	–
18-6, 35-37	1.04	–	–	–	–	0.7	–	1.0	–	–	–	–	0.3	–	0.6	1.0
19-6, 11-13	0.74	1.6	0.4	–	0.8	0.4	–	–	–	–	0.4	–	–	–	–	–
20-6, 20-22	2.82	–	–	–	–	–	–	0.3	–	–	–	–	–	–	0.3	0.7
21-6, 38-40	1.52	–	–	–	0.4	–	–	0.4	–	–	–	–	0.7	–	0.7	0.7
22-4, 73-75	0.85	0.7	–	0.4	2.5	0.4	–	0.4	–	–	–	–	–	0.4	–	1.8
23-6, 139-141	2.54	–	0.2	0.2	1.3	–	–	–	–	–	–	–	–	–	–	–
24-6, 42-44	0.30	–	3.0	0.8	1.1	–	–	–	–	–	–	–	–	–	–	–
25-6, 77-79	0.35	–	4.5	1.0	1.4	0.4	–	–	–	–	–	–	–	–	0.4	0.4
26-5, 15-17	0.60	0.8	2.1	2.3	2.2	0.8	–	–	–	–	–	–	1.0	–	–	–
27-5, 56-58	0.84	–	–	2.9	13.2	–	–	–	–	–	–	–	–	–	1.5	1.4
28-6, 11-13	0.33	–	–	1.4	0.3	1.1	–	0.3	–	–	–	–	0.3	–	0.6	2.7
29-5, 118-120	0.64	–	–	0.3	–	–	–	–	–	0.3	–	–	–	–	0.3	0.6
30-6, 47-49	0.27	1.1	0.7	1.1	2.1	0.3	–	–	–	–	–	–	0.3	–	1.0	1.4
31-6, 10-12	0.86	–	–	–	0.6	–	–	0.3	–	–	0.3	–	–	–	0.3	–
32-6, 21-23	0.37	–	–	0.3	1.3	3.7	–	0.7	–	–	–	–	0.3	–	0.3	0.7
33-6, 65-67	2.87	–	–	0.7	–	–	–	0.3	–	0.3	–	–	–	–	0.3	1.3
34-5, 24-26	8.53	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
35-3, 29-31	2.00	–	–	–	0.3	–	–	0.3	–	–	–	–	–	–	–	0.3
36-6, 38-39	31.20	0.4	–	–	–	–	–	–	–	–	–	–	–	–	–	0.7
38-6, 34-36	7.34	0.3	–	–	–	–	–	–	0.3	–	–	–	0.3	–	–	–
39-6, 58-60	0.29	0.6	7.6	–	1.9	–	–	–	–	–	–	–	–	–	0.6	–
40-6, 86-88	7.86	0.3	–	–	1.0	0.7	–	–	0.3	–	–	–	0.3	–	0.3	–
41-6, 3-5	2.77	–	–	–	–	0.8	–	–	–	–	–	–	–	–	–	–
42-6, 77-79	5.02	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
43-6, 25-27	5.76	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
44-6, 47-49	3.14	–	1.6	–	0.9	0.6	–	0.3	0.3	–	–	–	–	–	–	0.3
45-6, 35-37	0.47	–	–	–	1.2	–	–	0.3	–	–	–	–	0.3	–	0.3	1.2
46-3, 16-18	25.46	1.5	3.7	3.7	3.0	–	–	–	–	–	–	–	–	–	0.7	–
Site 373																
1-2, 64-66	0.96	3.8	2.8	–	3.8	0.3	–	1.3	3.8	–	–	–	2.0	0.5	2.3	0.3
1-3, 50-52	8.95	0.6	0.3	–	0.8	–	–	0.8	1.4	–	–	–	3.1	–	0.6	–

TABLE 5 – *Continued*

Terrigenous													Terrigenous-Volcanogenous							
Muscovite	Green mica	Zircon	Apatite	Sphene	Rutile	Garnet	Tourmaline	Staurolite	Chloritoid	Disthene	Rare (Topaz, Monazite, Andalusite)	Carbonates	Weathered grains	Monoclinic pyroxenes	Rhombic pyroxenes	Olivine	Iddingsite	Ash, Rock fragments	Basic glasses	Acid glasses
0.3	1.7	–	0.3	–	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.3	1.6	–	–	–	–	1.0	1.6	–	–	–	0.3	–	–	–	–	–	–	–	–	–
0.3	–	0.6	0.6	–	0.6	–	0.3	–	0.3	–	–	–	–	1.2	0.3	–	–	–	–	–
0.6	1.3	1.0	–	0.6	0.7	–	0.3	–	–	–	3.6	–	–	–	–	–	–	–	–	–
–	–	–	–	0.4	0.7	2.5	0.7	–	–	0.4	2.6	–	–	0.4	0.8	–	–	–	–	–
–	–	–	0.8	0.3	–	1.4	0.6	–	–	–	0.9	–	–	0.3	–	–	–	–	–	–
0.6	–	–	–	–	0.6	0.6	–	–	–	–	0.9	–	–	0.3	–	–	–	–	–	–
0.3	–	0.3	–	0.3	–	–	0.5	–	–	–	0.3	–	–	0.3	–	–	–	–	–	–
0.3	1.2	–	–	0.3	–	0.6	1.2	–	–	–	0.6	–	–	–	–	–	–	–	–	–
0.6	0.3	0.3	–	0.6	–	2.0	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–
0.3	1.9	0.3	–	0.3	–	–	0.3	–	–	–	0.3	–	–	–	–	–	–	–	–	–
1.0	–	0.3	–	0.3	0.3	1.0	0.3	0.3	0.3	–	–	–	1.0	0.7	–	–	–	0.7	–	–
0.8	4.7	0.4	0.4	0.4	–	1.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1.1	–	0.3	0.3	–	–	0.3	–	–	–	–	–	–	1.1	–	–	–	–	–	–	–
0.8	–	–	0.4	–	–	–	–	–	–	–	0.4	–	1.6	–	–	–	–	1.6	–	–
0.3	–	–	0.3	–	–	–	0.3	–	–	–	0.3	–	1.4	–	–	–	–	–	–	–
–	–	0.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.3	–	–	–	–	–	0.3	0.3	–	–	–	–	–	–	0.3	–	–	–	–	–	–
–	0.7	–	–	–	–	0.3	–	–	–	–	0.6	–	–	–	0.3	–	–	–	–	–
0.6	0.3	–	–	–	–	–	–	–	–	–	0.3	–	1.0	1.0	–	–	–	–	–	–
0.3	–	–	–	–	–	0.3	–	–	–	–	0.3	–	1.0	1.0	–	–	–	–	–	–
–	–	0.4	0.4	–	–	–	–	–	–	–	–	–	1.6	–	–	–	–	–	–	0.4
0.3	–	–	–	0.3	–	–	–	–	–	–	0.3	–	1.0	–	–	–	–	–	–	–
0.4	–	–	0.4	0.4	–	0.4	0.4	–	–	–	0.4	–	0.7	0.7	–	–	–	–	–	–
0.7	–	0.4	–	–	–	–	0.4	–	–	–	0.4	–	0.7	–	–	–	–	–	–	–
–	0.2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	0.4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	–	0.8	0.5	0.3	–	–	0.3	–	–	–	0.5	–	–	0.3	–	–	–	–	–	–
–	–	–	–	–	–	1.5	–	–	–	–	–	–	2.9	–	–	–	–	1.5	–	–
0.3	–	0.6	–	0.3	0.3	0.3	0.6	–	–	–	–	–	2.4	–	–	–	–	0.9	–	–
–	–	–	–	0.3	0.3	0.3	–	–	–	–	–	–	1.0	–	–	–	–	–	–	0.3
0.7	–	0.3	–	0.3	–	0.3	0.3	–	–	–	0.3	–	3.5	–	–	–	–	–	–	0.3
–	–	0.9	0.7	–	–	0.3	0.3	–	–	–	0.3	–	1.6	0.3	–	–	–	0.3	–	0.3
–	–	1.1	0.3	0.3	0.3	0.3	0.3	–	–	–	0.3	–	1.5	–	–	–	–	1.7	–	–
0.3	–	–	–	–	–	0.3	–	–	–	–	–	–	0.9	–	–	–	–	–	–	–
–	0.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.3	–	–	0.3	–	0.3	–	–	–	–	–	–	–	0.9	0.3	–	–	–	0.7	–	0.7
0.4	–	0.4	–	–	–	–	–	–	–	–	–	–	3.2	0.4	–	–	–	0.4	–	0.4
–	–	–	–	–	0.3	0.3	–	–	–	–	0.3	–	0.3	–	–	–	–	–	–	–
1.0	2.2	0.3	–	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
0.3	0.6	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1.0	0.5	0.3	–	–	–	–	0.3	–	–	–	0.3	–	–	–	–	–	–	–	–	–
0.8	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	–	–	–	–	–
0.3	0.6	–	0.6	–	–	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2.8	–	–	–	–	–	–	–	–	–	–	–	–	4.8	–	–	–	–	–	–	–
0.8	0.7	–	–	–	–	0.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–
–	0.5	0.3	0.8	0.3	0.3	0.8	–	–	–	–	–	–	1.5	12.1	0.5	–	–	1.5	–	0.5
0.3	0.3	0.3	–	0.3	–	0.3	–	–	–	–	–	0.6	63.3	5.1	0.8	–	–	7.2	–	–

TABLE 5 – *Continued*

		Bio-genic	Authigenic, Chemogenic												
Sample (Interval in cm)	Heavy Sub-fraction (%)	Teeth, Bones	Carbonates	Carbonates	Carbonates	Carbonates Undivided	Siderite	Barite	Zeolites	Phosphates	Chamozite	Glauconite	Fe-Mn Concretions	Sulfides	Total (%)
Site 371															
8-1, 120-122	3.63	–	–	–	–	32.7	–	–	–	–	–	0.3	–	1.0	99.8
8-2, 135-137	5.46	–	–	–	–	26.0	–	–	–	–	–	0.7	–	0.3	100.2
8-3, 111-137	6.16	–	–	–	–	19.1	–	–	–	–	–	2.2	–	6.2	99.8
8-3, 29-31	5.99	–	–	–	–	17.0	–	–	–	–	–	2.3	–	3.7	99.8
8-3, 46-48	6.23	–	–	–	–	18.9	–	–	–	–	–	1.5	–	2.5	100.0
8-3, 68-70	5.45	–	–	–	–	18.3	–	–	–	–	–	0.6	–	5.4	100.0
8-3, 91-93	5.17	–	–	–	–	26.2	–	–	–	–	–	0.6	–	3.8	99.9
8-3, 109-111	3.11	–	–	–	–	23.5	–	–	–	–	–	2.4	–	21.6	99.9
8-3, 132-134	4.49	–	–	–	–	26.9	–	–	–	–	–	2.7	–	13.9	99.8
8-3, 147-149	0.34	–	–	–	–	26.8	–	–	–	–	–	–	–	15.9	99.9
Site 372															
1-4, 24-26	0.98	–	–	–	–	–	–	–	–	–	–	–	–	86.0	100.0
2-4, 15-18	3.24	0.3	–	–	–	3.0	–	–	–	–	–	–	–	27.5	
3-3, 17-19	0.36	8.4	–	–	–	–	–	–	–	–	–	–	–	31.9	99.7
4-2, 6-8	0.43	2.5	–	–	–	0.7	–	–	–	–	–	–	–	88.3	99.7
12-6, 20-22	0.03	8.5	–	–	–	2.3	–	0.8	–	–	–	–	–	78.2	100.1
13-6, 20-22	1.34	2.7	–	–	–	0.3	–	0.3	–	–	–	–	–	91.1	99.7
14-6, 70-72	2.10	2.4	–	–	–	–	–	68.1	–	–	–	–	–	25.7	99.9
15-6, 19-21	4.91	2.1	–	–	–	0.7	–	0.3	–	–	–	–	–	91.9	99.7
16-6, 10-12	1.51	2.4	–	–	–	3.8	–	–	–	–	–	–	–	84.4	100.0
17-6, 47-49	11.83	1.7	–	–	–	0.5	–	–	–	–	–	–	–	98.0	99.9
18-6, 35-37	1.04	1.7	–	–	–	0.7	–	–	–	–	–	–	–	90.8	99.7
19-6, 11-13	0.74	4.8	0.4	–	–	–	–	–	–	–	–	–	–	88.4	100.0
20-6, 20-22	2.82	0.7	–	–	0.7	–	0.3	–	–	–	–	0.3	–	94.7	99.9
21-6, 38-40	1.52	3.7	–	0.7	–	–	–	–	–	–	–	–	–	88.8	99.9
22-4, 73-75	0.85	8.6	0.4	–	–	–	–	–	–	–	–	–	–	82.0	100.2
23-6, 139-141	2.54	–	–	–	–	–	–	–	–	–	–	0.6	–	49.9	99.9
24-6, 42-44	0.30	27.4	–	–	–	–	–	–	–	–	–	–	–	61.3	99.9
25-6, 77-79	0.35	8.7	–	–	–	–	–	–	–	–	–	–	–	82.8	99.8
26-5, 15-17	0.60	6.0	–	–	–	–	–	–	–	–	–	–	–	80.1	99.9
27-5, 56-58	0.84	14.7	–	2.9	–	–	–	–	–	–	–	–	–	57.3	99.8
28-6, 11-13	0.33	2.1	–	2.1	–	–	–	–	–	–	–	–	–	83.5	100.1
29-5, 118-120	0.64	2.0	–	9.5	+	–	–	–	–	–	–	–	–	84.6	99.8
30-6, 47-49	0.27	4.9	+	+	1.8	–	–	0.7	–	–	–	–	–	78.3	99.7
31-6, 10-12	0.86	0.7	–	–	0.7	–	–	–	–	–	–	–	–	91.9	99.8
32-6, 21-23	0.37	1.7	–	–	1.5	–	–	–	–	–	–	0.3	–	83.2	99.8
33-6, 65-67	2.87	1.3	–	–	0.3	–	–	–	–	–	–	–	–	93.7	99.7
34-5, 24-26	8.53	–	–	–	–	–	–	–	–	–	–	–	–	99.5	
35-3, 29-31	2.00	0.3	–	–	3.5	–	–	–	–	–	–	–	–	91.7	99.9
36-6, 38-39	31.20	0.4	–	–	2.9	–	–	0.7	–	–	–	0.4	–	89.5	100.2
38-6, 34-36	7.34	0.3	9.3	+	+	–	–	3.6	–	–	–	–	–	84.4	99.7
39-6, 58-60	0.29	–	–	–	–	–	–	–	–	–	–	–	–	85.4	99.9
40-6, 86-88	7.86	–	–	–	–	0.3	–	–	–	–	–	–	–	94.0	99.9
41-6, 3-5	2.77	–	–	–	–	1.9	–	–	–	–	–	–	–	96.4	100.0
42-6, 77-79	5.02	–	–	–	–	6.4	–	–	–	–	–	–	–	91.2	100.0
43-6, 25-27	5.76	–	–	–	–	10.5	–	–	–	–	–	–	–	88.4	100.0
44-6, 47-49	3.14	–	–	–	–	–	–	–	–	–	–	–	–	94.0	99.8
45-6, 35-37	0.47	–	70.0	–	–	–	–	–	–	–	–	–	–	18.8	99.7
46-3, 16-18	25.46	0.8	–	–	–	–	–	–	–	–	–	–	–	82.8	100.0
Site 373															
1-2, 64-66	0.96	0.5	–	–	–	–	–	–	–	–	–	–	–	58.4	99.8
1-3, 50-52	8.95	–	–	–	–	13.7	–	–	–	–	–	–	–	–	99.4

Authigenic sulfides are the predominant heavy minerals of the Miocene sediments. Chlorite is present in practically all samples studied and is particularly abundant in the Quaternary sediments. Opaque iron minerals are also common. Epidote, hornblende, micas, zircon, garnet, and oxidized iron minerals occur in some samples; pyroxenes and other heavy minerals are present only in a few samples. The light fraction was also studied. Aside from foraminifers and quartz grains, aggregates of clay minerals constitute the bulk of the 0.1-0.05 mm fraction of all samples.

The mineralogic composition of the Site 377 samples is not particularly distinctive. The abundance of chlorite is surprising, considering the rarity of chlorite in the Holocene sediments (cf. Tables 3 and 6); the difference may be attributed to size-sorting effects. On the whole, the neavy mineral composition is consistent with the interpretation of its derivation from the Peloponnesus-Crete drainage system.

SITE 378

This site is within the Cretan heavy-mineral province. The samples studied are mainly Pliocene-Quaternary marl oozes, and the 0.1-0.05 mm fraction constitutes 1.5%-3.7% of the bulk.

Authigenic sulfides are the dominant heavy minerals, and constitute 75%-93% of the heavy-mineral suite. The detrital heavy minerals are hornblende, fibrous, and alkali amphiboles, epidotes, micas, garnets, and opaque iron minerals. Pyroxenes and other volcanogenic minerals are rare or absent. The heavy-mineral suite suggests a detrital source from the Crete-Rhodos drainage system; the volcanogenic components are far less common in the Pliocene-Pleistocene than in the Holocene sediments.

NEOGENE SEDIMENTARY HISTORY AS DEDUCED FROM HEAVY-MINERAL STUDIES

The studies of heavy minerals revealed a difference in the sedimentary trends between the eastern and western Mediterranean basins. The heavy-mineral composition of the Neogene sediments at Sites 371 and 372 in the Balearic Basin, and of Site 373 in the Tyrrhenian Basin is practically identical or very similar to that of the Holocene. This suggests that the terrigenous source areas for the western Mediterranean sediments have remained relatively constant since Burdigalian time. The effect of the Messinian salinity crisis on the heavy-mineral composition was minor, and is manifested by a moderate increase of the relatively unstable species in the heavy-mineral suite.

The sediments from the Messina Abyssal Plain, Site 374, showed significant temporal changes in the heavy-mineral suites. The Messinian and the Quaternary suites have a large detrital component, but the heavy minerals in the early Pliocene sediments are mainly biogenic fish teeth and bones. This difference is related to change in rate of sediment accumulation. In early Pliocene, when the desiccated Mediterranean was again flooded by marine waters, much of the terrigenous material was trapped in drowned river valleys (Malovitsky et al., 1975; Cita et al., this volume). Only some of the finest suspensions could reach the abyssal plain sites such as Site 374.

The most significant temporal changes of the mineral composition occurred in the Florence Rise and the Antalya Basin region. The changes are related in part to tectonics, and in part to the Messinian salinity crisis. Geology on land, and structural interpretations of submarine seismic profiles indicate a late Miocene orogenic movement, when the Cyprus Arc was deformed (Site 375-376 Report). The uplift and possible exposure of the Troodos Massif on Cyprus may have provided the ultramafic heavy minerals for the Messinian sediments. The influx of the Nile detritus was probably related to the Messinian salinity crisis. Advocates of the desiccated deep-basin model suggested that the Mediterranean water level was lowered some 2 km during the Messinian desiccation (Hsü et al., 1973a,b; this volume). The data from Soviet scientists have also indicated that the Mediterranean level was substantially lower during the Messinian than it is now (Malovitsky et al., 1975). The coastline retreated considerably towards the basin center. The Nile acquired considerable vigor and carried a large sediment load at times of the lowered base-level of erosion. Furthermore, the Florence Rise probably did not reach its present height. The Nile sediments were transported directly north and some detritus was able to reach the Antalya Basin by wind transport or by other means. Prior to the Messinian, and during the Pliocene-Quaternary, the Nile detritus was transported eastward by surface currents, and only very little of the Nile load could reach the Antalya Basin by circumscribing the Cyprus Island (Figure 2). Therefore, the heavy-mineral suites of Sites 375 and 376 contained practically no Nile contribution except during deposition of the Messinian sediments.

Investigations of the heavy minerals of Sites 377 and 378 suggests that the Peloponnesus-Crete-Rhodos drainage system was an important contributor of detritus to the north and to the south of the Cretan Arc during much of Neogene time. Volcanogenic constitutes did not become important until the late Quaternary when the Santorini became active.

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TABLE 6
Mineral Composition (%) of Heavy (sp. weight >2.9) Subfraction (0.1-0.05 mm) of the Sites 374-378 Sediments, Leg 42A

Sample (Interval in cm)	Heavy Sub-fraction (%)	Ore Black	Hydrogoethite	Leucoxene	Common Hornblende	Actinolite-Tremolite, etc.	Alkaline Amphiboles	Basaltic Hornblende	Epidote-Clinozoizite, Zoizite	Biotite	Chlorite	Muscovite	Zircon	Apatite	Sphene	Rutile	Garnet	Tourmaline	Staurolite
Site 374																			
1-1, 123-125	1.58	–	0.9	–	13.8	–	–	–	3.6	1.8	9.4	1.3	–	–	–	–	–	–	–
2-1, 93-95	4.17	–	2.3	–	–	–	–	–	–	31.9	29.9	33.2	–	–	–	–	–	–	–
2-2, 132-134	8.13	–	0.6	–	–	–	–	–	0.3	11.2	34.2	49.2	–	–	–	–	–	–	–
2-3, 114-116	12.56	–	1.5	–	–	–	–	–	–	5.3	10.7	17.2	–	–	–	–	–	–	–
3-1, 135-137	2.47	–	0.3	–	0.3	–	–	–	0.9	1.7	5.8	–	–	–	–	–	–	–	–
4-1, 140-142	24.87	–	0.3	–	0.7	0.3	–	–	–	–	0.3	0.7	–	–	–	–	1.5	–	–
4-2, 142-144	5.26	3.3	46.7	–	–	1.7	–	–	–	–	3.3	5.0	–	–	–	–	–	–	–
4-3, 140-142	3.00	4.8	37.9	0.8	9.7	1.6	–	–	1.6	0.8	8.1	1.6	0.8	0.8	–	–	1.6	–	0.8
4-4, 123-125	2.63	0.6	2.7	–	0.3	–	0.3	–	0.3	9.8	32.4	48.6	0.3	–	–	–	–	–	–
5-1, 126-128	1.15	–	–	–	0.7	–	–	–	1.1	4.5	58.4	13.1	0.4	–	–	–	0.4	–	–
5-2, 127-129	0.60	–	1.0	–	1.3	–	–	–	0.3	–	3.7	1.7	0.3	–	–	–	–	–	0.3
5-3, 136-138	4.57	–	–	–	0.3	–	–	–	–	0.3	2.1	1.8	–	–	–	–	–	–	–
5-4, 127-129	0.10	–	2.8	–	2.1	–	–	–	–	0.7	63.2	9.2	–	–	–	–	1.3	–	–
5-5, 136-138	0.04	15.8	12.3	–	1.7	–	–	–	3.5	–	33.3	5.3	–	–	–	1.7	1.7	1.7	–
6-1, 126-128	0.08	–	4.5	–	1.5	–	–	–	1.5	–	13.6	3.0	–	–	–	–	1.5	–	–
6-2, 110-112	0.27	0.4	2.2	–	0.4	–	–	–	–	1.8	19.4	3.2	–	0.4	–	–	–	–	–
6-3, 119-121	tr.	+	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
6-4, 117-119	0.02	+	–	–	–	–	–	–	–	–	++	–	–	–	–	–	+	–	–
6-5, 123-125	0.06	–	+	–	–	–	–	–	–	–	++	+	–	–	–	–	–	–	–
6-6, 128-130	0.02	+	+	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–
7-1, 112-114	tr.	–	++	–	–	–	–	–	+	–	–	–	–	–	–	–	–	–	–
7-2, 111-113	0.04	–	20.0	–	2.0	–	–	–	–	2.0	54.0	–	–	–	–	–	–	–	–
7-3, 117-119	tr.	+	+	–	–	–	–	–	–	–	+	–	–	–	–	–	+	–	–
7-4, 125-127	0.07	4.0	1.0	–	5.0	–	–	–	3.0	1.0	65.0	1.0	1.0	–	–	–	1.0	2.0	–
7-5, 125-127	0.01	–	+	+	–	–	–	–	+	–	++	–	–	–	–	–	+	–	–
7-6, 132-134	0.02	–	–	–	–	–	–	–	–	–	++	–	–	–	–	–	+	–	–
8-1, 136-138	0.02	8.0	50.0	–	–	–	–	–	2.0	–	2.0	–	–	–	–	–	4.0	–	–
8-2, 120-122	0.05	3.6	16.1	–	3.6	–	–	–	–	–	60.7	5.4	–	–	–	–	–	–	–
8-3, 143-145	0.07	–	1.4	0.7	–	–	–	–	0.7	–	2.1	0.7	–	–	–	–	–	–	–
8-4, 127-129	0.03	–	5.2	–	–	–	1.7	–	–	–	3.4	1.7	–	–	–	–	–	–	–
9-1, 135-137	0.05	1.6	2.7	–	–	–	–	–	–	–	2.1	–	–	–	–	–	–	–	–
9-2, 144-146	0.12	–	1.5	–	–	–	–	–	–	–	12.3	7.7	–	–	–	–	–	–	–
9-3, 4-6	0.05	2.3	1.8	0.4	–	–	–	–	–	–	1.4	6.8	–	0.4	–	–	–	–	–
9-4, 135-137	0.07	3.5	12.3	–	1.8	–	–	–	3.5	–	15.8	7.0	–	–	–	–	1.8	–	–
10-1, 146-148	0.10	9.0	5.4	–	–	–	–	–	–	–	5.4	7.1	–	–	–	–	–	–	–
11-1, 86-88	0.53	–	1.8	–	–	–	–	–	1.8	–	7.0	–	–	–	–	–	–	–	–
12-1, 120-122	91.15	–	–	–	0.3	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–
13-1, 128-130	45.45	++	+	–	+	–	–	–	–	–	+	+	–	–	–	–	–	–	–
14-1, 128-130	25.00	–	–	–	–	–	–	–	–	–	+	+	–	–	–	–	–	–	–
15-1, 128-130	0.20	–	8.0	2.0	2.0	–	–	–	4.0	–	2.0	2.0	–	–	–	–	–	–	–
Site 375																			
2-4, 1-3	0.23	3.7	–	1.1	4.8	0.7	0.4	–	8.9	–	0.7	–	1.1	0.7	–	–	1.5	–	–
4-4, 99-101	54.55	–	–	–	0.3	–	–	–	–	–	0.3	–	–	–	–	–	–	–	–
5-4, 98-100	83.78	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	–	–
6-1, 117-119	3.24	4.7	0.4	0.7	21.1	4.3	0.7	0.7	40.2[x]	1.4	6.8	1.4	–	0.4	–	0.4	1.8	–	0.4
6-2, 93-95	6.04	7.0	–	0.7	21.8	1.8	0.4	0.4	29.9	0.7	3.5	0.7	1.1	0.7	0.4	–	1.4	–	–
6-3, 132-137	2.42	3.1	2.2	1.4	19.8	2.5	0.4	0.4	23.0	0.7	9.3	4.0	0.4	0.4	–	0.4	1.1	–	–
6-4, 62-64	2.28	8.8	5.4	1.0	18.9	6.1	0.3	0.3	25.0	0.3	7.4	1.0	–	0.3	–	–	0.7	0.3	–
7-1, 110-112	0.88	1.0	1.0	0.7	2.1	1.7	0.7	–	1.0	3.4	24.3	22.3	–	–	–	–	–	–	–
7-5, 40-42	2.99	–	–	–	0.7	–	–	–	1.0	1.0	14.5	9.0	–	–	–	–	–	–	–
8-3, 52-54	15.17	1.8	6.1	–	–	1.8	–	–	2.6	3.5	40.3	17.5	0.9	–	–	–	1.8	–	–
9-1, 98-100	46.88	–	–	–	0.3	–	–	–	0.3	–	0.3	0.7	–	–	–	–	–	–	–
10-2, 114-116	0.04	0.5	0.9	–	0.9	–	–	–	0.5	–	1.9	2.4	–	0.5	–	–	0.5	–	–
11-1, 133-135	0.06	–	–	–	4.0	2.0	2.0	2.0	–	–	4.0	–	–	–	–	–	–	–	–

TABLE 6 – *Continued*

			Volcanogenic										Bio-genic	Authigenic, Chemogenic							
Chloritoid	Disthene	Monazite and Other Rare Minerals	Carbonates	Weathered Grains	Monoclinic Pyroxenes	Rhombic Pyroxenes	Olivine, Iddingsite	Spinel	Ash, Basalt and Rocks Fragments	Brown Glasses	Colorless Glasses	Palagonite	Teeth, Bones	Carbonates	Barite	Zeolites	Phosphates	Glauconite	Fe-Mn Concretions	Sulfides	Total (%)
–	–	–	–	–	1.3	–	–	–	–	–	–	–	0.4	–	–	–	–	–	–	67.4	99.9
–	–	–	–	1.9	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	0.3	99.8
–	–	–	–	1.7	–	–	–	–	–	–	–	–	0.3	1.4	–	–	–	–	–	1.0	99.9
–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	65.0	100.0
–	–	–	–	7.5	0.8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	82.5	99.8
–	–	–	1.1	–	0.3	0.7	–	–	–	–	–	–	–	0.3	–	–	–	–	–	93.6	99.8
–	–	–	–	–	–	–	–	–	1.7	–	–	–	–	1.7	–	–	–	–	–	36.7	100.1
–	–	–	0.8	–	11.3	0.8	–	–	1.6	–	0.8	–	–	3.3	–	–	–	–	–	10.5	99.9
–	–	–	1.0	0.8	–	–	–	–	–	–	–	–	–	0.6	–	–	–	–	–	2.1	99.8
–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.4	–	–	–	–	–	21.0	100.0
–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	91.0	99.9
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	95.4	99.9
–	–	–	–	1.8	–	–	–	–	–	–	–	–	17.8	–	–	–	–	–	–	1.3	100.2
–	–	–	–	–	1.7	–	–	–	–	–	–	–	3.5	3.5	–	–	–	–	–	14.1	99.8
–	–	–	–	–	–	–	–	–	–	–	1.5	–	66.7	–	–	–	–	–	3.0	3.0	99.8
–	–	–	–	2.6	0.4	–	–	–	–	–	–	–	2.6	–	–	–	–	–	1.2	65.2	99.8
–	–	–	–	–	–	–	–	–	–	–	–	–	++	–	–	–	–	–	–	+	+
–	–	–	–	–	–	–	–	–	+	–	–	–	+	–	–	–	–	–	–	–	+
–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	+
–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	+
–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	+
–	–	2.0	–	10.0	–	–	–	–	–	–	–	–	10.0	–	–	–	–	–	–	–	+
–	–	–	–	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–	+
–	–	–	–	10.0	–	–	–	–	2.0	–	–	–	2.0	–	–	–	–	–	–	2.0	100.0
–	–	–	–	+	–	–	–	–	–	–	+	–	+	–	–	–	–	–	–	+	+
–	–	–	–	+	–	–	–	–	–	–	–	–	+	–	–	–	–	–	+	+	+
–	–	–	–	6.0	–	–	–	–	–	–	2.0	–	36.0	–	–	–	–	–	–	–	100.0
–	–	–	–	–	–	–	–	–	–	–	–	–	5.4	1.8	–	–	–	–	–	3.6	100.0
–	–	–	–	–	–	–	–	–	–	–	–	–	82.9	0.7	–	–	–	–	3.6	7.1	99.7
–	–	–	–	–	–	1.7	–	–	–	–	–	–	48.3	1.7	–	–	–	–	–	36.2	99.9
–	–	–	–	–	0.5	–	–	–	2.1	–	–	–	89.8	–	–	–	–	–	–	1.1	99.9
–	–	–	–	–	–	–	–	–	1.5	–	–	–	66.2	–	–	–	–	–	–	10.8	100.0
–	–	–	–	–	–	–	–	–	0.4	–	0.4	–	73.4	0.4	–	–	–	–	–	12.2	99.9
–	–	–	–	–	–	–	–	–	–	–	–	–	40.0	1.8	–	–	–	–	–	12.3	99.8
–	–	–	–	21.4	–	–	–	–	7.1	–	–	–	41.1	1.8	–	–	–	–	–	1.8	100.1
–	–	–	–	–	–	–	–	–	–	–	–	–	3.5	–	–	–	–	–	–	86.0	100.1
–	–	–	–	0.7	–	–	–	–	–	–	0.3	–	–	–	–	–	–	–	–	98.4	100.0
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	++	–
–	–	–	–	+	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	++	–
–	–	–	–	–	–	–	–	–	2.0	–	–	–	–	2.0	–	–	–	–	–	76.0	100.0
–	–	1.5	–	–	6.7	0.7	–	1.9	1.5	–	–	–	2.6	1.5	–	–	–	–	–	60.0	100.0
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	99.6	100.2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	99.7	100.0
0.7	–	–	–	–	1.8	0.4	–	–	6.8	–	–	–	–	2.9	–	–	–	–	–	1.8	99.8
0.7	0.4	–	–	9.2	4.9	–	–	0.4	4.9	–	–	–	–	6.3	–	–	–	–	–	2.8	100.1
0.4	–	0.4	–	10.1	1.4	0.4	–	0.4	4.7	–	–	–	0.4	7.5	–	–	–	–	–	5.4	100.4
1.0	–	–	–	6.8	2.4	–	–	0.7	4.4	–	–	–	–	4.7	–	–	–	–	–	4.1	99.9
–	–	0.3	–	18.2	–	–	–	0.3	–	–	–	–	2.1	3.1	–	–	–	–	–	17.8	100.0
–	–	–	–	3.1	–	–	–	–	–	–	–	–	0.3	1.7	–	–	–	–	–	68.6	99.9
–	–	–	–	7.9	–	–	–	0.9	2.6	–	–	–	0.8	7.0	–	–	–	–	–	4.4	100.0
–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	98.4	100.0
–	0.5	–	–	1.9	–	–	–	–	0.9	–	–	–	86.3	0.5	–	–	–	–	–	1.9	100.1
–	–	–	–	14.0	4.0	–	–	–	–	–	2.0	–	46.0	4.0	–	–	–	–	–	16.0	100.0

TABLE 6 – *Continued*

Sample (Interval in cm)	Heavy Sub-fraction (%)	Ore Black	Hydrogoethite	Leucoxene	Common Hornblende	Actinolite-Tremolite, etc.	Alkaline Amphiboles	Basaltic Hornblende	Epidote-Clinozoizite, Zoizite	Biotite	Chlorite	Muscovite	Zircon	Apatite	Sphene	Rutile	Garnet	Tourmaline	Staurolite
Site 376																			
1-1, 99-101	0.83	1.3	0.7	–	3.3	0.7	–	0.7	13.7	–	2.6	–	0.7	–	–	–	–	–	–
1-3, 99-103	0.41	7.7	2.1	–	11.8	6.9	–	0.7	31.2	–	3.5	0.7	0.7	0.7	–	–	–	–	–
2-1, 125-127	1.94	–	–	–	0.7	1.8	–	–	0.4	4.1	0.4	0.4	–	–	–	–	–	–	–
2-3, 118-120	5.75	–	–	–	–	–	–	–	–	0.7	–	–	–	–	–	–	–	–	–
3-1, 125-127	0.20	0.3	0.3	–	3.1	1.7	–	–	1.0	28.5	0.3	2.1	0.3	–	–	–	0.3	–	–
3-3, 99-101	0.35	–	1.0	–	1.0	–	–	–	19.8	4.9	1.0	1.0	–	–	–	–	–	–	–
4-1, 98-100	0.53	40.8	29.6	–	5.2	0.9	–	–	7.0	3.5	0.9	–	–	–	–	–	–	–	–
5-1, 95-97	1.31	0.4	2.5	–	3.9	1.8	–	–	9.5	–	0.4	–	–	–	–	–	–	–	–
8-1, 128-130	0.90	23.6	–	0.7	17.0	0.8	0.7	–	16.2	1.5	4.1	0.4	0.7	0.4	0.4	–	3.3	0.4	–
8-3, 119-121	1.37	24.0	3.1	–	21.9	1.0	–	–	18.1	0.7	2.4	–	1.0	0.7	–	–	1.7	–	–
9-1, 84-86	1.22	1.4	–	0.3	15.9	2.1	–	–	15.2	1.7	1.0	0.7	0.7	0.7	–	0.3	1.4	0.3	0.3
9-3, 121-123	0.09	–	0.3	–	1.3	1.0	–	–	–	70.2	1.3	3.4	0.3	–	–	–	–	–	–
10-1, 124-126	0.28	8.2	6.7	2.6	16.8	4.9	–	0.4	25.0	5.6	3.4	0.7	0.7	0.4	–	0.7	2.2	–	–
11-1, 137-139	0.86	11.3	7.5	0.8	21.0	1.5	–	–	14.3	0.8	3.0	0.8	0.8	0.8	–	0.8	4.5	0.8	–
12-1, 146-148	0.95	8.4	–	0.4	5.5	3.6	–	–	19.4	0.4	0.7	0.4	0.4	1.1	–	–	0.7	–	–
12-3, 93-95	0.20	2.5	1.8	3.5	16.3	8.2	0.4	–	15.2	2.2	3.5	1.1	–	0.4	–	–	0.4	–	–
13-1, 100-102	0.32	10.7	1.0	0.7	15.3	2.4	–	–	20.9	2.1	1.4	1.4	0.3	1.4	0.3	0.3	2.1	0.7	–
13-3, 78-80	0.30	5.1	0.4	–	20.2	7.0	–	0.7	24.6	0.4	3.3	1.5	0.4	0.4	–	–	0.4	0.4	–
15-1, 132-134	0.47	6.7	–	0.7	11.9	3.9	–	0.3	24.9	0.3	0.9	1.4	–	–	–	–	3.1	–	–
15-2, 31-33	0.11	4.4	–	1.7	17.0	2.2	0.4	–	29.7	–	1.7	2.6	–	0.4	–	–	0.4	–	–
Site 377																			
1-1, 99-101	1.52	–	2.4	1.2	1.2	–	–	–	1.2	1.2	85.3	1.2	–	–	–	–	–	–	–
1-2, 48-50	0.20	4.4	2.9	2.9	4.3	–	–	–	2.9	–	30.4	4.3	–	–	–	–	–	–	–
1-2, 101-103	2.04	–	1.5	–	3.0	–	–	–	–	–	9.1	1.5	–	–	–	1.5	–	–	–
3-1, 120-122	38.60	–	–	–	0.7	–	–	–	0.7	–	–	–	–	–	–	–	–	–	–
3-2, 62-64	24.44	–	0.3	0.3	–	–	–	–	0.7	0.3	0.3	–	0.3	–	–	–	–	–	–
3-2, 80-82	1.50	1.3	–	–	–	–	–	–	–	1.3	17.1	2.6	–	–	–	–	–	–	–
3-2, 101-103	2.40	0.3	–	–	–	0.6	–	–	0.9	–	0.3	–	–	–	–	–	–	–	–
3-2, 120-122	2.00	+	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	–	–
4-1, 76-78	6.78	1.5	2.2	–	–	–	–	–	0.4	–	0.7	0.4	–	–	–	–	0.4	–	–
4-1, 120-122	3.53	1.3	4.2	0.3	0.3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
4-2, 40-42	5.74	5.8	14.4	2.5	–	–	–	–	0.4	–	0.4	–	–	–	–	–	–	–	–
4-2, 80-82	5.40	7.0	16.3	–	–	–	–	–	–	0.6	1.9	0.6	–	–	–	–	–	–	–
4-2, 120-122	3.44	7.6	8.9	2.3	–	–	–	–	0.8	0.5	1.5	0.5	–	–	–	0.5	0.8	–	–
4-3, 20-22	5.00	10.7	6.5	0.7	–	–	–	–	0.4	–	1.0	0.4	–	–	–	–	0.4	–	0.4
4-3, 40-42	2.17	11.8	3.2	–	0.4	–	–	–	0.4	–	0.4	0.4	0.4	0.4	–	–	–	–	–
4-3, 80-82	5.78	16.0	3.4	0.9	–	–	–	–	0.4	0.4	1.3	0.4	0.4	–	–	–	–	0.4	–
4-4, 20-22	3.93	8.1	1.5	–	–	0.4	–	–	1.5	–	0.4	–	0.4	–	–	–	0.7	–	–
4-4, 80-82	2.00	9.6	0.4	0.4	0.4	–	–	–	0.4	–	–	–	–	0.4	–	–	0.4	–	–
4-4, CC	2.50	8.0	4.5	–	0.4	–	–	–	–	–	0.4	–	–	–	–	–	–	–	–
Site 378																			
1-1, 101-103	11.90	0.3	–	–	0.7	0.6	0.7	0.3	4.4	–	1.7	0.7	0.3	–	–	–	–	–	–
2-2, 98-100	11.19	0.3	0.7	0.3	1.5	–	–	–	0.3	0.7	1.1	–	–	–	–	–	0.6	–	–
3-2, 98-100	2.88	0.3	0.3	–	0.7	0.3	0.3	0.3	1.7	1.0	0.7	0.3	–	–	–	–	0.3	–	–
5-2, 99-101	4.58	0.3	–	–	0.6	–	0.3	0.3	1.8	0.3	1.2	0.6	–	–	–	–	–	–	–
6-2, 97-99	2.84	6.7	0.7	–	9.4	0.3	0.7	–	1.7	2.8	0.7	0.7	0.3	0.3	0.3	–	–	–	–
7-2, 104-106	2.71	0.3	–	–	2.3	–	0.7	–	4.3	0.7	1.7	1.3	0.3	–	–	–	0.3	–	–
8-2, 100-102	2.44	0.7	0.3	–	0.7	0.3	–	–	0.7	2.5	0.7	0.3	–	–	–	–	0.7	–	–

Note: 1 – content of heavy (sp. weight >2.9) subfraction; 2-27 – terrigenous matter; 2 – ore opaque minerals (ilmenite, magnetite, titano-magnetite, chromite); 3 – leucoxene.

TABLE 6 – *Continued*

			Volcanogenous										Biogenic	Authigenic, Chemogenic							
Chloritoid	Disthene	Monazite and Other Rare Minerals	Carbonates	Weathered Grains	Monoclinic Pyroxenes	Rhombic Pyroxenes	Olivine, Iddingsite	Spinel	Ash, Basalt and Rocks Fragments	Brown Glasses	Colorless Glasses	Palagonite	Teeth, Bones	Carbonates	Barite	Zeolites	Phosphates	Glauconite	Fe-Mn Concretions	Sulfides	Total (%)
–	–	1.4	–	29.4	1.3	–	–	0.7	–	–	–	–	–	2.6	–	–	–	–	–	41.2	100.3
–	–	0.7	–	7.6	7.6	0.7	0.7	0.7	3.5	0.7	2.1	–	1.4	2.1	–	–	–	–	–	6.2	100.0
–	–	–	–	4.5	2.2	–	–	–	–	–	1.1	–	–	–	–	–	–	–	–	84.3	99.9
–	–	–	–	–	–	–	–	–	–	–	–	–	0.9	–	–	–	–	–	–	98.4	100.0
–	–	–	–	2.4	3.1	0.3	–	–	–	–	1.0	–	–	0.3	–	–	–	–	–	54.6	99.6
–	–	–	–	–	–	1.0	–	–	–	–	–	–	–	1.0	–	–	–	–	–	69.3	100.0
–	–	–	–	2.6	–	–	–	–	–	–	–	–	–	0.9	–	–	–	–	–	8.7	100.1
–	–	0.4	–	–	1.8	–	–	0.7	–	–	–	–	0.4	0.4	–	–	–	0.4	–	77.8	100.4
0.4	–	0.4	–	0.7	3.0	0.7	–	1.1	4.8	–	–	–	0.4	6.6	–	–	–	–	–	12.2	100.2
–	–	0.4	–	5.5	12.7	0.3	–	1.7	2.4	–	–	–	–	1.4	–	–	–	–	–	1.0	99.9
–	–	–	–	3.8	1.4	0.3	–	–	–	–	–	–	–	5.5	–	–	–	–	–	47.2	100.2
–	–	–	–	10.1	0.7	0.3	–	–	–	–	1.3	–	–	1.7	–	–	–	–	–	8.1	100.0
–	–	0.4	–	4.5	4.1	1.5	–	0.7	3.0	–	0.4	–	0.4	6.0	–	–	–	–	–	0.7	100.0
–	–	–	–	6.0	4.5	0.8	–	–	1.5	–	–	–	–	15.8	–	–	–	–	–	3.0	100.3
–	–	–	–	4.0	1.8	0.7	–	12.0	6.6	–	–	–	0.7	8.0	–	–	–	–	–	25.2	100.0
–	0.4	–	–	7.8	–	0.4	–	2.8	7.8	0.4	0.4	–	5.0	17.7	–	–	–	–	–	2.1	100.3
–	–	–	–	8.0	–	0.3	–	2.8	8.4	–	–	–	8.4	7.7	–	–	–	–	–	31.0	99.7
0.4	–	1.5	–	4.0	0.7	0.4	–	1.5	10.3	–	–	–	4.4	9.9	–	–	–	–	–	2.2	100.1
–	–	0.3	–	5.6	7.0	1.8	–	23.2	2.8	–	–	–	2.8	2.1	–	–	–	–	–	–	99.7
–	–	–	–	10.0	4.8	1.3	–	9.6	1.3	–	–	–	6.1	6.1	–	–	–	–	–	–	99.7
–	–	–	–	2.4	–	–	–	–	–	–	–	–	1.2	1.2	–	–	–	–	–	1.2	99.7
–	–	–	–	27.5	–	1.5	–	–	–	–	–	–	–	2.9	–	–	–	–	–	15.9	99.9
–	–	–	–	13.6	–	–	–	–	–	–	–	–	1.5	–	–	–	–	–	–	68.1	99.8
–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.7	–	–	–	–	–	97.9	100.0
–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	97.5	100.0
–	–	–	–	22.3	–	–	–	–	–	–	1.3	–	3.9	1.3	–	–	–	–	–	48.7	99.8
–	–	–	–	0.7	0.3	–	–	–	–	–	–	–	0.7	0.7	–	–	–	–	–	95.6	100.1
–	–	–	–	+	–	–	–	–	–	–	–	–	–	+	–	–	–	–	–	++	–
–	–	–	–	–	–	–	–	–	–	–	–	–	0.4	0.4	0.7	–	–	–	–	92.9	100.0
–	–	–	–	–	–	–	–	–	–	–	–	–	0.3	–	0.3	–	–	–	–	93.3	100.0
–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.7	0.7	–	–	–	–	75.0	99.9
–	–	–	–	6.3	0.6	–	–	–	1.3	–	1.9	–	–	5.2	0.6	–	–	–	–	57.4	99.7
–	–	–	–	11.3	–	–	–	–	–	–	–	–	0.5	1.8	2.6	–	–	–	–	60.6	100.2
–	–	–	–	3.6	–	–	–	–	–	–	–	–	0.7	0.4	0.7	–	–	–	–	73.9	99.8
–	–	–	–	5.2	–	–	–	0.4	–	–	–	–	0.4	1.6	1.2	–	–	–	–	73.6	99.8
–	–	–	–	5.6	–	–	–	–	–	–	–	–	–	1.3	1.3	–	–	–	–	68.1	99.9
–	–	–	–	3.6	0.4	–	–	–	–	–	–	–	–	0.7	3.0	–	–	–	–	79.6	100.3
0.8	–	0.4	–	1.1	0.4	–	–	–	–	–	–	–	0.4	0.8	1.1	–	–	–	–	84.0	100.0
–	–	–	–	1.1	–	–	–	–	–	–	–	–	0.4	–	1.5	–	–	–	–	83.7	100.0
–	0.3	0.3	–	–	–	–	–	–	–	–	–	–	–	0.3	0.3	–	–	–	–	88.8	99.7
–	–	–	–	–	–	–		–	–	–	0.3	–	0.7	–	–	–		–	–	93.2	99.7
–	–	–	–	2.2	–	–		–	–	–	–	–	0.3	0.3	–	–		–	–	90.7	99.7
–	–	–	–	0.3	–	–		–	–	–	–	–	0.6	0.3	–	–		–	–	93.2	99.8
–	–	–	–	–	–	–	–	0.3	–	–	–	–	–	0.3	–	–	–	–	–	74.9	100.1
–	–	0.3	–	0.7	–	–	–	–	0.7	–	–	–	0.7	0.7	–	–	–	–	–	84.9	99.9
–	–	–	–	–	0.3	–	–	–	0.3	–	0.3	–	1.1	0.3	–	–	–	–	–	90.7	99.9

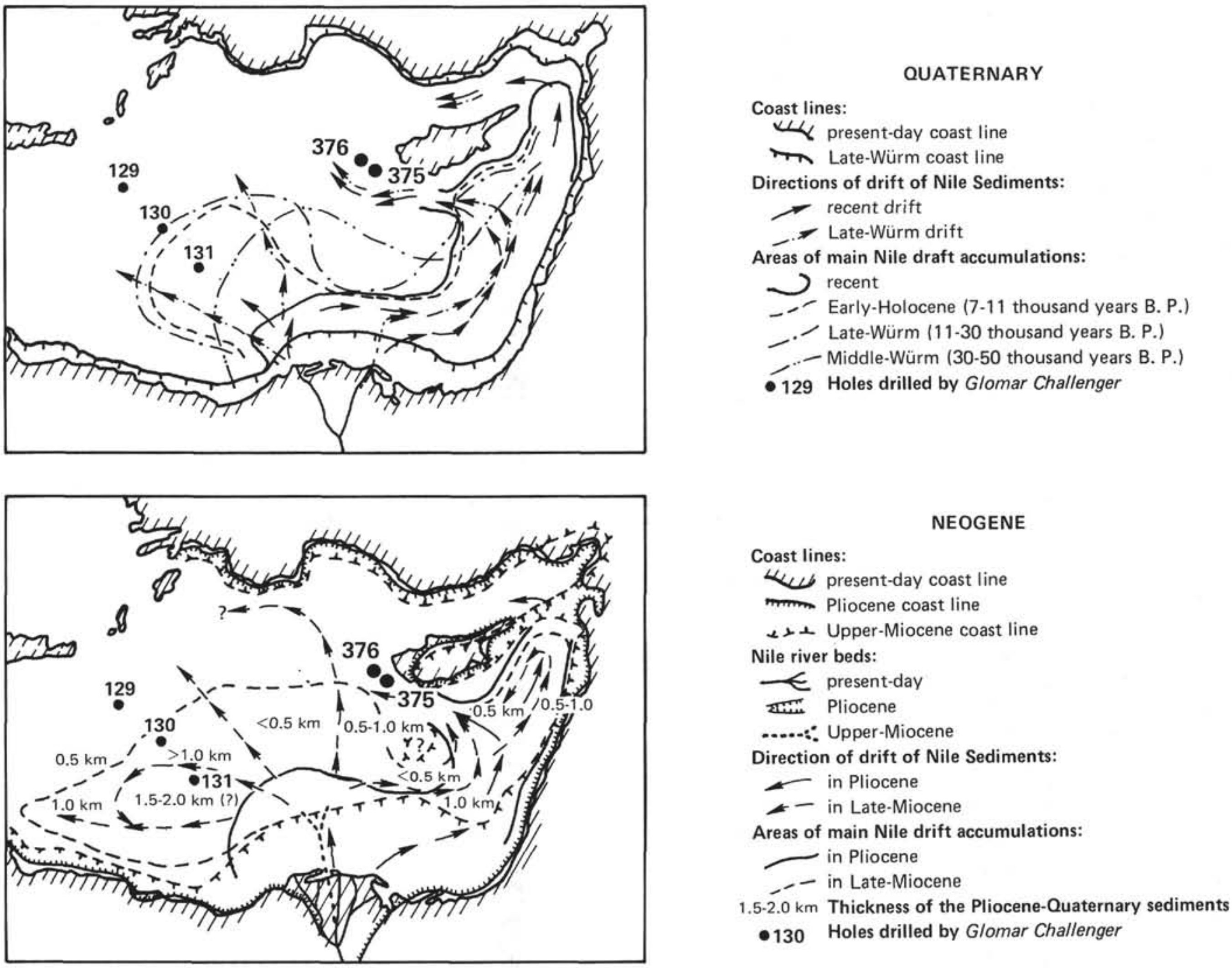

Figure 2. *Diagram (compiled by E. M. Emelyanov and K. M. Shimkus) of the distribution of Nile sediment loads in the Mediterranean Sea at different stages of Quaternary (Q) and Neogene (N) periods (Malovitsky et al., 1975).*

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TABLE 7
Mineral Composition (%) of Light Subfraction 0.1-0.05 mm of the Sediments, Leg 42A

Sample (Interval in cm)	Minerals																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Site 374																										
1-1, 123-125	1.6	–	0.3	–	1.0	–	–	13.6	2.4	1.0	–	–	–	43.2	36.7	–	–	–	–	–	–	–	–	–	–	99.8
2-1, 93-95	2.7	–	8.3	12.0	9.0	–	–	10.3	2.7	2.4	–	–	–	49.3	–	–	–	–	–	1.4	2.0	–	–	–	–	100.1
2-2, 132-134	2.7	–	22.9	5.3	14.3	–	–	0.7	–	0.3	–	–	–	49.5	–	–	–	–	–	4.0	0.3	–	–	–	–	100.0
2-3, 114-116	17.1	–	9.9	3.4	10.6	–	–	13.0	5.1	3.4	–	–	–	29.0	–	–	–	–	–	1.7	6.8	–	–	–	–	100.0
3-1, 135-137	25.1	–	0.3	0.3	1.0	–	–	1.0	0.6	0.3	–	–	–	71.2	–	–	–	–	–	–	–	–	–	–	–	99.9
4-1, 140-142	34.0	0.3	0.3	–	1.3	–	–	26.6	4.2	3.5	+	–	–	20.5	–	+	–	–	–	–	9.3	–	–	–	–	100.0
4-2, 142-144	38.9	–	2.7	1.5	7.6	–	–	20.2	2.7	3.6	3.6	0.3	–	12.9	1.1	0.3	–	–	–	–	4.2	0.3	0.3	–	–	100.2
4-3, 140-142	1.7	–	–	–	2.7	–	–	16.1	8.7	7.7	–	–	–	54.2	4.7	–	–	–	–	–	3.7	–	0.6	–	–	100.1
4-4, 123-125	–	1.7	32.0	2.0	17.5	–	–	10.1	1.7	2.7	–	–	–	23.9	3.0	0.3	–	–	–	1.0	3.4	–	0.7	–	–	100.0
5-1, 126-128	–	2.0	0.3	–	3.1	–	–	2.8	–	0.7	–	–	–	81.2	8.2	–	–	–	–	0.3	1.4	–	–	–	–	100.0
5-2, 127-129	0.3	–	–	–	0.7	–	–	1.4	0.3	0.3	–	–	–	96.9	–	–	–	–	–	–	–	–	–	–	–	99.9
5-3, 136-138	–	1.6	–	–	0.9	–	–	1.3	–	0.6	–	–	–	94.6	0.6	–	–	–	0.3	–	–	–	–	–	–	99.9
5-4, 127-129	0.7	–	–	–	1.8	–	–	1.1	0.7	–	–	–	–	95.4	–	–	–	–	0.3	–	–	–	–	–	–	100.0
5-5, 136-138	0.3	–	–	–	–	–	–	0.7	0.3	–	–	–	–	98.1	–	–	–	–	0.3	–	–	–	0.3	–	–	100.0
6-1, 126-128	0.7	–	–	–	–	–	–	0.3	0.3	0.3	–	–	–	98.4	–	–	–	–	–	–	–	–	–	–	–	100.0
6-2, 110-112	0.3	–	–	–	1.5	–	–	2.1	–	–	–	–	–	95.5	–	–	–	–	0.3	–	–	–	0.3	–	–	100.0
6-3, 119-121	0.3	–	–	–	0.3	–	–	0.3	–	–	–	–	–	98.4	–	–	–	–	0.7	–	–	–	–	–	–	100.0
6-4, 117-119	0.3	–	–	–	1.7	–	–	0.3	–	–	–	–	–	97.6	–	–	–	–	–	–	–	–	–	–	–	99.9
6-5, 123-125	0.3	–	–	0.3	0.3	–	–	–	–	–	–	–	–	99.1	–	–	–	–	–	–	–	–	–	–	–	100.0
6-6, 128-130	–	–	–	–	0.6	–	–	–	–	–	–	–	–	98.7	–	–	–	–	0.6	–	–	–	–	–	–	99.9
7-1, 112-114	–	–	–	–	0.3	–	–	–	–	–	–	–	–	98.8	–	–	–	–	0.9	–	–	–	–	–	–	100.0
7-2, 111-113	1.0	–	–	–	1.0	–	–	0.3	–	0.7	0.3	–	–	96.2	–	–	–	–	–	–	–	–	–	–	–	99.8
7-3, 117-119	–	0.3	–	–	0.3	–	–	–	–	–	–	–	–	99.4	–	–	–	–	0.3	–	–	–	–	–	–	100.0
7-4, 125-127	0.3	–	0.3	–	0.6	–	–	2.7	–	–	–	–	–	95.2	–	–	–	–	0.3	–	0.3	–	0.3	–	–	100.0
7-5, 125-127	0.6	–	–	0.6	0.3	–	–	0.6	–	0.3	–	–	–	97.0	–	–	–	–	0.3	–	0.3	–	–	–	–	100.0
7-6, 132-134	0.3	–	–	–	0.3	–	–	0.3	–	–	–	–	–	99.1	–	–	–	–	–	–	–	–	–	–	–	100.0
8-1, 136-138	–	–	0.3	–	0.3	–	–	0.3	–	–	–	–	–	98.8	–	–	–	–	0.3	–	–	–	–	–	–	100.0
8-2, 120-122	0.3	–	–	–	0.9	–	–	0.6	0.3	0.3	–	–	–	96.8	–	–	–	–	–	–	0.6	–	–	–	–	99.8
8-3, 143-145	–	–	–	–	–	–	–	–	–	–	–	–	–	99.7	–	–	–	–	0.3	–	–	–	–	–	–	100.0
8-4, 127-129	–	0.4	–	–	–	–	–	0.7	–	–	–	–	–	97.8	–	–	–	–	0.4	–	0.7	–	–	–	–	100.0
9-1, 135-137	0.3	–	0.3	–	0.6	–	–	0.7	–	–	–	–	–	97.8	–	–	–	–	0.3	–	–	–	–	–	–	100.0
9-2, 144-146	0.3	–	–	0.3	0.3	–	–	0.3	–	–	0.3	–	–	97.9	–	–	–	–	0.6	–	–	–	–	–	–	100.0
9-3, 4-6	–	–	–	–	0.3	–	–	–	–	–	–	–	–	99.4	–	–	–	–	0.3	–	–	–	–	–	–	100.0
9-4, 135-137	0.3	–	0.3	–	0.6	–	–	0.9	–	–	–	–	–	97.3	–	–	–	–	0.6	–	–	–	–	–	–	100.0
10-1, 146-148	–	–	–	–	–	–	–	0.3	–	–	–	–	–	99.4	–	–	–	–	0.3	–	–	–	–	–	–	100.0
11-1, 86-88	–	–	0.4	0.4	2.2	–	–	2.9	–	0.4	–	–	–	93.5	–	–	–	–	0.4	–	–	–	–	–	–	100.2
12-1, 120-122	10.4	19.5	3.2	–	3.2	–	–	9.7	–	2.6	1.3	–	–	45.5	–	0.7	–	–	1.9	–	0.7	–	–	–	1.3	100.0
13-1, 128-130	9.8	7.3	2.4	–	6.1	–	1.2	40.2	1.2	4.9	–	–	–	22.0	–	–	–	–	–	1.2	3.7	–	–	–	–	100.0
14-1, 128-130	0.5	2.6	0.5	0.5	1.0	0.5	0.4	15.9	1.0	2.6	1.0	–	–	68.2	–	–	–	–	–	2.5	1.5	–	–	–	1.0	99.8
15-1, 128-130	71.4	–	1.4	2.1	3.5	–	–	4.6	1.1	6.7	0.4	–	–	4.3	–	–	–	–	–	1.4	2.5	0.4	0.4	–	–	100.2
Site 375																										
2-4, 1-3	8.1	0.7	0.4	2.2	1.5	0.7	–	1.8	0.7	1.1	–	–	–	81.2	–	–	–	–	0.7	–	0.4	–	–	–	0.4	99.9
4-9, 99-101	6.8	5.8	0.6	1.0	1.3	1.0	–	1.3	0.6	1.6	–	–	–	74.3	–	0.6	–	–	–	1.9	1.6	0.6	–	–	1.0	100.0
5-4, 98-100	–	0.6	0.3	–	1.6	–	–	1.2	0.6	1.2	0.9	–	–	92.9	0.3	–	–	–	–	–	0.3	–	–	–	–	99.9
6-1, 117-119	5.1	16.4	0.4	5.8	3.3	1.5	–	18.2	8.7	3.6	–	–	–	21.5	–	–	–	–	–	–	15.6	–	–	–	–	100.1
6-2, 93-95	1.1	20.5	0.4	6.0	6.7	1.8	–	7.7	2.5	8.8	–	–	–	19.1	–	–	–	–	–	–	25.0	–	–	–	–	99.6
6-3, 132-137	1.1	13.8	1.8	7.8	8.5	–	–	13.1	8.8	5.7	–	–	–	12.0	–	–	–	–	–	–	27.6	–	–	–	–	100.2
6-4, 62-64	8.2	15.2	0.7	7.4	5.3	1.1	–	15.2	8.2	3.9	–	–	–	17.1	–	–	–	–	–	–	17.7	–	–	–	–	100.0
7-1, 110-112	2.1	–	1.1	3.2	3.9	–	–	10.6	3.5	2.8	–	–	–	49.5	12.7	–	–	–	–	–	10.6	–	–	–	–	100.0
7-5, 40-42	6.6	17.1	2.4	7.7	8.7	–	–	4.8	2.8	5.9	–	–	–	34.9	2.1	–	–	–	–	–	6.6	–	–	–	–	99.7
8-3, 52-54	4.8	20.3	3.0	6.2	7.4	–	–	15.5	6.3	4.1	2.2	–	–	20.6	–	–	–	–	0.7	–	8.9	–	–	–	–	100.0

TABLE 7 – *Continued*

9-1, 98-100	–	48.6	2.2	2.8	4.4	–	–	6.1	2.2	1.7	0.6	–	–	26.5	–		–	–	–	–	5.0	–	–	–	–	100.1
10-2, 114-116	–	–	0.4	–	0.4	–	–	0.7	0.4	–	0.7	–	–	97.0	0.4		–	–	–	–	–	–	–	–	–	100.0
11-1, 133-135	–	–	–	–	–	–	–	0.3	–	–	–	–	–	98.8	–	–	–	–	0.9	–	–	–	–	–	–	100.0

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1-1, 99-101	4.0	–	–	2.8	1.5	–	–	2.5	0.3	0.3	1.5	–	–	85.2	0.9	–	–	–	0.6	–	0.3	–	–	–	–	99.9
1-3, 99-101	3.5	–	–	1.1	0.4	–	–	3.5	1.4	0.7	37.4	–	–	51.8	–	–	–	–	–	–	0.4	–	–	–	–	100.2
2-1, 125-127	1.8	–	–	0.7	1.5	–	–	1.5	–	0.4	77.4	–	–	14.6	0.7	–	–	0.4	–	–	1.1	–	–	–	–	100.1
2-3, 118-120	7.8	–	–	–	0.4	–	–	–	–	–	–	–	–	91.5	–	–	–	–	0.4	–	–	–	–	–	–	100.1
3-1, 125-127	0.3	–	–	–	3.0	–	–	1.6	1.3	0.7	85.5	–	–	7.2	–	–	–	0.3	–	–	–	–	–	–	–	99.9
3-3, 99-101	0.7	–	–	1.0	0.7	–	–	0.7	0.7	0.3	0.3	–	–	95.6	–	–	–	–	–	–	–	–	–	–	–	100.0
4-1, 98-100	1.0	–	–	1.7	1.0	–	–	2.1	1.0	–	–	–	–	92.8	–	–	–	–	–	–	0.3	–	–	–	–	99.9
5-1, 95-97	7.2	–	0.4	1.4	1.4	0.4	–	0.7	0.4	0.4	–	–	–	86.6	–	–	–	–	0.4	–	0.7	–	–	–	–	100.0
8-1, 128-130	–	6.9	1.1	4.7	6.2	–	–	12.4	15.7	8.8	0.4	–	–	21.9	–	–	–	–	–	–	21.2	–	–	–	0.7	100.0
8-3, 119-121	–	3.4	0.7	12.6	0.7	–	–	19.0	8.5	11.2	–	–	–	26.9	–	–	–	–	–	–	17.0	–	–	–	–	100.0
9-1, 84-86	–	6.1	0.4	6.5	1.8	0.4	–	18.7	11.5	6.5	–	–	–	27.0	–	–	–	–	–	–	20.5	–	–	–	0.7	100.1
9-3, 121-123	46.7	–	1.8	4.0	1.8	–	–	3.3	1.1	0.7	0.4	–	–	36.4	–	–	–	–	–	–	2.6	1.1	–	–	0.7	100.6
10-1, 124-126	–	5.4	1.3	1.7	2.4	–	–	18.2	8.4	14.5	0.3	–	–	26.3	–	–	–	–	–	–	21.2	–	–	–	0.3	100.0
11-1, 137-139	–	8.3	1.1	4.3	0.7	–	–	20.1	8.6	6.8	0.7	–	–	33.4	–	–	–	–	–	–	15.5	–	–	–	0.4	99.9
12-1, 146-148	–	8.9	–	10.3	1.8	2.8	–	10.3	3.9	1.8	0.4	–	–	48.4	–	–	0.4	–	0.4	–	7.8	–	–	–	0.4	100.1
12-3, 93-95	–	14.3	0.3	11.6	0.3	0.3	–	3.1	2.7	0.3	0.3	–	–	56.7	–	–	0.3	–	–	–	8.2	0.3	–	–	0.3	99.7
13-1, 100-102	–	18.7	–	2.1	0.3	–	–	5.2	4.8	0.7	–	–	–	54.3	–	–	8.0	–	–	–	5.2	–	–	–	0.3	99.9
13-3, 78-80	–	10.2	–	1.4	–	–	–	3.9	2.8	1.4	–	–	–	71.9	–	–	1.4	–	–	–	6.3	–	–	–	0.7	100.0
15-1, 132-134	–	8.1	–	20.8	0.7	–	–	2.0	2.3	–	–	–	–	58.3	–	–	–	–	0.3	–	7.0	0.3	–	–	0.3	100.1
15-2, 31-33	–	4.2	–	0.7	0.7	–	–	4.2	1.8	19.4	0.3	–	–	61.4	–	–	–	–	–	–	7.0	–	–	–	–	99.9

Site 377

1-1, 99-101	–	2.1	–	0.7	0.3	–	–	1.4	0.3	–	–	–	–	94.0	–	–	–	–	0.7	–	0.3	–	–	–	–	99.8
1-2, 48-50	–	5.1	0.3	–	–	–	–	0.3	0.3	0.3	–	–	–	93.8	–	–	–	–	–	–	–	–	–	–	–	100.1
1-2, 101-103	3.7	0.7	–	0.4	–	–	–	0.7	–	–	–	–	–	12.3	81.8	–	–	–	0.4	–	–	–	–	–	–	100.0
3-1, 120-122	23.9	1.9	0.7	2.0	0.7	0.7	–	9.3	0.4	1.6	11.8	–	–	31.9	0.4	–	–	–	–	–	14.1	–	–	–	0.4	99.8
3-2, 62-64	22.1	0.4	0.8	1.9	1.5	–	–	25.5	11.0	1.9	0.8	–	–	17.3	–	–	0.4	0.4	–	–	15.0	–	–	–	1.1	100.1
3-2, 80-82	3.2	7.8	0.3	1.1	2.2	0.3	–	25.4	5.7	2.5	0.3	–	–	36.1	1.1	–	–	–	–	0.3	13.4	–	–	–	0.3	100.0
3-2, 101-103	39.1	0.3	0.3	0.3	0.7	–	–	5.0	2.7	0.7	–	–	–	47.8	–	–	–	–	0.3	–	2.3	–	–	–	0.3	99.8
3-2, 120-122	53.7	–	0.4	1.6	0.8	–	–	5.4	3.8	0.8	3.8	–	–	24.8	–	1.2	–	–	–	0.8	2.3	–	–	–	0.4	99.8
4-1, 76-78	78.3	–	–	0.3	0.3	–	–	5.9	2.6	0.3	0.3	–	–	10.8	–	–	–	–	0.3	–	0.7	–	–	–	–	99.8
4-1, 120-122	89.4	–	–	0.6	0.7	–	–	0.9	0.7	0.3	0.7	–	–	5.1	0.3	0.3	–	–	–	0.6	0.3	–	–	–	–	99.9
4-2, 40-42	52.8	0.7	–	1.4	0.3	–	–	9.5	5.3	0.7	–	–	–	24.6	1.4	–	–	–	–	–	3.2	–	–	–	–	99.9
4-2, 80-82	62.0	1.0	0.3	0.3	1.3	–	–	12.3	5.8	2.0	1.0	–	–	7.5	–	–	–	–	–	0.3	5.8	–	0.3	–	–	99.9
4-2, 120-122	70.5	1.2	–	0.8	1.4	–	–	8.1	1.8	0.4	–	–	–	10.0	–	–	–	–	–	–	5.9	–	–	–	–	100.1
4-3, 20-22	72.8	1.0	0.4	1.2	–	0.8	–	4.2	3.1	2.4	0.4	–	–	11.1	–	–	–	–	–	–	2.3	–	–	–	–	99.7
4-3, 40-42	85.5	–	–	0.9	0.3	–	–	2.0	0.9	–	–	–	–	8.6	0.3	–	–	–	–	–	1.2	–	–	–	–	99.7
4-3, 80-82	46.4	4.9	0.3	0.9	0.7	–	–	8.5	9.2	0.3	–	–	–	21.5	–	–	–	–	–	–	6.3	–	–	–	0.4	99.7
4-4, 20-22	63.6	2.3	0.3	0.9	0.6	–	–	4.0	2.0	1.0	0.3	–	–	21.3	0.3	–	–	–	–	–	2.7	–	–	–	0.6	99.9
4-4, 80-82	72.6	0.3	0.3	1.2	0.6	–	–	4.8	2.6	0.6	0.3	–	–	15.8	–	–	–	–	–	–	0.6	–	–	–	–	99.7
4, CC	60.5	–	0.3	0.6	0.3	–	–	3.9	1.6	–	0.3	–	–	30.7	0.9	–	–	–	–	–	0.6	–	–	–	–	99.7

Site 378

1-1, 101-103	0.3	–	2.7	0.7	3.3	0.3	–	12.3	3.3	6.0	–	–	–	62.7	5.6	–	0.3	–	–	–	1.7	–	–	–	–	99.9
2-2, 98-100	–	–	0.6	0.3	1.2	0.3	–	1.6	3.2	0.3	–	–	–	90.7	0.3	–	–	–	–	–	–	–	0.6	–	–	99.8
3-2, 98-100	1.7	–	–	0.3	0.7	–	–	2.0	1.0	0.3	–	–	–	91.4	–	–	–	–	–	–	1.0	–	0.3	–	–	100.0
5-2, 99-101	0.3	1.1	0.7	0.3	0.7	–	–	1.9	2.7	1.1	1.1	–	–	84.4	–	–	1.9	2.2	–	–	0.7	–	0.3	–	0.3	99.7
6-2, 97-99	0.3	–	–	–	2.4	–	–	2.5	9.8	1.0	–	–	–	79.7	1.7	–	–	–	–	–	0.3	–	–	–	–	99.7
7-2, 104-106	–	–	1.1	0.3	1.4	–	–	3.9	4.9	0.7	–	–	–	84.5	1.8	–	–	–	–	–	0.7	–	0.7	–	–	100.0
8-2, 100-102	0.7	12.1	–	–	1.1	–	–	2.5	2.5	1.1	12.1	–	–	76.6	–	0.3	0.7	0.7	–	–	1.1	–	0.3	–	0.3	100.0

Note: Minerals: 1 – clay particles, 2 – weathered rock grains, 3 – colorless mica, 4 – yellow mica, 5 – green mica, 6 – serpentinite, 7 – rounded carbonates, 8 – quartz, 9 – feldspars (>1.545), 10 – feldspars (<1.545), 11 – colorless glasses, 12 – green glasses, brown, 13 – palagonite, 14 – foraminifera, 15 – other minerals, 16 – diatoms, 17 – radiolarians, their spines, 18 – spiculae, 19 – bones, teeth, 20 – wood, 21 – carbonates, 22 – zeolites, 23 – glauconite, 24 – phosphates, 25 – chalcedony etc., 26 – total in % from subfraction.