16. GRAIN-SIZE ANALYSIS

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PROCEDURES

The grain-size samples taken from opened sections of the cores consisted of 10 cc of sediment. Project directions for the actual sampling procedure were followed; however, personal judgment, in most cases, governed the decision as to where in the core the actual sample was taken. More often than not, specific coarse-grained silt or sand units (turbidite layers), or ash-bearing units were sampled. Therefore, the data presented in the accompanying charts and tables should not be considered as derived from a random sampling program. It is also highly probable that some of the sand units sampled had been subjected to washing during core-barrel retrieval. The data presented for these sand units should be interpreted carefully. Core sections that were highly deformed were sampled only if a distinct coarse-grained lithology was present.

The shore laboratory method of grain-size analysis followed standard methods as outlined in the DSDP project manual. In general, the methods consisted of sediment dispersal in a calgon solution, or other suitable dispersant, using an ultrasonic bath. Sand and any coarser fractions were sieved, while the silt and clay fractions were analyzed by pipette methods. There were 113 samples taken for grain-size analysis, and 23 of these samples were further analyzed for detailed size determinations in the sand- and silt-size fractions (Tables 1 and 2 and Figures 1 and 2).

NOMENCLATURE

The size analyses are plotted on a triangular diagram (Figure 1) which has sand, silt, and clay as end members (Shepard, 1954). The nomenclature used (Table 1) is also in accordance with that of Shepard (1954). The nomenclature sand, silt, and clay do not imply any compositional characteristics. Specific discussion of the compositional nature of the size fractions are considered in the following section for each site.

RESULTS

Triangular diagrams, based on the results of grain-size analyses from each site, are given in Figure 1. A complete listing of grain-size results is presented as Tables 1 and 2. Cumulative curves of the 23 detailed analyses are presented as Figure 2.

Site 239

Site 239 is in the western Mascarene Basin, 180 miles east of Madagascar, in water 4971 meters deep. Core recovery totaled 106.1 meters from a total penetration of 326 meters. At Site 239, silty clays are dominant, comprising 75 percent of the 16 grain-size samples. The remaining samples are equally divided among clays and clayey silts, at a little over 6 percent each. Two samples, or 12 percent, were classified as sandy silts. Of the 16 samples taken, 14 came from cores whose dominant lithology was that of interbeds of clays, clayey or sandy silts, and silty clays within nannofossil oozes. Two samples, from Cores 13 and 14, came from brown silty clay and clayey silt units that were the dominant lithology. Many of the interbeds from which samples were obtained did exhibit a grading described as vague to obvious. The silt-size component generally includes quartz, feldspars, and trace amounts of heavy minerals, including augite, hornblende, biotite, zircon, garnet, and rare staurolite. For all samples, the sand component contains on the average 4.4 percent (lo=0%, hi=33.7%); the silts, 40.9 percent (lo=15.1%, hi=58.2%); and the clay component contains on the average 54.7 percent, with a low of 13.6 percent to a high of 84.9 percent.

One sample from a sandy silt unit (Core 1, Section 1) was analyzed for detailed grain size in the sand-silt-clay fractions. The sample shows 28.2, 58.2, and 13.2 percent in the sand-silt-clay fractions, respectively, with the bulk of the sand fraction in the very fine sand range (26.5%). X-ray analyses, (Cook and Zemmels, this volume) correspond in depth to two grain-size samples. Both samples are nanno-bearing silty clays (Cores 3 and 8). The bulk analyses are strikingly different; the sample in Core 8 has a higher calcite-aragonite content (79.9%), a lower potassium feldspar (2.2%) and plagioclase (4.7%) content, and a lower montmorillonite content (3.0%). These trends are not true for the 2 to 20μ or less than 2μ analyses.

Heavy mineral studies on samples at this site, although not necessarily at grain-size sample depths, show amphiboles > orthopyroxenes or clinopyroxenes, along with epidote, garnet, zircon, apatite, and tourmaline.

Site 240 (Holes 240 and 240A)

Two complementary holes were drilled in the central abyssal plain of the west Somali Basin, in water depth of 5082 meters. For Hole 240, 25.1 meters of sediment was recovered from 195 meters penetration, and for Hole 240A, 3.2 meters was recovered from 202 meters of penetration. At Hole 240, eleven grain-size samples were taken of which seven were examined for detailed grain-size determinations. All samples contain on an average 55 percent sand, 17 percent clay, and 27 percent silt. The two samples for Hole 240A show an average of 55 percent sand, 40 percent clay, and 5 percent silt. Further size nomenclature for the samples of the sites are as follows: The 11 samples of Site 240 were recorded as silty clays (9%), clayey silts (18%), silty sand (9%), sand (54%), and silts (9%), and the two samples of Hole 240A were recorded as a sand and as a clay.

For the most part, the samples taken from the cores of these two sites came from silty clay or clayey silt interbeds

TABLE 1
Grain-Size Determinations, Leg 25

Sample (Top of Interval in cm)	Sand (%)	Silt (%)	Clay (%)	Classification
239-1-1, 49	0.2	36.8	63.0	Silty clay
239-1-1, 96	33.7	54.6	11.7	Sandy silt
239-1-1, 99[a]	28.2	58.2	13.6	Sandy silt
239-3-1, 132	0.1	36.9	63.0	Silty clay
239-3-2, 30	0.0	33.2	66.8	Silty clay
239-3-3, 60	0.0	45.7	54.2	Silty clay
239-4-2, 145	0.8	44.2	55.0	Silty clay
239-4-3, 30	0.4	42.5	57.1	Silty clay
239-4-4, 60	0.2	35.6	64.3	Silty clay
239-7-4, 135	0.0	48.7	51.3	Silty clay
239-8-1, 45	0.2	44.4	55.5	Silty clay
239-8-2, 138	0.6	41.5	57.9	Silty clay
239-8-5, 90	0.6	38.7	60.8	Silty clay
239-9-2, 85	0.1	28.5	71.4	Silty clay
239-13-2, 108	5.3	50.3	44.4	Clayey silt
239-14-2, 145	0.1	15.1	84.9	Clay
240-1-1, 74	8.8	29.2	62.0	Silty clay
240-1-2, 129	3.8	50.9	45.3	Clayey silt
240-1-3, 15[a]	5.1	86.0	8.9	Silt
240-1-4, 49[a]	4.6	74.5	21.0	Clayey silt
240-3-1, 27	65.5	19.3	15.1	Silty sand
240-4-2, 21[a]	66.1	19.8	14.1	Sand
240-4-2, 79[a]	96.4	0.7	2.9	Sand
240-4-2, 123[a]	97.1	0.7	2.2	Sand
240-5-2, 111	93.0	1.2	5.8	Sand
240-5-6, 121[a]	85.4	7.1	7.4	Sand
240-5-6, 136[a]	83.3	9.7	7.0	Sand
240A-1-1, 94	12.8	10.7	76.5	Clay
240A-2-1, 99	96.6	0.5	2.9	Sand
241-2-1, 42	3.0	17.5	79.5	Clay
241-3-2, 19	10.9	58.0	31.2	Clayey silt
241-3-3, 97	52.6	28.4	19.0	Silty sand
241-4-3, 93	27.1	36.8	36.1	Sand-silt-clay
241-4-5, 23	23.9	26.4	49.7	Sand-silt-clay
241-5-3, 90	37.4	40.3	22.4	Sand-silt-clay
241-10-3, 87	26.1	35.6	38.3	Sand-silt-clay
241-10-4, 75	67.1	20.2	12.8	Silty sand
241-10-4, 78	66.0	21.7	12.3	Silty sand
241-10-4, 81	69.1	20.2	10.7	Silty sand
241-10-4, 85	69.2	20.1	10.7	Silty sand
241-10-4, 88[a]	36.4	36.4	27.3	Sand-silt-clay
241-11-2, 18	15.1	33.0	51.8	Silty clay
241-11-3, 77[a]	36.4	43.5	20.1	Sand-silt-clay
241-11-4, 30[a]	65.2	19.2	15.5	Sand
241-11-4, 39[a]	40.5	37.4	22.1	Sand-silt-clay
241-15-1, 144	26.8	32.1	41.1	Sand-silt-clay
241-16-2, 63	29.2	42.4	28.4	Sand-silt-clay
241-19-1, 124	0.0	7.4	92.5	Clay
241-19-2, 87	1.0	80.6	18.4	Silt
241-23-3, 47	22.5	45.8	31.7	Sand-silt-clay
241-25-3, 123	0.0	11.8	88.2	Clay
241-27-1, 124	0.1	17.3	82.7	Clay
241-27-2, 32[a]	1.5	54.5	43.9	Clayey silt
241-24-3, 110[a]	0.1	51.9	48.0	Clayey silt
241-27-3, 126	0.1	23.4	76.5	Clay
241-27-4, 62[a]	0.0	20.6	79.3	Silty clay
241-27-4, 68[a]	0.0	23.7	76.3	Silty clay
241-28-1, 101	36.3	49.6	14.1	Sandy silt
241-28-1, 141[a]	40.5	43.0	16.5	Sandy silt
241-28-2, 71[a]	19.2	51.8	28.9	Clayey silt
241-28-3, 18[a]	0.6	62.7	36.7	Clayey silt
241-28-3, 95[a]	2.0	58.9	39.1	Clayey silt
241-29-1, 140	0.3	8.7	91.0	Clay
241-29-2, 39	0.0	13.8	86.2	Clay
242-7-6, 65	0.6	26.3	73.0	Silty clay
242-8-1, 107	0.1	23.9	76.0	Clay
242-19-3, 136	0.5	35.1	64.5	Silty clay
243-1-1, 127[a]	100.0	0.0	0.0	Sand
245-1-2, 100	0.0	29.7	70.3	Silty clay
245-1-4, 29	0.0	23.6	76.4	Clay
245-14-5, 7	3.5	55.3	41.2	Clayey silt
245A-2-5, 120	0.1	22.6	77.3	Clay
245A-4-2, 134	0.1	26.2	73.8	Silty clay
245A-5-1, 89	0.0	14.6	85.4	Clay
245A-5-4, 129	0.0	16.6	83.4	Clay
246-5-1, 94	88.1	7.0	5.0	Sand
246-5-3, 99	71.2	18.3	10.5	Silty sand
246-5-3, 146	76.0	15.6	8.4	Sand
246-5-4, 44	67.9	20.7	11.3	Silty sand
246-5-5, 89	73.2	16.5	10.4	Silty sand
246-9-1, 119	83.6	9.9	6.5	Sand
246-9-2, 139	67.7	18.5	13.8	Silty sand
246-9-6, 29	64.6	22.1	13.3	Silty sand
246-11-1, 99	93.1	3.4	3.5	Sand
246-11-2, 1	93.7	2.6	3.7	Sand
246-11-2, 19	92.8	3.6	3.6	Sand
246-11-2, 49	92.9	3.4	3.7	Sand
246-11-2, 72	93.1	3.7	3.1	Sand
246-11-2, 100	65.4	20.0	14.6	Silty sand
246-11-2, 100	67.6	18.9	13.5	Silty sand
248-2-2, 90	3.8	33.0	63.2	Silty clay
248-2-3, 54	3.6	38.3	58.1	Silty clay
248-4-5, 50	0.4	30.8	68.8	Silty clay
248-6-1, 146[a]	67.0	16.0	17.1	Sand
248-8-1, 40	98.5	0.4	1.1	Sand
248-8-1, 90	98.5	0.3	1.2	Sand
248-8-1, 143	3.4	12.5	84.1	Clay
248-9-1, 67[a]	94.9	1.0	4.1	Sand
248-9-2, 80	98.4	0.2	1.4	Sand
248-11-1, 127	0.3	30.5	69.1	Silty clay
249-8-1, 134	1.7	31.4	66.9	Silty clay
249-9-3, 79	3.7	31.3	65.0	Silty clay
249-23-2, 58	1.5	26.2	72.2	Silty clay
249-23-4, 129	6.8	40.0	53.1	Silty clay
249-23-5, 70	0.1	32.7	67.2	Silty clay
249-24-1, 75	0.0	28.9	71.1	Silty clay
249-25-1, 82	5.8	41.4	52.9	Silty clay
249-25-2, 82	4.0	34.7	61.3	Silty clay
249-25-3, 17	13.0	20.6	66.4	Silty clay
249-27-2, 90	3.7	45.9	50.4	Silty clay
249-30-7, 0	4.2	38.1	57.7	Silty clay
249-31-3, 36	5.5	43.1	51.5	Silty clay
249-32-7, 0	0.1	13.8	86.1	Clay

[a]Detailed analysis is shown in Table 2.

within dominant nannofossil-radiolarian ooze lithologies. In three instances, the samples came from well-defined sandy silt or silty sand interbeds within a dominant silty clay or silt-rich nannofossil ooze lithology. Compositionally, the sand-and silt-size fractions consist of fossiliferous components or fragments as well as terrigenous or detrital minerals, including quartz, feldspar, heavy minerals, and opaques. The heavy minerals include clinopyroxenes, orthopyroxenes, amphiboles, garnet, and epidote. Faint traces of graded bedding were observed in the interbeds sampled; however, most of the coarser units tend to be soupy and infiltration and in-core mixing is common.

Detailed grain-size determinations were preformed on seven samples representing silt or sand units in Cores 1, 4, and 5 of Site 240 (Table 2). The samples are classified (Table 1, Figure 2) as sands (five samples or 71%), silts, and clayey silts. The sand samples contain on an average 87.7 percent sand, with 53 percent of this sand fraction equally divided into the medium and fine sand sizes. About

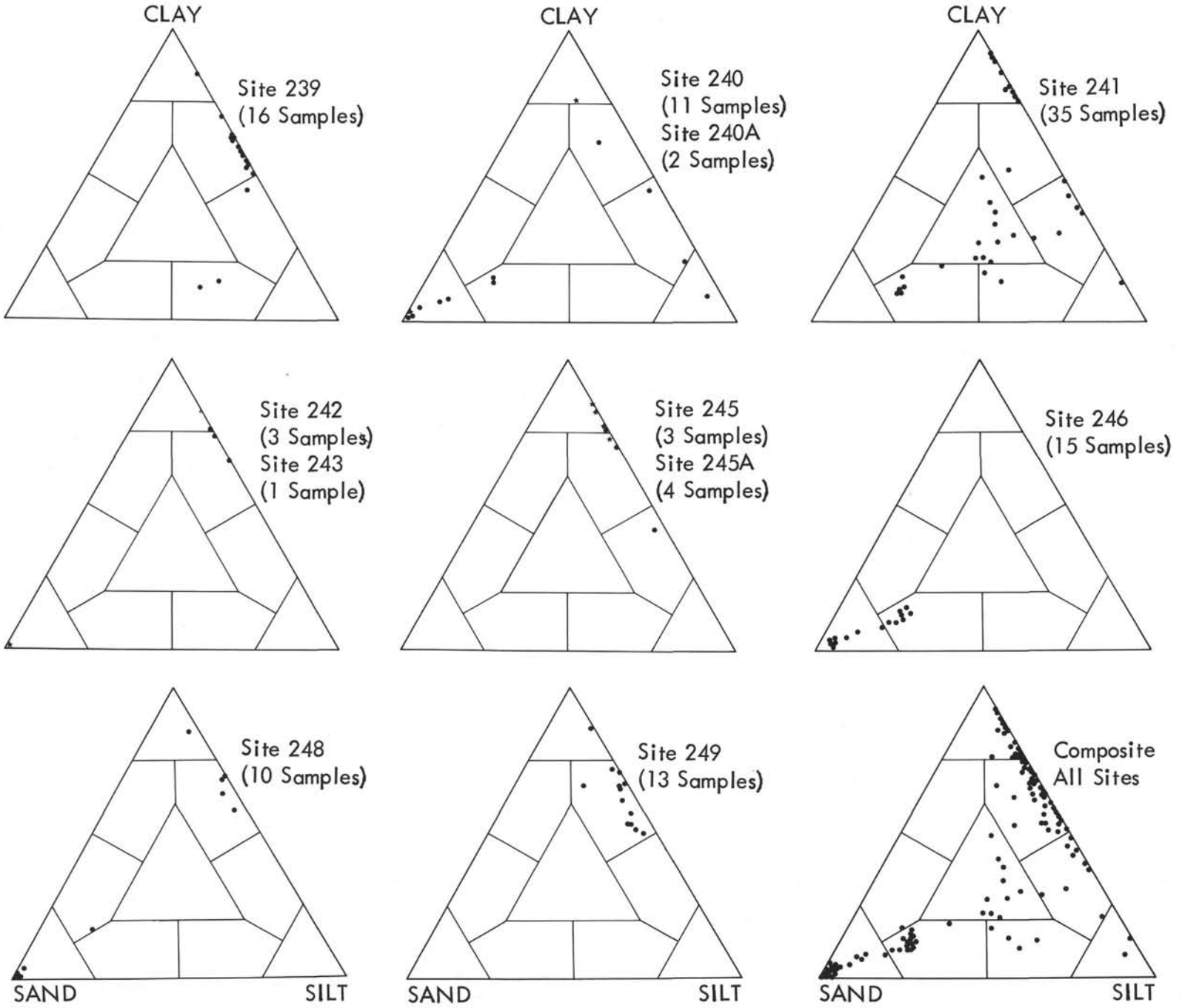

Figure 1. *Results of grain size analyses of samples from cores collected on Leg 25.*

TABLE 2
Detailed Grain Size Determinations, Leg 25

Sample (top of interval in cm)	Percent at Phi Units												Sand (%)	Silt (%)	Clay (%)
	0	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10			
239-1-1, 99	0.0	0.0	0.0	1.7	26.5	35.3	12.4	6.7	3.8	2.1	2.2	9.2	28.2	58.2	13.6
240-1-3, 15	0.0	0.0	0.0	0.1	5.0	57.2	22.1	4.8	1.9	1.0	1.2	6.6	5.1	86.0	8.9
240-1-4, 49	0.0	0.0	0.1	0.2	4.3	39.2	25.1	7.2	3.0	3.4	3.8	13.7	4.6	74.5	21.0
240-4-2, 21	0.0	0.0	0.5	20.6	45.0	14.9	2.7	1.6	0.6	0.9	0.8	12.4	66.1	19.8	14.1
240-4-2, 79	0.1	5.5	39.5	46.0	5.3	0.7	0.0	0.4	0.5	0.3	0.2	2.4	96.4	0.7	2.9
240-4-2, 123	0.7	19.9	47.4	26.8	2.3	0.5	0.1	0.1	0.1	0.1	0.1	0.1	97.1	0.7	2.2
240-5-6, 121	7.0	21.6	24.4	22.3	10.2	3.7	1.5	1.0	0.9	0.7	0.7	6.0	85.4	7.1	7.4
240-5-6, 136	6.3	18.9	25.2	22.3	10.5	4.6	2.3	1.5	1.3	1.0	0.9	5.0	83.3	9.7	7.0
241-10-4, 88	0.0	0.0	0.1	8.5	27.7	15.1	10.5	6.4	4.4	3.7	3.1	20.5	36.4	36.4	27.3
241-11-3, 77	0.0	0.0	0.0	5.3	31.2	27.0	7.3	5.3	3.9	3.6	6.2	10.3	36.4	43.5	20.1
241-11-4, 30	0.0	1.1	13.9	40.6	9.6	5.1	4.8	5.1	4.2	3.1	2.8	9.6	65.2	19.2	15.5
241-11-4, 39	0.0	3.0	12.4	18.2	7.0	13.5	4.0	5.9	13.9	9.7	6.7	5.6	40.5	37.4	22.1
241-27-2, 32	0.0	0.0	0.0	0.3	1.2	11.7	25.4	12.5	4.9	9.2	10.1	24.6	1.5	54.5	43.9
241-27-3, 110	0.0	0.0	0.0	0.0	0.0	2.5	25.4	15.4	8.6	8.5	11.2	28.2	0.1	51.9	48.0
241-27-4, 62	0.0	0.0	0.0	0.0	0.0	0.7	5.9	6.9	7.2	9.0	14.4	56.0	0.0	20.6	79.3
241-27-4, 68	0.0	0.0	0.0	0.0	0.0	0.6	1.8	10.0	12.5	14.4	16.8	45.1	0.0	23.7	76.3
241-28-1, 141	0.0	0.0	0.9	15.6	24.0	27.2	8.9	4.3	2.6	2.7	2.9	10.8	40.5	43.0	16.5
241-28-2, 71	0.0	0.2	0.5	2.6	16.0	28.2	12.6	7.2	3.8	5.7	4.6	18.6	19.2	51.8	28.9
241-28-3, 18	0.0	0.0	0.0	0.0	0.6	16.6	31.6	9.2	5.2	8.0	10.0	18.7	0.6	62.7	36.7
241-28-3, 95	0.0	0.0	0.0	0.1	1.8	16.1	28.2	10.7	3.9	8.7	11.3	19.1	2.0	58.9	39.1
243-1-1, 127	74.5	25.4	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.1	0.2	100.0	0.0	0.0
248-6-1, 146	0.0	0.2	6.5	35.9	24.4	10.2	2.6	1.8	1.4	1.4	1.4	14.2	67.0	16.0	17.1
248-9-1, 67	0.0	0.0	1.8	83.2	9.9	0.5	0.1	0.2	0.3	0.5	0.4	3.2	94.9	1.0	4.1

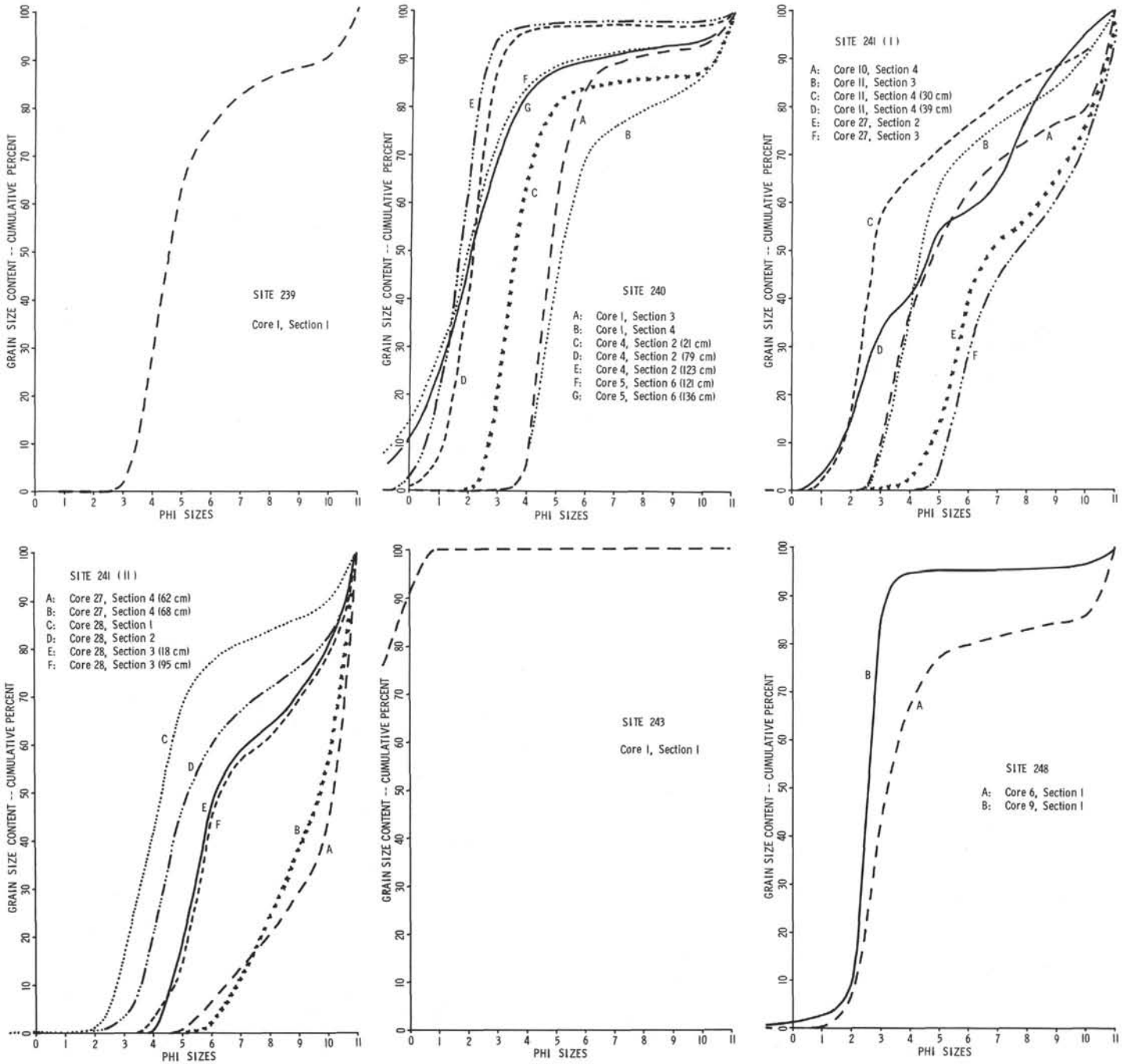

Figure 2. *Cumulative curves from detailed grain size analyses of samples from cores collected on Leg 25.*

2 percent is very coarse sand, with 14 percent each of the coarse and very fine sand sizes.

X-ray and carbon-carbonate samples were not taken sufficiently close to the grain-size sample depths to warrant discussion here.

Site 241

Site 241 was drilled on the east African continental rise in 4054 meters of water. The site, 170 miles from the coast, was drilled to a depth of 1174 meters, with 136.7 meters of sediment recovered.

For the 35 samples from Site 241, of which 12 were subjected to detailed grain-size analyses, 30 percent are in the sand-silt-clay classification, 22 percent are clays, and 14 percent are silty sands. The remaining samples are distributed among silts (2%), clayey silts (17%), sandy silts (2%), silty clays (8%), sand-silt-clays (28%), and one sample (2%) each for silt and sand. The averages for sand, silt, and clay for all 35 samples show 23.6, 34.1, and 42.3 percent, respectively. The samples were taken basically from two major lithologies present in the cored interval. Twenty-three samples were taken from streaks or interbeds of clayey silts, or silty clays within nannofossil oozes. Twelve samples were taken from claystone, clayey siltstone, and fine sandstone units. Compositionally, the high silt or sand units, especially in the upper portion of the cored interval (Cores 1-11), show a high percentage of fossiliferous fragments (benthic foraminifera), with accompanying percentages of quartz and feldspar, and with traces of pyrite and volcanic glass. The samples from the lower portion of the cored interval (Cores 12-29) consist of detrital quartz (25%-65%), feldspar (2%-5%), detrital (?) or microcarbonate (5%-15%), foraminiferal tests (1%-2%), dolomite rhombs (2%-4%), and with minor percentages of rock fragments and accessory minerals.

Graded beds are common and generally well defined in the basal portions, with the tops of the beds frequently indistinct. Twelve samples were subjected to detailed grain-size determinations (Figure 2, Table 2). The samples are dominantly clayey silts (five samples or 41.8%), with sand-silt-clay classifications containing on the average 25 percent and silty clays, 16.8 percent. Others reported, include sand (8.4%) and sandy silt (8.4%). The average sand, silt, and clay content for all 12 samples is 20.2, 42.0, and 37.8 percent, respectively. The majority of the sand fraction is fine to very fine sand.

It appears that about five carbon-carbonate samples represent similar depths as the grain-size samples. These occur in Cores 11, 16, 27, and 28. Two samples represent sand-silt-clay units and show 7.2-9.7 percent total carbon, 0.1-0.2 percent organic carbon, and 58-80 percent calcium-carbonate. One sample, a clay, shows 0.3, 0.2 and 1.0 percent for total carbon, organic carbon, and calcium-carbonate, respectively. The final two samples are sandy and clayey silts with 2.5-4.0 percent total carbon, 0.3-2.0 percent organic carbon, and 17-19 percent calcium-carbonate.

Heavy mineral studies of the sand-silt units illustrate a heavy mineralogy of orthopyroxenes $\cong$ amphiboles $>$ clinopyroxenes. Garnet, epidote, apatite, monazite, tourmaline, and staurolite are also present.

Site 242

Site 242, in a water depth of 2275 meters, is on the east flank of the weakly seismic Davie Ridge in the northern Mozambique Channel. At the site, 676 meters were drilled with 103.1 meters of core recovered. Three grain-size samples were taken and contain on the average less than 1 percent sand, 28 percent silt, and 72 percent clay. Two samples, or 66 percent, were classified as silty clays, and one sample, or 33 percent, as a clay. All three samples were taken from clay or silt interbeds within a dominant lithology of a nannofossil chalk. Composition of the silt fraction includes authigenic(?) carbonate grains as well as detrital quartz, micro-carbonate, and heavy minerals.

A carbon-carbonate sample, equivalent in depth to a grain-size sample, shows a total carbon content of 3.7 percent, organic carbon of 0.1 percent, and calcium-carbonate of 30.0 percent. The sample is a silty clay interbed within foram-bearing clayey nannofossil chalk. Similarly, one X-ray sample corresponds to a grain-size sample. The sample, in Core 8, shows a bulk analysis of calcite $>$ mica $>$ quartz. Palygorskite and montmorillonite were also reported.

Sites 243-244

One grain-size sample was taken from Site 243. Both sites (243 and 244) represented an attempt to drill within the Zambesi Submarine Canyon, and both were abandoned due to technical problems of hole stability. At Site 243, 0.3 meters were recovered, consisting of moderately well-rounded sand and fine gravel. The sample consists of 95 percent quartz, 2 percent feldspar, and 2 percent rock fragments, and 1 percent shell fragments. A detailed grain-size analysis (Table 2, Figure 2) shows the gross size analysis to be 100 percent sand. The detailed analysis showed 74.5 percent very coarse sand, and 25.4 percent coarse sand. Minor percentages (less than 1%) were found from the medium sand through the silt range.

Site 245 (Holes 245 and 245A)

Two complementary holes were drilled in the area of the southern Madagascar Basin. The site is 200 miles northwest of the axis of the Southwest Indian Ridge in 4857 meters of water. Hole 245 penetrated 397 meters and Hole 245A, 149 meters. Core recovery for Hole 245 was 82.1 meters and 47.4 meters were recovered at Hole 245A. Three grain-size samples at Hole 245 contain on an average 1 percent sand, 36 percent silt, and 63 percent clay. The classifications of the samples show that the three samples are represented by a silty clay, a clayey silt, and a clay. For Hole 245A, four samples were taken and contain on the average 20 percent silt and 80 percent clay with, at the most, 0.1 percent sand in two samples. For these samples, three, or 75 percent, were clay and one, or 25 percent, was a silty clay.

Two of the samples taken from the cores of Hole 245 came from a dominant core lithology of brown silt-rich clay. The silt composition includes quartz, feldspar, micas, and iron and manganese opaques. The one remaining sample represents a devitrified volcanic ash interbed within a dominant lithology of nannofossil chalk.

The four samples at Hole 245A were all taken from silty clay units, which tended to be the dominant lithology. The silt fraction consists of quartz, feldspar, micas, opaques, and heavy minerals, which included epidote and rutile.

Only one carbon-carbonate sample from Hole 245A is close to the depth of a grain-size sample. The values shown for total carbon, organic carbon, and calcium carbonate are 0.1, 0.2, and 0.0, respectively. The lithology is a brown silty clay.

Site 246

Site 246, in 1030 meters of water, was located on the Madagascar Ridge. Recovery was 23.8 meters in 203 meters penetration. A complementary hole, Site 247, was attempted with no recovery in 26 meters penetration.

The fifteen grain-size samples show 80 percent sand, 12 percent silt, and 8 percent clay. The sand percentages range from a low of 76 percent to a high of 93 percent. Silts have a high percentage of 22 percent and a low of 2.6 percent. The clays range from 3.1 to 14.6 percent. A further classification showed 54 percent of the samples as sands and 46 percent as silty sands.

The samples were taken from only three cores (Cores 5, 9 and 11). Their dominant lithologies are shelly calcareous sands and glauconite-rich calcareous sands. The coarse fraction composition consists of 50-75 percent skeletal and carbonate fragments, 5-20 percent glauconite pellets, 5-14 percent lithic fragments, and 5-10 percent quartz, feldspar, volcanic glass, and accessory minerals, including tourmaline.

Samples taken for X-ray or carbon-carbonate do not correspond to grain-size sampling depths. Heavy mineral studies of the silt-sand fractions are remarkable in their high tourmaline contents which, in some cases, exceed the amphiboles and pyroxenes.

Site 248

This site is in the northwestern Mozambique Basin close to the eastern scarp-like slope of the Mozambique Ridge. The hole was drilled in a water depth of 4994 meters with 434 meters penetration and 40.8 meters of core recovered. Size averages for 10 samples show 46.8 percent sand, 16.3 percent silt, and 36.9 percent clay. Fifty percent of the samples are sands, 40 percent silty clays, and 10 percent clays. The sand samples (5), which have from 67 to 98 percent sand, were taken from distinct sand lithologies in Cores 6, 8, and 9. The clay (representing one sample) was from a clay interbed within the sand units of Core 8. The silty clays represent interbeds within foraminiferal-nannofossil oozes. Grading was not overly apparent in the units sampled; however, sharp basal contacts and burrow mottling at the tops do suggest a turbidite origin.

Compositionally, the silt units consist of quartz, feldspar, granitic rock fragments, and heavy minerals, including hornblende, zircon, garnet, and sphene. The sand-size composition includes 75 percent quartz, with abundant feldspar and accessory minerals, such as hornblende, garnet, tourmaline, and epidote.

Two samples had detailed grain-size determinations performed. The two samples contain on the average 81 percent sand, 8.5 percent silt, and 10.6 percent clay. In the sand fraction, the dominant mode is fine sand. One carbon-carbonate sample corresponds to a grain-size sample. The values reported were 2.6 percent total carbon, 0.3 percent organic carbon, and 19.0 percent calcium-carbonate. The sample is in a sandy silt-silty clay interbed in a nannofossil ooze.

Site 249

Site 249 is in water 2088 meters deep over a small sediment-filled basin near the west side of Mozambique Ridge. A 412-meter penetration yielded 221.4 meters of core recovered.

Thirteen grain-size samples were taken and found to contain on the average 2.8 percent sand, 32.9 percent silt, and 63.2 percent clay. Of the 13 samples, 92 percent or 12 samples, are classified as silty clays and 8 percent (one sample) is a clay. Two samples came from interbeds within foraminifera-rich nannofossil oozes (Cores 8 and 9) while the remaining 11 samples came from silt-rich claystones, clays, clay-rich siltstones, and volcanic ash siltstones. The composition of the coarse fraction includes quartz (1%-12%), feldspar (1%-4%), opaques (5%-20%), volcanic glass (5%-40%), and glauconite (1%-5%). One sample from a volcanic ash siltstone contains 95 percent glass shards and 5 percent feldspar. Nine carbon-carbonate samples are equivalent in depth to the grain-size samples. Eight of the samples are silty clays and one is a clay. In the cores, these units are silty claystones or claystones. Six samples show the organic carbon content to be greater than 0.4 percent, to a maximum of 1.6 percent, and have calcium carbonate contents greater than 6.0 percent, to a high of 37.0 percent, with total carbon greater than 1.7 percent, to a maximum of 5.5 percent. All six samples show little or no sand (0.0% to 5.0%), a silt content of 28 to 45 percent and a clay content of 41 to 71 percent. Generally, the higher the clay content, the higher the content of calcium carbonate.

Six X-ray samples correspond in depth to grain-size samples in Cores 23, 25, 30, 31, and 32. The bulk analysis data is variable, showing that of the six samples, only montmorillonite was reported in all samples.

REFERENCES

Shepard, F.P., 1954, Nomenclature based on sand-silt-clay ratios: Jour. Sed. Pet., v. 24, no. 3, p. 151-158.