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RECENT SEDIMENTS IN THE SOUTH CYCLADES MARINE AREA, AEGEAN SEA

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ABSTRACT

Investigation of 40 samples, taken from water depths of 15-380 m, were carried out in order to decipher the lateral distribution of sediments and of clay minerals in fine-grained clastic seafloor sediments from the south Cyclades marine area of the Aegean sea. The sediments of the area are mainly characterised by relatively high concentrations in carbonates. The distribution of grain size classes follows more or less the bathymetry, coarser sediments in depths up to 150-180 m, finer sediments in deeper areas. The distribution pattern of the phyllosilicates (crystallites or aggregates) illite/muscovite, chlorite, kaolinite, smectite and mixed layers is, in contrast to the fractions <2μm, most evident in the fraction 6-20 μm: Illite/muscovite are dominant in the northeastern part of the Aegean sea between the islands of Sifnos/Folegandros and in the Santorini caldera, and chlorite near Folegandros and Sikinos. Mixed layers are found in the entire area with low variations in concentration.

The distribution pattern is predominantly influenced by three factors:

1. source area (Milos and Santorini: volcanic rocks, Folegandros: chloritic schists, Naxos: metamorphic rocks and acid magmatites),
2. ocean currents (the currents of this region seem to modify the primary source area pattern),
3. grain size/water depth (smectite is dominant in the fraction <2μm, independent of water depth; however, the dominance is most evident in the more than 200 m deep area north of Folegandros/Sikinos).

KEY WORDS: recent sediments, grain size analysis, clay minerals, Cyclades, Greece

ΠΕΡΙΛΗΨΗ

Στην περιοχή των νοτίων Κυκλάδων αναλύθηκαν 40 επιφανειακά δείγματα ιζημάτων. Τα αποτελέσματα των αναλύσεων μας επέτρεψαν την αποτύπωση της κατάστασης της κατανομής των ιζημάτων στο χώρο και της ορυκτολογίας των αργίλων. Στην περιοχή επικρατούν ιζήματα πλούσια σε ανθρακικά και η κοκκομετρική τους κατανομή συσχετίζεται με το βάθος. Επικρατούν αδρομερή ιζήματα αμμώδους υφής στα βάθη μέχρι 150-180 m και λεπτόκοκκα ιλυαργιλώδη στα μεγαλύτερα βάθη.

Τα αργιλικά ορυκτά της κοκκομετρικής τάξης της αργίλου (Φ<2μm) φαίνεται ότι δεν συσχετίζονται με το βάθος.

Η αυξημένη συμμετοχή του σμεκτίτη στα ποσοστά των αργιλλικών ορυκτών εξηγείται ως η επίδραση των γειτονικών χέρσων, που αποτελούνται από ηφαιστειακά πετρώματα (Μήλος και Σαντορίνη). Οι ιλυώδεις φάσεις (2-6 μm και 6-20 μm) σχετίζονται με το χώρο προέλευσης του υλικού. Υψηλές συγκεντρώσεις του χλωρίτη έχουν σαν πηγή προέλευσης τους χλωριτικούς σχιστόλιθους της Φολέγανδρου και Σίκινου. Η επικράτηση του ιλλίτη/μοσχοβίτη στα ΒΑ της υπό μελέτη περιοχής συσχετίζεται με τα μεταμορφωμένα και όξινα πετρώματα της Νάξου.

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1. INTRODUCTION

This paper studies the grain size distribution of surface sediments and their clay minerals, in the marine area of southern Cyclades islands. The area under investigation is the marine basin between the island complex Milos, Paros, Naxos, Ios, Sikinos and Folegandros (Fig. 1). Supplementary and for comparison, closed gulfs of Milos and Santorini were also examined.

The area has the character of an epicontinental sea with island complex. It belongs to the wider epicontinental Cyclades plateau and it is differentiated from the other Aegean regions due to relatively shallow depths. Depths reach up to 280 m in the marine basin between the island complex. The marine area forms an elongated and asymmetric basin of 75 km length and 25 km width, with the long axe oriented SW-NE and bends mainly in a SW direction. Coastal zones are characterised by steep slopes. In the NE part of the basin relief is relatively smooth up to 100 m (dips up to 0.13°), followed by a steeper slope up to 200 m (dips up to 0.77°). After this dips are getting smaller again (0.57°) and finally relief becomes smooth while depths are varying between 250 and 280 m.

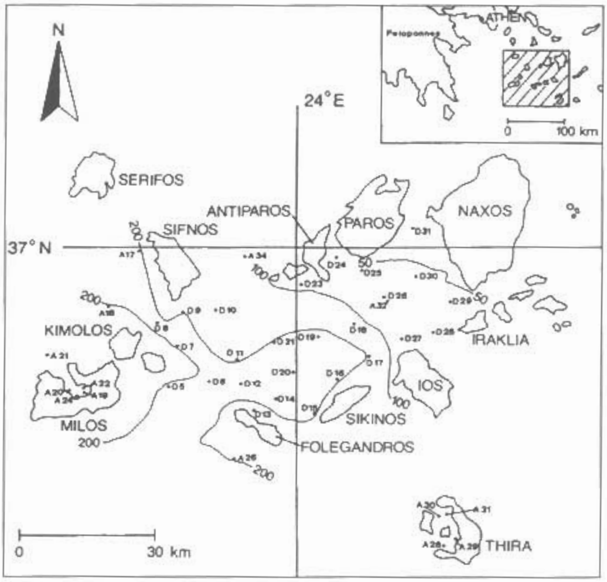

Fig. 1: Working area, bottom morphology and surface sediment samples locations.

In contrast to the submarine morphology the islands have an intense relief, with hights up to 1000 m (Naxos isl.). However hights vary between 300 and 1000m.

From the geological point of view Cyclades islands belong to the metamorphic zone of Atticocycladic mass (JACOBSHAGEN, 1986). Some small areas are covered by neogene and quaternary sediments and recent volcanic formations. The metamorphic Atticocycladic mass is represented by gneiss, schists, quarzites and marbles. Metamorphism took place in phases from Eocene to M. Miocene. The post-alpidic sedimentation begun in M. Miocene and in the most recent geological history volcanic activity took place in the area (Pliocene and Quaternary in Milos, up today in Santorini).

Similar sedimentological studies in the area under investigation are limited to a paper about sediments between Paros and Naxos isl. (MUELLER, 1975). In Santorini area similar work is referenced (PUCHELT, et al., 1973) and the recent works about the sediments in Milos gulf, 1993, KARAGEORGIS et al. 1997a, KARAGEORGIS et al. 1997b). On the other hand in the wider area and within the research scopes of National Centre for Marine Research (NCMR), several publications study and map the sediments quality (ANAGNOSTOU et al, 1993; KARAGEORGIS, et al., 1993; 1996; VOLAKIS & ANAGNOSTOU, 1995).

This study has been carried out in cooperation with the department of Marine Geology and Geophysics of National Centre for Marine Research (NCMR), Athens and the Institute of Geology in the Ruhr University in Bochum, Germany within the frame of NCMR's research project "Oceanography of the Greek Open Seas".

2. METHODS

Sediment samples were collected in two phases during July 1986 and December 1987, with the research vessel "AEGAIO" of NCMR, which utilises the necessary equipment (for positioning, depth and sampling). Sediments were collected mainly with a REINECK grab (NCMR's construction) and a short gravity corer. The final sample was the top 1-2 cm of the sediment column coming up on the deck. Sample locations are presented in Fig. 1. Sediment samples coordinates, depth and macroscopic characteristics are listed in Table I.

Table I: List of sediment samples, co-ordinates and depths of sampling, macroscopic characteristics of the sediments

Sample No	Latitude	Longitude	Depth	Macroscopic characteristics
A 17	36,990°	24,647°	200 m	sandy mud, grey-brown
A 18	36,881°	24,526°	200 m	sandy mud, grey-brown
A 19	36,708°	24,454°	30 m	sand, grey-brown
A 20	36,720°	25,219°	70 m	sandy mud, grey-brown
A 21	36,792°	24,338°	180 m	mud, brown
A 22	36,722°	24,447°	15 m	sand, grey-green
A 24	36,697°	24,446°	44 m	sand, grey-green
A 26	36,592°	24,876°	130 m	sand, grey-green
A 28	36,393°	25,373°	210 m	sand, brown
A 29	36,396°	25,417°	285 m	sand, brown
A 30	36,440°	25,366°	380 m	muddy sand, brown
A 31	36,454°	25,410°	330 m	muddy sand, brown
A 32	36,897°	25,247°	75 m	sand, green-grey
A 34	36,973°	24,883°	150 m	sand, green-grey
D 5	36,710°	24,666°	237 m	sandy mud, yellow
D 6	36,746°	24,764°	265 m	mud, yellow-brown
D 7	36,815°	24,696°	211 m	mud, brown
D 8	36,857°	24,661°	272 m	mud, brown
D 9	36,869°	24,744°	220 m	mud, brown
D 10	36,871°	24,822°	185 m	sandy mud, brown
D 11	36,802°	24,844°	230 m	mud, brown
D 12	36,739°	24,843°	257 m	mud, yellow
D 13	36,669°	24,553°	107 m	sand, green-grey
D 14	36,706°	24,947°	270 m	mud, brown
D 15	36,651°	25,037°	240 m	biogenous sand, green-grey
D 16	36,745°	25,109°	270 m	mud, yellow
D 17	36,788°	25,175°	190 m	coarser sand
D 18	36,872°	25,116°	102 m	mittle sand
D 19	36,843°	25,049°	230 m	mud, brown
D 20	36,766°	24,978°	255 m	mud, brown
D 21	36,827°	24,940°	225 m	mud, brown
D 23	36,939°	25,011°	95 m	sand with biogenous debris brown
D 24	36,954°	25,091°	55 m	sand, brown
D 25	36,953°	25,163°	80 m	sand with red algae debris, green-grey
D 26	36,910°	25,247°	79 m	sand with biogenous debris, green
D 27	36,835°	25,270°	73 m	sand with biogenous and red algae debris, green
D 28	36,826°	25,355°	82 m	sand with biogenous debris, green
D 29	36,887°	25,404°	81 m	muddy sand, green
D 30	36,961°	25,319°	51 m	sand with biogenous debris, green
D 31	37,0[illegible]	[illegible]	[illegible]	sa[illegible]is, green

In the laboratory grain size analysis was carried out. At first sample was separated by wet sieving in the classes >63 μm, and <63 μm. The class Φ>63 μm was further separated by dry sieving in the classes 63-90 μm, 90-125 μm, 125-180 μm, 180-250 μm, 250-355 μm, 355-500 μm, 500-1000 μm and >1000 μm.

The fine part of the samples was treated with H_2O_2 and EDTA for the removal of organic material and carbonates respectively. Afterwards the sub-sample was further separated in classes <2 μm, 2-6 μm, 6-20 μm and 20-63 μm in Atterberg cylinders (MUELLER, 1964). Total carbonates concentration in the sample was measured with SCHEIBLER apparatus, which calculates the CO_2 volume produced during the carbonates reaction with acid (MUELLER, 1964).

Oriented mounts were prepared from the sub-samples of the classes Φ<2 μm, 2-6 μm, 6-20 μm, by sedimentation on a glass slide, in order to identify clay minerals by X-ray diffraction. Size separation in the mounts, and therefore analytical bias, was faced by the use of certain quantity of material, well homogenized in certain volume of water, in order to produce a thin film totally penetrated by the X-rays. All samples were measured in normal condition, glycolated, heated in 370 °C and heated in 500 °C. Equipment used was XRD-Philips PW 1050/25 with AMR monochromator (alternatively nickel filter) and generator PW 1130/00 with Cu tube. The measurements conditions were 40 kW/35 mA and paper speed 1 or 2 cm/min. Semiquantitative estimation of clay minerals abundance was obtained by area calculation of representative peaks in diagrams of glycolated and heated in 370 °C samples. Final results assume the sum of the weighted peak areas to respresent 100% of the material.

3. RESULTS

Grain size sediments characteristics and distribution: Grain size analysis data show a variety of sediment types, from sand to silty-clay. Distribution of the grain size classes, which is presented in figure 2 indicates that the line Sifnos - Ios sets boundaries of two areas with different grain-size features. The NE area is dominated by sandy sediments, while in the SW area sediments are finer (silt + clay).

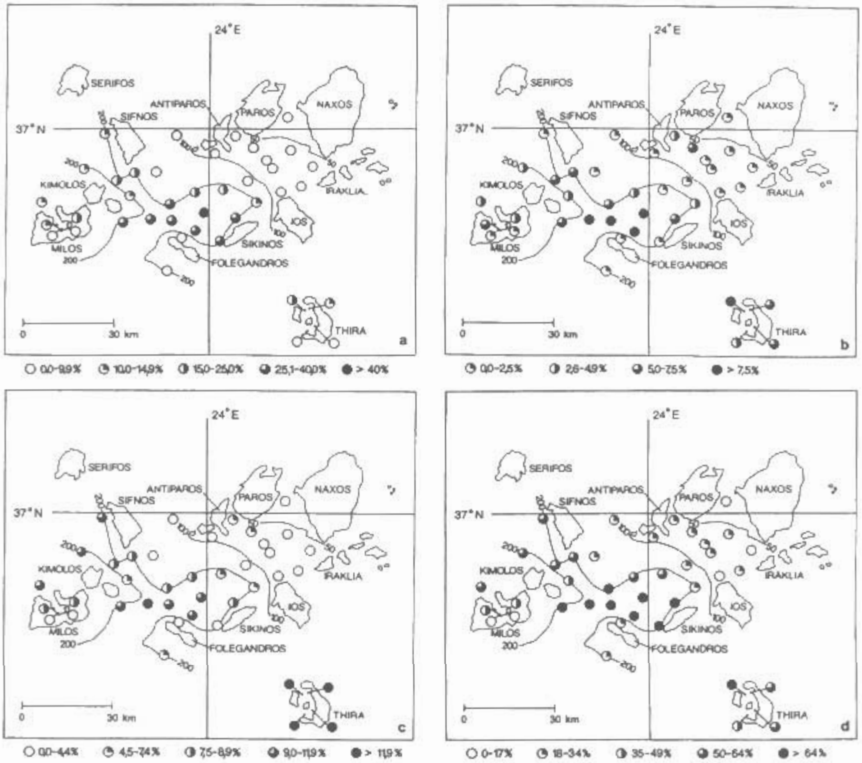

Fig. 2: Distribution of the percentages of the grain size classes <2μm (a), 2-6μm (b), 6-20μm (c) and of the fraction <63μm of each sediment sample (d).

Sediments distribution follows more or less the bathymetry. Sandy sediments dominate up to 150-180 m depth, while in the deeper parts of the basin the fine fraction comes up to 64%. This distribution is more obvious in figure 2a, where the clay fraction distribution is presented. Comparing these data to the carbonates content of the sediments (Fig. 3) and as well as to the macroscopic description, we come to the conclusion that despite detrital sand, sand fraction is related to biogenous shells and debris. Sorting is a parameter related to the dynamical processes during sedimentation. Sorting values vary from "very poor" to "well" (Fig. 4). In the NE shallower area sorting is better than the SW deeper area. This indicates a higher hydrodynamical status in the NE area.

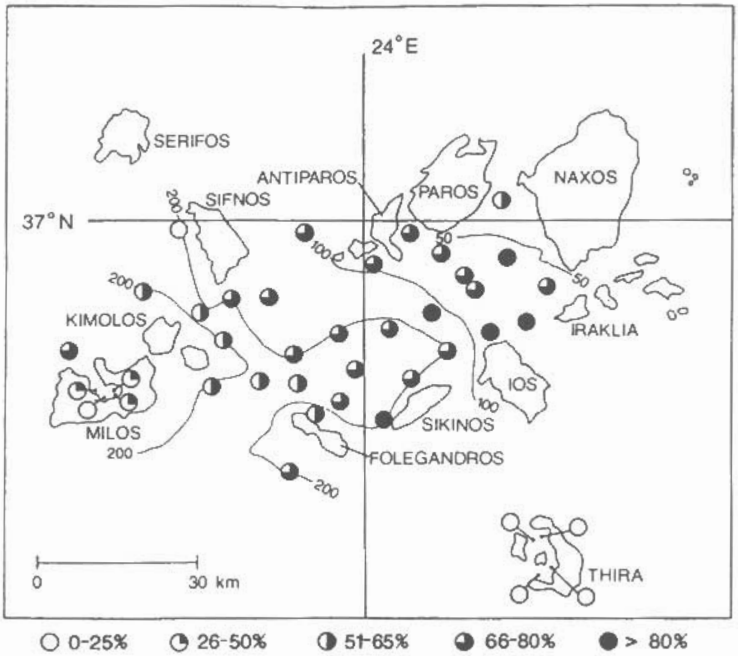

Fig. 3: Distribution of the total carbonates in the surface sediments

Carbonates distribution: Carbonate content of the samples is presented in the Table II and the regional distribution is illustrated in Fig. 3. Sediments are generally rich in carbonates. Sediments eastern of the line Folegandros-Sifnos show high percentages >60%, while concentrations in the western sediments vary for 50-65%. Sediments form the closed areas of Milos and Santorini show low concentrations. Mainly carbonate content in the area is coming from shells and biogenous debris.

Clay Mineralogy: Identified clay minerals in the area under investigation are: illite (=Muscovite), Chrorite, Smectite, Kaolinite and a Mixed-Layer. The results of the semiquantitative analysis of the clay minerals abundance for each sample, differentiated in the grain size classes <2μm, 2-6μm and 6-20μm are listed in Table II. Representative X-ray diffractograms in the different measurement conditions are illustrated in the Fig. 5. Illite major peak is observed in 10 Å and remains stable after the various treatments. In the coarser classes (2-6 μm, 6-20 μm), a part of the peak is due to muscovite. Chlorite is observed in 14.2 Å and 7.1 Å along with Kaolinite. Smectite is an expanding mineral and so after the treatment with glycole its peak is moving towards lower angles (higher d values 16.5 - 17.0 Å). In higher temperatures (e.g. 370 °C) smectites crystal structure is destroyed and it's degraded to illite (see Fig. 5). Kaolinite is observed in 7.1 Å and remains stable after glycole treatment and heating in 370 °C, but it is destroyed after heating in 500 °C (see Fig. 5). Mixed-Layer shows up like a curve without a distinct peak in the area 10-12 Å and it seems to be a smectite-illite mixed layer (see REYNOLDS & HOWER, 1970).

Semi quantitative calculation was carried out in the classes Φ<2 μm, 2-6 μm, and 6-20 μm, after BISCAYE (1965) and let us:

a) correlate data to grain size and
b) differentiate the area under investigation according to the clay percentages.

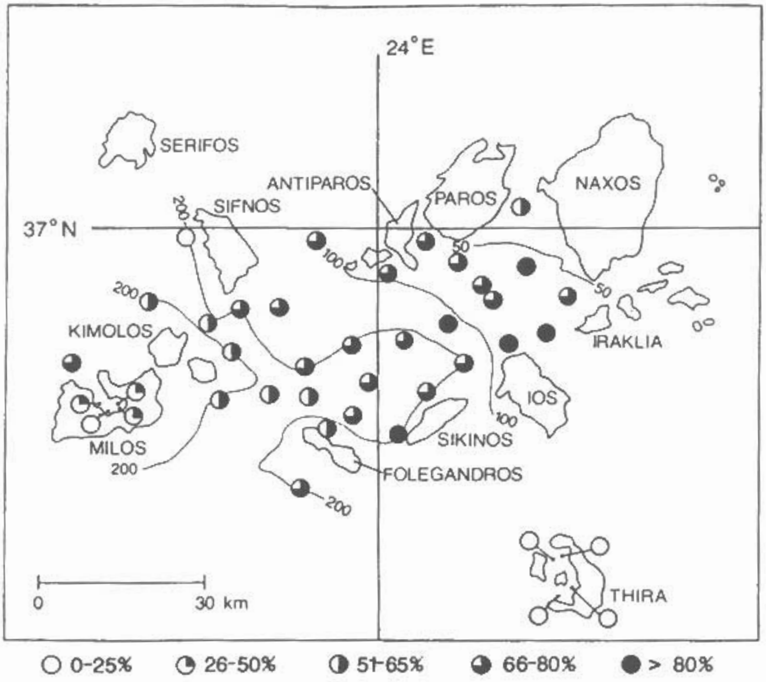

Fig. 4: Surface sediments sorting according to the method of Trask

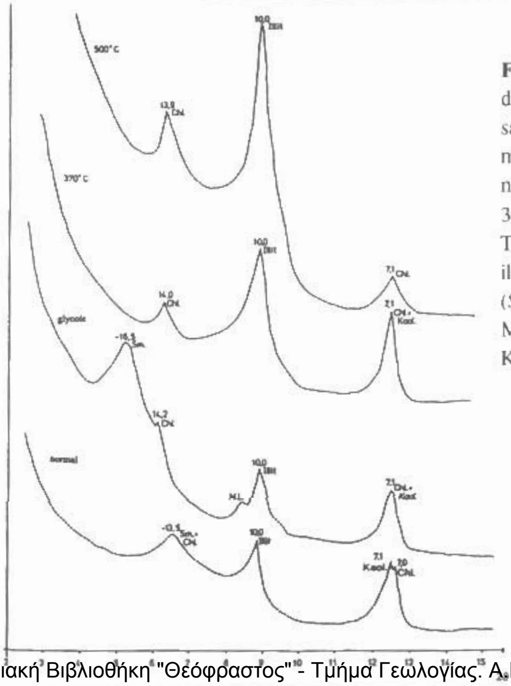

Fig. 5: Representative X-ray diffractograms, from the sample D11, in the different measurement conditions, normal, glycolated, heated in 370 °C and heated in 500 °C. The d-spacing values are illustrated on top of the peaks (Sm=Smectite, Chl=Chlorite, M.L.=Mixed Layer, Kaol.=Kaolinite).

Correlation of clay minerals to grain-size: Clay minerals distribution in every grain - size class (average of all samples) shows a reduce of smectite and increase of chlorite while grain - size is getting coarser. A similar behaviour is observed for illite and chlorite which both increase with grain - size. For kaolinite and mixed-layer we didn't observe any linear variation between percentages and grain - size.

It is very important to note that in samples from the island complex smectite and illite have the same abundance in the class <2 µm while in Milos and Santorini areas smectite dominates relatively to illite. Concentrations of the other clay minerals do not vary considerately in the diagrams.

Table II: Carbonate content of the samples and the results of the semiquantitive analysis of the clay mineral abundance for each sample, differentiated in the grain size classes <2µm, 2-6µm, 6-20µm

Sample	% $CaCO_3$	Clay Minerals	Smectite %	Mixed Layer %	Illite %	Chlorite %	Kaolinite %
A 17	16 %	< 2 µm	76.6	1.8	13.4	2.5	5.7
		2-6 µm	41.9	3.2	36.1	9.4	9.4
		6-20 µm	35.0	5.0	38.9	12.7	8.4
A 18	55%	< 2 µm	55.6	3.9	22.1	7.4	11.0
		2-6 µm	34.6	6.4	35.5	11.8	11.7
		6-20 µm	25.5	6.2	46.5	13.1	8.7
A 19	32%	< 2 µm	73.5	3.1	12.3	3.3	7.8
		2-6 µm	26.8	2.8	47.2	13.9	9.3
		6-20 µm	3.9	3.6	59.7	29.5	3.3
A 20	48%	< 2 µm	38.2	4.6	34.3	9.2	13.7
		2-6 µm	24.0	2.2	47.3	13.0	13.0
		6-20 µm	7.2	3.4	62.5	21.5	5.4
A 21	67%	< 2 µm	60.0	5.9	18.5	4.7	10.9
		2-6 µm	29.3	4.4	46.3	10.0	10.0
		6-20 µm	10.5	6.8	58.7	16.8	7.2
A 22	42%	< 2 µm	67.9	4.9	15.7	2.3	9.2
		2-6 µm	23.2	1.5	47.6	13.9	13.8
		6-20 µm	12.3	9.8	44.8	23.2	9.9
A 24	19%	< 2 µm	62.0	3.4	20.1	4.4	10.1
		2-6 µm	25.1	2.7	48.4	14.3	9.5
		6-20 µm	11.6	4.4	50.7	30.0	3.3
A 26	72%	< 2 µm	29.3	6.7	34.4	17.7	11.9
		2-6 µm	6.9	3.9	52.7	29.2	7.3
		6-20 µm	2.9	2.0	56.0	37.2	1.9
A 28	7%	< 2 µm	56.8	6.6	22.0	7.3	7.3
		2-6 µm	38.3	6.2	32.1	11.7	11.7
		6-20 µm	0.0	18.7	54.2	18.8	8.3
A 29	6%	< 2 µm	60.3	2.6	20.8	9.8	6.5
		2-6 µm	31.3	3.5	39.3	18.2	7.7
		6-20 µm	14.6	7.8	46.6	21.7	9.3
A 30	11%	< 2 µm	56.9	7.2	25.9	4.0	6.0
		2-6 µm	31.9	5.6	39.1	14.0	9.4
		6-20 µm	15.4	9.8	46.6	11.3	16.9
A 31	0%	< 2 µm	88.3	1.0	7.8	0.6	2.3
		2-6 µm	-	-	-	-	-
		6-20 µm	-	-	-	-	-
A 32	75%	< 2 µm	28.5	5.2	41.0	10.1	15.2
		2-6 µm	7.0	5.6	64.9	13.5	9.0
		6-20 µm	2.3	11.4	70.1	11.4	2.8
A 34	76%	< 2 µm	35.3	5.4	36.6	9.1	13.6
		2-6 µm	6.9	6.9	64.3	13.2	8.7
		6-20 µm	2.7	8.4	74.3	11.6	3.0
D 5	51%	< 2 µm	49.9	6.4	29.6	3.0	12.0
		2-6 µm	10.8	2.5	54.9	20.7	11.1
		6-20 µm	6.4	3.9	59.2	24.4	6.1
D 6	65%	< 2 µm	35.8	7.2	40.6	8.2	8.2
		2-6 µm	9.5	5.9	57.3	16.4	10.9
		6-20 µm	7.2	4.4	60.4	22.4	5.6

D 7	55%	< 2 µm	50.0	8.0	25.2	5.0	11.8
		2-6 µm	13.8	5.3	56.1	14.8	8.0
		6-20 µm	7.4	5.9	61.3	17.8	7.6
D 8	60%	< 2 µm	54.3	4.5	26.7	5.8	8.7
		2-6 µm	12.4	5.1	55.0	16.5	11.0
	68%	6-20 µm	5.6	6.6	61.8	20.8	5.2
D 9		< 2 µm	38.6	5.6	39.5	8.1	8.2
		2-6 µm	10.3	3.6	58.7	17.8	9.6
		6-20 µm	6.1	5.8	63.3	19.9	4.9
D10	78%	< 2 µm	36.9	3.8	40.2	9.5	9.6
		2-6 µm	8.8	6.1	58.2	16.2	10.7
		6-20 µm	2.2	5.5	65.4	21.5	5.4
D11	68%	< 2 µm	42.9	7.1	33.7	8.1	8.2
		2-6 µm	8.2	3.7	58.4	19.3	10.4
		6-20 µm	3.5	6.6	62.0	22.3	5.6
D12	64%	< 2 µm	42.8	5.2	34.6	8.7	8.7
		2-6 µm	9.3	6.2	57.1	17.8	9.6
		6-20 µm	2.8	2.9	63.3	27.9	3.1
D13	65%	< 2 µm	32.0	5.2	38.3	17.2	7.3
		2-6 µm	4.9	3.3	58.3	30.2	3.3
		6-20 µm	1.2	4.3	59.3	33.5	1.7
D14	70%	< 2 µm	40.6	6.0	36.1	8.6	8.7
		2-6 µm	8.0	4.8	53.4	23.7	10.1
		6-20 µm	3.1	3.1	60.0	30.4	3.4
D15	82%	< 2 µm	34.9	7.6	38.5	9.5	9.5
		2-6 µm	3.5	4.4	59.7	22.8	9.6
		6-20 µm	2.6	5.1	62.4	29.9	3.0
D16	73%	< 2 µm	47.3	5.5	28.6	9.3	9.3
		2-6 µm	10.1	5.7	51.9	21.0	11.3
		6-20 µm	2.5	3.7	57.3	32.9	3.6
D17	73%	< 2 µm	30.6	5.1	38.6	12.8	12.9
		2-6 µm	10.7	6.1	55.1	16.9	11.2
		6-20 µm	33.3	6.1	65.0	23.3	5.8
D18	89%	< 2 µm	38.1	3.3	38.9	7.9	11.8
		2-6 µm	7.2	5.4	63.2	14.5	9.7
		6-20 µm	1.2	6.2	68.4	19.4	4.8
D19	66%	< 2 µm	47.4	4.8	29.0	9.4	9.4
		2-6 µm	8.7	6.1	65.5	11.8	7.9
		6-20 µm	1.0	6.5	76.8	11.0	4.7
D20	72%	< 2 µm	37.8	6.1	34.7	10.7	10.7
		2-6 µm	8.0	3.1	63.7	16.4	8.8
		6-20 µm	2.4	2.9	67.7	21.6	5.4
D21	67%	< 2 µm	40.9	4.6	33.2	10.6	10.7
		2-6 µm	8.7	4.5	59.6	19.0	8.2
		6-20 µm	2.8	6.7	67.1	18.7	4.7
D23	79%	< 2 µm	40.9	5.3	35.8	9.0	9.0
		2-6 µm	14.7	6.9	57.7	14.6	6.1
		6-20 µm	1.9	4.9	66.7	23.9	2.6
D24	74%	< 2 µm	34.5	4.2	42.5	9.4	9.4
		2-6 µm	8.8	4.8	60.8	17.9	7.7
		6-20 µm	3.9	6.3	68.6	19.1	2.1
D25	74%	< 2 µm	45.9	4.3	34.7	7.5	7.6
		2-6 µm	7.5	4.4	65.2	13.7	9.2
		6-20 µm	1.9	7.6	75.0	12.4	3.1
D26	77%	< 2 µm	39.7	4.8	37.3	9.1	9.1
		2-6 µm	7.0	2.8	63.5	16.0	10.7
		6-20 µm	0.9	5.1	78.2	12.6	3.2
D27	85%	< 2 µm	41.9	6.1	32.8	7.7	11.5
		2-6 µm	6.1	4.8	73.7	9.2	6.2
		6-20 µm	2.5	6.8	71.3	15.5	3.9
D28	90%	< 2 µm	38.4	3.9	40.1	8.8	8.8
		2-6 µm	6.5	2.4	64.0	16.3	10.8
		6-20 µm	1.5	7.3	72.5	15.0	3.7
D29	72%	< 2 µm	39.1	4.4	39.5	6.8	10.2
		2-6 µm	1.0	4.3	73.7	10.5	10.5
		6-20 µm	2.5	7.3	75.6	13.1	1.5

D30	90%	< 2 µm	36.4	5.7	40.6	8.6	8.7
		2-6 µm	4.4	4.5	71.7	9.7	9.7
		6-20 µm	1.2	8.6	77.5	8.9	3.8
D31	62%	< 2 µm	14.4	5.3	60.1	10.1	10.1
		2-6 µm	8.7	7.2	63.0	9.5	11.6
		6-20 µm	1.0	5.9	78.6	8.7	5.8

The average of clay minerals abundance in the marine area between the islands of Milos, Paros, Naxos, Ios, Sikinos and Folegandros lies in the boundary of maximum-minimum, in comparison to EMELYANOV & SHIMKUS (1986) data (Table III).

Geographical distribution of clay minerals: The geographical distribution for smectite and illite in the class Φ<2 µm are presented in figures 6 and 7. Both distributions don't show a linear relationship versus depth. Nevertheless a complementary relation is observed between the distribution of the two minerals, any increase of smectite is followed by the decrease of the illite and vice versa. We note that high concentrations for smectite are encountered in the volcanic islands Milos and Santorini area. In the island complex area we observe lower values for smectite in accordance to EMELYANOV & SHIMKUS (1986) data (Table III). Chlorites distribution is influenced by detrital contribution, since high concentrations are encountered near the islands of Folegandros and Sikinos.

4. DISCUSSION

Sediments in the area under investigation are mainly characterised by relatively high concentrations in carbonates of biogenous origin. We observe wellsorted coarse sediments(mainly of biogenous debris constitution) in the NE part of the area.

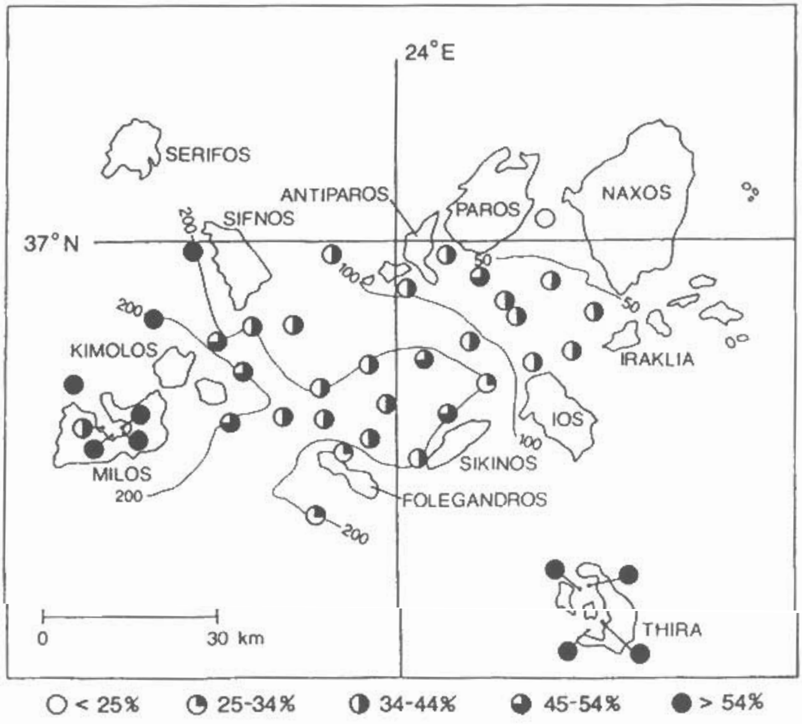

Fig. 6: Distribution of smectite in the class <2 µm

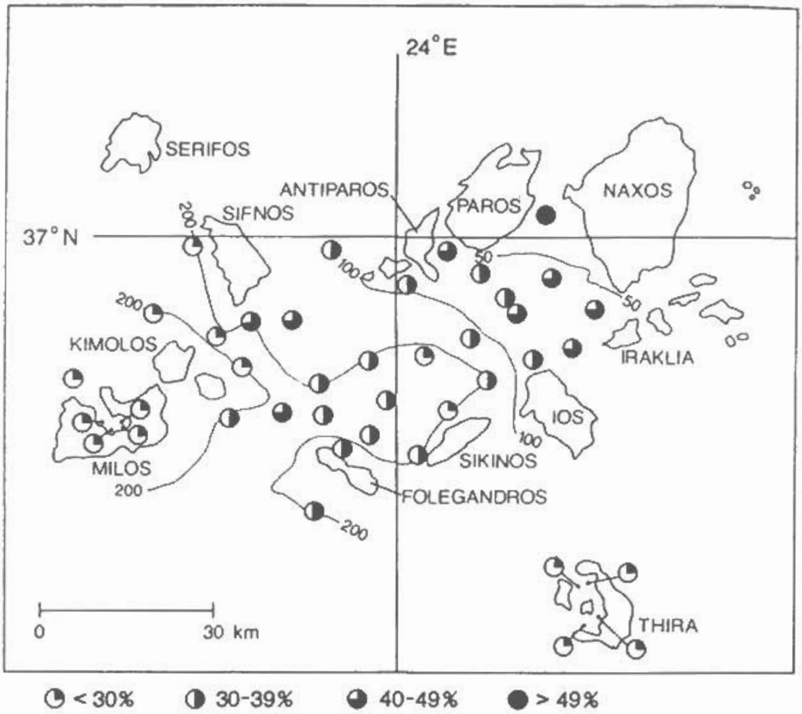

Fig. 7: Distribution of illite in the class <2 μm

This is related to a re-sedimentation mechanism of biogenous shells and debris because of the currents status in the area. Currents carry the fine particles to the deeper parts of the area.

This mechanism, as well as detrital supply, controls clay minerals distribution. Clay minerals are the major part of the sediments fine classes.

In the area under investigation we haven't located a distinct area of terrigenous supply. It seems that the wider land area of the island complex supplies the marine area with detrital material. While distribution of grain size classes follows more or less the bathymetry, clay minerals distribution doesn't shows clear trends. Fraction Φ<2 μm in the area shows high concentrations in smectite, which would be even higher if semi-quantitative analysis was carried out in the fraction Φ<1 μm, as EMELYANOV & SHIMKUS have. This abundance is due to the volcanic formations of the islands Milos and Santorini, which supply the area with terrigenous material through their drainage system and by aeolian transport as well.

Table III: The average of clay minerals abundance in the study area in comparison to the data showing the boundary values by EMELYANOV & SHIMKUS (1986). The average of the clay minerals form the volcanic islands area (Milos and Santorin) is separately presented

Mineral	% abundance by EMELYANOV & SHIMKUS (1986) <1μm	% abundance, samples of the study area <2μm	% abundance, samples of Milos and Santorin <2μm
Smectite	30-40	39,7	63,0
Mixed Layer	-	5,4	4,2
Illite	30-40	36,5	19,9
Chlorite	>12	8,8	5,1
Kaolinite	15-20	9,6	7,8

This view is certified by the domination of smectite in the gulfs of Milos and Santorini. The coarser classes (medium-coarse silt) are more related to the area of origin. High concentrations of chlorite in the south part of the deposition area are possibly due to the chloritic schists of the Folegandros and Sikinos. Abundance of illite-muscovite in the NE part of the area is related to the metamorphic and the acid magmatites formations of Naxos.

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