GEOMORPHOLOGY AND BOTTOM SEDIMENTS OF THE PILOS AREA.

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The Pilos area is situated in the Central Mediterranean on the flank of the Ellin deep sea trough in south-west of the Navarino Bay, Peloponnesus peninsula (Fig.I).

The Central Mediterranean is rather complicate in respect of it geological structure. The part of Alpine folded zone separated by faults to many lifted and lowered blocks with deep sea troughs between its was collapsed in Pliocene-Quaternary period (about 5 mln.y.ago). This region is tectonically active during many millions years. According to seismic results (Malovitsky, 1978) and deep sea drilling data (Initial Reports...,1973,1978) the sedimentary stratum in the Ionic sea consists of three main parts: Quaternary-Pliocene sediments, evaporites and pre-evaporite deposits. The thickness of sediment stratum reduces and some parts perhaps come out completely towards Peloponnesus peninsula. So some material changes of the sedimentary stratum are possible in the Pilos area.

Geomorphological and geological investigations in the Pilos area was made during 29-th cruise of r/v "Akademik Mstislav Keldysh" (November,1992).

<u>Bottom relief.</u> The ELAC echo-sounder and navigation system GPS aboard r/v "Akademik Mstislav - Keldysh" enabled us to obtain relyable data. The

boundaries of the Pilos area .included a strip or Sapiendza Island slope to depth of 3000 m and a vaster area to depth of 4500 m. Relief record has made up a little over 200 miles totally. Reconnaissance survey was performed within a mile interval, while in the areas of more detailed investigation sounding tracks were performed every 0,5 mile. The data obtained enabled us to compile a bathymetric map (scale 1:100 000) (Fig.2), in which a number of structural elements are singled out; they are - slope-scrap, extended cutting, stepped surface and a small depression in the south-western part of the Pilos area.

Though the slope surface is rather homogeneous, the lengthwise ridges 60-100 m high appear in some places (Fig.3). Apparently, they are widely spread but not registered distinctly enough on the echo-tape. In some cases this is connected with presence of sediments, in others - with the low altitude. But the character of the recording, however, testifies to the presence of the ridges. The calculations of angles of gradient show, that against the background of homogeneous field data for this parameter (10-15° up to 20°) the individual values of angles of gradient exceed 30° in some places (Fig.4). Zero values on the map should be related to the methods of processing, i.e. to making a denser matrix base. This does not, however, affect the basic field of the angles. More detailed research should consider the angles for individual surfaces enclosed between the bending points.

The central part of the Pilos area is occupied by the valley, limited in the north-west and south-east with isobaths of 3400-3700 m, on the slope and at the base respectively. The bottom width increaces from 1,5 to 4 miles. The valley's length within limiting isobath does not exceed 4 miles. Both profiles of preliminary survey and additional tacks reveal weakly rolling surface of the valley bottom area. This fact was also proved by the photographs of the bottom. In the south-west the valley develops into a terraced area 1,5 miles wide, represented by three steps stretching from north-west to south-east along the entire investigated area width. Apparently, they originated from the fault and represent a result of structural reconstruction, as the strike of subsequent elements is subjected to the position of the Ellin trough system.

A three-radial depression is the last among structural elements of the Pilos area. Its general outline is contoured with isobath of 4100 m and its bottom - with isobath of 4350 m. At the bottom level, along north-west and south-east axis it is about 4 miles long, while along a smaller axis it is 2 miles long. The morphology of its floor does not differ much from that of the valley that is why the rolling surface is contoured with isobath of 4350 m, i.e. individual relief forms are 40-80 m higher.

Summarizing the processed data we provide a three - dimensional picture of the Pilos area relief, in which its individual elements are represented more vividly (Fig.5).

Bottom sediments. Sampling or the bottom sediments was carried out by grab "Ocean-50" and gravity corer (diameter 72 mm). In total, geological investigations was made at 9 stations (Table I), which was located on the comparatively small plateau within isobaths of 3700 m and 3800 m (Fig.6). Preliminary processing of the bottom sediments on the board included visual description, selection of samples for different analytical treatments in the shore laboratories and determination of density and moisture of the sediments (Table 2). The moisture of sediments (W) was calculated using formula $W=m_I/m \cdot IOO\%$, where m_I - mass of water in bottom sediments and m - mass of natural sediments.

Bottom surface in the investigated area is covered by the light brownish-grey calcareous mud which gradually turn into light brown clay within some cm. Nature of the upper layer is not changing practically, density is equal to 1,47-1,49 g/cm^3, moisture - 49,9-51,4% (Table 2). Thickness of the surface layer is varying from 7 up to 18 cm (Fig. 6). Individual small black lava pieces are found sometimes on the top of the sediment layer (station AMK-2831). As usual the thin pteropod-forami-niferal layer is underlying at the bottom of clay. Nearly such pteropod layers were described in a number cores from Mediterranean where its age determined by ^{14}C dating was approximately equal to 3 thousands years (Shimkus,I98I). Below dark greenish-grey laminated muds with microlayers and lenses of silt are deposited. The muds are underlying by bluish-grey to light grey clay with distinctive spots and thin silty laminas in the lower part of this layer- Presumably the Interval recovered is not older than Holocene (10 th.y.) but it need confirm by analytical determination of absolute age.

Lower cyclic alternation of clays and silts partially turbidites are deposited (Fig.6). More detail lithological characteristic of bottom sediments is given in table I.

So the character of bottom sediments indicates that this region had relatively uniform environment during modern and Late Holocene sedimentation. Preliminary visual description of bottom sediments makes it possible to suppose that the rate of accumulation was low and the investigated area was transit zone of sedimentary matter mostly. The bottom surface is smooth with a rare and small (some cm) knobs (Fig. 7). There are not soft recent sediments on the more steep slopes and the deposits which was met there are slightly lithified and indurated (Fig.8).

References

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Malovitsky Ya.P. Tectonic of the bottom of the Mediterranean Sea (in Russian),Moscow,Nauks, 1978, 96p.

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Table I

PRELIMINARY LITHOLOGICAL DATA OF THE BOTTOM SEDIMENTS IN THE PILOS AREA

Horizone From top Of the sea Bottom, cm	Types of sendiments
I	2
Station AMK-2804, grab (36°36.8'N, 2I°33.8'E, depth 3737m)	
0-8	Light brown calcareous mud with admixture of pteropod's detritus
8-13	Light brown clay
Station AMK-2804, gravity corer (36°37.3'N, 2I°33.3'E, depth 3709m)	
0-16	Light brown calcareous mud and clay in lower part. Consists thin silt layers of pteropods and foraminifera detritus
16-68	Dark greenish-grey mud, cyclic laminated (turbidites)
68-90	Light grey clay with thin silty layers and lenses
90-165	Cyclic alternation clay and silt layers
Station AMK-2810, gravity corer (36°38.0[1]N, 2I°34.7'E, depth 3740m)	
0-10	Light brown calcareous mud
10-98	Dark greenish-grey mud, cyclic laminated, enriched in organic matter

Table I (continued)

I	2
	Consists two pteropods layers (49-50 cm and 96-96,8 cm) with sharp boundaries
98-132	Bluish-grey, light grey clay
132-134	Light grey silt (foraminiferal layer)
134-134,6	Light blue clay
134,6-140	Dark greenish-grey clay
Station AMK-2812, gravity corer (36°35.7'N, 2I°32.3'E, depth 3850m)	
0-8	Light brown calcareous mud
8-10	Pteropods layer with sharp boundaries
10-40	Dark greenish-grey laminated mud
40-62	Light grey clay
62-107	Greyish-brown to light brown clay with small spots, lenses and thin layers of silt (foraminiferal detritus)
107-115	Thin laminated clay, brown, green, light grey and grey with thin silty lamina in lower part
115-128	Light greenish clay
128-168	Dark grey mud with rare thin foraminiferal lamina
Station AMK-2817, gravity corer (36°37.0'N, 2I°31.7'E, depth 3759m)	
0-10	Light brown calcareous mud
10-12	Light brown clay
12-13	Light grey calcareous (foraminiferal) silt

Table I (continued)

I	2
Station AMK-2824, gravity corer (36°36.1'N, 2I°34.5'E, depth 3735m)	
0-7	Light brown calcareous mud
7-9	Pteropods layer
9-14	Slump block of light bluish-grey clay with foraminiferal-pteropods silty clay near boundaries
14-18,5	Light brown to light brownish-grey clay, thin laminated
18,5-99	Dark greenish-grey mud, laminated
99-110	Light bluish-grey clay
110-137	Light brownish-grey clay with lenses and thin lamina of silt
Station AMK-2827, gravity corer (36°36.5'N, 2I°33.2'E, depth 3765m)	
0-18	Light brown calcareous mud transitional to clay
18-34	Dark greenish-grey laminated mud
34-60	Light bluish-grey to light grey clay
60-61	Light grey pteropod-foraminiferal silty sand
61-101	Cyclic alternation brownish-grey to light brown clay and foraminiferal silt or silty sand
Station AMK-2831, grab (36°37.0'N, 2I°33.9'E, depth 3738m)	
0-11	Light brown calcareous mud transitional to clay

Table I (continued)

I	2
11-12	Light brownish-grey foraminiferal-pteropod layer
Station AMK-2837, gravity corer (36°36.2'N, 2I°34.3'E, depth 3744m)	
0-11	Light brown calcareous mud transitional to clay
11-15	Light grey pteropod-foraminiferal silty sand
15-21	Thin laminated and banded many-coloured clay
21-78	Dark greenish-grey laminated mud
78-85	Light bluish-grey clay
85-100	Light grey clay
100-115	Light yellowish-grey clay

Table 2

DENSITY AND MOISTURE OF BOTTOM SEDIMENTS
IN THE PILOS AREA
(Location of stations and types of
sediments is given in table I)

Station	Sampling gear	Horizone from top of the sea bottom, cm	Density, g/cm^3	Moisture %
AMK-2804	Grab	0-4	1.48	50.2
AMK-2804	Grab	10-13	1.63	39.4
AMK-2804	Gr.corer	45-48	1.54	48.1
AMK-2804	Gr.corer	160-163	1.68	35.3
AMK-281O	Gr.corer	16-19	1.40	52.9
AMK-281O	Gr.corer	105-108	1.62	38.2
AMK-2812	Gr.corer	20-23	1.44	50.4
AMK-2812	Gr.corer	97-100	1.58	41.6
AMK-2812	Gr.corer	150-153	1.31	59.6
AMK-2817	Grab	0-4	1.47	51.4
AMK-2824	Gr.corer	25-28	1.49	47.2
AMK-2824	Gr.corer	105-108	1.68	36.2
AMK-2824	Gr.corer	130-133	1.81	27.1
AMK-2827	Gr.corer	5-8	1.65	37.6
AMK-2827	Gr.corer	22-25	1.48	49.9
AMK-2827	Gr.corer	40-43	1.66	37.5
AMK-2827	Gr.corer	97-100	1.62	38.2
AMK-2831	Grab	0-4	1.49	49.9

LIST OF FIGURES

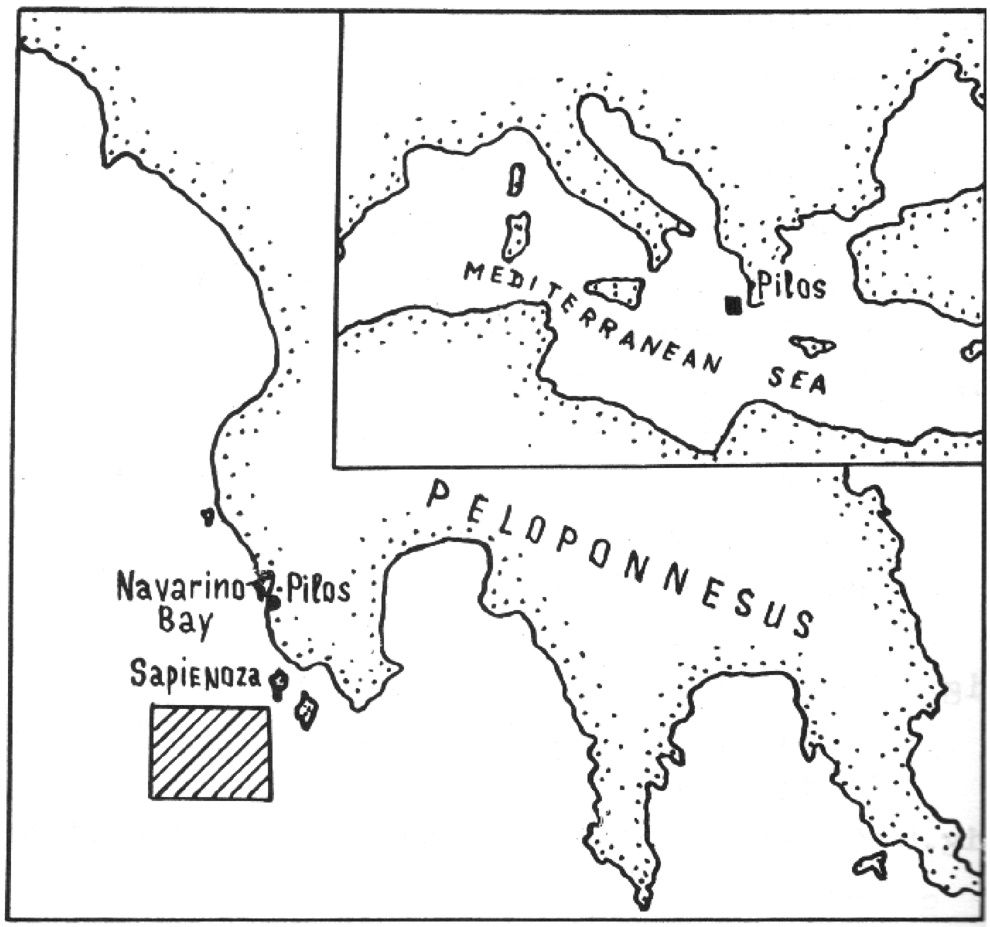


Fig.1 Location of the Pilos area

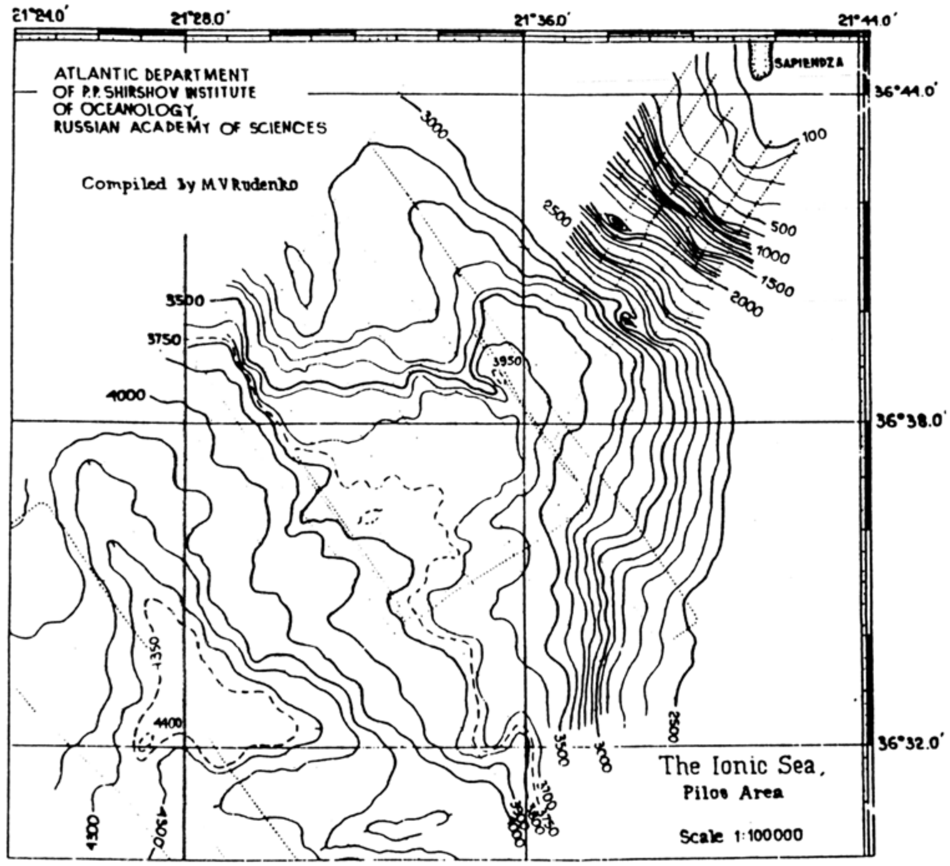


Fig.2 Bathymetric map of Pilos area
Track of ship is shown by dot lines

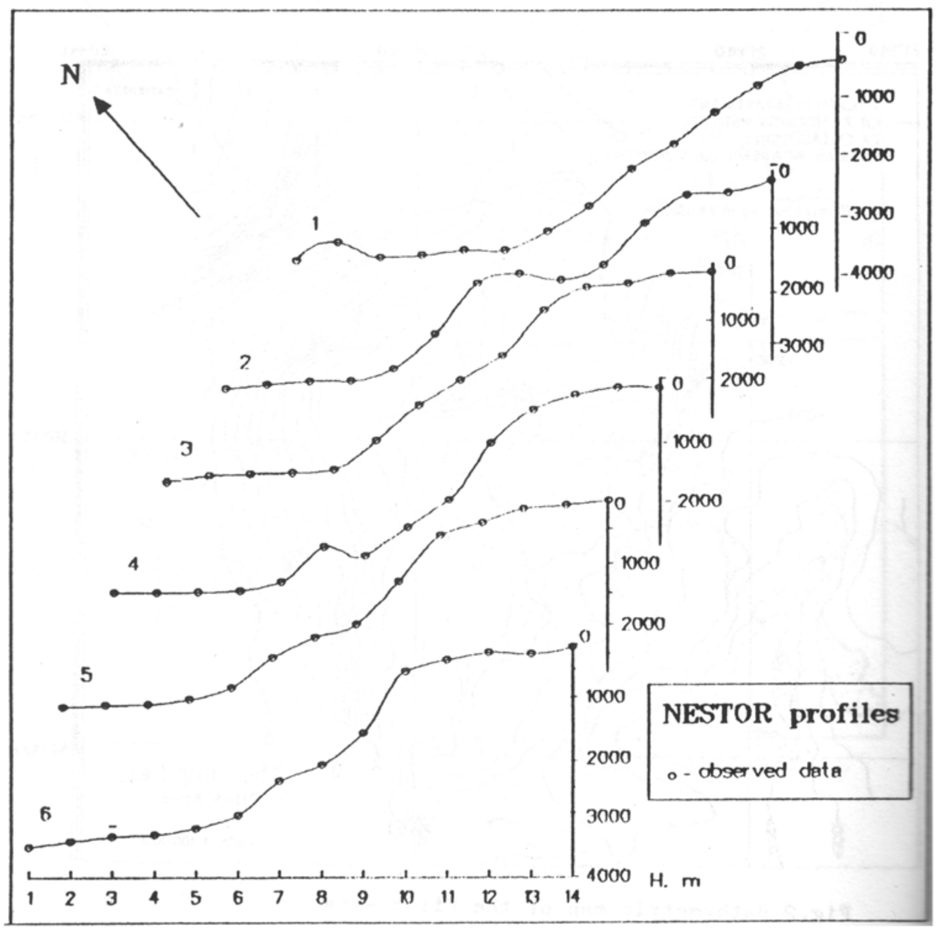


Fig.3 Profiles of the Sapiendza slope

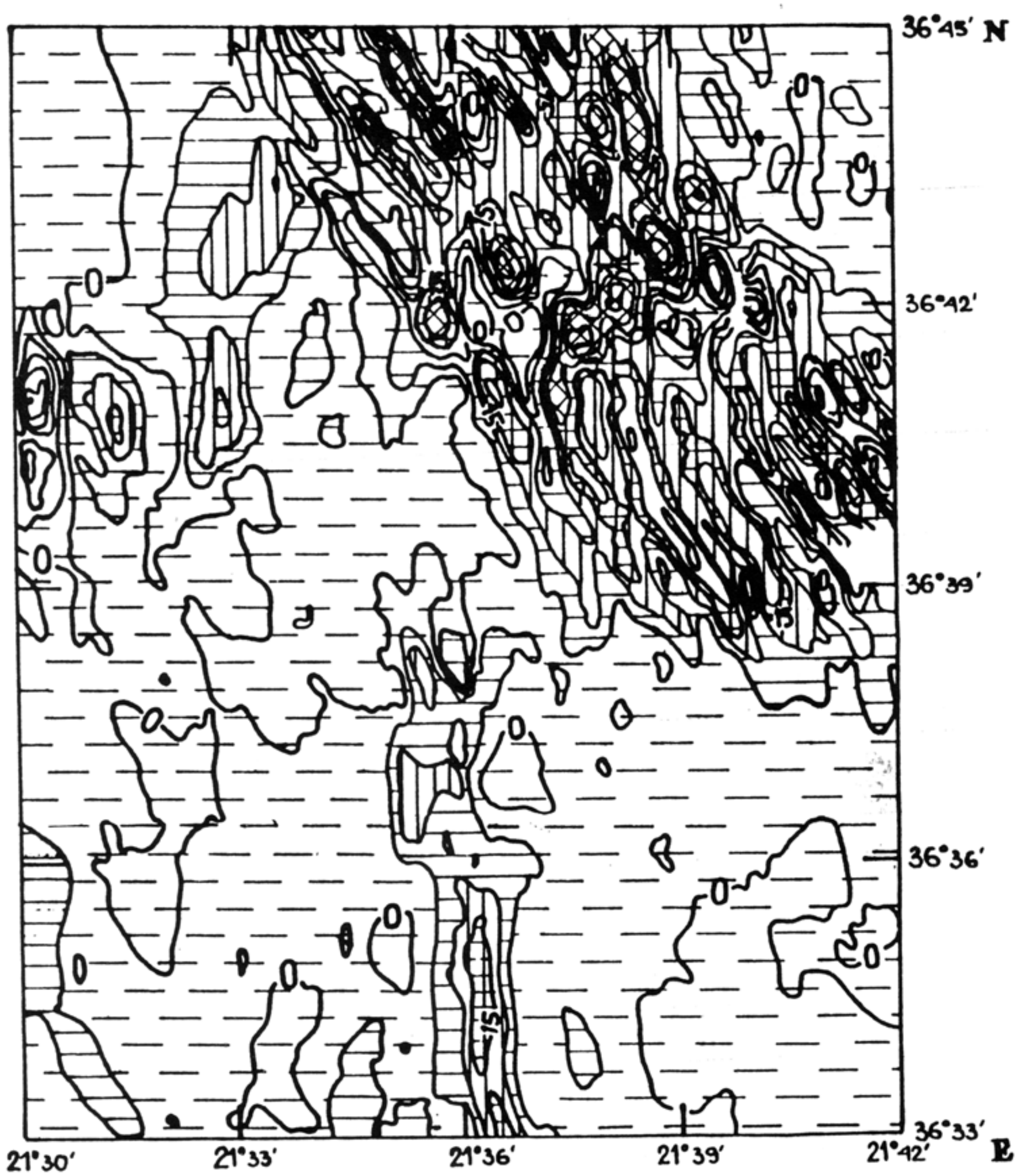
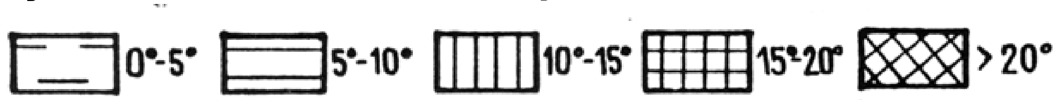


Fig.4 Distribution of the angles in the Pilos area



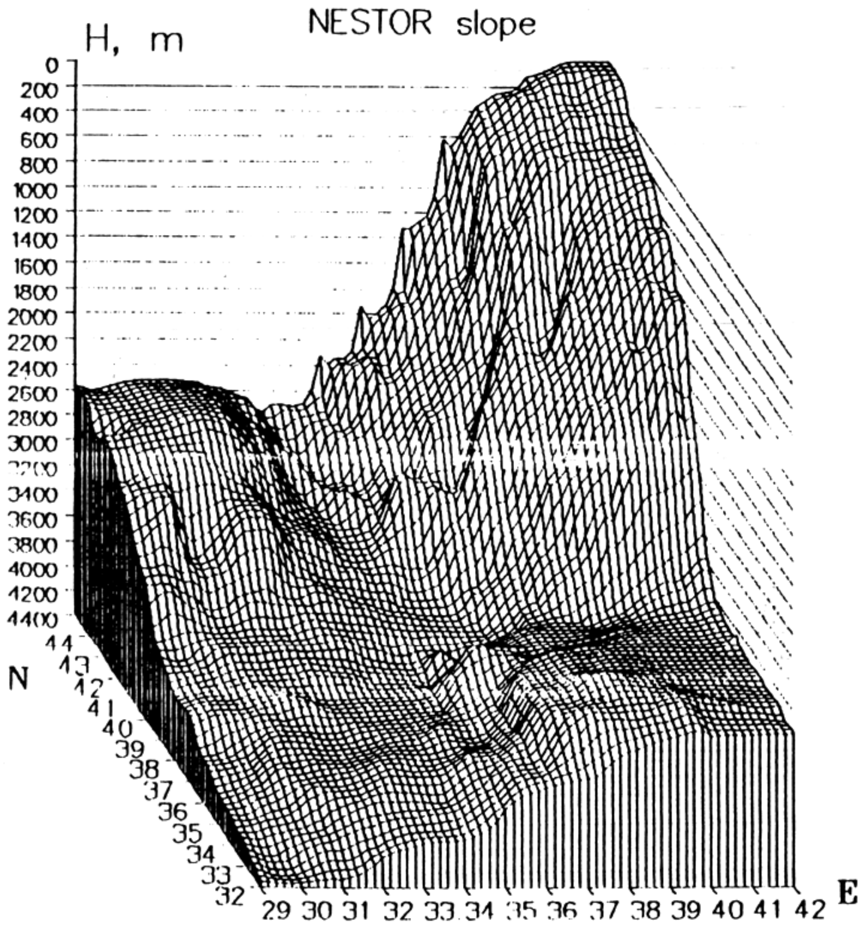


Fig.5 3D histogram of the Pilos area

Bottom sediments in the Pilos area
1 – Light brown mud transitional to clay;
2 – Dark greenish-grey mud;
3 – Light grey, bluish-grey clay;
4 – Light brown clay;
5 – Many-coloured laminated clay;
6 – Dark grey (black) mud

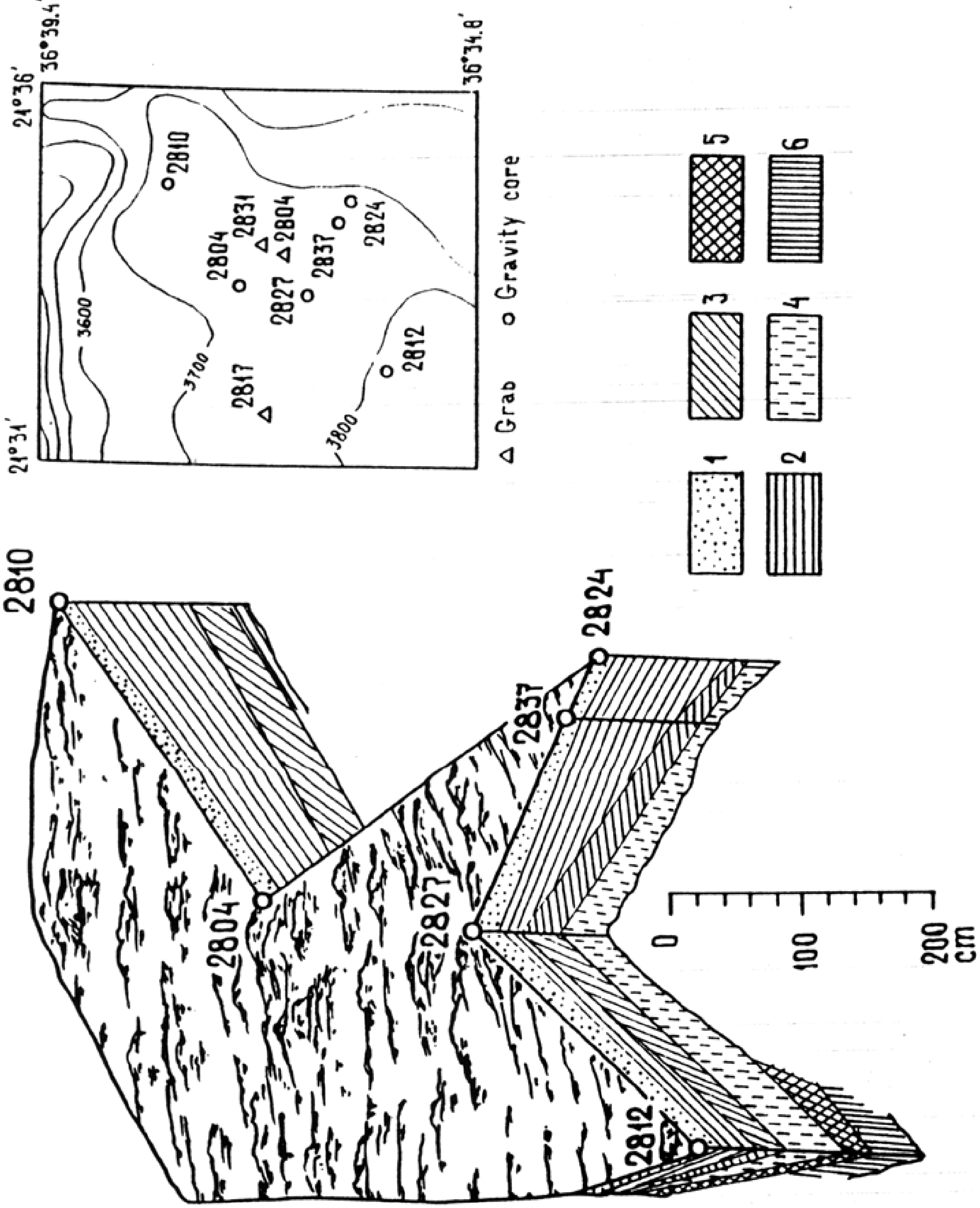


Fig.7 Recent muds in the Pilos area
(position 36°35.1'N, 2I°35.4'E,depth 3604m)
Photo by V.Kolchugin

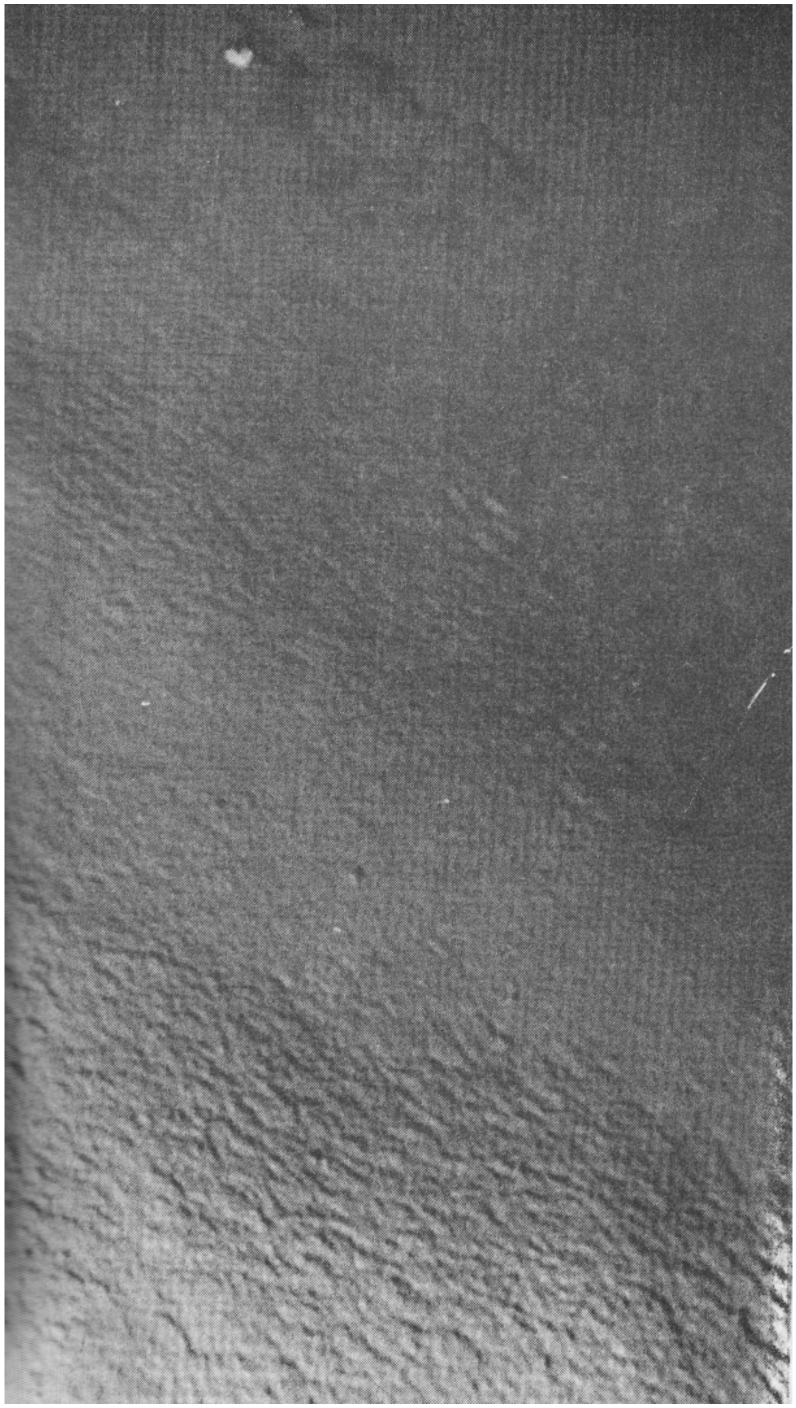


Fig.8 Bottom sediments on the slope of the Pilos area (position 36°39.3'N,21°30.3'E, depth 3265m) Photo by V.Kolchugin