

Lithological features of the upper Holocene in the east part of Black sea

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1. Introduction

During the 55th cruise of R/V "Prof. Vodyanitskiy" from 20.09. till 13.10.2000 by a project of IAEA, Viena many sediment cores from the east part of Black sea were collected (Fig. 1). This material was systematized and described in the vessel laboratory. Some cores were more in detail studied and analyzed in IO – BAS, Varna. Information for the lithology and the rate of sedimentation in the investigated region is provided as well as some other characteristics are presented. The sediment cores are mainly from the upper Holocene.

2. Material and Methods

The cores are collected by means of Multicorer – Bowers and Connelly – UK with 4 tubes. The tubes are with length of 60 cm. They are from 23 station. The stations on the shelf with taken cores are 2, 5, 6, 7, 8, 14, 15, 17, 18, 26, 27, 28, 29, 30, 31. The station on the continental slope foot and the bottom in the deepwater east part of Black sea with sediment sampling are 4, 9, 11, 19, 20, 23, 33, 37 (Fig. 1). Part of shelf cores are from two polygons. The polygons are on the shelf of Black sea near by Bathumy and Sinop (Fig. 2).

Lithological and macrofaunal (stratigraphic) analyses were made visually (Fig. 3) and the chemical analysis for determination contents of Corg, Porg, Pinorg in the sediments was made by means of spectrophotometric method (Iliina, 1966; Nevevska ya, 1963; Methods of..., 1980). The samples were taken at intervals of 0.5 cm 1 cm 2 cm 3 cm.

3. Results and discussion.

On the table-1 the rates of sedimentation

for the Upper Holocene in each station for sediments is presented. But the information for a computation of the rate of sedimentation in many cores is insufficient, because the Upper-Middle Holocene boundary was not reached by means of the multicorer.

The rate of sedimentation in station-29 can not be calculated because it is impossible to make a stratigraphic delimitation. Molluscs generate mixed tanatocoenose, formed by mechanical mode. Older sediments together with their typical frith, brackish-lacustrine fauna contents are mixed with younger deposits with marine fauna contents and Mediterranean immigrants. The biocoenose is of Holocene (*Modiolus phaseolinus*, *Abra alba*, *Abra ovata*, *Mytilus galloprovincialis*, *Rissoa parva* etc.) and Neoeuxinian (*Dreissena rostriformis*, *Monodacna caspia*, *Theodoxus pallasi*, *Turricaspia caspia lincta* etc.) stages.

A smell of H₂S was sensed in the deepwater cores and the core-8 on the shelf. Gas porous structures were found in the cores: 8 (2-44 cm); 2 (11-12 cm, 32-34 cm); 5 (3-8 cm). The channels of worms and living worms were found in the cores: 2 (1-2 cm-living worms, 0-2 cm); 14 (1-6 cm, 26-38 cm, 42-51 cm); 15 (13-16 cm, 19-39 cm); 17 (0-1 cm-living worms, 14-15 cm, 19-21 cm, 26-32 cm); 18 (15-32cm); 26 (5-36cm); 27 (3-43cm); 28 (0-2 cm-living worm, 0-42 cm); 29 (4-5 cm-living worms, 3-40 cm) 30 (1-34 cm) 33 (6-28 cm, 32-42 cm).

Analyses of the cores 5, 23, 29, 37 for a determination of organic carbon, organic phosphorus and inorganic phosphorus were made. The biggest quantity of Corg is in the

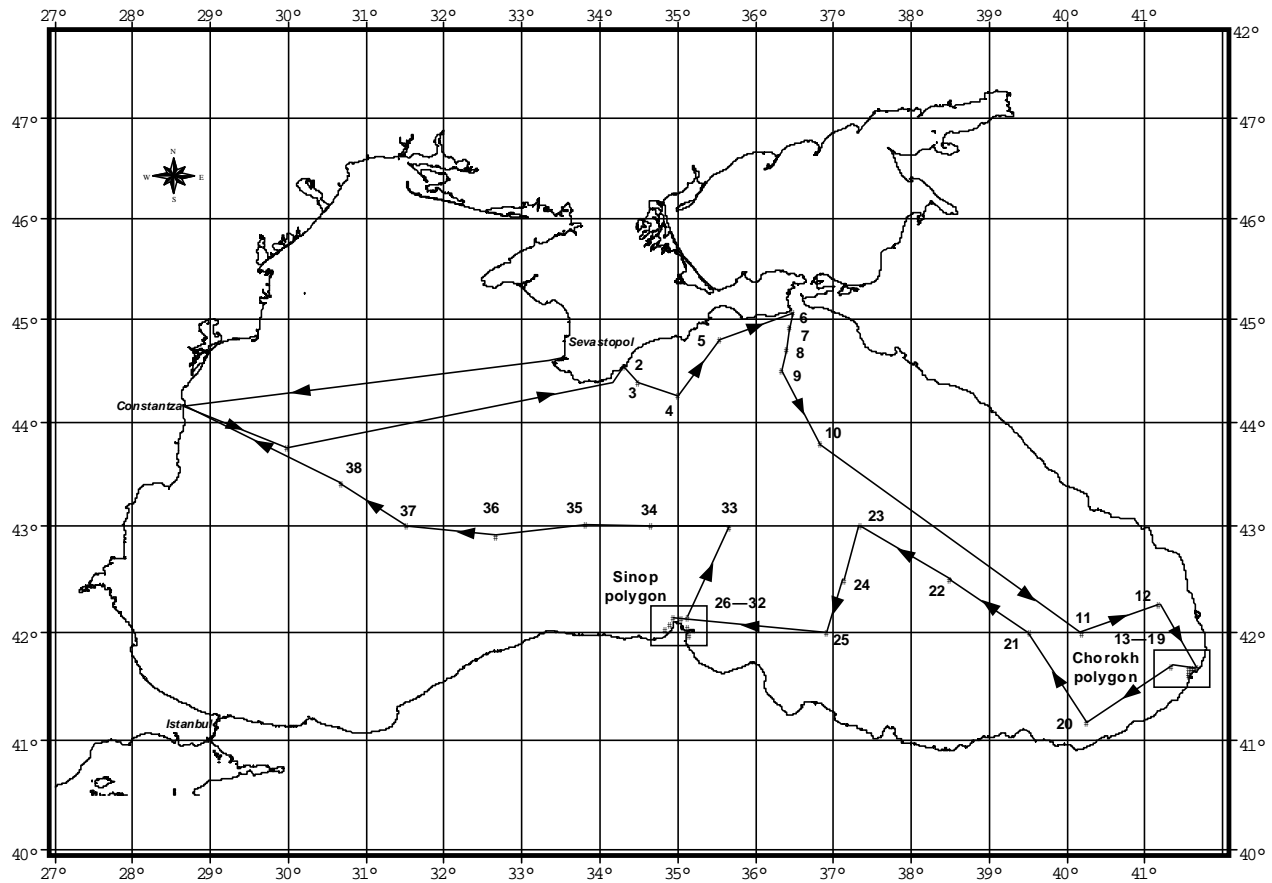


Fig. 1. The Map of Research Area
Black Sea Technical Co-operation Research Cruise "RADEUX"
(55th Cruise R/V Prof. Vodyanitsky, 20 September—13 October 2000)

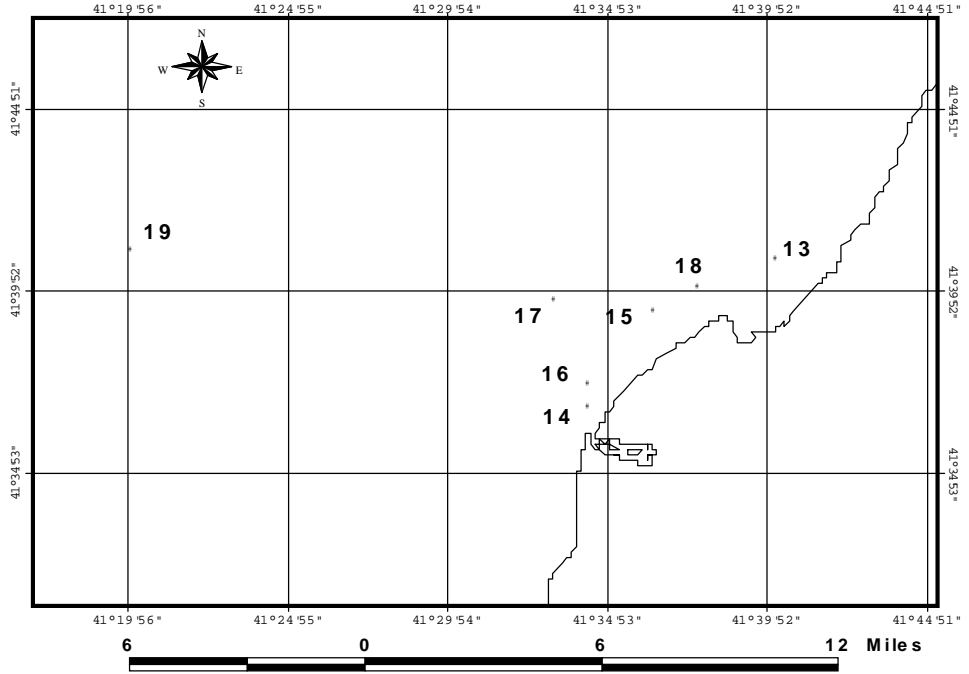


Fig. 2-A. The Map of the Chorokh Polygon

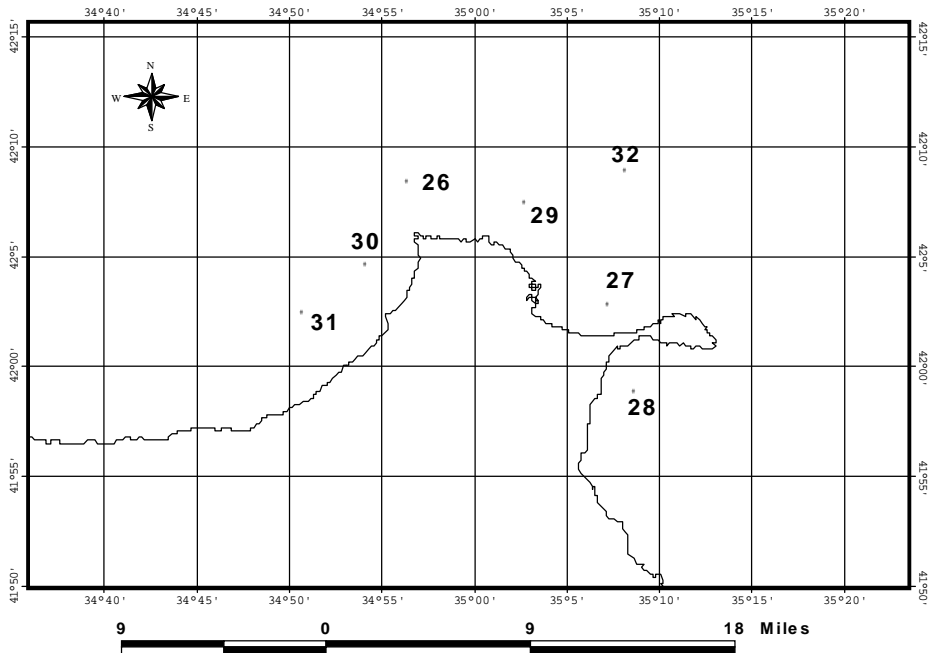


Fig. 2-B. The Map of the Sinop Polygon

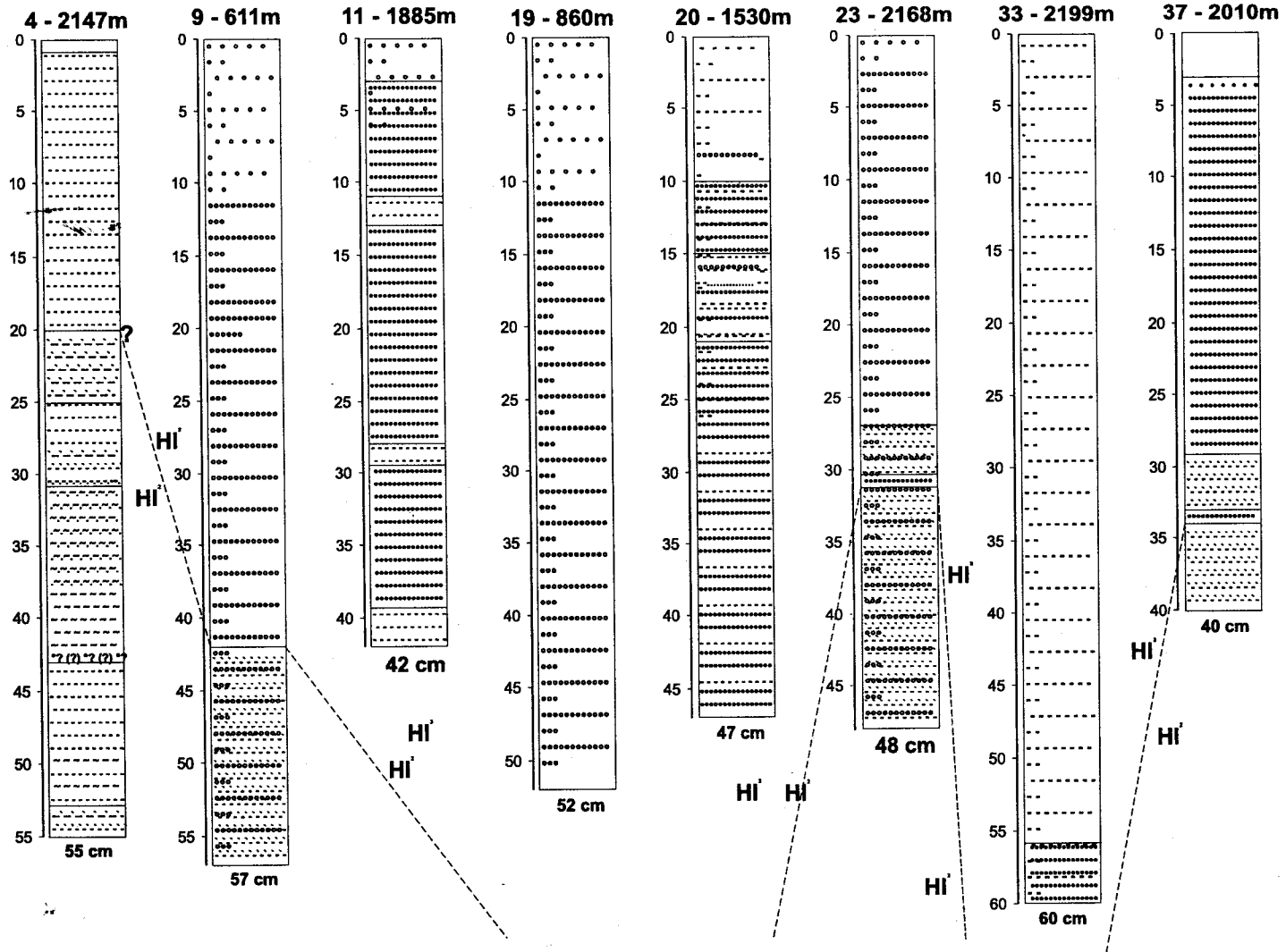


Fig. 3-A Lithological columns - deep-water area

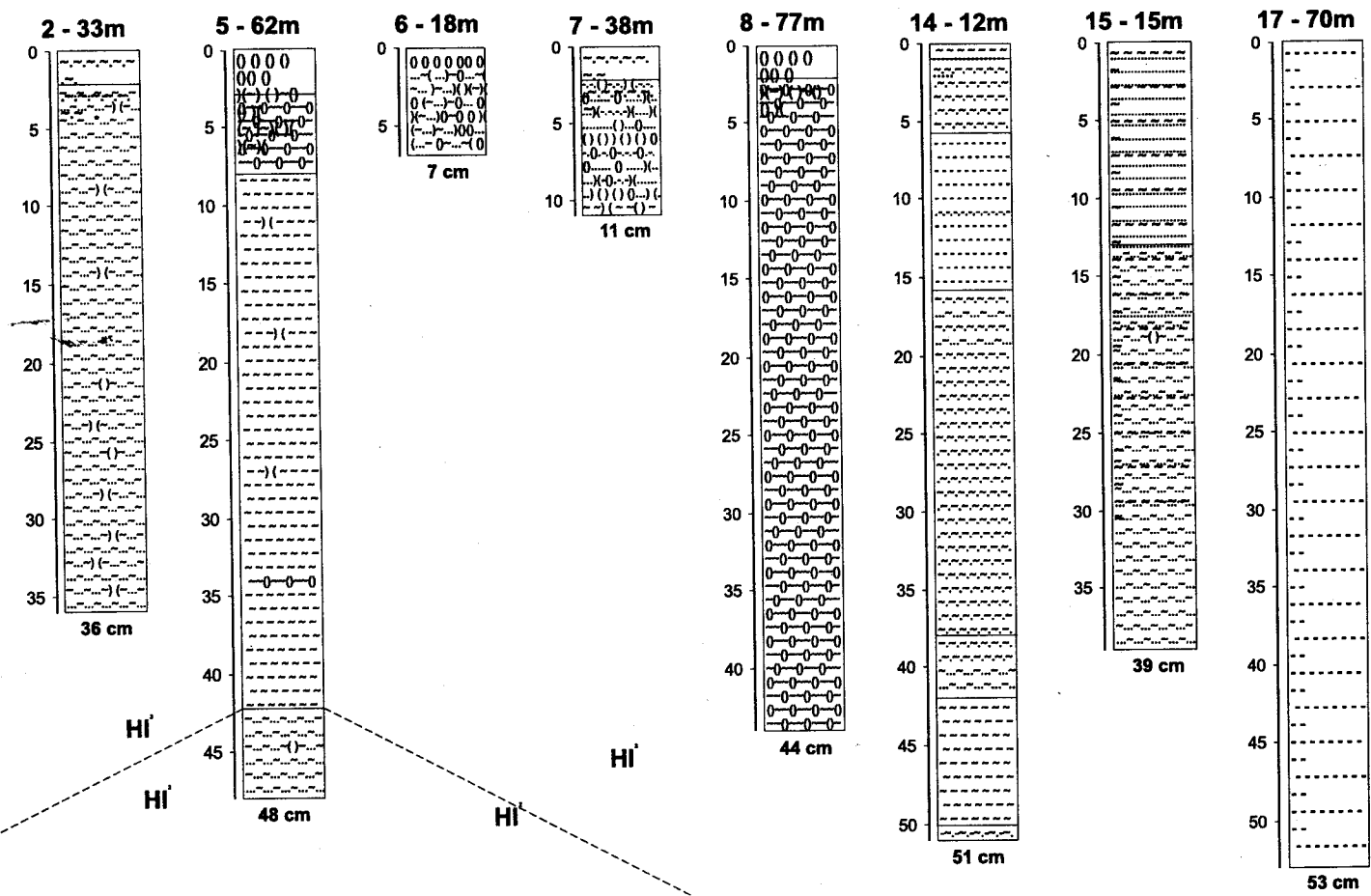


Fig. 3-B Lithological columns - shelf area

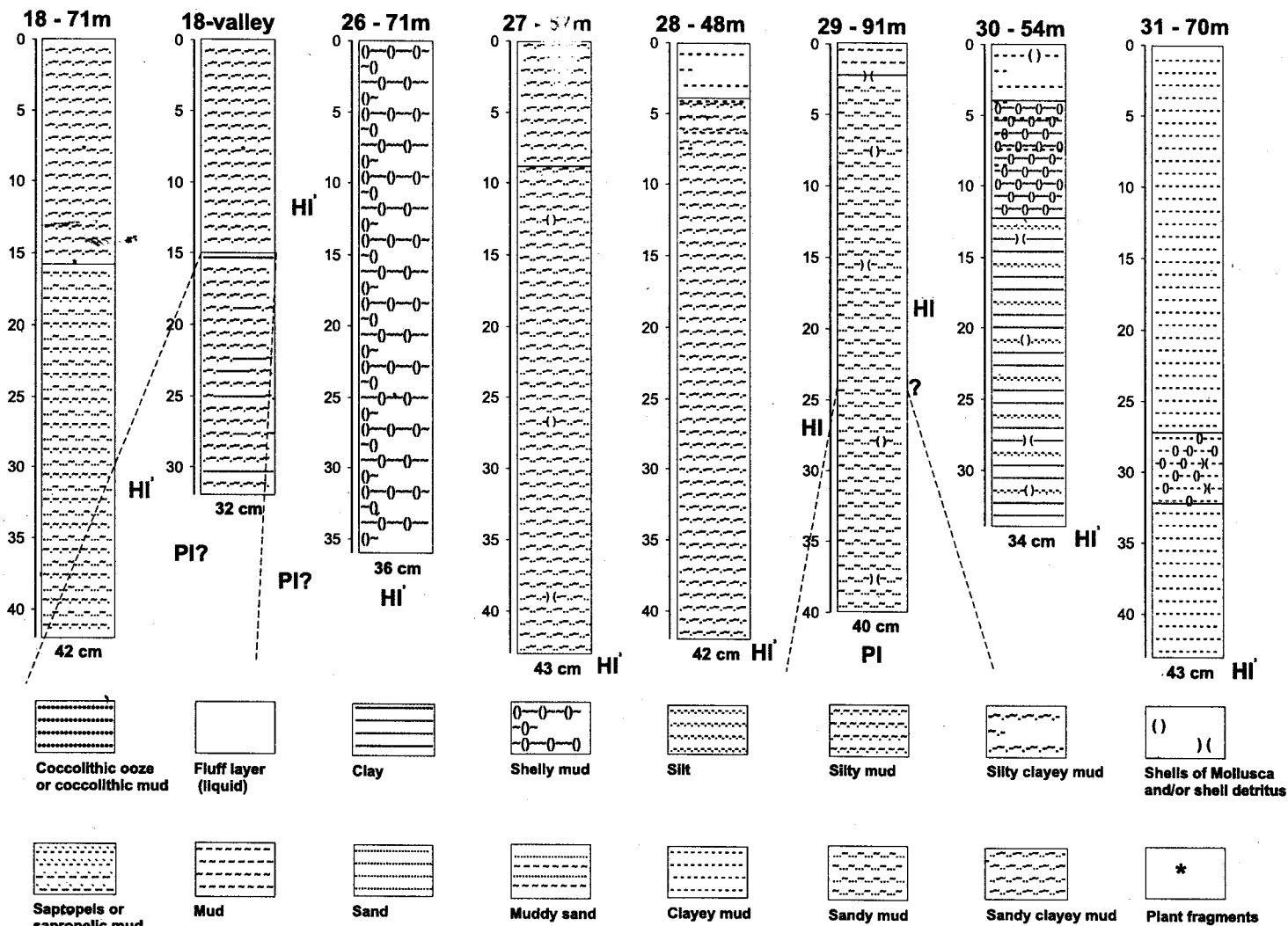


Fig. 3-C Lithological columns - shelf area

Table 1. Rates of sedimentation

| Core N° | Depth, m | Rate of sedimentation, cm/1000 years | | |
|---------|----------|--------------------------------------|----------------------------|-------------------|
| | | Shelf | Continental slope and foot | Deep-water kettle |
| 2 | 33 | >12 | | |
| 4 | 2147 | | | 6.(6)-8.(3) |
| 5 | 62 | 14 | | |
| 6 | 18 | >2.(3) | | |
| 7 | 38 | >3(6) | | |
| 8 | 77 | >14.(6) | | |
| 9 | 611 | | 14 | |
| 11 | 1885 | | >14 | |
| 14 | 12 | >17 | | |
| 15 | 15 | >13 | | |
| 17 | 70 | >17.(6) | | |
| 18 | 71 | >14 | | |
| 19 | 860 | | >17.(3) | |
| 20 | 1530 | | >15.(6) | |
| 23 | 2168 | | | 10.5 |
| 26 | 71 | >12 | | |
| 27 | 57 | >14.(3) | | |
| 28 | 48 | >14 | | |
| 29 | 91 | ? | | |
| 30 | 54 | >10.(3) | | |
| 31 | 69,5 | >14.(3) | | |
| 33 | 2199 | | | >20 |
| 37 | 2010 | | | 11.(3) |

sapropels (core 23 – 9.4-18.37 %; core 37 – 9.04-17.81 %), less in the coccolithic ooze (core 23 – 4.8-9.73 %; core 37 – 4.04-9.76 %) and the least quantity of Corg is in the shelf sediments (core 5 – 1.44-2.12 %; core 29 – 0.69-1.92 %). The contents of organic phosphorus in the sapropels are: core 23 – 0-0.01 %; core 37 – 0.002-0.013 %, in the coccolithic ooze are: core 23 – 0-0.01; core 37 – 0-0.038 %, in the shelf deposits are: core 5 – 0-0.007 %; core 29 – 0-0.012 %. The contents of inorganic phosphorus in the sapropels are: core 23 – 0.016-0.023 %; core 37 – 0.008-0.023 %, in the coccolithic ooze are: core 23 – 0.002-0.02 %, core 37 – 0.006-0.011 %, in the shelf deposits are: core 5 – 0.018-0.01 %, core 29 – 0.002-0.011 %.

The more part of sediments are with varied gray color. The sediments on the polygon near by Bathumy town (Fig. 2-A) are influenced by the alluvium of Chorokh river and their colors are from greenish gray and black to brown. Same intervals in the cores 2 (6-18 cm, 24-30 cm, 34-36 cm); 5 (8-42 cm); 14 (26-38 cm, 50-51 cm); 15 (19-39); 17 (1-40 cm); 18 (15-32 cm); 27 (9-43 cm); 28 (4-42 cm); 31 (32-43 cm) are with spotted

(mottled) pattern. The spots mainly dark gray and black with irregular shapes are usually related to the channels of worms. There are cores from Station-18 absolutely different for each other (Fig.3-C). It is most likely the sediments are formed in different conditions: near bottom flows related to side of underwater canyon(valley) and positive relief.

In deep-water part calm sedimentation is fixed in the stations 9, 19, 23, 37, and unstable sedimentation is fixed in the stations 4, 11, 20, 33 (Fig. 3-A). The unstable sedimentation can be explained with tectonic (seismic) activity and water currents acting near by the continental slope of the east part of Black sea (stations: 4, 11, 20) and the Andrusov swell (station 33) (Fig. 1). Perhaps these are the reasons which induce gravitational sediment fluxes in mentioned areas.

4. Conclusions

The rates of sedimentation, calculated for the analyzed cores from the east parts of the shelf, continental slope and foot are 14 cm/1000 years at the least and more. The computed rate of sedimentation for the deep-water kettle is low, up to 11 cm/1000 years,

but it near by The Andrusov swell can be higher than 20 cm/1000 years.

The tectonic activity and/or the water current activity could be marked by unstable

sedimentation in deep-water part of the Black sea. Such marine areas, fixed during the above mentioned cruise are in front Georgia, Crimea and the east part of Andrusov swell.

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Литоложки особености на горния холоцен в източната част на Черно море

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(Резюме)

В статията са изнесени данни от литолого-стратиграфски анализ на ядров материал, събран по време на 55-ия круиз на изследователския кораб "Проф. Водяницкий" (20.09. – 13.10.2000 г.). Данните включват скорости на седиментация, стратиграфско разчленение, литоложка характеристика и др. и са за източната част на Черно море. Добавена е и кратка информация от химически анализи за определяне на органичен въглерод, органичен фосфор и неорганичен фосфор на част от ядките.

В заключение е направено обобщение на изнесените данни. Скоростите на седиментация на континенталния шелф, континенталния склон и подножие в източната част на Черно море са над около 14 cm/1000 г., а в източната дълбоководна котловина са ниски до 11 cm/1000 г., но те могат да бъдат и по високи от 20 cm/1000 г. близо до вала Андрусов.

Тектонската активност и/или активността на морските течения могат да бъдат маркирани чрез нестабилна седиментация установена в дълбоководните геоложки ядки от източната част на Черно море. Такива области, установени по време на споменатата по-горе експедиция, са пред Крим, Грузия и източната част на вала Андрусов.

Постъпила 12.06.2001 г.