



PALEOECOLOGICAL INVESTIGATION OF THE PALAEOGENOUS INVERTEBRATES IN THE KARDZHALI REGION

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Abstract: With the help of the palaeogenou limestone of the species: *Ostrea*, *Chlamys*, *Pycnodonte*, *Spondylus*, *Gryphaea*, *Pitar*, *Dendrophyllia*, *Orbicella*, *Heliastrea*, *Flabellum*, and *Madrepora* an experiment have been made in order to reconstruct the life conditions and some other parameters of the sea environment in the region at the northwest of the town of Kardzhali. It is emphasized the importance of *Bivalvia* and *Anthozoa* as facies limestone in the view of their benthos way of life and their close relation and dependence on the conditions of the environment they once existed.

Key words: Paleogene, Palaeoecology, Invertebrata, Kardzhali, Bulgaria

INTRODUCTION

Geological investigations into the region of Kardzhali and around the town of Kardzhali, in regard with the unearthing of ores and non-metallic minerals have been made by many authors: KOSTADINOV & KARAGIULEVA (1957), IVANOV (1960), MINCHEV *et al.* (1964) etc. Paleontological investigation of the Palaeogene in the same region is represented in the publications of KARAGIULEVA (1964), SAPOUNDJIEVA (1964) and BELMUSTAKOV (1968). Defined are the representatives of the classes *Anthozoa*, *Bivalvia*, *Gastropoda*, *Echinoidea* and *Foraminifera* with series of leading species. During the seventies and eighties have been worked out detailed lithostratigraphics of the Eocene – Oligocene, on the ground of fossils faunas of the above-mentioned authors. The age of the sediments, subject of our investigation is Upper Eocene (Priabon).

It can be definitely said that during the overall investigations none of the authors ever touched the paleoecology on the basis of the definite fossils fauna. In this regard our experiments were considered as initial ones.

The aim of the publication herewith is to give overall paleoecological characteristics of the well known and discovered by us invertebrate fossil fauna, consisted in the palaeogenous limestone disposed in the neighbourhood of town of Kardzhali and the outcomes to be used for the restoration of the condition of life in the palaeogenous sea basin located in the region of the present Eastern Rhodopes.

MATERIAL AND METHODS

Fossils material is mainly from the classes *Bivalvia* and *Anthozoa* and it is collected from naturally unearthed surface by removal of external layers of fossil material artificially by us or by various excavation works. This was possible in the region on the westwards of the town of Kardzhali and Sredinka Village (Fig.1), UTM – LG61 at 246-400 m a.s.l. (MICHEV, 1999).

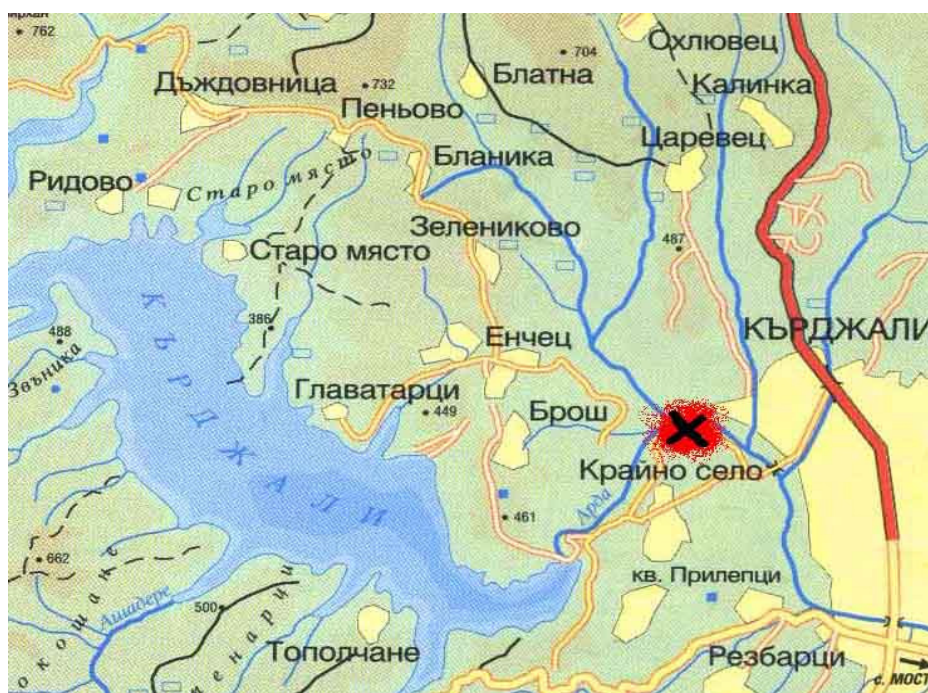


Fig. 1. The indicated spot shows the exposure in proximity to village of Sredinka

The organisms consisted in the clayey, sandy and limestone sediments, although not well preserved and considerably destroyed were extracted rather easily from the rock where included. For obtaining of fossil material we took into consideration the eroded exposures where the fossils came apart naturally from the rock by weathering processes. In this case the state of fossils preservation is not good enough which forced us to carry out additional treatment and cleaning.

During the obtaining of fossil material our tendency was to find a great number of the largest exemplars as in vertical as well as in horizontal direction of the open exposure. At the same time we have been taken specimens from the rock

matrix. The exposures have been described and drawings have been made. The spots where the fossils have been obtained were indicated and photographs taken. Regardless that our studies concentrate on the researching of molluscs and corals we looked over for the representatives of other groups of invertebrates as well. Thus we added to our collection representatives of the classes *Bryozoa* and *Foraminifera* that we used during the restoration of some paleoecological parameters of the sea environment. Although some authors (KARAGYULEVA, 1964) mention that some exemplars of the class *Gastropoda* have been found in the same region we could not find any. We used the data given by these authors because we exclude the lack of the fossils of class *Gastropoda* in these fields.

The collected fossil material is in various state of preservation. The organisms are greatly destroyed by the tectonic movements, which moved the sediment layers out of their surrounding material or they are accreted within the rock where consist in, so that it is almost impossible or practically unworkable to be extracted. In this way we have been discovered for the first time fossils of the class *Gryphaea*.

After mechanical and chemical methods of separation, cleaning, segregation and mounting of microfossils have been used, with the help of the available literature the fossils have been determined and specified in classes as well as with the help of consultations with the specialists. The following publications were used: ORLOV (Ed.) (1960), KARAGYULEVA (1964), TZANKOV (1969), NEVESSKAYA & ILINA (1983), DRUSHTITS (1974), BONDARENKO & MICHAILOVA (1984), PAMUKCHIEV & CHESHMEDZHIEVA (1987), CHOLAKOV & LUTSKANOV (1995) and others.

We had the possibility to compare with separate copies, property of the Department of Ecology and Environment Conservation, University of Plovdiv "St. Paisii Hilendarski" – Plovdiv, Bulgaria.

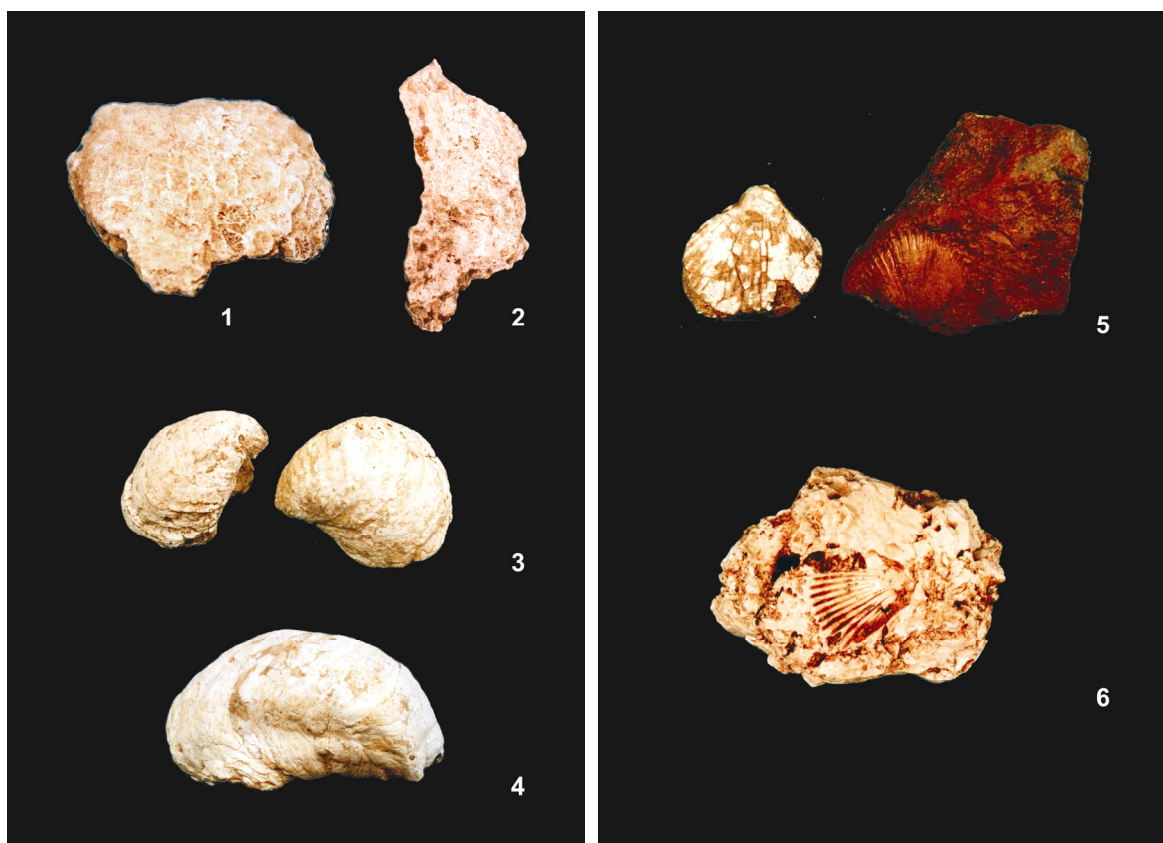
We consider that determination according to species and classes is fairly enough for the carrying out of paleological reconstructions and conclusions. In this regard have been used data obtained for the whole discovered paleobiocenosis.

RESULTS AND DISCUSSION

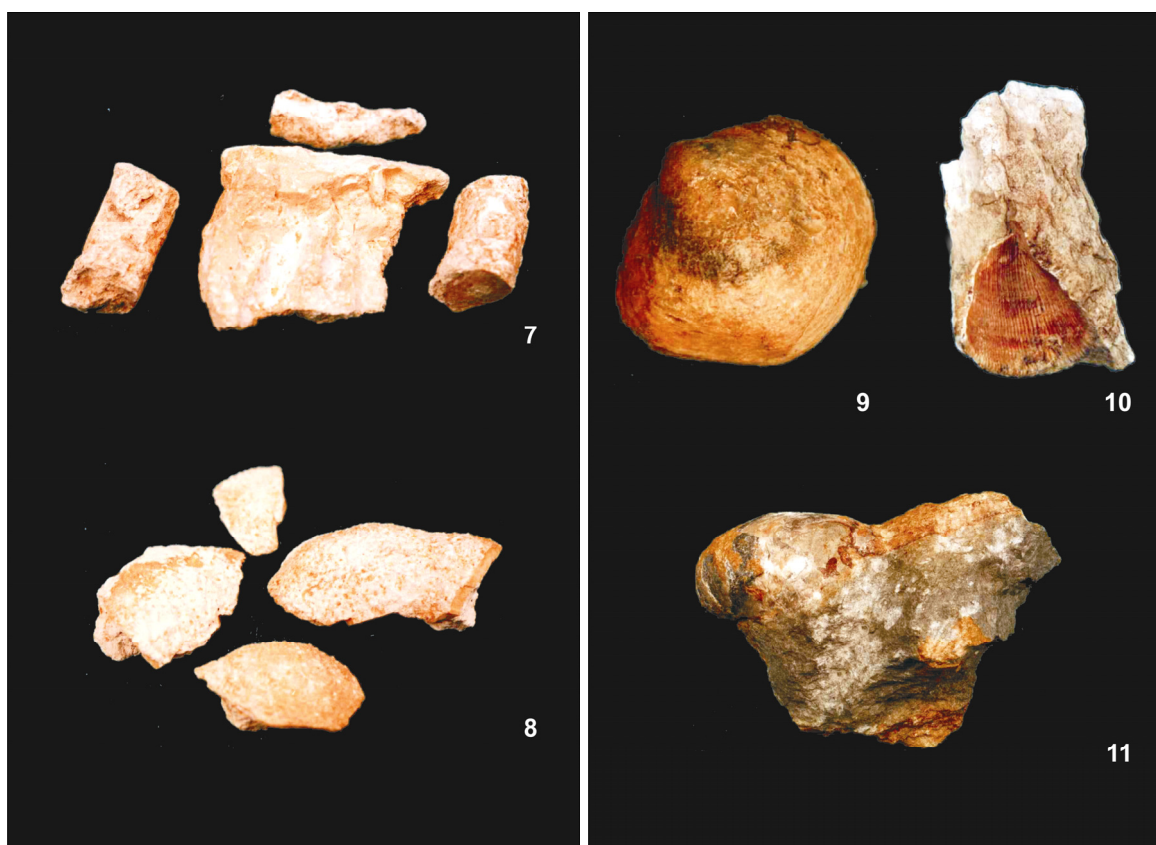
As a result of the field researches, laboratory works and taxonomical identifications have been determined the following fossil representatives – species of class *Bivalvia*, and from the type molluscs: *Ostrea*, *Chlamys*, *Pycnodonte*, *Spondylus*, *Gryphaea*, *Pitar*; species of class *Anthozoa* of type *Coelenterata*: *Dendrophyllia*, *Orbicella*, *Helistrea* and *Madrepora* (Fig. 2)

Paleological characteristic of the discovered fossil fauna

The discovered representatives of the class *Anthozoa* are stenotherm and stenohaline ones (minimal temperature degree 18.5° C, average 22-24° C, maximum about 36° C; salt content 27-39‰). This characteristic is referred mainly to the reef corals from the species *Dendrophyllia* and *Heliastrea*. Single corals from the species *Flabellum* develop within wide ranging temperature interval. Generally the corals subject to our determination could live in the air environment not for long. The last is linked to the presence of the high and low tides at the related sea basin.



1-Heliastrea; 2-Madrepora; 3-Gryphaea; 4-Pycnodonte; 5-Chlamys; 6-Pecten



7 - Dendrophyllia; 8 - Orbicella 9 - Pitar; 10 - Spondylus; 11 - Gryphaea



12 - *Ostrea*

Fig. 2. *Discovered fossils, which are identified to origins*

Bigger stability at these conditions has the corals that have porous vertebra (*Dendrophyllia*, *Heliastera*, *Flabellum*). Condition necessary for the normal life of the colonial corals is the light, while the single corals (we refer here the determined species by us) have been developed not so poorly in the darkness.

The normal life of the coral reefs necessitates certain hydrodynamic, connected with the circulation and the rough seawaters. This by one side provides food to the organisms and by other side wash away the various sediments from the reef construction. Usually the corals, also this is referred to the ones determined by us rarely exist in environment with heavy sedimentation. The last might contaminate the coral calyces and thus reduce their normal living activities. The motion and rough waters in basins where the coral exist as well as the water stream processes shape the way polyps look and function and reefs

Almost all reef-building forms of corals are in symbiosis with single-celled flagellate seaweeds – zooxanthellae, which during the photosynthesis evolve oxygen and consume carbon dioxide, which is obtained in the tissue of the actively growing polyps. This necessitates at the metabolism process of the corals, during the growth of their vertebra to live in depth in which exist zooxanthellae. The findings and the described by various authors oncolytic limestone prove this coexistence.

The fossilized coral reefs have considerably great importance at the restoration of the paleoecological situation for the certain period of time of geological past. Interpreting this information provides a way to reconstruct past climate change. The fact that the reef building and single corals live within very strict ecological requirements is a proof of our study about the sea basin of the region and all other zones with similar conditions. Where nowadays there is a composition of

palaeogenous sediments and yet observations made by us on the revelation of the reef formations of colonial corals are an evident of the existence of such environmental conditions in the palaeogenous period.

Mussels live in different kind of water basins within normal increased or decreased salinity range. The most representatives of the species (including all determined ones by us) live in the bottom i.e. they are typical benthos organisms. Usually mussels occupy waters in a certain section of the basin, which cause their relatively small mobility. It is peculiar for mussels that they hardly stand even slight changes in the amplitude of the ecological factors. This gives us a reason to accept them as good indicators for the conditions of the environment in the palaeogenous basin in the Eastern Rhodopes.

Upon the completion of the larvae stage of growth of the determined representatives of *Bivalvia*, the rest of their life is drifting in the bottom of the palaeogenous water basin. Depending on the character of the grunt some species are fastened (*Spondylus* and *Ostrea*), others creeping and leaping on the sea bottom (*Pecten*, *Clamys*). The last probably could get rapidly imbedded in the sand. For this had helped the identical valve of the shell. The mussels fastening themselves – *Spondylus* and *Ostrea* had been used to lie upon one of the valve as well as adapted to the cementation. Thus the shape of the shell had been affected, making one of the walls protruded from one side but the other one flat sided. In connection to this fastened way of life the foot got considerably reduced. Peculiar to the representatives of the species *Spondylus*, which occupied the shallow sections of the water basin is the fact that they used to fastening themselves with the help of prickles and byssus. Very likely the fastening have been temporary related to provide food and gave reflection to the difference between the two valves. In relation to the feeding the determined by us *Bivalvia* species had being filtrating mussels (*Ostrea*) and the other predatory ones.

Conditions for life in the paleogenous sea basin in Kardzhali region

The section of the sea basin, subject of our study is included in the composition of the Paleogenous Sea in the region of the Eastern Rhodopes. The life conditions of the organisms existing in this sea basin had been similar. The only difference is the lower depth in the Kardzhali zone, which we ascertained by the presence of hard shell organisms and fastening bivalves. Here could be proven the concentricity of very high salinity, which were causing the formation of the massif layers of limestone as well as helping for the growth of the reef corals. The developed here molluscs and coral fauna had had comparatively constant conditions for growth and the small changes in the environment had no influence and had not aroused much changes.

The analysis of the found and determined fossils as well as the lithological study of the sediments in which they are found show that the life conditions in the paleogenous basin within the part of our study were similar and the like to the conditions of the subtropical sea basins that can be seen in the present time. These conditions refer to depth up to 200 m.

The sedimentation carbonated and mechanical had been performing in basin with normal or near to the normal salt contents, which often made the water shallow. The shallow water is fixed by forming of thick carbonated sediments. The flows continually had accumulated fine sandy material. The studies on that section of the paleogenous basin carried out by us, investigation on the fossil fauna give the consideration to assume that in the Kardzhali region had been formed shallow water sea basin with favourable life conditions for corals and bivalves. In this aspect it is difficult to be explained the absence of gastropods, which were found and described in the north and northwest of Kardzhali.

The depth of the basin where the precipitation settled and the discovered fossil fauna existed, had been up till 200 m, the temperature of the water – 18-20-22° C, and the salinity of the water 32-36‰. The elucidation had been comparatively good and the dynamics of the waters favourable for the growth of the corals.

The bottom of the basin had been sandy and rocky at the core. The water had been pure and especially around Kardzhali with high calcium and magnesium content.

The particularized factors had not been constant at one time or another, which had affected the available paleo-biocenosis and likely caused the lack of any representatives of the gastropods. Typical for the sea bottom and for the bottom of the whole paleogenous sea basin in the East Rhodopes have been frequent pulsations, salient by the comparatively momentary quietness followed by lowering of the bottom.

According to the fossil fauna subject to our study, the temperature had remained comparatively constant in determined temperature limits. The temperature fluctuation as far as occurred had not exceeded 26° C. We associate the fluctuation in the temperature of the seawaters with the frequent motion of the sea bottom and the water currents. In other regions of the basin there are evidences for the lowering of the temperature of the waters, likely related to the climate changes (GORANOV, 1960).

Elucidation of the sea bottom had been defined by the low depth of the studied by us zone. It had been normal like and had helped for the better growth of the corals. We do consider that at least changes underwent on the salinity of the waters in the basin, which levels throughout the whole period of the Palaeogene were kept within the normal range.

All information is obtained during the study and the comparing together of the fossil fauna. The representatives that were studied reveal information for almost similar conditions. The changes (even small), which we have emphasized, show the wide variety of the biotope where they existed.

CONCLUSIONS

The studied paleogenous invertebrates near town of Kardzhali give us the reason to make a set of conclusions regarding the conditions for life in the sea basin where they had lived and give accurate information about some peculiarities of the concomitant paleo-biocenosis at the same places.

We can mention the following conclusions in the items as it appears below:

- Sedimentary rocks, which contain the found and determined fossil invertebrates, have been formed on the bottom of the sea basin, which had existed during the Palaeogene in the region of Kardzhali and the whole East Rhodopes.

- An experiment was worked out, on the basis of the determined fauna in order to be give paleoecological explanation of series of facts during the Palaeogene period in the Eastern Rhodopean sea basin.

- Abiotic factors of the sea environment, covering the studied palaeo-biogeocenosis, in which they have been included are close to these, that exists nowadays in the current tropical and subtropical sea basins in depth of about 150-200 meters.

- The biotope of the palaeo-biogeocenosis represents a zone of open sea basin, wide, with labile bottom due to continuous tectonic movements.

- The researched bivalves had been a part of the palaeogenous palaeo-biocenosis of the palaeoecosystem, and they had been in a process of ascending development, after that a period of dynamical equilibrium is on and continues until the present time.

- With our studies we do corroborate the importance of the fossil forms as facies limestone, in view of their benthos way of life and the narrow correlation with the conditions of the living surroundings.

- The researches on the palaeo-biogeocenosis show that the life in the Palaeogene's sea basin in the Kardzhali region is described with complicated interactions, whatever nowadays can be observed within similar biocenosis in some neoteric tropical sea basins.

REFERENCES

- BELMUSTAKOV E. 1968. Paleogen in Bulgaria. In: Stratigraphy Bulgaria. „Nauka i izkustvo”, Sofia, pp. 309-340 (In Bulgarian).
- BONDARENKO O., I. MICHAILOVA. 1984. Kratkii opredelitel izkopaemi bezpazvonochnih. “Nedra” Moscow, 533 p. (In Russian).
- GORANOV A. 1960. Litologia na paleogenskite otlozenia v chast ot Iztochnite Rodopi. Trudove varhu geologiat na Bulgaria, Seria geohimia i pol. izkopaemi. Izd. ABS, Sofia, 1: pp. 259-310 (In Bulgarian).
- DRUSHTITS V. 1974. Paleontology Invertebrata. Izd. MGU, Moskov (in Russian).
- IVANOV R. 1960. Magmatizam v Iztochnorodopskoto paleogensko ponizhenie. Part I – Geology. Trudove varhu geologiat na Bulgaria, seria geohimia i pol. izkopaemi. Izd. ABS, Sofia, 1: pp. 311-387 (In Bulgarian).
- KARAGIULEVA J. 1964. Les fossiles de Bulgarie VI^a – Paleogene Mollusca. Изд. БАН, Sofia, 270 p (In Bulgarian).
- KOSTADINOV V., J. KARAGIULEVA. 1957. Doklad za geolozhki prouchvania na chast ot Severoiztochnite Rodopi (Haskovsko, Kardzhaliisko, Momchilgradsko i Krumovgradsko). Geofond KG, Sofia (In Bulgarian).
- MICHEV T. 1999. UTM Directory of Bulgaria. Manuscript.
- MINCHEV D., G. GRIGOROV, E. BLANK. 1964. Novi Danni za stratigraphiata na vaglenosnia Priabon severno ot grad Kardzhali – Iztochni Rodopi. God. na SU, GG fakultet, v. 57, kn. 1. Izd. SU “Kliment Ohridski” (In Bulgarian).
- NEVESSKAYA L., A. ILINA. 1983. Dvustvorchatie I bruhonogie moluski kak pokazateli tipov baseinov. In: Problemii ecology faunii I flotii drevnih baseinv. Izd. “Nauka”, Moscow (In Russian).
- ORLOV U. (Ed.). 1960. Fundamentals Of Paleontology – Mollusca, Izd. AN SSSR, Moscow, 300 p. (In Russian).
- PAMUKCHIEV A., V. CHESHMEDZHIEVA. 1987. Paleontolozhki opredelitel. Bezgrabnachni. Izd. SU “Kl. Ohridski”, Sofia, 346 p. (In Bulgarian).
- SAPOUNDJIEVA V. 1964. Les fossiles de Bulgarie, VIb – Paleogene Echinoidea. Izd. ABS, Sofia, 64 p.
- TZANKOV V. 1969. Paleontology. Izd. “Nauka i Izkustvo”, Sofia, 560 p. (In Bulgarian).
- CHOLAKOV N., D. LUTSKANOV. 1995. Opredelitel na fosilni bezgrabnachni. Izd. PU “P. Hilendarski”, Plovdiv, 110 p. (In Bulgarian).

ПАЛЕОЕКОЛОГИЧНИ ПРОУЧВАНИЯ НА ПАЛЕОГЕНСКИ БЕЗГРЪБНАЧНИ ОТ КЪРДЖАЛИЙСКО

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(Резюме)

С помощта на Палеогенски вкаменелости от родовете : *Ostrea*, *Chlamys*, *Pycnodonte*, *Spondylus*, *Gryphaea*, *Pitar*, *Dendrophyllia*, *Orbicella*, *Heliastrea*, *Flabellum*, и *Madrepora* е направен опит за реконструкция на условията на живот и някои параметри на морската среда в района северозападно от гр. Кърджали. Изтъкнато е значението на *Bivalvia* и *Anthozoa* като фациални вкаменелости, поради бентосния им начин на живот и тясната им зависимост от условията на заобикалящата ги среда.