Δελτίο Ελληνικής Γεωλογικής Εταιρείας τομ. XXV/2, 549-560, 1991
Πρακτικά 5ου Επιστημονικού Συνεδρίου, Θεσσαλονίκη, Μάϊος 1990

Bulletin of the Geological Society of Greece vol. XXV/2, 549-560, 1991
Proceedings of the 5th Congress, Thessaloniki, May 1990

THE MIOCENE ECHINOIDS OF POLAND

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A B S T R A C T

The assemblage of echinoids from Poland (Paratethys) is coming from Badenian deposits - Middle Miocene and representing 27 species (and 6 specifically indeterminable) belonging to 15 genera. Some of unit of classification assigned only fragmentarily preserved material. Is worthy to notice completely preserved tests of *Parasakebua fontannesi* Cotteau and occuring in great number representants of genus *Echinocyamus* Phelsum coming from Korytnica Basin. The assemblage of echinoids from Badenian of Poland indicates for great similarity to assemblages from Miocene deposits of France, Sardinia and Transylvania. Some species are common with the Miocene of Ukraina, Hungaria, Jugoslavia, Greece and Egypt. On the basis of the described echinoids the palaeoecological conditions of the investigated region are also given.

INTRODUCTION

The occurrence of the Miocene echinoids of Poland is limited to the Badenian - Middle Miocene deposits. They were found on the Central, South and South-eastern Poland (Southern Poland).

The fauna assemblage of those areas is dominated by the mollusca,while the echinoids make up a rather accessory element which, however, attracte attantion by the variability of forms representing it. The presence of the echinoids was mentioned by the authors of geological works who mostly cited single genera only, e.g. Gołąb (1932), Radwański (1973). A detailed description of the Miocene echinoids of Poland dates from 1977 year (Mączyńska 1977-1988).

LOCALITIES AND CHARACTERISTICS OF MATERIAL

The Middle Miocene echinoids occur in six areas: Kraków-Miechów Region (South Poland), Wojcza-Pińczów Range and Korytnica Basin (the southern of the Holy Cross Mountains - Central Poland), Raków-Klimontów Shore (Southern Poland), Roztocze Region (South-eastern Poland) and Rzeszów Region (South Poland);(Fig.1).

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The fauna collected in this areas comes from different facies and displays some differences in assemblage of occurring in them.

At outcrops of Kraków-Miechów Region only remains of echinoids at the *Heterostegina* sands, in form of spines, plates or small test fragments, which represent three genera of Cidaridae and specifically undeterminable species *Centrostephanus* Peters order Diadematoida and *Echinolampas* Gray order Cassiduloida.

Echinoids of Wojcza-Pińczów Range occur at Pińczów Limestones pay attention numerous spines or their fragments and well preserved test fragments or isolated plates, mainly regular echinoids represent generally Cidaridae. Completly preserved test of regular echinoids its representatives of genus *Parasalenia* A. Agassiz and *Psammechinus* L. Agassiz and Desor. Between irregular echinoids sufficient numerously found tests of representatives of genus *Echinocyamus* Phelsum and test fragments of representatives of genus *Echinolampas* Gray; (Mączyńska in press)

The fauna collected in the Korytnica Basin occur in the clays and *Heterostegina* sands. The Korytnica clays provided a more divers and relatively well preserved material including complete tests of *Parasalenia* Cotteau and *Arbacina* Pomel representatives of the genera or some fragments of the tests, as well as deteched plates, spines and loose elements of the Aristotle's lanterns; (Pl. III, figs 1-2 a-c). Unfortunately, larger specimens in the Korytnica clays have completely been destroyed. The washing of large samples from the Korytnica clays have yelded many remains of echinoid tests, apical systems, spines and elements of Aristotle's lanterns which are indicative of the occurrence of the representatives of the genera *Scutella* Lamarck, *Clypeaster* Lamarck, *Spatangus* Gray, *Echinolampas* Gray and probably, other genera. In the *Heterostegina* sands occurrence numerous specimens of the genus *Echinocyamus* Phelsum (Pl. I, fig. 7), represented by four species, one of them, *Echinocyamus linearis* Capeder (Pl. I, fig. 5), abundant and the remaining three a few specimens only. The analysis of the materials from the Korytnica Basin indicated that echinoid assemblage comprises 13 genera and contiens 16 species item 5 specifically undeterminable; (Mączyńska 1977, 1987).

An interesting assemblage of echinoids was collected from the sandy facies of outcrops situated in the eastern part of the Raków-Klimontów Shore. They occur in a fine-grained quartz sand, horyzontally or diagonally stratified and localy cemented with calcium carbonate (about 4 m thickness at Rybnica and 20 m thickness at Swiniary), as well as unit of four gravel layers alternating with fine-grained unstratified sand layrs (1 m thickness at Rybnica); (Radwański 1973, Studencka 1986). Particularly noteworthy is more than 20 m thickness outcrop at Swiniary where whole assemblages of echinoids (Pl. II, fig. 4) and startfishes abundantly occur in very fine-grained sands. This locality, different from all other Badenian ones Poland, can be considered unique in Europe; (Radwański 1973)

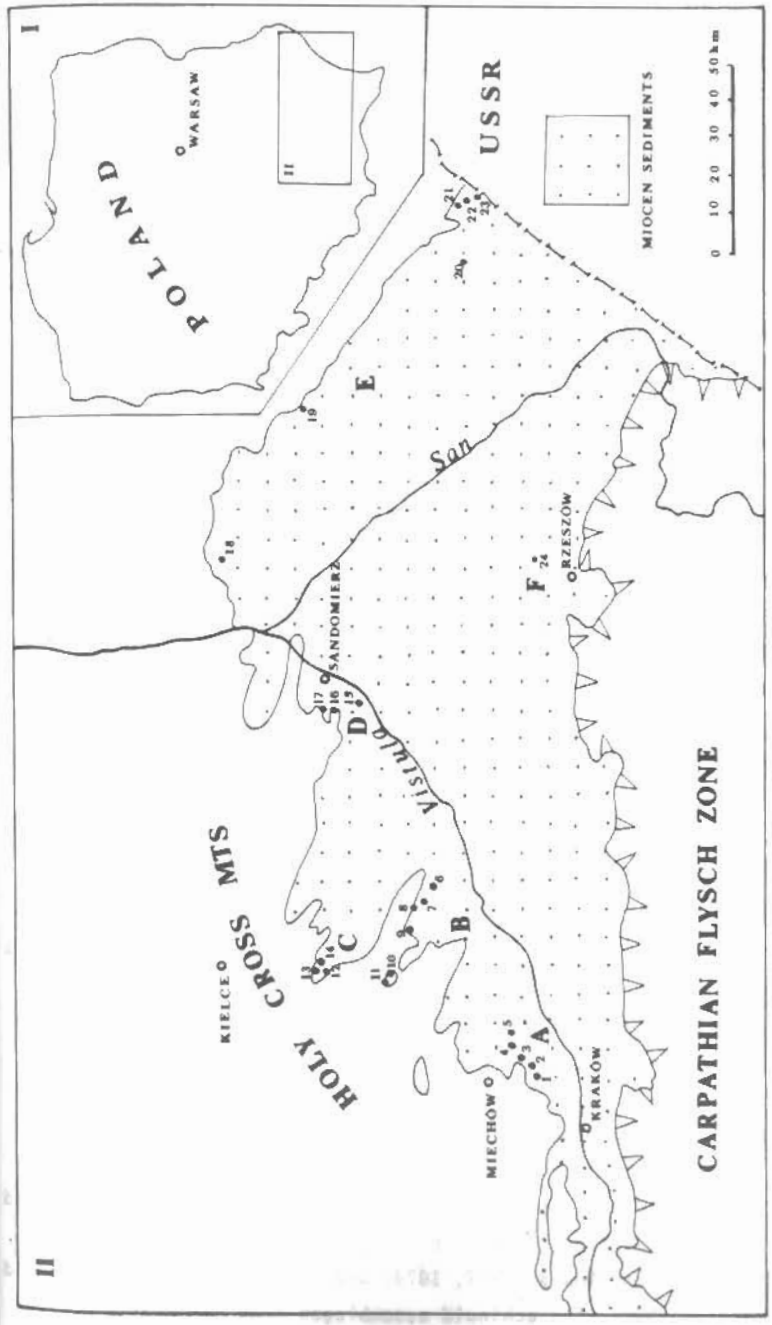

Fig. 1. Location map of the Middle Miocene - Badenian echinoids of Poland.
A. Kraków-Miechów Region: 1. Dziewięcioły, 2. Sosnówka, 3. Niesiechowice, 4. Lelowice, 5. Pakeczbuca,
B. Wojcza-Pińczów Region: 6. Kików, 7. Szczaworyż, 8. Żerniki, 9. Busko, 10. Pińczów, 11. Skowronno.
C. Korytnica Basin: 12. Korytnica, 13. Chomentów, 14. Karsy.
D. Raków-Klimontów Shore: 15. Swiniary, 16. Rybnica, 17. Nawodzice.
E. Roztocze Region: 18. Węglin, 19. Trzęsiny, 20, Huta Lubycka, 21. Huta Różaniecka, 22. Monastyrz, 23, Radruż.
E. Rzeszów Region: 24. Niechobrz.

In these sands with calcareus cementation, the echinoids form banks dominated by the representatives of the genus *Psammechinus* L. Agassiz and Desor, with a majority of their specimens preserved in their lifetime position, frequently with spines and Aristotle's lanterns. Twelve species and two specificaly indeterminable to belong for eight genera was found in the Raków-Klimontów Shore; (Mączyńska 1988).

In the Roztocze Region the echinoids fauna was colected in limestones and sandstones at Monastyrz, in quartziticcalcareus sandstones at Trzęsiny, in sandy-lithothamnian facies at Huta Lubycka and Huta Rózaniecka, in calcareus sandstones at Radruź and in glauconite sands and marly clays at Węglin. Most numerously represented (three species and one specificaly indeterminable) is the genus *Spatangus* Gray, the specimens of which display largest dimensiones of tests ever found in the Middle Miocene of Poland. The occurrence twelve and one species undeterminable of echinoids of six genera has so far been found in the Middle Miocene of Roztocze Region; (Mączyńska 1979).

In the Rzeszów-Region the echinoid fauna was collected in clays and lithothamnian limestones. Known from one outcrop - Niechobrz is represented by seven genre, between them for particular consideration deserve representative of *Clypeaster scillae* Desmoulins probably delimiting Northern range of occurrence of representatives of this genus; (Kalabis 1949). In general ascertained occurrence of representatives of seven genera represente by four species and three specific identification is impossible. The echinoid assemblage of this region is presently subject to investigation; (Mączyńska in prep.).

CONCLUSION

As indicated by the results of geological-paleontological studies, the Middle Miocene sea was not very deep in the area discussed. In the Korytnica Basin, as shown by the fauna of corals in the Korytnica clays, the depts of the sea amounted presumably to about 12 m Likewise, the *Heterostegina* clays display a stron shallowing of the see; (Hoffman 1977). The Raków-Klimontów Shore, in which an assemblage of open-sea fauna occurs, preserved in its liftime position, was adjucted to life in a near-shore environement of sandy bottom (at Nawodzice) and the depth of the basin in determined to be twentyodd (at Rybnica) or more (at Swiniary) meters; Radwański 1973). In the Roztocze Region, the depth of the sea is determined to be 30 m and, in some places, 100 m (at Monastyrz). The water had a normal or nearly normal salinity, favorable in particular to the development of malacofauna (Jakubowski and Musial 1977, 1979) and the water temperature could rich 25° C. (Macioszczyk 1988). The echinoid assemblages from the Middle Miocene of Poland, including such termophilic forms as *Clypeaster* Lamarck, *Echinolampas* Phelsum and *Schizaster* L. Agassiz are indicative of tropical and or subtropical climatic conditiones; (Marcopoulou-Diacantoni 1973, Mączyńska 1987).

The Middle Miocene species of echinoids occurring in Poland are mostly known from the Miocene deposits of France - in the Rhone Basin (Lambert 1910, Philippe 1984), Sardynia and Transylvania. Some species are common with the Miocene of the Ukraina (Szörenyi 1953), Hungaria (Vadász 1915, Mihály 1985), Greece (Marcopoulou-Diacantoni 1973) and Egypt (Ali and Mączyńska 1986).

The comparative investigations of echinoid fauna give evidence of very probably communications between the Tethys and Paratethys during the Middle Miocene. This can be demonstrated by several common echinoid genera and species (Ali and Mączyńska 1986; Mitrović-Petrović and Marcopoulou-Diacantoni 1986) shared those two provinces.

ECHINOID TAXA OCCURRING IN THE MIDDLE MIOCENE (BADENIAN) DEPOSITS OF CENTRAL AND SOUTHERN POLAND (PARATETHYS)

Taxonomy	Material
Order Cidaroida Claus, 1880	
Family Cidaridae Gray, 1825	
Genus *Cidaris* Leske, 1842	
1. *Cidaris desmoulinsi* Sismonda, 1842	spines
2. *Cidaris seamais* Sismonda, 1842	spines
Genus *Cyathocidaris* Lambert, 1919	
3. *Cyathocidaris avenionensis* (Desmoulins, 1837)	plates, spines, test fragments
Genus *Plagiocidaris* Pomel, 1883	
4. *Plegiocidaris peroni* (Cotteau, 1905)	spines, plates
Order Diadematoida Duncan, 1889	
Family Diadematidae Gray, 1855	
Genus *Centrostephanus* Peters, 1855	
5. *Centrostephanus calarensis* Cotteau, 1845	spines
6. *Centrostephanus rhodonicus* (Mayer-Eymar,1910)	spines
7. *Centrostephanus* sp.	spines
Order Temnopleuroida Mortensen, 1942	
Family Temnopleuridae A. Agassiz, 1872	
Genus *Arbacina* Pomel, 1869	
8. *Arbacina monilis* Desmarest, 1822	tests
9. *Arbacina catenata* (Desor, 1847)	test fragments
10. *Arbacina* sp.	spines

Family Toxopneustidae Troschel, 1872

Genus *Schizechinus* Pomel, 1869

11. *Schizechinus duciei* (Wright, 1855) — test
12. *Schizechinus dux* (Laube, 1871) — tests
13. *Schizechinus hungaricus* (Laube, 1871) — test
14. *Schizechinus chateleti* Lambert, 1910 — test

Order Echinoida Claus, 1876

Family Echinidae Gray, 1825

Genus *Psammechinus* L. Agassiz and Desor, 1846

15. *Psammechinus dubius* L. Agassiz, 1840 — tests, test fragments

Family Parasaleniidae Mortensen, 1903

Genus *Parasalenia* A. Agassiz, 1863

16. *Parasalenia fontannesi* Cotteau, 1888 — tests, test fragments

Order Clypeastroida A. Agassiz, 1872

Family Clypeasteridae L. Agassiz, 1835

Genus *Clypeaster* Lamarck, 1801

17. *Clypeaster scillae* Desmoulins, 1837 — test
18. *Clypeaster* sp. — test fragments

Family Fibularidae Gray, 1855

Genus *Echinocyamus* von Phelsum, 1774

19. *Echinocyamus pusillus* (O.F. Müller, 1776) — tests
20. *Echinocyamus pseudopusillus* Cotteau, 1895 — tests
21. *Echinocyamus circularis* Capeder, 1906 — tests
22. *Echinocyamus linearis* Capeder, 1906 — tests

Family Scutellidae Gray, 1880

Genus *Scutella* Lamarck, 1818

23. *Scutella* sp. — test fragments

Order Cassiduloida Claus, 1880

Family Echinolampidae Gray, 1851

Genus *Echinolampas* Gray, 1825

24. *Echinolampas* sp. — test fragments

Order Spatangoida Claus, 1876

Family Schizasteridae Lambert, 1905

Genus *Schizaster* L. Agassiz, 1836

25. *Schizaster karreri* Laube, 1871 — test
26. *Schizaster ventiensis* Lambert, 1906 — test

Family Spatangidae Gray, 1825

Genus *Spatangus* Gray, 1825

27. *Spatangus austriacus* Laube, 1871 — tests

28. *Spatangus delphinus* Defrance, 1827 — test
29. *Spatangus hungaricus* (Vadász, 1915) — test
30. *Spatangus fabianii* (Lambert, 1924) — test
31. *Spatangus* sp. — test fragments

Family Lovenidae Lambert, 1905

Genus *Echinocardium* Gray, 1825

32. *Echinocardium deikei* Desor, 1857 — tests
33. *Echinocardium biaense* Mihály, 1985 — test

EXPLANATIONS OF PLATES

Pl. I.

Fig. 1. *Cidaris zeamais* Sismonda; spines, Korytnica, No VIII MZ Ee 1248, x 6.

Fig. 2. *Cyathocidaris avenionensis* (Desmoulins); a-b isolated ambulacral plates, Niechobrz, No MZ VIII Ee 1396, c - isolated interambulacral plate, Korytnica, No MZ VIII Ee 888, x ca 7.

Fig. 3. *Parasalenia fontannesi* Cotteau, Korytnica, No MZ VIII Ee 931, a - adoral, b - aboral views, x 7.

Fig. 4. *Echinocyamus pseudopussilus* Cotteau; Korytnica, No MZ VIII Ee 901, a - adoral, b - aboral, c - lateral views, x 7.

Fig. 5. *Echinocyamus linearis* Capeder; Korytnica, No MZ VIII Ee 907, a - adoral, b - aboral, c - lateral views, x 7.

Fig. 6. *Echinocyamus circularis* Capeder; Korytnica, No MZ VIII Ee 902, a - adoral, b - aboral, c - lateral views, x 7.

Fig. 7. A sample of the sifted material with abondant, diverse species of *Echinocyamus* Phelsum from the marly sands at Korytnica, x 5.

Fig. 8. *Schizaster ventiensis* Lambert; Korytnica, No MZ VIII Ee 900, a - adoral, b - aboral, c - lateral views, nat. size.

Fig. 9. *Echinocardium biaense* Mihály; Swiniary, No MZ VIII Ee 1325, a - adoral, b - lateral, c - anterior, d - posterior views, nat. size.

Pl. II.

Fig. 1. *Clypeaster scillae* Desmoulins; Niechobrz, No MZ VIII Ee 1265, a - aboral, b - adoral, c - anterior, d - posterior, e - lateral views, x 0.5.

Fig. 2. *Spatangus austriacus* (Laube); Huta Lubycka (specimen from Warsaw University collection), a - aboral, b - lateral views, nat. size.

Fig. 3. *Spatangus austriacus* (Laube); Swiniary, fragment of the test with visible spines, No MZ VIII Ee 1322, x 4.

Fig. 4. Fragment of the echinoid-bearing at Swiniary, most of them represent *Psammechinus dubius* L. Agassiz in their lifetime position, No MZ VIII Ee 1309, nat. size.

Pl. III.

Sifted material from Korytnica.

Fig. 1. Spines abundantly, those of *Cidaris seamais* Sismonda are visible, No MZ VIII Ee 1248, x 5.

Fig. 2. Elements of Aristotl's lantern; a - rotules, b - demipyramids, No MZ VIII Ee 1270, c - epichyses and labra, No MZ VIII Ee 1260 and 1268, x 5.

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