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EOCENE BENTHONIC SMALLER FORAMINIFERA FAUNA FROM DUDAR

by

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EOCÉN BENTOSZ KIS-FORAMINIFERA FAUNA DUDARRÓL

I. BEVEZETÉS

A dudari eocén kőszénösszlet közvetlen fedőjéből előkerült bentosz kis-Foraminifera faunájának feldolgozásával elsődleges célom az eocénben egyedülállóan gazdag és jó megtartású anyag korszerű leírása és dokumentálása volt.

Az első magyarországi eocén bentosz kis-Foraminifera vizsgálatok a múlt század második felében HANTKEN M. nevéhez fűződnek, de munkásságának fő területe az Esztergomi-medence, valamint Buda és környéke volt. Azóta erről csak néhány kisebb terjedelmű feldolgozás született (VITÁLISNÉ ZILAHY L. 1967, 1969, NYÍRŐ R. 1970). Jelen dolgozatommal ezt a hiányt igyekszem részben pótolni.

A dolgozat célja a bentosz kis-Foraminifera fauna korszerű rendszertani feldolgozása mellett, annak biosztratigráfiai, paleoökológiai és paleobiogeográfiai értékelése, a vizsgált képződmény rétegtani helyzetének tisztázása.

Köszönettel tartozom DR. SZŐTS ENDRÉ-nek, aki saját gyűjtését adta át feldolgozásra és munkámat kezdettől fogva önzetlenül segítette hasznos tanácsaival. Köszönetemet fejezem ki DR. MONOSTORI MIKLÓS-nak és DR. HORVÁTH MÁRIÁ-nak értékes tanácsaikért. Itt mondok köszönetet DR. VÖRÖS ATTILA, BERNHARDT BARNA, DR. KECSKEMÉTI TIBOR, DR. BÁLDINÉ BEKE MÁRIA és DR. ORAVECZNÉ SCHEFFER ANNA kollégáimnak, akik munkámat kezdettől fogva figyelemmel kísérték, és a felmerülő szakmai problémáknál folyamatosan segítségemre voltak. TAKÁCS BARNÁNÉ, LAKY ILDIKÓ készítették a scanning elektronmikroszkópos felvételeket, GYARMATI JUDIT és FÜLÖP JÓZSEF-né a technikai feladatok elvégzésében nyújtottak segítséget.

Végül köszönetet mondok a Magyar Állami Földtani Intézet vezetőségének, hogy számomra a munka elvégzését lehetővé tette.

II. A FÖLDTANI MEGISMERÉS TÖRTÉNETE

A Bakony hegység területén fekvő Dudari-medence és közvetlen környékének kutatása már a múlt században megkezdődött. Itt azokkal a főbb munkákkal kívánok foglalkozni, melyek a dolgozatomban tárgyalt szűkebb területet tárgyalták.

E területre vonatkozó első adatok G. STACHE (1862a, b) és HANTKEN M. (1867, 1874, 1875a, b, 1878) nevéhez fűződnek. Az 1900-as évek elején PRINZ GY. (1904) majd TAEGER H. (1910, 1936) és TOMOR-THIRRING J. (1934, 1935, 1936) foglalkozott a terület eocén képződményeivel. PRINZ GY. (1904) megkísérli az eocén képződmények rétegtani besorolását alsó-, középső- és felső-eocénre bontva. TAEGER H. (1936) már egy teljesebb eocén rétegsort közöl a területről a kőszénösszlet alatti tarkaagyagtól kezdődően, aminek korát középső-eocénbe teszi. TOMOR-THIRRING J. (1934) Dudar—Csesznek környékéről a középső-eocén kőszénösszlettől kezdődő rétegsort ír le. A kőszénkutatáshoz kapcsolódik VITÁLIS I. (1923, 1928, 1932, 1946) számos munkája is.

Az e területről szóló kutatástörténet új szakasza SZŐTS E. (1948, 1956) munkásságával kezdődik. Munkájában (1956) a korábbi rétegtani beosztás helyett újat javasol az eocén (paleogén) képződményekre, melyek a következők:

felső-eocén:	rupéli lattorfi
középső-eocén:	bartoni lutéciai londoni
alsó-eocén:	thanéti monsi

Ez a rétegtani beosztás már nem használatos, SZŐTS E. pontos rétegsorai azonban ma is helytállóak.

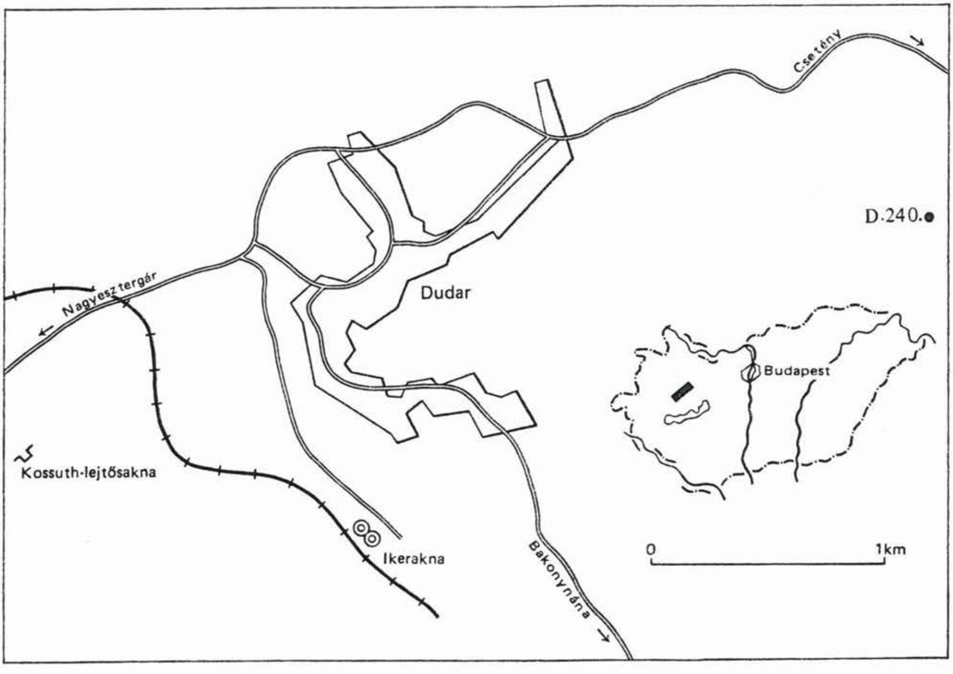
Az 1960-as évektől kezdődően a Bakony hegység területén végzett eocén kutatás elsősorban KOPEK G. nevéhez fűződik. Munkája során főként a terepen is aránylag könnyen felismerhető nagy-Foraminiferákat használta fel a sztratigráfiai kép kialakításánál. Munkásságához később szorosan kapcsolódtak KECSKEMÉTI T. és DUDICH E. vizsgálatai. A külön-külön és közösen publikált számos munkájuk nagymértékben vitte előre a bakonyi eocén földtani megismerését (KOPEK G. 1962, 1964, 1966, 1971, 1980, KOPEK G.—DUDICH E.—KECSKEMÉTI T. 1971a, b, KOPEK G.—KECSKEMÉTI T. 1960, 1964a, b, 1965a, b, KOPEK G.—KECSKEMÉTI T.—DUDICH E. 1965, 1966). A fenti munkákban a Dunántúli-középhegységre kialakított 16 eocén szint közül Dudaron a középső-eocénben 6 szintet lehetett kimutatni: alsó-lutéciai kőszénösszlet (II. szint), *Nummulites perforatus*-os kőszénösszlet (IX. szint), *Nummulites perforatus*-os szint (X. és XI. szint), *Nummulites millecaput*-os szint (XII. szint) és a glaukonitos márga szint (XIII. szint).

Legújabban BÁLDINÉ BEKE M. és KECSKEMÉTI T. (1983) egy dudari medencebeli rétegsor (Dudar 230. sz. fúrás) feldolgozása során a kőszénösszletet közvetlenül fedő képződményeket a *Nummulites perforatus*-os zónába, illetve az NP 16-os nannoplankton zónába sorolták.

III. A DUDARI-MEDENCE VÁZLATOS FÖLDTANI FELÉPÍTÉSE

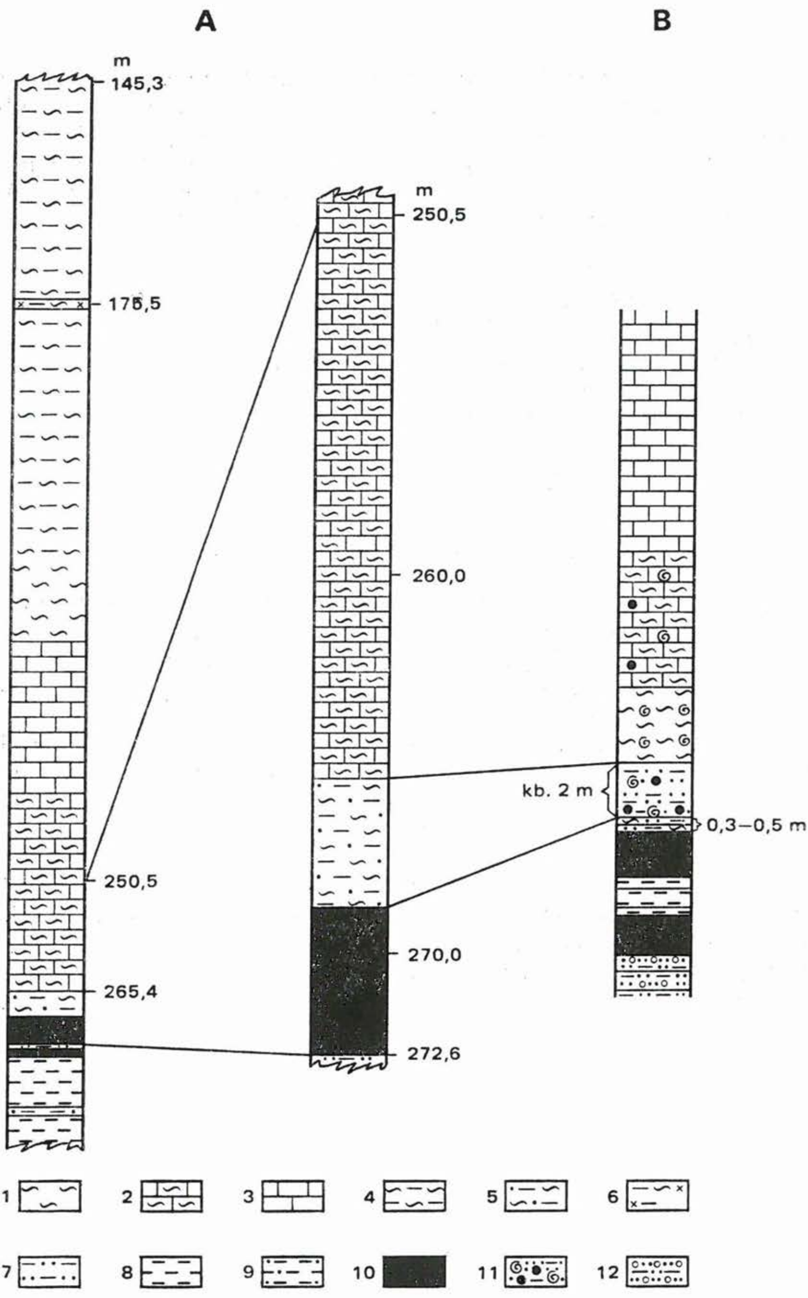
A Dudari-medence eocén fekvőjében különböző korú mezozóos képződmények találhatók. A Magas- és Sűrű-hegy környékén főleg felső-triász fődolomit és dachsteini mészkő, ettől délre triász, jura, kréta mészkőféleségek képezik a feküképződményeket. Helyenként apti agyag és kréta turriliteses márga alkotja a feküt (Szőts E. 1956, Kopek G. 1971, 1980).

Ezekre települ a középső-eocén kőszénösszlet (Tatabányai Formáció), melyet két telepcsoport alkot. A telepek és a köztük levő kőzetek részletes leírását Szőts E. (1956) és Kopek G. (1980) munkáiból ismerjük. Kopek G. (1980), Kopek G.—Kecskeméti T. (1964), Kopek G.—Kecskeméti T.—Dudich E. (1965, 1966), Kopek G.—Dudich E.—Kecskeméti T. (1971)



1. ábra. A Dudar környéki eocén faunalelőhelyek és szelvények földrajzi helyzete

Fig. 1. Geographic distribution of Eocene faunal localities and profiles in the vicinity



2. *ábra.* A Dudar 240. sz. fúrás és a dudari foraminiferás lelőhely rétegsora

A) Dudar 240. sz. fúrás, B) Kossuth-lejtakna területe (Szőts E. nyomán) — 1. Nummuliteses márga, 2. miliolinás, alveolinás, meszes márga, 3. mészkő, 4. agyagmárga, 5. homokos agyagmárga, 6. tufás agyagmárga, 7. agyagos homok, 8. agyag, 9. homokos agyag, 10. barnakőszén, 11. nummuliteses—molluscumos, agyagos homok, 12. kavicsos, agyagos homok

Fig. 2. Geological columns of borehole Dudar 240 and of the foraminiferal locality of Dudar

A) Borehole Dudar 240, B) area of Kossuth adit (after E. Szőts) — 1. Nummulitic marl, 2. Calcareous Miliolina-Alveolina marl, 3. limestone, 4. claymarl, 5. sandy claymarl, 6. tuffaceous claymarl, 7. clayey sand, 8. clay, 9. sandy clay, 10. browncoal, 11. nummulitic-molluscan clayey sand, 12. gravelly, clayey sand munkáiban egy alsó-lutéciai és egy felső-lutéciai *Nummulites perforatus*-os telepcsoportot ismertetnek, a két telepcsoport között intralutéciai denudációt feltételezve. A második kőszéntelep fölött már tengeri rétegek találhatók.

Szőts E. részletes terepi vizsgálatokat végzett Dudar környékén, elsősorban a ma már felhagyott Kossuth-lejtakna térségében (1. ábra). Az itt felvett és faunával is igazolt rétegsor a következő (Szőts E. 1956):

Középső-eocén: londoni emelet

1. mezozóos alaphegységre települő tarkaagyag
2. kövületes édesvízi kavicsos homok
3. kőszénképződmény
4. molluscumos—nummuliteses, agyagos homok
5. molluscumos márga
6. nummuliteses—molluscumos mészmárga

Középső-eocén: lutéciai emelet

7. főnummuliteses mészkő
8. foraminiferás—mulloscumos agyagmárga

Középső-eocén: bartoni emelet

9. glaukonitos, foraminiferás agyagmárga (feltételesen)

A rétegtani egységek egymásutánja a későbbi vizsgálatok során sem módosult.

A medenceperemeken képződött ún. főnummuliteses mészkő (Szőci Mészkő Formáció) és a medence belsejében lerakódott foraminiferás márga (Móri Aleurolit Formáció) vastagsága változó és összefogazódva jelentkezhet a medence különböző területein.

A parti fáciesen belül Kopek G., Kecskeméti T. és Dudich E. fent idézett munkáikban a középső-eocénben *Nummulites perforatus*-os, *N. millecaput*-os és glaukonitos márga szinteket említenek. A medencefáciesben kifejlődött egyöntetű márgás képződmény (foraminiferás márga) folyamatosan megy át a felső-eocénbe.

A 2. ábrán Szőts E. (1956) rétegsorát összehasonlítottam a Dudar 240. sz. fúrás rétegsorával, mely a Dudari-medence valamennyi képződményét harántolta. E fúrás anyagát részletesen tanulmányoztam, vizsgálati eredményeimet a biosztratigráfiai fejezetben ismertetem.

Az eocén képződmények felett diszkordánsan települnek az oligocén rétegek.

IV. BENTOSZ KIS-FORAMINIFERA FAUNA A NUMMULITESES–MOLLUSCUMOS AGYAGOS HOMOKBÓL

1. A lelőhely ismertetése

A jelen dolgozat témájául szolgáló mikrofauna egy, ma már hozzáférhetetlen lelőhelyről származik. A hajdani Kossuth-lejtakna Dudartól DNy-ra kb. 1500 m-re, a Nagyesztergár felé vezető út közelében volt található (1. ábra). Az eredeti lelőhely rétegtani viszonya Szőts E. (1956) és Strausz L. (1966) nyomán a 2. ábrán látható.

Az ábra mutatja, hogy a második kőszéntelep fölött 0,3–0,5 m vastagságú kőszén és márgás homok váltakozásából álló réteg található. Erre települ folyamatos átmenettel a nummuliteses–molluscumos agyagos homok, aminek vastagsága kb. 2 m. Ebből az összletből került ki az a jó megtartású csigafauna, melynek házkitöltéséből származik az általam vizsgált anyag.

E Molluscum fauna feldolgozását részben Szőts E. (1948, 1956), illetve bővebben Strausz L. (1966, 1969, 1970a, b) végezte el. Szőts E. a feldolgozás során felfigyelt arra, hogy nagy termetű csigák házkitöltését alkotó üledékben rendkívül jó megtartású Foraminifera fauna található. Szőts E. e Foraminiferák közül több mint 90 alakot határozott meg, kézirata azonban nem került publikálásra. Ezek a következők: *Textularia carinata* d'Orbigny *nalinnesensis* Kaasschieter, *T.* sp., *Valvulina pupa* d'Orb., *V.* sp., *Clavulina parisiensis* d'Orb., *Nubecularia lucifuga* Defrance, *Spiroloculina bicarinata* Le Calvez, *S. costigera* (Terquem), *S. costigera* (Terquem) *obliqua* Le Calvez, *S. tricarinata* Terquem *angulifera* Terquem, *Quinqueloculina carinata* d'Orb., *Q. costata* Karrer, *Q. grignonensis* Le Calvez, *Q. ludwigi* Reuss, *Q. seminula* (Linné), *Q. striata* d'Orb., *Pyrgo bulloides* (d'Orb.), *Triloculina angularis* d'Orb., *T. tricarinata* (Terquem) *belgica* Kaasschieter, *T. trigonula* (Lamarck), *Miliola birostris* (Lamarck), *M. prisca* (d'Orb.) *terquemi* Kaasschieter, *M. saxorum* (Lamarck), *Idalina ?* sp., *Miliolidae* div. sp., *Robulus arcuatostriatus* (Hantken), *Globulina gibba* (d'Orb.), *G. gibba* (d'Orb.) *punctata* d'Orb., *Guttulina irregularis* (d'Orb.), *Discorbis limbata* (Terquem), *D.* aff. *parisiensis* (d'Orb.), *D. perplexa* Le Calvez, *D. propinqua* (Terquem), *D.* div. sp., *Epistominella acutimargo* (Halkyard), *Boldia lobata* (Terquem), *Asterigerina bimammata* (Gümbel), *A. rotula* (Kaufmann), *Rotalia* aff. *lithothamnica* Uhlig, *R. trochidiformis* (Lamarck), *R. tuberculata* Schubert, *R.* div. sp., *Pararotalia inermis* (Terquem), *Eponides polygonus* Le Calvez, *Cibicides carinatus* (Terquem), *C. productus* (Terquem), *C. robustus* Le Calvez, *C. sublobatulus* (Gümbel), *C.* div. sp., *Stichocibicides cubensis* Cole et Bermudez, *St.* ? sp., *Eoannularia eocenica* Cole et Bermudez, *Linderina brugesi* Schlumberger, *Acervulina* sp., *Sphaerogypsina globula* (Reuss), *Cymbaloporetta* sp., *Fabiania cassis* (Oppenheim), *Halkyardia minima* (Liebus), *Eorupertia cristata* (Gümbel), *E. magna* (Le Calvez), *Cassidulina* ? sp., *Nonion* aff. *scaphum* (Fichtel et

MOLL), *Alabamina* aff. *obtusa* (BURROWS et HOLLAND), *Anomalina auris* LE CALVEZ, *Hanzawaia producta* (TERQUEM), *Lamarckina ovula* LE CALVEZ, *Mississippina* ? sp., *Stomatorbina torrei* (CUSHMANN et BERMUDEZ).

Ezt az anyagot SZŐTS E. részletes feldolgozásra részemre átadta, amit ezúton is hálásan köszönök.

A SZŐTS E.-től származó anyagot kiegészítettem egyrészt a M. Áll. Földtani Int. Őslénytárában elhelyezett eredeti csiga faunából iszapolt Foraminiferákkal, másrészt a dudari Ikerakna meddőhányójából származó csigák házkitöltéséből kikerült Foraminiferákkal. Ez utóbbi csak kevés felhasználható anyagot szolgáltatott, mivel az itteni előfordulás üledéke meszesebb, iszapolásra kevésbé alkalmas.

A Foraminifera fauna főleg az alábbi csiga fauna vázkitöltéséből származik:

Velates schmideli CHEMN.
Campanile urkutense MUN. CHALM.
Ampullina perusta DEFR.

2. Rendszertani leírás

A fajok feldolgozásánál A. LOEBLICH—H. TAPPAN (1964) rendszertanát vettem alapul. 63 faj részletes leírását végeztem el, melyek közül egy faj új. (A fajok leírását l. az angol szövegben.)

A szinonimikánál igyekeztem az összes elérhető szakirodalmi adatot figyelembe venni. A földrajzi elterjedésnél csak a már publikált adatokra támaszkodtam. Ez azt jelenti, hogy a fajok elterjedésének ismertetésénél nem szerepelnek az általam korábban vizsgált fúrások és feltárások adatai, mivel ezek még nem kerültek publikálásra.

A fajokról pásztázó elektronmikroszkópos felvételek készültek, amelyekhez járul az *Acervulina dudarensis* n. sp. új faj holotípusáról készült fénymikroszkópos felvétel, valamint csiszolati képek.

3. Biosztratigráfiai értékelés

A dudari nummuliteses—molluscumos agyagos homok a Móri Aleurolit Formáció legalsó szakaszát alkotja: 30—50 cm-es átmeneti réteg választja el a Tatabányai Formációhoz sorolt kőszéntelepes összlettől. Fölötte általában változó vastagságú mészkő (főnummuliteses mészkő: Szőci Mészkő Formáció) települ, melyet biosztratigráfiailag jól szintezhető, planktongazdag márgaréteg követ (Móri Aleurolit Formáció).

Az általam vizsgált dudari agyagos homok korára vonatkozóan több szerző munkájában találunk adatokat.

SZŐTS E. (1956) a középső-eocént londoni, lutéciai és bartoni emeletekre osztotta és a dudari „molluszkumos—nummuliteses agyagot homokot" a londoni emeletbe sorolta.

A dudari kőszénösszlet felső telepének („*Nummulites perforatus*-os kőszén") korát felső-lutéciainak határozták meg (KOPEK—KECSKEMÉTI 1964a, b, 1965a, b, KOPEK—KECSKEMÉTI—DUDICH 1965, 1966, KOPEK—DUDICH—

KECSKEMÉTI 1971a, b, KOPEK 1980). A szinte közvetlenül felette folyamatos átmenettel települő agyagos homok kora is ide sorolható.

STRAUSZ L. (1966) ugyanennek a képződménynek a korát csigafauna alapján szintén lutéciainak tartja.

A vizsgálat tárgyát képező agyagos homokréteg biosztratigráfiai értékelését — plankton Foraminiferák hiányában — bentosz alakok időbeli elterjedése alapján kísérlem meg. Bár a bentosz Foraminiferák legtöbbje elsősorban őskörnyezeti értékelésre használható, néhány fajuk vagy csoportjuk biosztratigráfiai értékű lehet. Minél több faj időbeli elterjedését ismerjük, annál nagyobb biztonsággal szűkíthetjük le a kérdéses képződmény lehetséges korát.

A kronosztratigráfiai egységek tisztázása érdekében külön táblázaton (1. táblázat) mutatom be az egyre gyakrabban és általánosabban használatos plankton és nannoplankton biozónákat az eocénen belül. A táblázaton az egyes időegységek radiometrikus kora HARDENBOL—BERGGREN (1978) munkájából származik. A kronosztratigráfiai beosztást, valamint a plankton és nannoplankton biozónákat BIGOT és CAVELIER összeállítása alapján használom (in POMEROL 1981). E kötetben a szerzők a plankton zónákat összevonva adják meg BOLLI (1966), BERGGREN (1971) és STAINFORTH et al. (1975) munkái alapján, ami világviszonylatban a leginkább elfogadott. A fenti zónákból néhányat korábban nálunk is sikerült kimutatni (VITÁLISNÉ ZILAHY L. 1967b, 1971, HORVÁTHNÉ KOLLÁNYI K. 1983).

BIGNOT és CAVELIER (in POMEROL 1981) a középső-eocént MARTINI (1971) nannoplankton vizsgálatai alapján lutéciai és bartoni emeletekre osztja. Ez a nézet azért alakult ki, mert bebizonyosodott, hogy az eredeti lutéciai sztratotípus szelvény csak a középső-eocén alsó szakaszát képviseli. Ezen felül MARTINI (1971) nannoplankton alapján (NP 17 zóna) bebizonyította, hogy a bartoni emelet a lutéciai emeletnél fiatalabb, de a priabonainál idősebb, így ma azt a középső-eocén felső szakaszába tartozónak tekintik.

A Párizsi-medencében a bartoni emelettel azonosították a korábban önálló emeletként kezelt auversi, marinesi és ludi képződményeket (POMEROL 1962, 1973, 1981, POMEROL et al. 1965, LE CALVEZ 1970) és az akkor még általánosan a felső-eocénnek tartott bartoni emelethez hasonlóan a felső-eocénbe tették. A bartoni emelet középső-eocén voltának újabb bizonyítéka, hogy BIGG (1982) LE GUEPELLE auversi szelvényéből középső-eocén plankton Foraminiferákat, *Truncorotaloides pseudodubius* (BANDY) (= *T. rohri* BRÖNNIMANN et BERMUDEZ) és *Morozovella spinulosa* (CUSHMAN) fajokat határozott meg.

A fentiek alapján elfogadom azt a felfogást, mely szerint a középső-eocén lutéciai és bartoni emeletekre tagolódik és a továbbiakban ilyen értelemben használom.

A 2. táblázaton összefoglalóan mutatom be a dudari nummuliteses—molluscumos agyagos homok általam meghatározott összes bentosz fajának időbeli elterjedését a hozzáférhető irodalom alapján.

Az emeletneveket az 1. táblázat alapján használom.

A vizsgált anyagból előkerült valamennyi fajt megjelenésük sorrendjében ábrázoltam. Néhány faj sztratigráfiai elterjedése bizonytalan, mivel régebben leírt lelőhelyekről származnak, melyek korbesorolása időközben változhatott, ezek ellenőrzésére nem volt módom.

A táblázatból kitűnik, hogy a dudari fauna kora középső-eocén, annak is inkább a középső részébe tartozik.

1. táblázat — Table 1

Eocén plankton zónák Bignot **és** Cavelier **(in** Pomerol **1981) szerint**
Eocene planctonic zones, after Bignot **&** Cavelier **(in** Pomerol **1981)**

millió év (m. d.)					
37	Felső (Upper)-eocén	priabonai	P 17 *Globigerina gortanii* *Globorotalia centralis*	*Turborotalia cerroazulensis*	NP 21
			P 16 *Cribrohantkenina inflata*		NP 20
			P 15 *Globigerinatheka semiinvoluta*		NP 19 / NP 18
40	Középső (Middle)-eocén	bartoni	P 14 *Truncorotaloides rohri*		NP 17
			P 13 *Orbulinoides beckmanni*		NP 16
			P 12 *Morozovella lehneri*		NP 16
44		lutéciai	P 11 *Globigerinatheka subconglobata*		NP 16 / NP 15
			P 10 *Hantkenina aragonensis*		NP 15 / NP 14
49	Alsó (Lower)-eocén	yprési	P 9 *Acarinina pentacamerata*		NP 13
			P 8 *Morozovella aragonensis*		NP 13 / NP 12
			P 7 *Morozovella formosa*		NP 12
			P 6 *Morozovella subbotinae*		NP 11
			P 5 *Morozovella velascoensis*		NP 10 / NP 9
55,3			P 4 *Planorotalites pseudomenardii*		NP 9

Ezt támasztja alá a *Valvulina pupa* D'ORB., *V. guillaumei* LE CALVEZ, *Miliola brevidentata* (LE CALVEZ), *Discorbis rotata* (TERQUEM), *Rotalia trochidiformis* LAMARCK, *Cibicides robustus* LE CALVEZ stb. fajok jelenléte, melyek eddig kizárólag a középső-eocén középső részéből ismertek.

Hogy a problémát más irányból is megközelítsem, elvégeztem a Dudar 240. sz. fúrás vizsgálatát, ami a kőszénösszlet feletti teljes, folyamatos rétegsort feltárta. Vizsgálati eredményeimet a 3. táblázat tartalmazza. A fúrásban a kőszénösszlet (Tatabányai Formáció) felett 268,3–268,7 m között települ az általam vizsgált nummuliteses–molluscumos agyagos homok (Móri Aleurolit Formáció). Fölötte folyamatos átmenettel 218,0 m-ig az ún. főnummuliteses mészkő (Szőci Mészkő Formáció), végül a foraminiferás márga (Móri Aleurolit Formáció) következik 145,3 m-ig.

Ez a rétegsor jellemzően mutatja be a Dudari-medence eocén rétegtani viszonyait. A mészkő és a márga vastagságában jelentős eltérések lehetnek attól függően, hogy medenceperemi, vagy medencén belüli a rétegsor. A medence belsejében a mészköves kifejlődést teljes egészében helyettesítheti a foraminiferás márga, mely 120–140 m-es vastagságot is elérhet (SZŐTS 1956), míg a medenceperemeken vastag, 100 m körüli (SZŐTS 1956) mészköves összlettel találkozunk.

A fúrásban 268,3–268,7 m között hasonló faunaegyüttes található, mint a csigákból kiiszapolt agyagban, csak annál jóval szegényesebb és rosszabb megtartású. A kőzetben főleg azok az alakok találhatók, amelyek vastagabb vázúak és a csigákból nyert anyagban is igen gyakoriak: pl. *Halkyardia minima* (LIEBUS), *Pararotalia inermis* (TERQUEM), *Clavulina parisiensis* D'ORB.; a vékonyabb házfalú fajok képviselői ritkán fordulnak elő: *Cibicides carinatus* (TERQUEM), *Discorbis perplexa* LE CALVEZ stb.

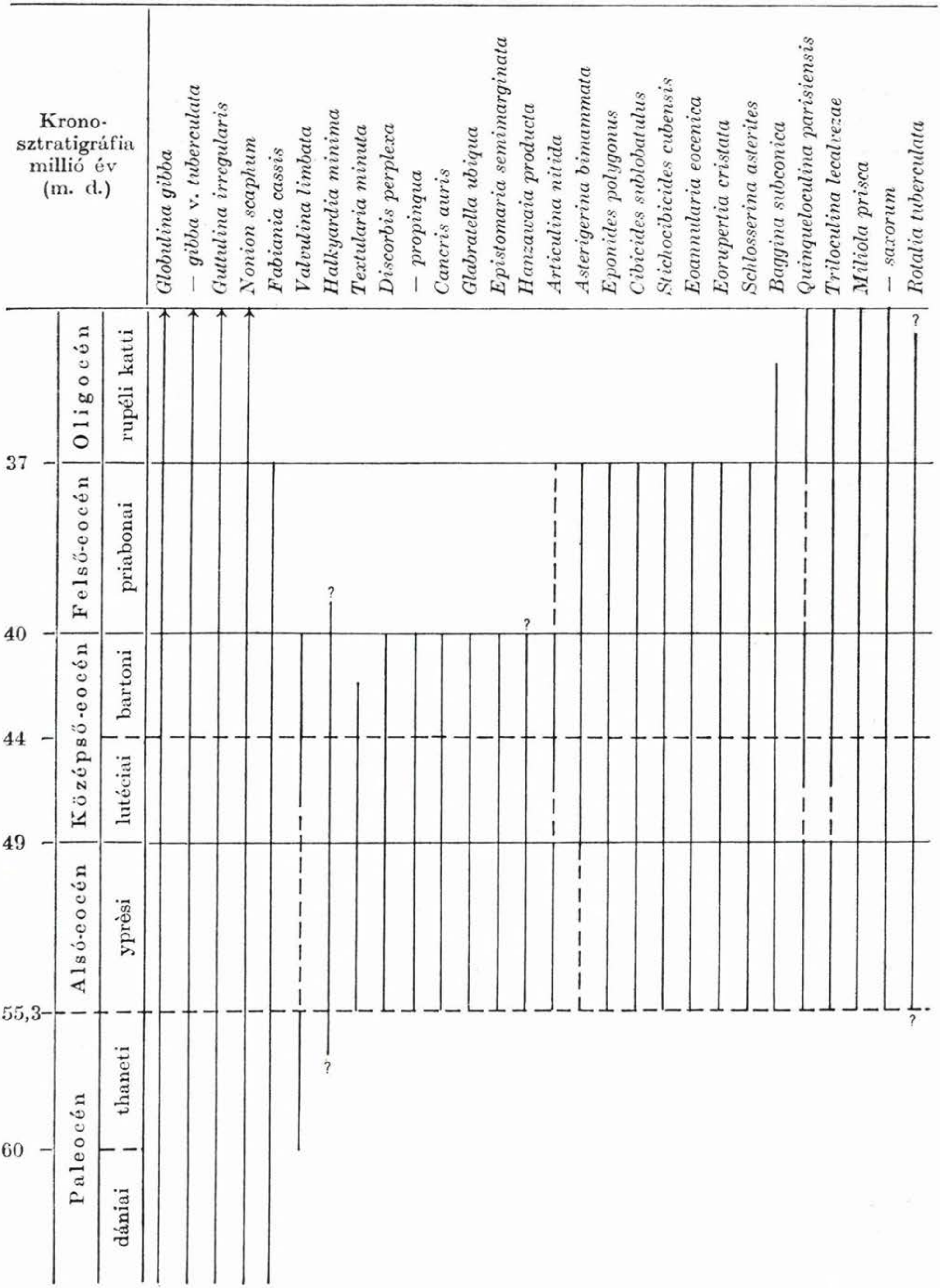
Az agyagos homok felett levő majdnem 50 m vastag főnummuliteses mészkőből kis-Foraminifera vizsgálat nem történt. A mészkőből és a csigaházakból előkerült nagy-Foraminiferák: *Nummulites puschi* D'ARCHIAC, *N. majzoni* KECSKEMÉTI, *N. iohannis* KECSKEMÉTI, *N. zircensis* KECSKEMÉTI, *N. variolarius* (LAMARCK) stb. alapján a dudari nummuliteses–molluscumos agyagos homok és a Szőci Mészkő Formációnak ez a szakasza is a középső-eocén felső részét képviseli (KECSKEMÉTI T. szóbeli közlése).

A mészkő fölött folyamatos átmenettel található a Móri Aleurolit Formáció foraminiferás márgája (218,0–145,3 m). Felfelé haladva a fúrásban, a bentosz Foraminiferák mellett egyre jelentősebb szerepet kapnak a plankton Foraminiferák és végül ezek dominálnak.

A könnyebb áttekinthetőség kedvéért a 4. táblázaton feltüntettem a Dudar 240. sz. fúrásban előforduló plankton Foraminiferák sztratigráfiai elterjedését, irodalmi adatok alapján.

218,0 m-től felfelé haladva fokozatosan jelennek meg a középső-eocénre jellemző plankton Foraminiferák, mint a *Truncorotaloides topilensis* (CUSHMAN), *T. rohri* BRÖNNIMANN et BERMUDEZ, *Globorotalia spinuloinflata* (BANDY), *G. spinulosa* CUSHMAN stb., amelyek a középső-eocén tetején kihalnak, valamint a *Globigerinatheka mexicana barri* BRÖNNIMANN, ami csak a középső-eocén *Globigerinatheka subconglobata* zóna tetején jelenik meg. Így biztosan megállapítható, hogy a fúrásnak ez a 218,0–170,6 m-ig terjedő szakasza sem lehet a középső-eocén *Globigerinatheka subconglobata* zóna felső részénél idősebb.

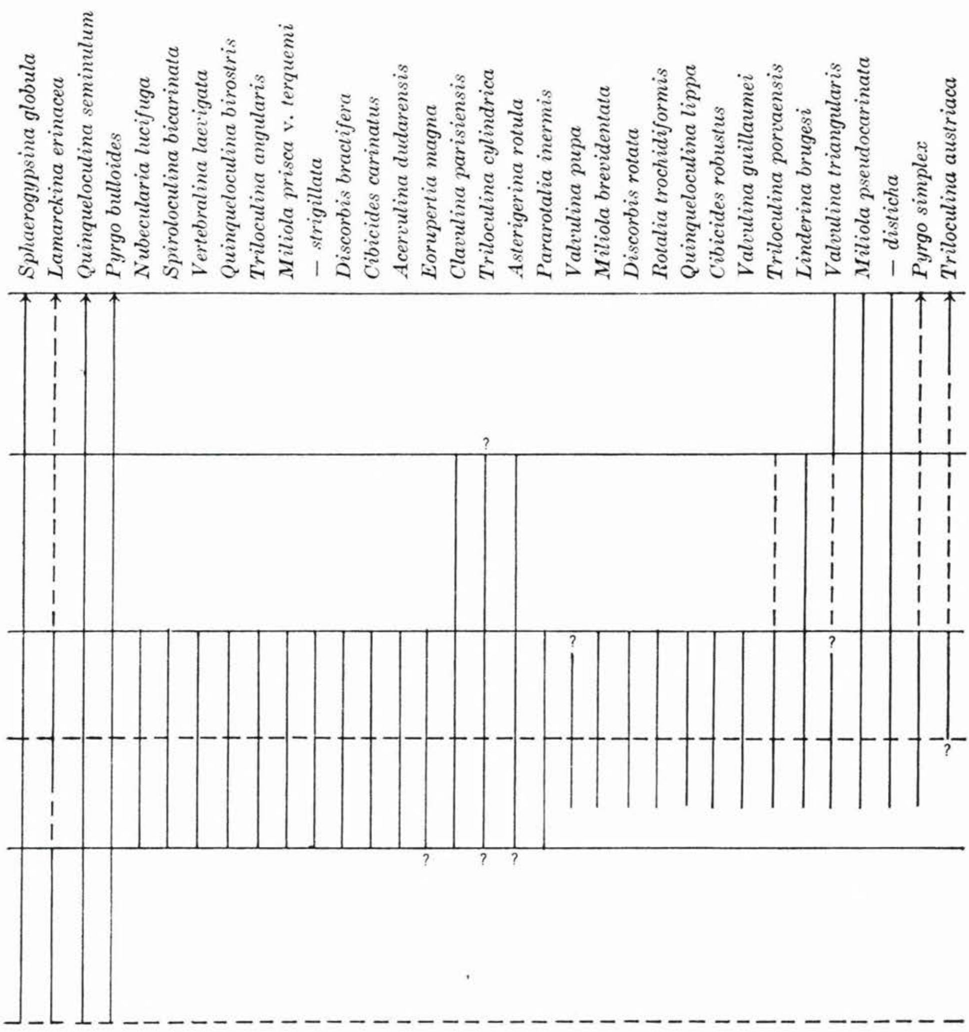
A dudari nummulitesés—molluscumos, agyagos homok bentosz
Stratigraphic ranges of benthonic smaller foraminifera from the



2. táblázat – Table 2

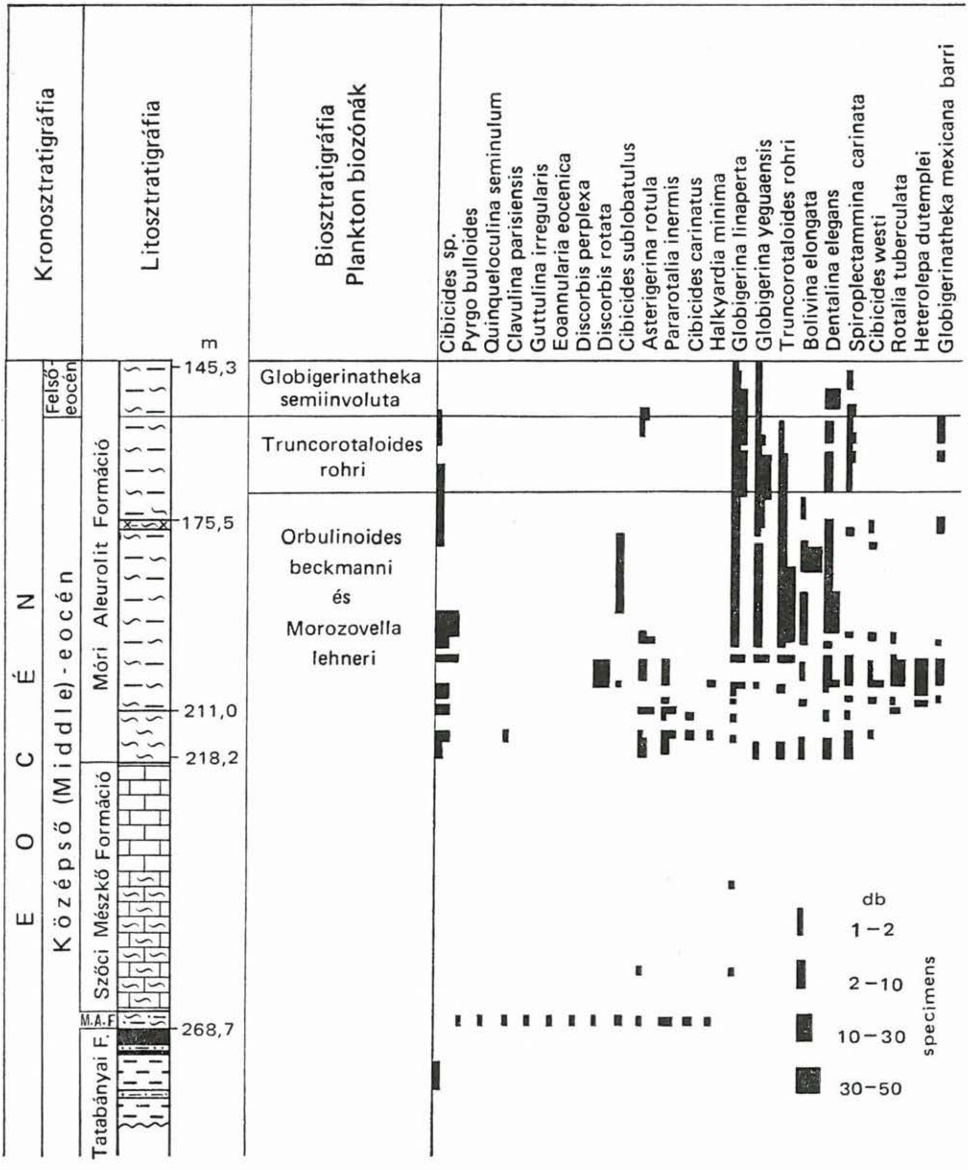
kis-Foraminiferáinak sztratigráfiai elterjedése irodalmi adatok alapján

nummulitic-molluscan argillaceous sands of Dudar (based on published data)

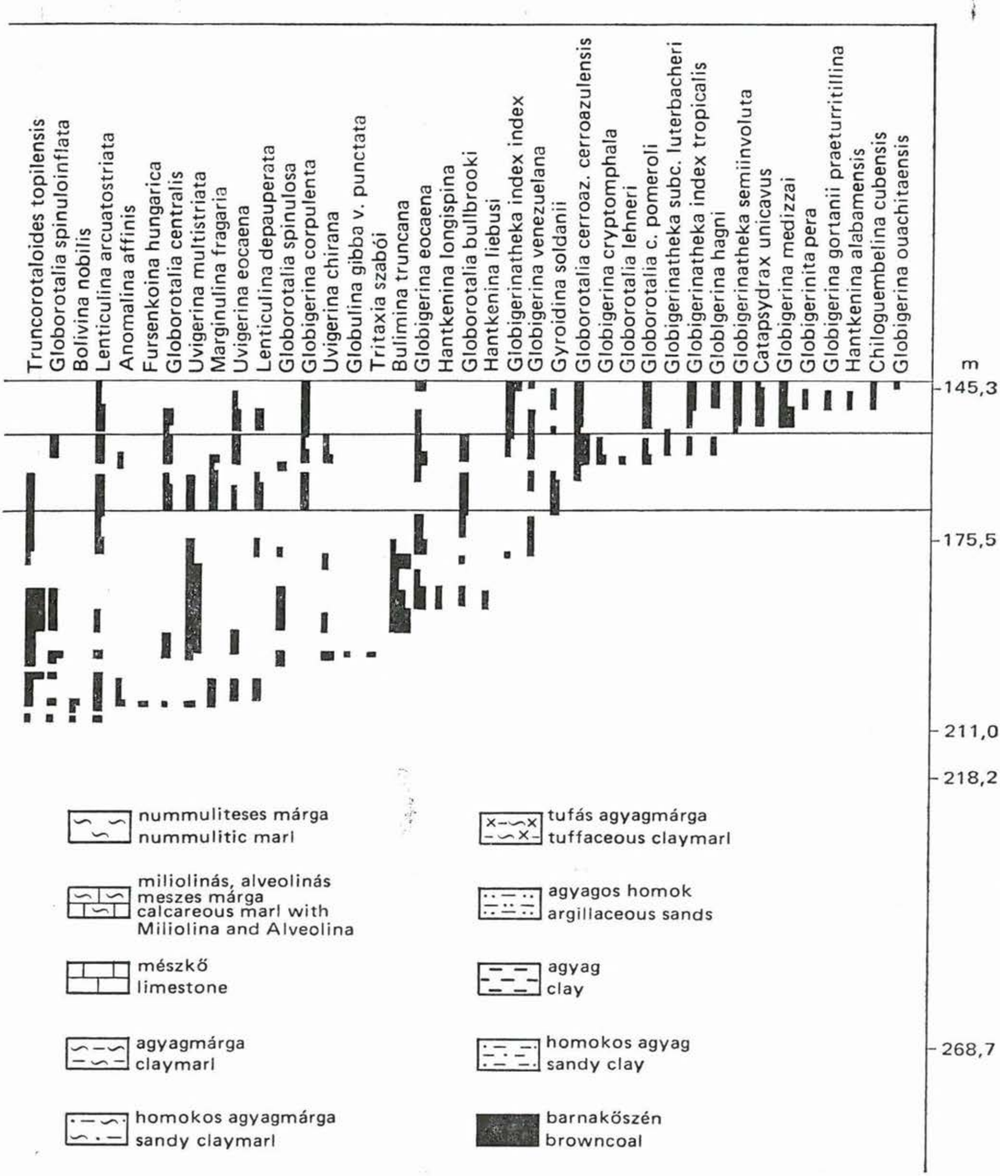


A Dudar 240. sz. fúrás kis-Foraminiferái és gyakoriságuk

Smaller foraminifera from borehole Dudar 240 and their abundances



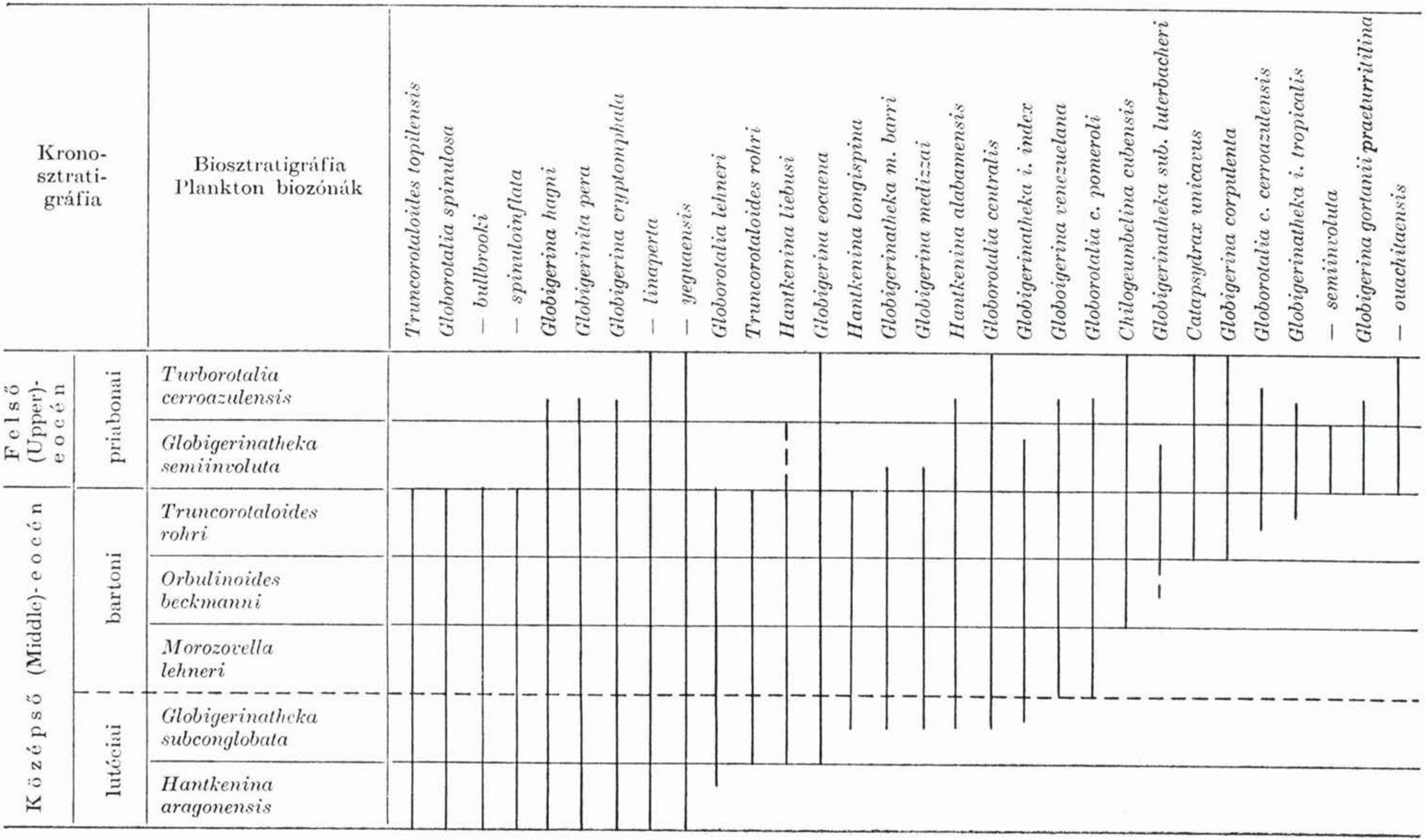
3. táblázat – Table 3



4. táblázat — Table 4

A Dudar 240. sz. fúrásban előforduló plankton Foraminiferák sztratigráfiai elterjedése, irodalmi adatok alapján

Stratigraphic ranges of planktonic foraminifera from borehole Dudar 240 (based on published data)



170,6–155,2 m között a plankton Foraminiferák egyre nagyobb faj- és egyedszámban találhatók a képződményben. Fokozatosan megjelennek már a felső-eocén alakok is, mint a *Globigerina corpulenta* SUBBOTINA, *Globigerinatheka subconglobata luterbacheri* BOLLI, de még ezekkel együtt fordulnak elő a középső-eocén tetején kihaló alakok, mint a *Truncorotaloides rohri* BRÖNNIMANN et BERMUDEZ, *T. topilensis* (CUSHMAN), *Globorotalia spinulosa* CUSHMAN, *G. spinuloinflata* (BANDY), *G. bullbrooki* BOLLI, *G. lehneri* CUSHMAN et JARVIS stb. A fenti fajok együttes előfordulása jelzi, hogy a fúrásnak ez a szakasza biztosan a *Truncorotaloides rohri* zónába tartozik.

155,2 m-től kezdődően kimaradnak a középső-eocén tetején kihaló formák és megjelenik a *Globigerinatheka semiinvoluta* (KEIJZER) faj. Ennek a fajnak a megjelenése és kihalása is a felső-eocén alsó zónájába a *Globigerinatheka semiinvoluta* zónára esik. Mellette több felső-eocén alak is megjelenik, mint a *Globigerinatheka index tropicalis* (BLOW et BANNER), *Globorotalia cerroazulensis cerroazulensis* (COLE), *Globigerina gortanii praeturritillina* BLOW et BANNER stb.

Ez közelítően azonos BÁLDINÉ (1971) munkájában szintén a Dudar 240. sz. fúrásból leírt *Isthmolitus recurvus* felső-eocén zónával (155,2 m felett), mely valamivel a középső-eocén–felső-eocén határ felett kezdődik.

SAMUEL (1972) a Bakonyból több fúrás rétegsorának plankton Foraminiferáit dolgozta fel, köztük a Dudar 240. sz. fúrásét is. Vizsgálatai alapján a Bakonyban a középső- és a felső-eocén határán megtalálni vélte a SZUBBOTINA (1953) által felállított *Turborotalia (A.) rotundimarginata* szubzónát. Szerinte együtt fordul elő a *Truncorotaloides* ex gr. *rohri* BRÖNNIMANN et BERMUDEZ és a *Globigerapsis mexicana* (CUSHMAN) [= *Globigerapsis semiinvoluta* (KEIJZER)] faj. Ezzel tehát feltételezte, hogy a Truncorotaloides fajok a Bakonyban nem halnak ki a középső-eocén végénél, hanem még a felső-eocén alján is megtalálhatók. A Dudar 240. sz. fúrásban a középső-eocén felső határát 178,0 m-nél húzza meg, valószínűleg a fent említett okok miatt. A Truncorotaloides fajok felső-eocénben való előfordulására azonban más irodalmi adat nem utal és a bakonyi területen történt lokális túlélésük valószínűsége is csekély. A modern feldolgozások a Truncorotaloides fajok kihalásától, illetve a *Globigerinatheka semiinvoluta* (KEIJZER) faj megjelenésétől számítják a felső-eocén alsó határát.

Vizsgálataim SAMUEL fenti megállapítását egyébként nem támasztják alá, mivel a 178,0 m alatti és feletti minták faunája közel azonos, semmi sem indokolja azok elválasztását.

Összefoglalóan megállapítható, hogy a vizsgált Foraminifera faunát tartalmazó képződmény a kőszénösszlet felett elhelyezkedő Móri Aleurolit Formáció alsó részébe tartozó nummuliteses–molluscumos agyagos homok, kora a középső-eocén közepére tehető, bentosz kis-Foraminiferák alapján. Ez nagy valószínűséggel megfelel a *Morozovella lehneri* (= *Globorotalia lehneri*) zónának.

Ezt támasztja alá a fölötte levő képződmények kora is. Az agyagos homokból folyamatos átmenettel kifejlődött mészkő, nagy-Foraminiferák alapján is a középső-eocén felső szakaszát, a *Nummulites perforatus*-os szintet jelöli (KECSKEMÉTI T. szóbeli közlése). Az ebből szintén folyamatos átmenettel kifejlődő foraminiferás márga kora plankton Foraminiferákkal igazolható és biztosan nem idősebb a *Morozovella lehneri* zónánál, de a legfelső szakasza már a felső-eocén *Globigerinatheka semiinvoluta* zónába tartozik. Pontos zónahatárokat csak a középső- és felső-eocén, valamint a *Truncorotaloides rohri* zóna alsó határán sikerült kijelölni. A mészkő és a foraminiferás márga alsó szakasza nagy valószínűséggel a *Morozovella lehneri* és az *Orbulinoides beckmanni* zónákba tartozik, de ezen belüli helyzetük nem pontosítható.

4. Paleoökológiai értékelés

Az ősmaradványanyag összetételéből levonható paleoökológiai következtetéseknél a recens faunaegyüttesek vizsgálata adja a legbiztosabb alapokat. Az aktualizmus elve alapján a hasonló faunaösszetétel nagy valószínűséggel hasonló életkörnyezetet jelöl.

A bentosz Foraminiferák életterét fizikai, kémiai és biológiai tényezők jellemzik. Fizikai tényezők: vízmélység, hőmérséklet, átvilágítottság, vízmozgások, aljzat jellege. Kémiai faktorok: tengervíz sótartalma, kémiai elemek eloszlása stb. Végül a biológiai tényezők: táplálék és annak utánpótlási lehetősége, szimbiotikus szervezetek, paraziták, ragadozók stb.

A recens Foraminiferák ökológiájának napjainkra kiterjedt irodalma lett. Ez leginkább a hatvanas évektől egyre intenzívebbé váló óceanográfiai kutatásoknak köszönhető.

Jelen dolgozatom összeállításánál elsősorban PHLEGER (1960), PHLEGER–PARKER (1951), MURRAY (1968a, b, 1973) összefoglaló munkáit, valamint HORVÁTH MÁRIA (1980) kandidátusi értekezését használtam fel.

Az ősmaradványanyag ökológiai értékelését két dolog nehezítette. Az egyik, hogy nem egy rétegsor, hanem egy adott litosztratigráfiai egység (Móri Aleurolit Formáció 1–2 m vastagságú alsó részének) bentosz Foraminiferái kerültek feldolgozásra. A másik, hogy e Foraminiferák túlnyomó része nagytestű csigák házkitöltéséből került elő. Ez utóbbi tény némiképp megváltoztathatta a faunaösszetételt, de semmiképpen sem jelentősen.

A Dudar 240. sz. fúrásban 268,3–268,7 m között a kőszénösszlet felett harántolt nummuliteses–molluscumos agyagos homokból az itt tárgyalt faunával lényegében azonos, de sokkal szegényesebb és rosszabb megtartású Foraminifera társaság került elő. Ebből két következtetés adódik: 1. a Foraminiferák és a csigák földtanilag egyidősek, 2. a csigaházak akadályozták meg a Foraminiferák koptatódását, töredezését és utólagos oldódását, ami a környező üledékekkel együtt-mozgó házaknál jelentős volt.

Az esetleges szelektálódás ellenőrzése érdekében, ahol az anyag erre lehetőséget nyújtott, kísérletet tettem a különböző csigafajokhoz köthető fauna-összetételi eltérések meghatározására. Az eltérések azonban jelentéktelennek bizonyultak: az egyes csigafajok házába beiszapolódott azonos fajú Foraminifera arányai nem mutattak szignifikáns különbséget.

Vizsgálati módszerek

A vizsgált anyag jellegéből következően az egész anyagra vonatkozóan csak relatív gyakorisági értékeket lehetett meghatározni. Ez százalékban kifejezve megadja az egyes fajok arányát az össz-egyedszámhoz viszonyítva.

Ezen kívül az anyag mennyisége lehetővé tette, hogy néhány *Velates schmideli* és *Campanile urkutense* példány házkitöltéséből, 5 g iszapolási anyagból az abszolút gyakoriságot meghatározzam. Itt is feltüntettem a fajok százalékos eloszlását.

A fajok egyedszámaiból kiszámítható a három subordo: Textulariina, Miliolina, Rotaliina százalékos eloszlása, ami MURRAY (1973) nyomán háromszög diagramon látható (3. ábra).

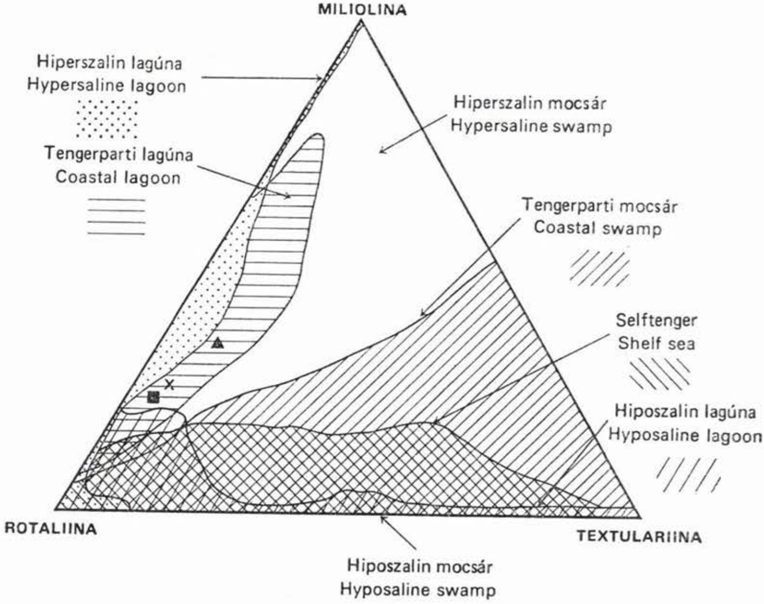
A paleokörnyezet elkülönítésére a FISHER-féle index (FISHER et al. 1943) jól értékelhető, amint MURRAY (1973) javasolja:

$$\alpha = \frac{n_1}{x},$$

ahol x = állandó, egynél kisebb érték;
$n_1 = N(1-x)$;
N = a populáció mérete.

Az értéket a fajszám és egyedszám ismeretében MURRAY (1968b, 1973) diagramjából olvastam le (4. ábra).

Ezen kívül meghatározható az aljzathoz vagy növényekhez rögzített (szesszilis) Foraminiferák százalékos eloszlása is.

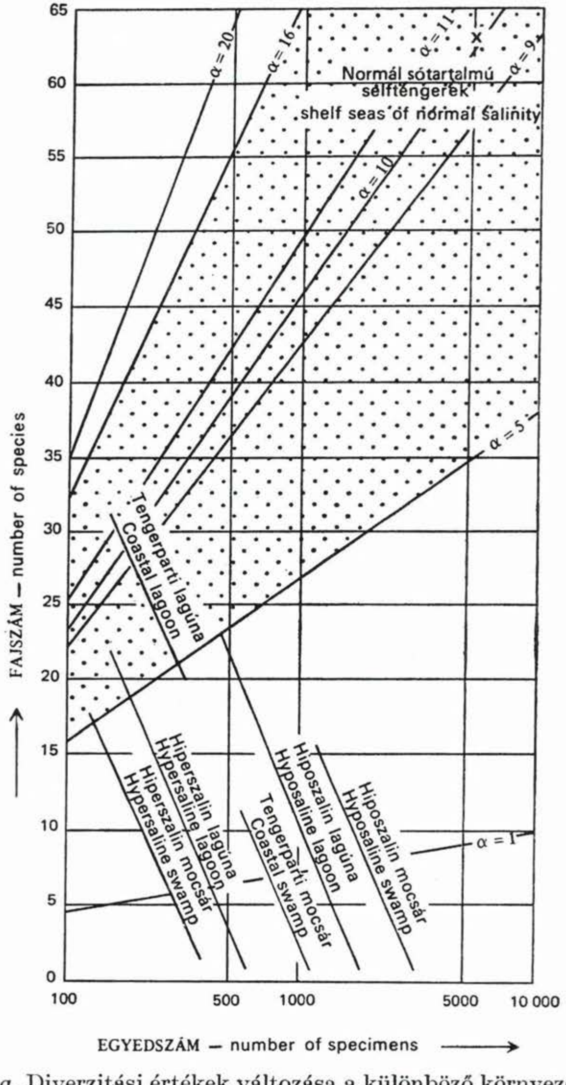


3. ábra. Háromszög diagram (MURRAY 1973. nyomán) a Foraminifera fauna összetételéről

× a teljes anyagmennyiségben levő fajok
■ a *Velates schmideli*-ből nyert fajok
▲ a *Campanile urkutense*-ből nyert fajok
} %-os eloszlása

Fig. 3. Triangular diagram (after MURRAY 1973) on the composition of the foraminiferal fauna

× species present throughout the material
■ species recovered from *Velates schmideli*
▲ species recovered from *Campanile urkutense*
} per cent distribution



4. ábra. Diverzitási értékek változása a különböző környezetben (MURRAY 1973. nyomán)
X a vizsgált fauna diverzitási értéke

Fig. 4. Variation of diversity values in different environments (after MURRAY 1973)
X diversity values of the studied fauna

Vizsgálati eredmények

A vizsgálat során előkerült fajok százalékos eloszlása az 5. táblázaton látható.

A fajok egyedszámaiból kiszámított Textulariina, Miliolina, Rotaliina subordok százalékos eloszlását MURRAY (1973) nyomán háromszög diagram ábrázolja (3. ábra). Itt három pontot tüntettem fel. Egyik pont a teljes fauna

5. táblázat — Table 5

A dudari fajok százalékos eloszlása

Per cent distribution of the species from Dudar

Fajok Species	Fajok %-os aránya a teljes anyaghoz viszonyítva Percentage of species as referred to the whole material	Percentage of species in 5 g of material *Campanile urkutense*-ből from *Campanile urkutense*	*Velates schmideli*-ből from *Velates schmideli*
		nyert 5 g-nyi anyagban levő fajok %-os aráuya	
a	b	c	d
Textularia minuta	1,95	3,44	1,72
— sp.	0,5	0,21	0,69
Valvulina guillaumei	0,09	0,14	—
— *limbata*	0,18	0,21	0,14
— *pupa*	0,23	0,55	—
— *triangularis*	0,66	0,89	0,18
Clavulina parisiensis	2,13	1,72	2,07
Nubecularia lucifuga	6,38	13,75	4,60
Spiroloculina bicarinata	1,06	2,06	1,15
Vertebralina laevigata	0,07	0,14	—
Quingueloculina birostris	0,18	0,21	0,14
— *lippa*	1,77	1,72	2,53
— *parisiensis*	0,18	0,21	0,14
— *seminulum*	8,15	6,19	4,14
Pyrgo bulloides	0,97	2,06	0,46
— *simplex*	0,07	0,14	—
Triloculina angularis	1,33	2,06	1,15
— *austriaca*	0,09	0,14	—
— *cylindrica*	0,27	0,14	0,46
— *lecalvezae*	0,44	1,24	0,23
— *porvaensis*	0,53	0,14	0,69
Miliola brevidentata	0,27	0,21	0,32
— *disticha*	0,71	0,34	1,15
— *prisca*	1,51	1,72	2,30
— *prisca* v. *terquemi*	0,14	0,21	—
— *pseudocarinata*	0,71	0,14	1,38
— *saxorum*	1,42	1,72	1,61
— *strigillata*	0,07	0,14	0,05
Articulina nitida	0,004	—	0,09
Globulina gibba	0,89	1,03	0,69
— *gibba* v. *tuberculata*	0,30	0,07	0,37
Guttulina irregularis	0,37	0,55	0,46

5. táblázat folyt.

a	b	c	d
Discorbis bractifera	0,09	0,21	—
— *perplexa*	1,77	2,41	2,07
— *propinqua*	0,09	0,21	—
— *rotata*	1,12	1,24	1,61
— sp.	0,07	0,14	—
Baggina subconica	0,05	0,07	—
Cancris auris	1,06	1,37	0,92
Glabratella ubiqua	0,41	0,21	0,69
Asterigerina bimammata	1,15	0,69	2,07
— *rotula*	10,9	2,41	16,55
Epistomaria semimarginata	0,23	0,21	0,46
Rotalia trochidiformis	0,19	0,21	—
— *tuberculata*	0,41	0,21	—
Pararotalia inermis	17,01	17,18	18,85
Eponides polygonus	0,41	0,21	0,69
Cibicides carinatus	7,97	7,56	12,87
— *robustus*	0,92	2,06	0,46
— *sublobatulus*	3,54	4,12	4,14
Stichocibicides cubensis	0,53	1,37	—
Eoannularia eocenica	2,04	3,78	2,30
Linderina brugesi	0,55	1,10	0,46
Acervulina dudarensis	10,91	2,47	3,68
Sphaerogypsina globula	0,12	0,34	—
Fabiania cassis	0,58	0,89	—
Halkyardia minima	2,30	2,41	2,99
Eorupertia cristata	0,21	0,14	—
— *magna*	0,27	0,34	—
Nonion scaphum	0,30	0,82	—
Hanzawaia producta	0,71	1,03	0,92
Lamarckina erinacea	0,09	0,21	—
Schlosserina asterites	0,35	0,69	—

százalékos összetételét ábrázolja, a másik két pont a *Velates schmideli* és *Campanile urkutense* csigafajok házkitöltéséből származó fauna százalékos összetételét mutatja.

A három subordo százalékos eloszlása alapján, a dudari faunát képviselő mindhárom pont a „tengerparti lagúna" mezőbe esik.

A teljes faunában uralkodóak a Rotaliinák 67,93%-ban, a Textulariina viszonylag alárendelt 5,72%, a Miliolina 26,35%.

A fajok közül gyakoriak a: *Pararotalia inermis* (Terquem) 17,01%, a *Cibicidesek* 12,43%, *Acervulina dudarensis* n. sp. 10,91%, *Asterigerina rotula* (Kaufman) 10,9%. Viszonylag gyakoriak még a *Quinqueloculina seminulum* (Linné) 8,15% és a *Nubecularia lucifuga* Defrance 6,38%.

A faunából a plankton Foraminiferák hiányoznak. A bentosz együttes viszonylag nagy egyedszámú és magas diverzitású, a Fisher-féle α érték: 10 (4. ábra).

A faunában az aljzatra vagy növényzetre fennőtt fajok 30,73%-ot tesznek ki.

Recens adatok

J. W. MURRAY (1973) nagyszabású munkájában, a Földközi-tengerről szóló fejezetben találhatjuk a legtöbb olyan adatot, amely esetünkben recens analógiaként szolgálhat. A K-Mediterraneumban max. 10 m-es vízmélységig algamezős környezetben hasonló Foraminifera-együttes fordul elő (Kréta-sziget, Égei-tenger É-i része). Ez az algás környezet kedvező élettér a Foraminiferák számára, mert nemcsak bőséges táplálékot szolgáltat, de a szaporodás számára is kitűnő feltételeket teremt.

A provencei tengerparton (BLANC—VERET 1969 in MURRAY 1973) Posidonia (tengeri fű) szálainak szövevénye alkotja a Foraminiferák számára kedvező környezetet. A *Nubecularia lucifuga* DEFRANCE, a Cibicides fajok, az Acervulina genus megközelítően hasonló százalékban találhatók ezen a tengerparton, mint a dudari faunában. A Posidonia szublitorális öv alatt él, leggyakoribb 15 m-es mélységben, de jól átvilágított tengerekben 50 m-ig is megtalálható (GÉCZY B. 1972).

Recens megfigyelések szerint (MURRAY 1968a, 1973) a dudari fauna gyakrabban előforduló genuszainak ökológiai adatai a következők:

Acervulina: Normál tengeri környezetben, mérsékelt égövön, 0—60 m-ig a belső selfeken él.

Asterigerina: Normál tengervízben, az üledék felszínén, trópusi—szubtrópusi környezetben a belső selfeken él.

Cibicides: Normál tengervízben, növényre, aljzatra, kagylóra vagy egyéb élő állatokra rátapadva él a hidegtől a trópusi éghajlatig, 0—2000 m mélységig.

Discorbis: Normál tengervízben, 12 °C-nál melegebb éghajlaton, 0—50 m mélységig a belső selfeken él.

Quinqueloculina: 32‰-es sótartalom felett, homokos üledéken és növényzeten él a mérsékelt éghajlattól a trópusig (de néhány faja a hideg vízben is), 0—40 m-ig a belső selfeken és hypersalin lagúnákban.

Rotalia: 36—38‰-es sótartalmú vízben, 14—25 °C hőmérsékleten, 0—40 m-es mélységben él a belső selfeken.

Paleoökológiai következtetések

A fauna ökológiai értékelésének egyik lehetőségét MURRAY (1973) alapján az α diverzitási index adja. A tengeri lagúnáknál az α érték 4—11 között mozog, de euhalin tengeri lagúnáknál 7,5-nél magasabb. Jellemző továbbá a Textulariinák alárendelt szerepe. A vízmélység ezekben a lagúnákban max. 25 m, de átlagosan kb. 10 m. A vizsgált anyagban az α érték 10, tehát az euhalin 20 m körüli mélységű tengeri lagúnák tartományába esik. Ugyancsak erre utal anyagunkban a Textulariinák kis mennyisége (5,72%).

A háromszög diagramról szintén leolvasható (3. ábra), hogy a faunaegyüttes normál tengerparti lagúnát jelez. A *Velates schmideli* és *Campanile urkutense* házkitöltéséből bemért 5 g iszapolási anyagból kiszámított százalékos értékek is ezt az eredményt adják. Ennek valószínű magyarázata az, hogy a csigák azonos biotópban éltek a Foramniferákkal, és a posztmortális összemosás jelentős szeparálódást nem okozott. Ugyanezt támasztja alá, hogy a házkitöltő üledék sem különbözik a bezáró kőzettől: mindkettő agyagos homok.

STRAUSZ L. (1966) a csiga fauna alapján a normálisnál kissé alacsonyabb sótartalmú környezetet, gyenge vízmozgást és védett medencerészt említ.

KRIVÁNNÉ HUTTER E. (1957) zöldalgák alapján trópusi–szubtrópusi éghajlatot, max. 30 m-es vízmélységet, erős parti vízmozgást és agyagos–homokos aljzatot feltételez ugyanerre a környezetre.

Az előbbiek alapján következtethetünk az egykori őskörnyezetre: a Foraminiferák normál sótartalmú tengervízben, trópusi–szubtrópusi éghajlaton, algás, tengeri füves vegetációs aljzat mellett, sekély-szublitorális övben 10–20 m közötti vízmélységben, az erős hullámveréstől védett tengerparti lagúnákban éltek, ahol a közepes–durvaszemű homokos üledék közeli partot jelez. Jelentős édesvízi befolyással a fajgazdag ősmaradvány-együttes alapján nem számolhatunk. A lagúna a nyílt tengerrel összeköttetésben állhatott, ahonnan a tengervíz-utánpótlás érkezett.

5. Paleobiogeográfiai értékelés

A dudari területen a középső-eocén bartoni emeletébe tartozó nummuliteses–molluscumos agyagos homok bentosz kis-Foraminifera faunájának gazdagsága kitűnő lehetőséget nyújt más területek faunáival történő összehasonlításra. Bentosz kis-Foraminiferák alapján végzett paleobiogeográfiai tanulmány a területről eddig még nem készült, de a szakirodalomban található egyéb állatcsoportokra alapozott következtetések, valamint ősföldrajzi és fejlődéstörténeti szintézisek sok segítséget nyújtottak eredményeim értékelésénél.

KECSKEMÉTI T. (1980) megállapította, hogy a Bakony felső-lutéciai Nummulites faunája az ősföldrajzi helyzet és faunaösszetétel alapján a mediterrán faunaprovincia északi pereméhez tartozik. A „perforátus-os transzgresszió" következtében a felső-lutéciaiban a kelet-atlanti Aquitaniai-medencével nő a rokoni kapcsolat a lutéciai emelet folyamán, a Párizsi-medencével viszont csekély volt.

STRAUSZ L. (1966) az általam is vizsgált dudari nummuliteses–molluscumos agyagos homok képződménynek a csiga faunáját dolgozta fel. (A bentosz kis-Foraminiferák ezekből a csigaház-kitöltésekből származnak.) A 100 összehasonlításra alkalmas Mollusca faj közül 40-et közösnek talált a párizsi-medencei faunával, ahol azok főleg a középső-, illetve középső- és felső-eocénben fordulnak elő. Ugyanezt a faunát Olaszország (Monte Postale: alsó-lutéciai; Ronca, Ilarione: felső-lutéciai lelőhelyek) eocén faunájával is összehasonlította; ennek során 48 közös fajt talált.

A jelen dolgozat tárgyát képező bentosz kis-Foraminifera faunát elsősorban a Párizsi-medence faunájához tudtam hasonlítani. Ennek oka az, hogy a hasonló korú előfordulások közül a Párizsi-medence képződményei a legjobban feltártak, a legrégebben és a legalaposabban vizsgáltak. Az ott előforduló Foraminiferák feldolgozása a múlt század elejétől napjainkig nagy intenzitással folyik (A. ORBIGNY 1826, M. TERQUEM 1882, Y. LE CALVEZ 1947, 1949, 1950, 1952, 1970). Y. LE CALVEZ (1970) a Párizsi-medence paleogén Foraminiferáiról szóló munkájában több száz, azonosításra kiválóan felhasználható scanning elektronmikroszkópos felvételt is közöl.

Ehhez hasonlóan gazdag és jól dokumentált feldolgozás a hozzáférhető irodalomban a hozzánk közelebb eső területekről nem található.

A Párizsi-medence faunájával való összehasonlításra irányuló első kísérletemről a Második Bentosz Foraminifera Szimpóziumon elhangzott előadásomban számoltam be, amelynek anyaga a Benthos '83 kötetben jelent meg (Horváthné Kollányi K. 1984). Jelen fejezetben az előadásban elhangzott anyag továbbfejlesztését és részletes kifejtését kívánom bemutatni.

A 6. táblázaton látható a Dudaron is megtalálható közös fajok előfordulása a Párizsi-medence különböző sztratigráfiai szintjeiben. Vizsgálataim során megállapítottam, hogy a Dudarról leírt 63 faj közül 47 faj közös a Párizsi-medence faunájával, ami a teljes fauna 68,4%-át teszi ki. A táblázatból kitűnik, hogy legnagyobb a faunaegyezés a Párizsi-medence IVa zónájával, ami az Abrard-féle (1925) *Cerithium giganteum* és *Orbitolites complanatus* zónával azonos. Ebben a nagyfokú egyezésben szerepet játszik a két képződmény igen közelálló litofáciese is.

A Párizsi-medence és a vizsgált dudari fauna közötti jelentős hasonlóság alapján a két terület között feltétlen összeköttetésnek kellett lennie.

Dudich E.—Kopek G. (1980) munkájukban megállapítják, hogy a felső-lutéciai transzgresszió Isztrián és D-Ausztrián (Guttaring vidéke) keresztül a mai Zalai-medencén át DNy-ról érte el a Bakony területét. A Dudari-medencében a felső-lutéciai láposodás (felső-barnakőszenes rétegcsoport) után a *Nummulites perforatus*-os transzgresszió következik, aminek során létesült kapcsolat az ÉK-i területek felé és a Balatontól D-re kialakult tengerággal.

A dudari bentosz Foraminifera-együttes mediterrán faunajelleget mutat. Élettere a mediterrán tenger É-i self területe. E tenger DNy-ról nyomult be fokozatosan a mai részmedencék területére. Kapcsolata az északi faunaprovinciával kerülő úton: nyugat felé a mai Isztrián, Olaszországon és az Aquitaniai-medencén, majd a Párizsi-medencén keresztül képzelhető el, keleten pedig az Orosz-táblán át (Báldi T. 1982).

A fentiek igazolásához további adatokat kínál a dudari és az Aquitaniai-medencebeli Cauneille-i lelőhely lutéciai kis-Foraminifera faunájának összehasonlítása. Az utóbbi lelőhelyről Szőts E. (1973) gazdag (73 db) bentosz és plankton Foraminifera-együttest ír le és ennek anyagát számomra tanulmányozásra átadta. A vizsgálat során a dudarival az alábbi 18 közös fajt sikerült meghatároznom: *Globulina gibba* d'Orb., *Guttulina irregularis* (d'Orb.), *Baggina subconica* (Terq.), *Asterigerina bimammata* (Gümb.), *A. rotula* (Kaufm.), *Rotalia tuberculata* Schubert, *Pararotalia inermis* (Terq.), *Cibicides carinatus* (Terq.), *C. robustus* Le Calv., *C. sublobatulus* (Gümb.), *Eoannularia eocenica* Cole et Bermudez, *Acervulina dudarensis* n. sp., *Sphaerogypsina globula* (Reuss), *Fabiania cassis* (Opp.), *Halkyardia minima* (Liebus), *Eorupertia cristata* (Gümb.), *E. magna* (Le Calv.), *Schlosserina asterites* (Gümb.).

Kísérletet tettem a dudari anyag és a hasonlóan gazdag Bajor-Alpok faunaegyüttesével való közvetlen összehasonlításra is. Módom volt megvizsgálni több Bajor-Alpokbeli lelőhelyről származó anyagot: Eitel-Graben, Kressen-Graben, Küchbach-Gebiet, Höll-Graben Südlich Bad Adelholzen stb. (Báldiné Beke M. gyűjtése). Hamarosan bebizonyosodott, hogy a faunaösszetétel teljesen eltérő, közös alakot nem találtam, ami valószínűleg faunaprovincia-különbségekkel magyarázható. A Bajor-Alpok más lelőhelyeiről leírt több száz faj közül is csupán öt faj található meg Dudaron is: az *Asterigerina bimammata* (Gümb.), *A. rotula* (Kaufm.), *Cibicides sublobatulus* (Gümb.), *Eorupertia cristata* (Gümb.), *Schlosserina asterites* (Gümb.).

A dudari, az aquitaniai (Cauneille), a Párizsi-medencebeli és a Bajor-Alpokból származó faunát összehasonlítva az látszik, hogy míg a dudari fauna 63 fajából 5 közös a Bajor-Alpok faunájával, addig az Aquitaniai-medencében

A dudari fajok rétegtani helyzete
Stratigraphic position of the species

A Párizsi-medence korbesorolása LE CALVEZ (1970) nyomán / Age assignation in the Paris basin, after LE CALVEZ (1970)			*Guttulina irregularis*	*Cibicides carinatus*	*Valvulina limbata*	*Nonion scaphum*	*Globulina gibba*	*Quinqueloculina parisiensis*	*Cancris auris*	*Hanzawaia producta*	*Epistomaria semimarginata*	*Glabratella ubiqua*	*Discorbis perplexa*	*– propinqua*	*Baggina subconica*	*Miliola saxorum*	*Lamarckina ovula*	*Miliola prisca*	*Articulina nitida*	*Eponides polygonus*	*Triloculina lecalvezae*
Oligocén						+	+														+
Eocén	bartoni	ludi					+											+	+		+
		marinesi	+	+	+	+	+		+	+	+	+	+	+	+	+				+	+
		auversi	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+
	lutéciai	IV. b.	+	+	+	+	+		+	+				+	+	+			+		+
		IV. a.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
		III.	+	+		+	+	+	+	+		+		+	+	+	+			+	+
		II.	+	+		+	+		+	+		+		+	+					+	
		I.	+	+		+	+		+	+					+					+	
	yprèsi	cuisi	+	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
		sparnacumi		+																	
Paleocén		thaneti	+	+	+	+	+														

6. táblázat — Table 6

a Párizsi-medencében
of Dudar in the Paris basin

Textularia minuta	*Pararotalia inermis*	*Discorbis bractifera*	*Triloculina angularis*	*Quinqueloculina lippa*	*Spiroloculina bicarinata*	*Pyrgo bulloides*	*Miliola pseudocarinata*	*— disticha*	*Linderina brugesi*	*Vertebralina laevigata*	*Valvulina triangularis*	*Miliola brevidentata*	*Quinqueloculina birostris*	*Pyrgo simplex*	*Nubecularia lucifuga*	*Rotalia trochidiformis*	*Fabiania cassis*	*Eorupertia magna*	*Valvulina pupa*	*Miliola strigillata*	*Valvulina guillaumei*	*Cibicides robustus*	*Discorbis rotata*	*Clavulina parisiensis*	*Halkyardia minima*	*Quinqueloculina seminulum*	*Triloculina porvaensis*
							+																			+	+
						+	+																			+	
	+	+			+		+		+													+	+	+	+		
+	+	+	+	+	+	+	+		+											+	+	+	+	+			
	+	+	+		+	+	+		+										+	+	+			+			
+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
+	+		+	+	+	+	+	+																			
+	+																										
+	+	+																									

18, a Párizsi-medencében 47 dudari fajt találtam. Az Aquitaniai-medence 18 közös faja között szerepel az az öt faj is, ami a Bajor-Alpokban is előfordul. Amennyiben a fauna kicserélődése a Párizsi-medencén keresztül történt, ott még nagyobb százalékban kellene a Bajor-Alpok faunáját megtalálni. A feldolgozott irodalomban erre való utalást nem találtam.

A Bajor-Alpok faunájából való nagyfokú különbség is alátámasztja azt az ősföldrajzi képet, mely szerint a lutéciaiban létezett egy É-i flis-tenger, ahol a Bajor-Alpok eocén üledékei lerakódtak és ettől egy szárazulattal elválasztva DNy felé a Tethys nagy kiterjedésű selftengere. Ez utóbbinak ÉK felé benyúló öblében képződött az egész dunántúli-középhegységi eocén is (BÁLDI T. 1982). Így magyarázható a viszonylag közel első szlovákiai és erdélyi-medencei eocén faunák jelentős eltérése a dudaritól, mely területen az É-i flis-tenger öblei voltak és a Bakonnyal nem álltak közvetlen összeköttetésben.

Összefoglalóan megállapítható, hogy a korábban ilyen szempontból még nem vizsgált bentosz kis-Foraminiferák elemzési eredményei megerősítik az egyéb ősmaradvány-csoportok és földtani adatok alapján felvázolt ősföldrajzi képet, vagyis hogy a Bakony (illetve az egész dunántúli eocén területe) középső-eocén üledékei a Tethys É-i selfjén rakódtak le. É és K felé (Szlovákia, Bajor-Alpok, Erdély) közvetlen faunakapcsolat kizárható. A bentosz kis-Foraminifera fauna a párizsi-medenceivel mutat feltűnő hasonlóságot. Ez a hasonlóság jóval hangsúlyozottabb, mint a Molluscumok és még inkább mint a fáciesre különösen érzékeny nagy-Foraminiferák esetében.

A bentosz kis-Foraminifera fauna nagyfokú hasonlósága a párizsi-medenceivel közvetlen tengeri összeköttetést igazol, feltehetőleg a Tethys É-i-selfjén, az Aquitaniai-medencén az Atlanti-óceán keleti peremén keresztül.

EOCENE BENTHONIC SMALLER FORAMINIFERA FAUNA FROM DUDAR

I. INTRODUCTION

The present writer's processing of the benthonic smaller Foraminifera fauna from the rock immediately overlying the Eocene coal measures of Dudar was primarily aimed at describing and documenting, in an up-to-date form, the material excelling with an abundance and a state of preservation that are unique to the Eocene.

The first studies of Eocene benthonic Foraminifera in Hungary in the second half of the last century are connected with the name of M. HANTKEN who was concerned, however, mainly with the Esztergom basin as well as Buda and its surroundings. The work that has since that time been done on this matter is restricted to a few minor syntheses (L. VITÁLIS-ZILAHY 1967, 1969, R. NYÍRŐ 1970). The present work has been done with the intention to seek to fill, at least partly, the gap.

The aim of this monograph is to give, along with an up-to-date systematic assessment of the benthonic smaller Foraminifera fauna, its biostratigraphic, paleoecologic and paleobiogeographic evaluation and to clear the stratigraphic position of the formations under study.

The author is indebted to DR. E. SZŐTS who gave her his own collection for being processed and who helped her disinterestedly with his valuable advice. Let us thank DR. M. MONOSTORI and DR. M. HORVÁTH for their valuable comments. The author is profiting of this opportunity to acknowledge her colleagues DR. A. VÖRÖS, B. BARNA, DR. T. KECSKEMÉTI, DR. M. BÁLDI-BEKE and DR. A. ORAVECZ-SCHEFFER the attention they have paid to her work from the very beginning and for the immediate help they have given her whenever a technical problem arose. Mrs. B. TAKÁCS and Miss I. LAKY are thanked for their preparation of the scanning electron microscopic images and Miss J. GYARMATI and Mrs. J. FÜLÖP for the assistance they provided in performing technical tasks.

Finally, let us express our gratitude to the head executives of the Hungarian Geological Institute for having provided the facilities that have enabled this work to come to completion.

II. RESEARCH HISTORY

The study of the Dudar basin and its surroundings in the very heart of the Bakony Mountains was started already in the last century. The principal works the author wants to review here include the ones discussing strictly the area dealt with in the present study.

The first data concerning the study area are connected with the names of G. STACHE (1862a, b) and M. HANTKEN (1867, 1874, 1875a, b, 1878). In the early 1900's the Eocene formations of the study area were dealt with by GY. PRINZ (1904), then by H. TAEGER (1910, 1936) and J. TOMOR-THIRRING (1934, 1935, 1936). GY. PRINZ (1904) made an attempt at the stratigraphic assignment of the Eocene formations by dividing them into Lower, Middle and Upper Eocene. H. TAEGER (1936) already described a more complete Eocene from the study area, beginning with the variegated underclay of the coal measures which he placed in the Middle Eoecene. J. TOMOR-THIRRING (1934) described a sequence beginning with the Middle Eocene coal measures from the Dudar–Csesznek area. Many works by I. VITÁLIS were connected with coal prospecting (1923, 1928, 1932, 1946), too.

A new stage in the research history of the study area began with the activities of E. SZŐTS (1948, 1956). In his work of 1956 he proposed to replace the earlier stratigraphic scale of the Eocene (Paleogene) by a new one, as follows:

Upper Eocene:	Rupelian
	Lattorfian
Middle Eocene:	Bartonian
	Lutetian
	Londonian
Lower Eocene:	Thanetian
	Montian

This stratigraphic classification is not in use anymore, but E. SZŐTS' exact stratigraphic successions are still reliable even now.

The stratigraphic research carried out from the 1960's onwards in the Bakony Mountains is associated primarily with the name of G. KOPEK. For his stratigraphic concept, he used mainly the larger forams that are comparatively easily identifiable even on the field. Closely tied with his work were subsequent studies by T. KECSKEMÉTI and E. DUDICH. A good many of works they published both separately and in co-authorship added further dimensions to the geological understanding of the Eocene in the Bakony area (G. KOPEK 1962, 1964, 1966, 1971, 1980, G. KOPEK–E. DUDICH–T. KECSKEMÉTI 1961a, b, G. KOPEK–T. KECSKEMÉTI 1960, 1964a, b, 1965a, b,

G. Kopek—T. Kecskeméti—E. Dudich 1965, 1966). Out of a total of 16 Eocene horizons distinguished in the above works throughout the Transdanubian Central Range, the Middle Eocene of Dudar could be shown to include 6 horizons as follows: Lower Lutetian coal measures (IInd horizon), *Nummulites perforatus* coal measures (IXth horizon), *Nummulites perforatus* horizon (Xth and XIth horizons), *Nummulites millecaput* horizon (XIIth horizon) and glauconitic marl horizon (XIIIth horizon).

Recently, while studying a borehole profile from the Dudar basin (borehole Dudar 230) in detail, M. Báldi-Beke and T. Kecskeméti (1983) assigned the rock immediately overlying the coal measures to the *Nummulites perforatus* Zone and the NP 16 nannoplankton zone respectively.

III. OUTLINE OF THE GEOLOGICAL SETTING OF THE DUDAR BASIN

The Eocene in the Dudar basin is underlain by Mesozoic formations of varying age. In the Magas- and Sűrű-hegy area mainly Upper Triassic Hauptdolomit and Dachstein Limestone constitute the underlying rock. Farther to the S, the Eocene is underlain by Triassic, Jurassic and Cretaceous limestones and, locally, by Aptian clays and Cretaceous Turrilites marls (E. Szőts 1956, G. Kopek 1971, 1980).

These rocks are overlain by the Middle Eocene coal measures (Tatabánya Formation) which is composed of two groups of seams. Detailed descriptions of the coal seams and the rocks in between are known to us from the works of E. Szőts (1956) and G. Kopek (1980). G. Kopek (1980), G. Kopek–T. Kecskeméti (1964), G. Kopek–T. Kecskeméti–E. Dudich (1965, 1966) and G. Kopek–E. Dudich–T. Kecskeméti (1971) described a Lower Lutetian and Upper Lutetian *Nummulites perforatus*-bearing group of seams, supposing an intra-Lutetian denudation between the two. The second coal seam is overlain already by marine deposits.

E. Szőts carried out detailed field studies in the Dudar area, primarily in the neighbourhood of the now-abandoned Kossuth adit (Fig. 1*). The stratigraphic sequence recorded here and confirmed by fossils is as follows (E. Szőts 1956):

Middle Eocene: Londonian stage

1. variegated clay overlying the Mesozoic basement
2. fossiliferous gravelly freshwater sands
3. coal formation
4. molluscan – nummulitic clayey sand
5. molluscan marl
6. nummulitic–molluscan calcareous marl

Middle Eocene: Lutetian stage

7. main nummulitic limestone
8. foraminiferal–molluscan claymarl

Middle Eocene: Bartonian stage

9. glauconitic, foraminiferal claymarl (with a question mark)

The succession of the stratigraphic units has not changed during subsequent studies.

The so-called main nummulitic limestone (Szőc Limestone Formation) of basin-marginal development and the foraminiferal marl (Mór Siltstone For-

* For illustrations and tables, see the Hungarian text.

mation) of basin-centre facies vary in thickness and may occur intertongued in different parts of the basin.

Within the coastal facies, *Nummulites perforatus-*, *N. millecaput-* and glauconitic marl horizons are mentioned by G. Kopek, T. Kecskeméti and E. Dudich, in their works just quoted, as occurring within the Middle Eocene. The uniform marly formation of basin facies (foraminiferal marl) grades with no interruption into the Upper Eocene.

In Fig. 2. E. Szőts' stratigraphic sequence (1956) has been compared with the geological log of borehole Dudar 240 which cut all the formations of the Dudar basin. The material of this borehole was studied in detail by the author and the results are presented in the biostratigraphic chapter.

The Eocene formations are unconformably overlain by the Oligocene beds.

IV. BENTHONIC SMALLER FORAMINIFERA FAUNA FROM THE NUMMULITIC–MOLLUSCAN CLAYEY SANDS

1. Description of the locality

The microfauna that has been the subject of the present work derives from a locality altogether inaccessible today. What used to be the Kossuth adit lay at a distance of about 1500 m SW of Dudar, near the road leading to Nagyesztergár (Fig. 1). The stratigraphy of the original site, as suggested by E. Szőts (1956) and L. Strausz (1966), is given in Fig. 2.

As evident from the figure, the second coal seam is overlain by a 0.3 to 0.5 m thick alternation of coal and marly sand. This is followed with a continuous transition by nummulitic–molluscan sands having a thickness of about 2 m. This is the sequence from which that well-preserved gastropod fauna was collected from the shell-fill of which the material studied by the author has been recovered.

The molluscan fauna under consideration was monographed partly by E. Szőts (1948, 1956), partly, and in more detail, by L. Strausz (1966, 1969, 1970a, b). During his processing of the fauna E. Szőts took notice of the fact that the sedimentary fill of the large gastropod shells contained an extremely well-preserved Foraminifera fauna. E. Szőts himself had determined more than 90 forms of these forams, but his manuscript remained unpublished. Let us quote the forms identified by him: *Textularia carinata* d'Orbigny *nalinnesensis* Kaasschieter, T. sp., *Valvulina pupa* d'Orb., *V.* sp., *Clavulina parisiensis* d'Orb., *Nubecularia lucifuga* Defrance, *Spiroloculina bicarinata* Le Calvez, *S. costigera* (Terquem), *S. costigera* (Terquem) *obliqua* Le Calvez, *S. tricarinata* Terquem *angulifera* Terquem, *Quinqueloculina carinata* d'Orb., *Q. costata* Karrer, *Q. grignonensis* Le Calvez, *Q. ludwigi* Reuss, *Q. seminula* (Linné), *Q. striata* d'Orb., *Pyrgo bulloides* (d'Orb.), *Triloculina angularis* d'Orb., *T. tricarinata* (Terquem) *belgica* Kaasschieter, *T. trigonula* (Lamarck), *Miliola birostris* (Lamarck), *M. prisca* (d'Orb.) *terquemi* Kaasschieter, *M. saxorum* (Lamarck), *Idalina* ? sp., *Miliolidae* div. sp., *Robulus arcuatostriatus* (Hantken), *Globulina gibba* (d'Orb.), *G. gibba* (d'Orb.) *punctata* d'Orb., *Guttulina irregularis* (d'Orb.), *Discorbis limbata* (Terquem), *D.* aff. *parisiensis* (d'Orb.), *D. perplexa* Le Calvez, *D. propinqua* (Terquem), *D.* div. sp., *Epistominella acutimargo* (Halkyard), *Boldia lobata* (Terquem), *Asterigerina bimammata* (Gümbel), *A. rotula* (Kaufmann), *Rotalia* aff. *lithothamnica* Uhlig, *R. trochidiformis* (Lamarck), *R. tuberculata* Schubert, *R.* div. sp., *Pararotalia inermis* (Terquem), *Eponides polygonus* Le Calvez, *Cibicides carinatus* (Terquem), *C. productus* (Terquem), *C. robustus* Le Calvez, *C. sublobatulus* (Gümbel), *C.* div. sp., *Stichocibicides cubensis* Cole et Bermudez, *St.* ? sp., *Eoannularia eocenica* Cole et Bermudez, *Linderina brugesi* Schlumberger, *Acervulina* sp., *Sphaerogypsina globula* (Reuss), *Cymbaloporetta* sp., *Fabiania cassis* (OPPENHEIM), *Halkyardia minima* (LIEBUS), *Eorupertia cristata* (GÜMBEL), *E. magna* (LE CALVEZ), *Cassidulina ?* sp., *Nonion* aff. *scaphum* (FICHTEL et MOLL), *Alabamina* aff. *obtusa* (BURROWS et HOLLAND), *Anomalina auris* LE CALVEZ, *Hanzawaia producta* (TERQUEM), *Lamarckina ovula* LE CALVEZ, *Mississippina ?* sp., *Stomatorbina torrei* (CUSHMANN et BERMUDEZ).

E. SZŐTS gave me that material for a detailed study for which I am greatly indebted to him.

I complemented E. SZŐTS' material, on the one hand, with the forams which had been recovered by decantation from the original gastropod fauna deposited in the Paleontological Collection of the Hungarian Geological Institute and, on the other hand, with forams deriving from the shell-fill of gastropods recovered from the spoil-bank of Ikerakna (Twin-Shaft) shaft at Dudar. The material derived from the latter source has proved to be of little use, since the sediment at that site is more calcareous, being less suited to decantation.

The Foraminifera fauna derives mainly from the shell-fill of the following gastropods:

Velates schmideli CHEMN.
Campanile urkutense MUN. CHALM.
Ampullina perusta DEFR.

2. Systematic description

In my systematic classification of the studied species I have adopted the system proposed by A. LOEBLICH and H. TAPPAN (1964). 63 species have been described in detail, of which only one is new.

In compiling the synonymy I have sought to take into consideration all data from the relevant literature available to me. In specifying the geographic distribution of a form I have relied on published data only. This means that the data of boreholes and outcrops earlier studied by me are not reflected in the data about the distribution of the particular species, since these data have not been published as yet.

The fossils have been reproduced in form of scanning electron microscopic images, to which a light microscopic image of the holotype of the new species *Acervulina dudarensis* n. sp. and thin section photographs are added.

Ordo: **FORAMINIFERA** EICHWALD, 1930
Subordo: TEXTULARIINA DELAGE et HÉROUARD, 1896
Superfamilia: **L i t u o l a c e a** DE BLAINVILLE, 1825
Familia: **Textulariidae** EHRENBERG, 1838
Subfamilia: T e x t u l a r i i n a e EHRENBERG, 1838
Genus: *Textularia* DEFRANCE in DE BLAINVILLE, 1824

Textularia minuta TERQUEM, 1882
Pl. I, f. 1–3

1882. *Textilaria minuta*, TERQ. – TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 147 Pl. XV. fig. 15.
1952. *Textularia minuta* (TERQUEM). – LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 19. Pl. II. fig. 9, 10.

1970. *Textularia minuta* TERQUEM. – LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 19. Pl. I. fig. 5, 6.

Description: Studied material—5 specimens. Wall agglutinated. Shape, in lateral view, resembling a rounded triangle, growing wide at the top and slightly concave at the aperture. When viewed from the last chamber, slightly rounded-oval in one of its half. Chambers biserially arranged. Shape of chambers resembling an elongated parallelepiped, getting pinched out at the meeting of the chambers in the middle. The chambers increase in size with the growth of the test, the last chambers being, in lateral view, slightly bent upwards. Sutures slightly curved and depressed in accordance with the shape of the chambers. Suture between younger chambers heavily depressed. At the margin of the last chamber there is a slit-like aperture with a narrow margin. It is at the centre of the suture, being about half as long as the suture.

Size: Length of biserial test 380–1300 μm. Width of last two chambers 540–1200 μm. Greatest thickness of last chamber, as viewed from the aperture, 340–750 μm.

Remark: The last chambers of the specimens studied by the author are somewhat wider than the holotype figured by TERQUEM (1882).

Geographic and stratigraphic range: Known from several localities from Cuisian, Lutetian and Auversian beds in the Parisian Basin. Not too rare at Dudar, in Lutetian nummulitic-molluscan clayey sands.

Textularia sp.
Pl. I, f. 4

Description: Studied material—6 specimens. Wall agglutinated. Shape, in lateral view, elongate, slightly emergent. Slightly flattened-circular, in apertural view. Chambers biserially arranged, rounded externally, ending in a carina in the middle. They slightly increase in size with the growth of the test. Test composed of a number of biserially arranged chambers. Sutures almost straight, slightly depressed. At the margin of the last chamber a slit-like aperture can be seen which is situated in the centre of the last suture, its length being about one-third of that of the suture.

Size: Length of biserially arranged test 650–1650 μm. Greatest width of test at the last two chambers 430–820 μm. Greatest thickness of last chamber 210–550 μm. Thickness of penultimate chamber 160–380 μm.

Remark: Resembles the species *Textularia agglutinans* D'ORBIGNY, but the chambers are wider at the top and, in apertural view, the outline of the test is slightly pointed, oval.

Geographic and stratigraphic range: Not too sparse in the Lutetian nummulitic-molluscan clayey sands at Dudar.

Familia: **Ataxophragmiidae** SCHWAGER, 1877
Subfamilia: Valvulininae BERTHELIN, 1880
Genus: *Valvulina* D'ORBIGNY, 1826

Valvulina guillaumei LE CALVEZ, 1952
Pl. I, f. 5

1952. *Valvulina guillaumei* n. sp. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 13. Pl. I. fig. 1.
1970. *Valvulina guillaumei* LE CALVEZ. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 23. Pl. I. fig. 3, 4.

Description: Studied material—3 specimens. Wall agglutinated. Shape, in lateral view, slightly elongate, rather squat triangle, rounded at the base, semicircular at the top and circular in apertural view. Chambers triserial in early stage; later may have more than three chambers to whorl spirally coiled. Chambers following proloculus more angular, later becoming rounded at their edge. Younger chamber more inflated than that preceding it. In the last whorl, four chambers are visible. Sutures in triserially arranged chambers straight, later becoming slightly curved. Aperture surrounded by slightly uncoiled last whorl composed of four chambers and provided with rather small tooth.

Size: Total length of test 800–1100 μm. Largest width at last chambers 600–830 μm.

Remark: With the initially triserial arrangement and the slightly uncoiled last wohrl, the species resembles *Valvulina triedra* LE CALVEZ, but it is much more squat, not so much elongate.

Geographic and stratigraphic range: Known from higher horizons of the Lutetian and from Auversian and Marinesian beds of some localities in the Paris Basin. Sparsely present in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Valvulina limbata TERQUEM, 1882
Pl. II, f. 1–2

1882. *Valvulina limbata,* TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 102. pl. XI. fig. 7.
1882. *Valvulina irregularis,* TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 103. pl. XI. fig. 9.
1937. *Valvulina limbata* TERQUEM. — CUSHMAN, J. A.: Cushm. Lab. Foram. Res. Spec. Publ. No 8. p. 7. pl. I. fig. 14, 15.
1952. *Valvulina limbata* TERQUEM. — LE CALVEZ, Y.: Mém. Carte Géol. Fr. pt. 4. p. 10. pl. I. fig. 4.
1970. *Valvulina limbata* TERQUEM. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 23. Pl. 2. fig. 3, 7.

Description: Studied material—5 specimens. Wall agglutinated. Size of cemented grains about 20–30 μm. Shape of test, in lateral view, long, elongate, the basal part ending in a triangle. Triangular in apertural view. Chambers triaserially arranged. Younger whorls consist of increasingly larger chambers. Outer wall of last two chambers rounded, chambers in earlier stage angular.

Sutures almost straight, forming an angle of about 45° with longitudinal axis. Aperture oval at base of final chamber, being provided with big valvular teeth.

Size: Total length of test 1700–2850 μm. Width of test at final chamber 750–960 μm.

Remark: The triserial arrangement of the chambers is very similar to the case of *Valvulina triangularis* D'ORBIGNY, but the test of D'ORBIGNY's species is much shorter and squatter and the final chambers are larger.

Geographic and stratigraphic range: Known from Thanetian beds, from higher parts of the Lutetian as well as from Auversian and Marinesian localities in the Paris Basin. Not too frequent at Dudar, in the Lutetian nummulitic-molluscan clayey sands.

Valvulina pupa D'ORBIGNY, 1850
Pl. II, f. 3–5

1850. *Valvulina pupa,* D'ORB., — D'ORBIGNY, A.: Vol. 2. p. 408.
1882. *Valvulina pupa,* D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 101. Pl. XI. fig. 5.
1904. *Valvulina pupa* — FORNASINI, C.: Mem. Accad. Sci. Bologna, ser. VI. t. I. p. 14. pl. IV. fig. 1, 2.
1937. *Valvulina pupa* D'ORBIGNY. — CUSHMAN, J. A.: — Cushm. Lab. Foram. Res. Spec. Publ. No 8. p. 6. pl. I. fig. 13.
1949. (non) *Valvulina pupa* D'ORBIGNY. — CUVILLIER, J.–SZAKALL, V.: Soc. Nat. Pétr. d'Aquitaine. Prem. Part. p. 26. Pl. 11. fig. 2.
1952. *Valvulina pupa* D'ORBIGNY. — LE CALVEZ, Y.: Mém. Carte Géol. Fr. pt. 4. p. 10. pl. I. fig. 7.
1970. *Valvulina pupa* D'ORBIGNY. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 23. fig. 3.

Description: Studied material—5 specimens. Wall agglutinated, the grains being about 20–30 μm in size. Shape of test, in lateral view, elongate, ending in a triangle, being circular in apertural view. Chambers arranged triserially in early stage of development, later whorls consisting of more than three chambers and being spirally coiled. In early triserial stage, chambers externally angular, to become later rounded. Last chamber strongly inflated, much larger than the penultimate one. Sutures by and large straight, forming an angle of about 45° with the longitudinal axis. Aperture oval at base of final chamber, being provided with big valvular tooth curved inwards.

Size: Total length of test 750–1650 μm, greatest width 380–710 μm.

Remark: The first record of the fossil was given by D'ORBIGNY in 1826 (p. 104) from the vicinity of Paris and from Valognes (nom. nud.).

Geographic and stratigraphic range: Known from higher horizons of the Lutetian at some localities in the Paris Basin. At Dudar, it can be incidentally encoutered in the Lutetian nummulitic-molluscan clayey sands.

Valvulina triangularis d'Orbigny, 1826
Pl. III, f. 1–2

1826. *Valvulina triangularis*, Nob. — D'Orbigny, A.: Ann. Sci. Nat. Paris sér. 1. t. 7. p. 104. (270) Modéles, No. 24, 1. livr.
1850. *Valvulina triangularis*, d'Orb., — D'Orbigny, A.: Vol. 2. p. 408.
1865. *Valvulina triangularis* d'Orb. — Parker, W. K.–Jones, T. R.–Brady, H. B.: Ann. Mag. Nat. Hist. ser. 3. v. 16. p. 29. Pl. I. fig. 24.
1882. *Valvulina triangularis*, d'Orb. — Terquem, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 101. Pl. XI. fig. 4.
1949. *Valvulina triangularis* d'Orbigny. — Cuvillier, J.–Szakall, V.: Soc. Nat. Pétr. d'Aquitaine Prem. Part. p. 26. Pl. 11. fig. 1.
1952. *Valvulina triangularis* d'Orbigny. — Le calvez, Y.: Mém. Carte Géol. Fr. pt. 4. p. 12.
1970. *Valvulina triangularis* d'Orbigny. — Le Calvez, Y.: Cahiers de Pal. C. N. R. Sc. p. 25. Pl. 2. fig. 8, 10.

Description: Studied material—3 specimens. Wall agglutinated. Shape of test, in lateral view, ending in a triangle, slightly elongate, peri-apertural area rounded. Cross section, in apertural view, subcircular, slightly lobate. Chambers arranged triserially, in early stage. Final chamber spirally coiled around longitudinal axis. In the triserial stage of development, 4–5 chambers are visible, of which the youngest is much more strongly inflated, occupying half of the whorl. Sutures depressed in varying measure, less strongly in triserial stage and more so in spiral stage, being slightly curved in this case. The chambers of the last whorl surround the aperture. This one is a large, subcircular opening with a rather small valvular tooth curved inwards.

Size: Total length of test 700–950 μm. Diameter of circularly arranged last whorl 580–700 μm.

Remark: Resembles *Valvulina guillaumei* Le Calvez as far as the arrangement of the chambers is concerned, but differs from it by its smaller size and by its triserially arranged chambers ending in a more a cute angle.

Geographic and stratigraphic range: Known from higher Lutetian horizons in the Paris Basin and from the Oligocene in the Aquitanian Basin. At Dudar it is rather sparse in the Lutetien nummulitic-molluscan clayey sands.

Genus: *Clavulina* d'Orbigny, 1826

Clavulina parisiensis d'Orbigny, 1826
Pl. III, f. 3–4

1826. *Clavulina Parisiensis* Nob. — D'Orbigny, A.: Tabl. méthodique. — Ann. Sci. Nat. Paris. sér. 1. t. 7. p. 102. (268). Modèles, No. 66. 3. livr.
1865. *Clavulina Parisiensis*, D'Orb. — Parker, W. K.–Jones, T. R.–Brady, H. B.: Ann. Mag. Nat. Hist. ser. 3. v. 16. p. 29. Pl. I. fig. 26.
1882. *Clavulina parisiensis*, d'Orb. — Terquem, M.: Mém. Soc. Géol. Fr. sér. 3., t. 2. p. 121. Pl. XII. fig. 34.
1927. *Clavulina Parisiensis* d'Orb. — Liebus, A.: Jahrb. Geol. Bundesanst. Bd. 77. p. 351. Pl. 12. Fig. 3.
1952. *Clavulina parisiensis* d'Orbigny. — Le Calvez, Y.: Mém. Carte Géol. Déta. Fr. p. 15.
1956. *Clavulina parisiensis* d'Orbigny. — Haque, M.: Palaeont. Pakistanica. Vol. I. p. 48. Pl. 5. fig. 7—9.

1961. *Clavulina parisiensis* D'ORBIGNY. — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 144. Pl. I. fig. 27–28.
1964. *Clavulina parisienisis* D'ORBIGNY. — LOEBLICH, A.–TAPPAN, H.: Treatise Invert. Paleont. — Part. C. Protista 2. p. C 279. fig. 187/4.
1967a. *Clavulina* cf. *parisiensis* D'ORBIGNY, 1826. — V. ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1965-ről p. 401. Pl. V. fig. 8.
1970. *Clavulina parisiensis* D'ORBIGNY. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 21. Pl. I. fig. 1.
1970. *Clavulina parisiensis* D'ORBIGNY. — NYÍRŐ R.: Ann. Hist. nat. Mus. Nat. Hung. Min. et Pal. T. 62. p. 71. Pl. I. fig. 1.
1983. *Clavulina parisiensis* D'ORBIGNY. — SETIAWAN, J. R.: Utrecht Micropal. Bull. 29. pp. 104–105. pl. VII. fig. 1.

Description: Studied material—8 specimens. Wall agglutinated. The shape, in lateral view, is a long, elongate parallelepiped getting narrower downwards, where the attenuated part is adjoined by a broader-based triangle. Round in apertural view. Chambers in early stage triserial, later to become uniserial. Chambers in triserial stage angular, in uniserial stage rounded discoidal. Chambers slightly increasing in size from beginning of uniserial stage, last chambers roughly equal in size. The uniserially arranged part may consists of about 7 to 15 chambers. Sutures in triserial stage straight, in uniserial stage circular. Aperture terminal, round, with not too large tooth.

Size: Length of test together with triserial portion 950–2000 μm. Length of triserial portion 270–310 μm. Diameter of last chamber 200–410 μm.

Remark: In 1826, D'ORBIGNY made a plaster mould of the species which was figured in drawing and published by W. K. PARKER–T. R. JONES–H. B. BRADY 1865.

Geographic and stratigraphic range: Frequently encounterable in higher zones of the Lutetian and the Auversian and Marinesian beds in the Paris Basin. Present in the Middle Eocene of Belgium and Dalmatia and in the Eocene of Pakistan. In Italy it was found in the Priabonian beds. In Hungary it is frequent in the *Nummulites perforatus* beds of the Lutetian, being very sparse in the Upper Eocene of the Bakony, the Vértes and the Esztergom Basin. It is rather widespread in the Lutetian nummulitic-molluscan clayey sands of the Dudar Basin.

Subordo: MILIOLINA DELAGE et HÉROUARD, 1896
Superfamilia: **Miliolacea** EHRENBERG, 1839
Familia: **Nubeculariidae** JONES, 1875
Subfamilia: Nubeculariinae JONES, 1875
Genus: *Nubecularia* DEFRANCE, 1825

Nubecularia lucifuga DEFRANCE, 1825
Pl. III, f. 5–6

1825. *Nubecularia lucifuga* DEFRANCE, 1825 — DEFRANCE, M. J. L.: Min. géol. Dict. Sci. Nat. Fr. tom. 35. p. 210. pl. 44. fig. 3. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1882. *Nubecularia lucifuga*, DEFR. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 32. Pl. IX. fig. 6–8.
1952. *Nubecularia lucifuga* DEFRANCE. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 32.
1964. *Nubecularia lucifuga* DEFRANCE. — LOEBLICH, A.–TAPPAN, H.: Treatise on Invert. Paleont. — Part C. Protista 2 p. C 445. fig. 338/1–3.

1970. *Nubecularia lucifuga* DEFRANCE — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 27. Pl. 13. fig. 5.
1978. *Sinzowella deformis* (KARRER et SINZOW). — LE CALVEZ, Y.–BONDEAU, A.: Bull. Inf. Géol. Bass. Paris. Vol. 15, No. 2. p. 24. Pl. I. fig. 3.

Description: Studied material—15 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test extremely variable and irregular. Being attached, the test is of a shape controlled by the object it is attached to. The umbilical area by which it is attached is a plain or a little folded irregular face, the dorsal side being convex. Chambers planispirally arranged in early stage of development, becoming later irregularly spread and ramified in dependence on what the test is attached to. Chambers in early stage angular rhomboidal, later becoming irregularly spread and varying size. Sutures visible only on flat or slightly folded umbilical side in two chambers following proloculus, being slightly curved. Aperture invisible in our specimens. The pores distributed irregularly over the dorsal side are probably due to dissolution.

Size: Given a species of extreme variability, it largely varies in size, too. Diameter of test about 600–1750 μm.

Remark: The species *Sinzowella deformis* (KARRER et SINZOW) figured by LE CALVEZ in 1978 from Miocene deposits is, in my opinion, identical with *Nubecularia lucifuga* DEFRANCE, since no rimmed aperture, feature typical of the genus Sinzowella, can be seen on the chambers on the dorsal side. The attached test with its irregularly arranged chambers is very similar to that of *Sinzowella deformis* (KARRER et SINZOW), but the dorsal side of this species is more inflated and, in addition, every chamber on the dorsal side has an aperture provided with a raised rim turned inside out.

Geographic and stratigraphic range: Known from the Lutetian of the Parisian Basin, being rather common in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Subfamilia: Spiroloculininae WIESNER, 1920
Genus: *Spiroloculina* D'ORBIGNY, 1826

Spiroloculina bicarinata ORBIGNY, 1882
Pl. III, f. 7–8

1882. *Spiroloculina bicarinata*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 155. Pl. XVI. fig. 5.
1882. *Spiroloculina tricarinata*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 158. Pl. XVI. fig. 21. (non) fig. 19, 20.
1904. *Spiroloculina bicarinata* — FORNASINI, C.: Mem. Accad. Sci. Bologna, ser. VI, t. I. p. 4. pl. I. fig. 5.
1944. *Spiroloculina bicarinata* TERQUEM. — CUSHMAN, J. A.–TODD, R.: Cushm. Lab. Foram. Res. Spec. Publ. No. 11. p. 8. pl. II. fig. 12.
1944. *Spiroloculina tricarinata* TERQUEM. — CUSHMAN, J. A.–TODD, R.: Cushm. Lab. Foram. Res. Spec. Publ. No. 11. p. 10. pl. II. fig. 21 (non) fig. 19, 20, 22.
1947. *Spiroloculina bicarinata* D'ORBIGNY. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 25. Pl. II. fig. 34—35.
1961. *Spiroloculina bicarinata* D'ORBIGNY. — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 154. Pl. III. fig. 17–19.
1970. *Spiroloculina bicarinata* D'ORBIGNY — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 59. Pl. 11. fig. 3, 4.

Description: Studied material—4 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, slightly elongated elliptical, in apertural view rectangular, the long side of the rectangle being broken at the height of the smaller chambers. Chambers following proloculus planispirally coiled over halflength of chamber. Chambers more flat, long, ribbonlike and slightly curved towards longitudinal axis. Chamber cross-section rectangular with visible ribs. Last chamber much larger, about one and a half times the size of penultimate chamber. Sutures slightly curved. Rounded rectangular aperture at end of last chamber. In our specimens no tooth visible, possibly broken off. No pores visible on test wall. Two distinct longitudinal ribs traceable over total length of last chamber, strikingly emerging from chamber wall.

Size: Length of test 950–1750 μm. Greatest width in lateral view 340–900 μm. Greatest width of youngest chamber in apertural view 150–190 μm.

Remark: D'ORBIGNY (p. 132) mentions it for the first time, in 1826, from the Paris Basin. In 1839 (p. 167), in his description of *Spiroloculina ornata*, he compares it to *Spiroloculina ornata* D'ORBIGNY. In 1850 (p. 409), he quotes it again (nom. nud.). TERQUEM is the first to describe the species in 1882. The shape of the test and the size of the last chamber are similar to the case of *Spiroloculina angulifera* TERQUEM, but this one has fewer chambers and lacks double ribs.

Geographic and stratigraphic range: Known from higher horizons of the Lutetian and from the Auversian and Marinesian beds of several localities in the Paris Basin. In Belgium it occurs in the Lutetian. At Dudar it is rather common in the Lutetian nummulitic-molluscan clayey sands.

Subfamilia: Nodobaculariinae CUSHMAN, 1927
Genus: *Vertebralina* D'ORBIGNY, 1826

Vertebralina laevigata TERQUEM, 1882
Pl. IV, f. 1–2

1882. *Vertebralina laevigata*, TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 44. pl. II. fig. 15–18.
1952. *Vertebralina laevigata* TERQUEM. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 31. pl. III. fig. 33–34.
1961. *Vertebralina laevigata* TERQUEM. — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147, p. 146. Pl. II. fig. 1–3.
1970. *Vertebralina laevigata* TERQUEM. — CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 28. Pl. 13. fig. 6.

Description: Studied material—3 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test flattened, oval and almost rounded parallelepiped in lateral view, and elongated elliptical in apertural view. Chambers in early stage trochospiral, younger part not coiled. Early chambers angular rhomboidal, later ones cylindrical. Young chamber much larger than the one preceding it. Sutures in trochospiral portion invisible, later straight, slightly depressed. Aperture narrow, loop-like slit at end of final chamber. Test wall covered by distant, irregularly located pores of varying size possibly resulting from postdepositional dissolution.

Size: Length of test 410–520 μm. Width of test, in lateral view, 310–390 μm. Length of aperture 110–130 μm. Thickness of last chamber in lateral view 180–230 μm.

Remark: LOEBLICH and TAPPAN (1964) quoted this genus as a modern one. It resembles *Vertebralina striata* D'ORB. in shape of test, the only difference being that striata has chambers ribbed longitudinally. *V. striata* D'ORB. was quoted as a modern form from the island of Delos, but LE CALVEZ found it in the Lutetian of the Paris Basin.

Geographic and stratigraphic range: Known in higher Lutetian horizons in the Paris Basin and from Middle Eocene deposits in Belgium. At Dudar it is rather sparse in the Lutetian nummulitic-molluscan clayey sands.

Familia: **Miliolidae** EHRENBERG, 1839
Subfamilia: Quinqueloculininae CUSHMAN, 1917
Genus: *Quinqueloculina* D'ORBIGNY, 1826

Quinqueloculina birostris (LAMARCK, 1804)
Pl. IV, f. 3–4

1804. *Miliolites birostris* LAMARCK. — LAMARCK, J. B.: Ann. Mus. Hist. Nat., Paris vol. 5 p. 353. (teste ELLIS–MESSINA: Catalogue of Foram.)
1850. *Quinqueloculina birostris,* D'ORB. — D'ORBIGNY, A.: Prodrome, vol. 2. p. 409.
1882. *Quinqueloculina birostris,* LMK. sp. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 181. Pl. XIX. fig. 23.
1905. *Quinqueloculina birostris* — FORNASINI, C.: Mem. Accad. Sci. Bologna, ser. VI. t. II. p. 62. pl. II. fig. 5.
1947. *Quinqueloculina birostris* (LAMARCK). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 8. Pl. I. fig. 4–6.
1952. *Miliola birostris* LAMARCK — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 46.
1961. *Miliola birostris* (LAMARCK). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 162. Pl. V. fig. 2.
1970. *Miliola birostris* LAMARCK — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 43. fig. 9–11.

Description: Studied materia—18 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, long elongate, in apertural view, oval, almost circular. Chambers arranged in quinqueloculined pattern, being coiled in five planes. 3 chambers visible on one side, 4 ones on other. Chambers long, elongate along longitudinal axis, their cross-section being slightly angular, almost rounded. The last chamber is much larger in size as compared to the penultimate one, being longer than this one both aperturally and at the opposite end. Sutures slightly curved in accordance with elongate test. Aperture round terminal opening with relatively small tooth. Chamber walls densely and coarsely pored, pores regularly arranged along longitudinal axis. Pore spacing 4—5 μm. Pores vary in size, being present even on tooth in aperture. Chamber surface ribbed in longitudinal direction quite densely, but not too heavily.

Size: Length of test 1400–1560 μm. Width 410–470 μm. Length of penultimate chamber 1010–1150 μm.

Remark: LAMARCK first quoted it in 1804 from Chaumont, D'ORBIGNY did so in 1826 (p. 135) also from the Paris Basin. The test is similar in shape to *Miliola saxorum* (LAMARCK), but is differs from saxorum by its aperture, since this species has a cribrate aperture and, in addition, there are no ribs of the surface of the chambers.

Geographic and stratigraphic range: Present in higher zones of the Lutetian in the Paris Basin and the Middle Eocene of Belgium. At Dudar, it is not too frequent in the Lutetian nummulitic-molluscan clayey sands.

Quinqueloculina lippa LE CALVEZ, 1947
Pl. V, f. 1–2

1947. *Quinqueloculina lippa* n. sp. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 15. Pl. I. fig. 7–9.
1970. *Quinqueloculina lippa* LE CALVEZ. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 37. Pl. 4. fig. 5.

Description: Studied material—3 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, elongate elliptical, in apertural view, angular, triangular. Chambers quinqueloculined, coiled in five planes. On one side, 3 chambers visible, on the other, 4. Chambers elongate longitudinally, angular in cross-section, last chamber much larger compared to preceding ones. Sutures slightly curved in direction of long axis. Aperture terminal round opening with slightly extruding rim and not too large, bifid Y-shaped tooth not attaining in length the centre of circular aperture. Chamber surface covered by coarse, large, irregularly arranged pores.

Size: Length of test 760–1160 μm, largest width in lateral view 470–570 μm. Length of penultimate chamber 630–920 μm, thickness of last chamber 135–210 μm.

Remark: The test resembles *Quinqueloculina parisiensis* D'ORBIGNY in shape, but the chambers of our species are more angular and their surface is not ribbed.

Geographic and stratigraphic range: Known in higher horizons of the Lutetian and in Auversian beds of several localities in the Paris Basin. At Dudar, it is rather sparse in the Lutetian nummulitic-molluscan clayey sands.

Quinqueloculina parisiensis D'ORBIGNY, 1850
Pl. V, f. 3–4

1850. *Quinqueloculina Parisiensis,* D'ORB., — D'ORBIGNY, A.: vol. 2. p. 409.
1882. *Quinqueloculina parisiensis,* D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 181. Pl. XIX. fig. 21.
1905. *Quinqueloculina parisiensis* — FORNASINI, C.: Mem. Accad. Sci. Bologna, ser. VI. t. II. p. 63. Pl. II. fig. 9.
1947. *Quinqueloculina parisiensis* D'ORBIGNY. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 12.
1958. *Quinqueloculina parisiensis* D'ORBIGNY. — BATJES, D. A. J.: Inst. R. Sc. Nat. Belg. Mém. No. 143. p. 104. Pl. II. fig. 4.
1970. *Quinqueloculina parisiensis* D'ORBIGNY — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 38. Pl. 3. fig. 1.

Description: Studied material—8 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of shell, in lateral view, elongate, elliptical, in apertural view, triangular, slightly rounded. Chambers arranged in quinqueloculined pattern, coiled in five planes, on one side 3 chambers on the other 4 chambers being visible. Chambers elongate in direction of long axis and slightly curved, slightly rounded triangular in cross section. Final chamber much larger compared to preceding one, being one and a half to twice its size. Chambers slightly curved in arcuate form. Aperture terminal, at end of final chamber. Round opening with slightly swollen and a little extruding rim and Y-shaped short tooth not attaining centre of aperture in length. Tiny pores of irregular size and arrangement visible on chamber wall. Chamber surface ornamented with strong, thin and sharp ribs in direction of long axis. Spacing of ribs about 12–16 μm.

Size: Length of test 800–910 μm, largest width in lateral view 380–440 μm. Length of penultimate chamber 550–620 μm, its width 120–140 μm.

Remark: This species is quoted by D'ORBIGNY (p. 135), as early as 1826, from the Paris Basin, but he gives neither a figure nor a description of it (nom. nud.). The test resembles *Quinqueloculina costata* D'ORBIGNY in shape but costata is more elongate. In addition, it shows some resemblance to *Q. lippa* LE CALVEZ, bit the surface of lippa is devoid of ribs.

Geographic and stratigraphic range: Known from the Cuisian and higher parts of the Lutetian and from Auversian beds in several localities within the Paris Basin. In Belgium it is quoted from the Oligocene. At Dudar, it is encountered, in not too large numbers, in the Lutetian nummulitic-molluscan clayey sands.

Quinqueloculina seminulum (LINNÉ, 1758)
Pl. V, f. 5–6; Pl. VI, f. 1

1758. *Serpula seminulum* LINNÉ. — Syst. Nat. ed 10. vol. 4, p. 786.
1846. *Quinqueloculina akneriana*, D'ORBIGNY. — D'ORBIGNY, A.: Foram. Foss. Bass. Tert. Vienne. p. 290. Pl. 18. fig. 16–21.
1949. *Quinquelocula seminulum* LINNAEUS. — CUVILLIER, J.–SZAKALL, V.: Soc. Nat. Pétrol. d'Aquitaine. Prem. Part. p. 37. pl. 17. fig. 4.
1955. *Quinqueloculina seminulum* (LINNÉ) — BHATIA, S. B.: Journal of Paleont. Vol. 29. No. 4. p. 674. Pl. 67. fig. 8 a-c.
1955. *Quinqueloculina seminula* (LINNÉ). — KAASSCHIETER, J. P. H.: Verh. Kon. Ned. Akad. Wet. Nat., ser. 1. Vol. 21. No. 2. p. 56. Pl. 2. fig. 3.
1956. *Quinqueloculina seminula* (LINNÉ). — GULLENTOPS, F.: Mém. Inst. Géol. Louvain. Vol. 20. pt. 1. p. 9. Pl. 1. fig. 1.
1958. *Quinqueloculina seminula* (LINNÉ). — BATJES, D. A. J.: Inst. Roy. Sc. Nat. Belg. Mém. No. 143. p. 102. Pl. 1. fig. 15.
1961. *Quinqueloculina seminula* (LINNÉ). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 147. Pl. II. fig. 5, 6.
1963. *Quinqueloculina seminula* (LINNÉ). — KÜMMERLE, E.: Abh. Hessich. Land. f. Bodenf. 45. p. 27. pl. 1. fig. 6.
1964. *Quinqueloculina seminulum* (LINNÉ). — LOEBLICH, A.–TAPPAN, H.: Treatise Invert. Paleont. — Part C. Protista 2. p. C 458. fig. 349/1.
1970. *Quinqueloculina seminula* (LINNÉ, 1758). — KIESEL, Y.: Paläont. Abh. A. Bd. IV. Heft. 2. p. 213. Pl. VI. fig. 7.
1970. *Quinqueloculina seminulum* (LINNÉ). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 40. Pl. 46. fig. 6, 7.
1973. *Quinqueloculina seminula* (LINNÉ), 1758. — NAGYNÉ GELLAI Á.: Ann. Inst. Geol. Publ. Hung. Vol. LV. fasc. 3. p. 447. Pl. II. fig. 9–10.
1982. *Quinqueloculina seminulum* (LINNÉ). — PETTERS, S. W.: Palaeontogr. Abt. A. Bd. 179. p. 50. Pl. 4. fig. 17.

Description: Studied material—10 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, oval, in apertural view slightly flattened, oval. Chambers arranged in quinqueloculined pattern, coiled in five planes with 3 chambers on one side and 4 ones on other. Chambers longitudinally elongate, inflated and curved in form of crescent. Chamber cross-section rounded triangular. Final chamber somewhat larger than the one preceding it. Sutures slightly curved. Aperture round opening with slightly thickened rim at end of final chamber and with larger triangular tooth. No pores visible on chamber wall.

Size: Length of test 1370–1760 μm. Width of test in lateral view 760–1070 μm. Length of penultimate chamber 1090–1370 μm, its thickness 240–450 μm.

Remark: I did not see LINNÉ's (1758) original description in which the species is assigned to the genus Serpula. I have borrowed the description from subsequent authors. In 1826, D'ORBIGNY (p. 137) assigned the species already to the genus Quinqueloculina. It resembles *Quinqueloculina simplex* TERQUEM in its aperture and in the lack of pores, but it differs from it by its less elongate test and its more inflated chambers.

Geographic and stratigraphic range: Species of wide stratigraphic range, being known from the Eocene up to present-day deposits of various localities. It is quoted from the Eocene of England, Belgium, the Netherlands, France and Germany. It can be found in the Oligocene of France, Germany and England. In the Vienna Basin it is known from Miocene deposits. It can be found in Lower Miocene to Pliocene deposits at the Niger delta. It occurs as a now-living form in the Adriatic Sea in Italy. In Hungary it is known from the Oligocene deposits of the Dorog Basin. At Dudar it is frequent in the Lutetian nummulitic-molluscan clayey sands.

Genus: *Pyrgo* DEFRANCE, 1824

Pyrgo bulloides (D'ORBIGNY, 1826)
Pl. VI, f. 2—3

1826. *[Biloculina] bulloides*, NOB. — D'ORBIGNY, A.: Ann. Sci. Nat. Paris sér. 1. t. 7. p. 131. (297) pl. VII. (16) fig. 1–4.
1882. *Biloculina bulloides*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 153. Pl. XV. fig. 37, 38.
1947. *Pyrgo bulloides* (D'ORBIGNY). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 21.
1955. *Pyrgo bulloides* (D'ORBIGNY). — KAASSCHIETER, J. P. H.: Verh. Kon. Ned. Akad. Wet., Nat., ser. 1. Vol. 21. No. 2. p. 62. Pl. 4. fig. 4.
1958. *Pyrgo bulloides* (D'ORBIGNY). — BATJES, D. A. J.: Inst. Roy. Sc. Nat. Belg. Mém. No. 143. p. 107.
1961. *Pyrgo bulloides* (D'ORBIGNY). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 167. Pl. V. fig. 18.
1963. *Pyrgo bulloides* D'ORBIGNY. — KÜMMERLE, E.: Abh. Hessisch. Land. f. Bodenf. Heft. 45. p. 29. pl. 2. fig. 4.
1970. *Pyrgo bulloides* (D'ORBIGNY). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 54. Pl. 6. fig. 5.

Description: Studied material—5 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, oval, in apertural view, almost round. Arrangement of chambers biloculinoid. Two chambers visible in last whorl, surrounding the earlier ones. Last two chambers strongly inflated, concealing hemispherically the older ones. Final chamber largely outscoring preceding one. Externally, just the subcircular septum of the last two chambers is visible. Aperture round at end of final chamber, with slightly thickened rim and Y-like tooth extending up to centre of aperture. Pores not visible on chamber wall.

Size: Length of test 410–870 μm. Greatest width in lateral view 380–750 μm. Length of penultimate chamber 460–480 μm. Its width 150–170 μm.

Remark: Resembles *Pyrgo simplex* (D'ORBIGNY), but simplex has a more elongate, oval test and its chambers are less inflated.

Geographic and stratigraphic range: The species has a wide stratigraphic range, being known from different stratigraphic horizons from the Eocene up to the Present. It is known from higher zones of the Lutetian and in Auversian and Ludian beds of a good many of localities in the Paris Basin. In Belgium it occurs in Eocene and Oligocene deposits. It is quoted as a now-living from from Italy. At Dudar it is rather common in the Lutetian nummulitic-molluscan clayey sands.

Pyrgo simplex (D'ORBIGNY, 1846)
Pl. VI, f. 4–5

1846. *Biloculina simplex*, D'ORBIGNY. — D'ORBIGNY, A.: Foram. foss. Bass. Tert. Vienne. p. 264. pl. 15. fig. 25–27.
1947. *Pyrgo simplex* (D'ORBIGNY). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 21.
1970. *Pyrgo simplex* (D'ORBIGNY). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 55. Pl. 8. fig. 7.

Description: Studied material—2 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape elongate oval in lateral view and oval in apertural view. Chambers arranged in biloculine pattern, the last two chambers surrounding the preceding ones. Adapertural part of final chamber more inflated than opposite one, hemispherically surrounding penultimate chamber. Externally, just the oval septum of the last two chambers is visible. The aperture at the end of the last chamber surrounds semicircularly the thickened and short tooth. Chamber walls show pores of irregular size and arrangement, probably representing traces of dissolution.

Size: Length of test 960–1250 μm. Greatest width in lateral view 750–860 μm. Length of penultimate chamber 850–960 μm.

Remark: Differs from *Pyrgo bulloides* (D'ORBIGNY) by its more elongate test and its less inflated chambers as well as its semicircular aperture.

Geographic and stratigraphic range: In the Paris Basin it occurs in higher horizons of the Lutetian. In the Vienna Basin it can be found in Miocene beds. At Dudar it is sparsely present in the Lutetian nummulitic-molluscan clayey sands.

Genus: *Triloculina* d'Orbigny, 1826

Triloculina angularis d'Orbigny, 1850
Pl. VII, f. 1–2

1850. *Triloculina angularis,* d'Orb., — D'Orbigny, A.: vol. 2. p. 409.
1882. *Triloculina angularis,* d'Orb. — Terquem, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 163. Pl. XVI. fig. 34, 35.
1905. *Triloculina angularis* — Fornasini, C.: Mem. Accad. Sci. Bologna. ser. VI. t. II. p. 59. Pl. I. fig. 2.
1947. *Triloculina angularis* d'Orbigny. — Le Calvez, Y.: Mém. Carte Géol. Déta. Fr. p. 17. Pl. IV. fig. 72.
1961. *Triloculina angularis* d'Orbigny. — Kaasschieter, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 166. Pl. V. fig. 15.
1970. *Triloculina angularis* d'Orbigny. — Le Calvez, Y.: Cahiers de Pal. C. N. R. Sc. p. 48. Pl. 13. fig. 9.

Description: Studied material—5 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape, in lateral view, elliptical, in apertural view, triangular. In last stage of development chambers arranged in three planes 120° apart around long axis. Only final three chambers visible externally. Chambers elongate in direction of long axis, being broken in sharp angle at rim. Last chamber larger than preceding one. Sutures slightly curved. Aperture in shape of a droplet at end of final chamber, being provided with slightly widening tooth. Pores not visible on chamber wall.

Size: Length of test 540–1230 μm. Largest width 360–960 μm. Length of penultimate chamber 400–1000 μm.

Remark: In 1826 (p. 133), d'Orbigny quoted it as a fossil form from Pauliac (Gironde), but he did not describe it (nom. nud.). The test resembles *Triloculina austriaca* d'Orbigny in shape, but the chambers of austriaca have a more rounded rim, being not broken in such a sharp angle as it is the case with our specimens.

Geographic and stratigraphic range: Present in several localities in higher parts of the Lutetian and in Auversian beds in the Parisian Basin, being known from the Lutetian and the Bartonian of Belgium. At Dudar it occurs, not too frequently, in the Lutetian nummulitic-molluscan clayey sands.

Triloculina austriaca d'Orbigny, 1846
Pl. VII, f. 3–4

1846. *Triloculina austriaca,* d'Orbigny. — d'Orbigny, A.: Foram. Foss. Bass. Tert. Vienne. p. 275. pl. XVI. fig. 25–27.
1963. *Triloculina austriaca* d'Orbigny. — Kümmerle, E.: Abh. Hessisch. Land. f. Bodenf. Heft. 45. p. 29. Pl. 2. fig. 2.

Description: Studied material—5 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, oval, almost circular, in apertural view, rounded triangular. Chamber in last stage of development coiled in three planes around long axis. Only final three chambers visible externally. Chambers elongate in direction of long axis, being rounded in cross-section. Final chamber larger than the one preceding it. Sutures slightly curved. Aperture round, with slightly thickening rim and triangular tooth at end of final chamber. Pores not visible on chamber wall.

Size: Length of test 380–620 μm. Largest width in lateral view 340–520 μm. Length of penultimate chamber 300–550 μm.

Remark: The shape of the test resembles that of *Triloculina gibba* D'ORBIGNY but the chambers of gibba are less inflated. Differs from *T. angularis* D'ORBIGNY by the presence of chambers with rounded rim and by the round aperture.

Geographic and stratigraphic range: Present in the Miocene of the Paris Basin and the Upper Oligocene of Germany. At Dudar it is sparsely present in the Lutetian nummulitic-molluscan clayey sands.

Triloculina cylindrica D'ORBIGNY, 1852
Pl. VII, f. 5; Pl. VIII, f. 1

1852. *Triloculina cylindrica*, D'ORB., — D'ORBIGNY, A.: Prodrome. Vol. 3. p. 161.
1905. *Triloculina cylindrica* — FORNASINI, C.: Mem. Accad. Sci. Bologna, ser. VI. t. II, p. 61. Pl. I. fig. 13.

Description: Studied material—5 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, elongate elliptical, in apertural view, oval. In the last whorl, three chambers around the long axis are externally visible. Chambers long, elongate, rounded in cross-section. Final chamber much larger than the one preceding it. Sutures slightly curved and difficult to discern. Aperture droplet-like, at end of final chamber with Y-like tooth. The irregular pores visible on the chamber wall are probably due to dissolution. Chamber surface ornamented by very fine longitudinal ribs.

Size: Length of test 2100–2340 μm. Largest width in lateral view 890–1040 μm.

Remark: The shape of the test resemble that of *Quinqueloculina ludwigi* REUSS, but the chambers of reussi are coiled in five planes.

Geographic and stratigraphic range: Known from Tertiary deposits in the Paris Basin. At Dudar, scarcely present in the Lutetian nummulitic-molluscan clayey sands.

Triloculina lecalvezae KAASSCHIETER, 1961
Pl. VIII, f. 2–3

1878. *Triloculina laevigata*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 1. p. 57. pl. 5. fig. 20—21.
1882. *Triloculina laevigata*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 168. Pl. XVII. fig. 22–23.
1905. *Triloculina laevigata* — FORNASINI, C.: Mem. Accad. Sci. Bologna, ser. VI. t. II. p. 61. Pl. I. fig. 10.
1927. *Triloculina laevigata* D'ORBIGNY. — CUSHMAN, J. A.: Contr. Cush. Lab. For. Res. Vol. 3. pt. 1. p. 35. Pl. 7. fig. 11.
1947. *Triloculina laevigata* D'ORBIGNY. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 17.

1961. *Triloculina lecalvezae* nov. nom. — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 166. pl. 5. fig. 16.
1970. *Triloculina lecalvezae* KAASSCHIETER. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 51. Pl. 7. fig. 1.

Description: Studied material—8 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, long, elongate, oval, in apertural view, slightly flattened, circular. In last whorl, three chambers coiled along long axis are visible. Shape of chambers long, inflated, with slightly curved, rounded rim. Last chamber larger than the one preceding it. Sutures between last two chambers slightly curved, in earlier stage almost straight, parallel to long axis. Aperture at end of last chamber elongate, droplet-like with long tooth widening at tip. No pores on chamber wall.

Size: Length of test 1400–1520 μm. Width in lateral view 500–610 μm. Length of penultimate chamber 980–1100 μm, its width 120–130 μm.

Remark: D'ORBIGNY mentioned this species for the first time in 1826 (p. 134) but did not give a description of it (nom. nud.). TERQUEM gave the first description in 1878 under the name of *Triloculina laevigata* D'ORBIGNY. This is homonymous with *Triloculina laevigata* BORNEMANN 1855. For this reason, KAASSCHIETER, in 1961, gave it a new name. The shape of the test resembles that of *Triloculina hemisphaerica* TERQUEM, but hemisphaerica has a less elongate test, its chambers being more inflated, its aperture round and its tooth bifid.

Geographic and stratigraphic range: Known from several horizons of a lot of localities in the Paris Basin. Present in the Cuisian, in higher horizons of the Lutetian, in Auversian, Marinesian and Ludian beds and from Oligocene localities. At Dudar, it is rather common in the Lutetian nummulitic-molluscan clayey sands.

Triloculina porvaensis HANTKEN, 1875
Pl. VIII, f. 4–5

1875a. *Triloculina porvaensis* n. sp. — HANTKEN, M.: Jb. ung. geol. Anst., Bd. 4. p. 21. Pl. 13. fig. 3.
1970. *Triloculina porvaensis* HANTKEN. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 52. Pl. 13. fig. 11.
1970. *Triloculina porvaensis* HANTKEN. — NYÍRŐ R.: Ann. Hist. nat. Mus. Nat. Hung. Min. et Pal. T. 62. p. 71. Pl. I. fig. 9.

Description: Studied material—5 specimens. Wall calcareous, porcelaneous with microcrystalline pore. Shape of test, in lateral view, oval, in apertural view, a triangle with rounded rim. In last whorl, three chambers coiled around long axis visible. Last chambers elongate, crescent-shaped with rounded rim. Last chamber larger than the one preceding it. Sutures slightly curved. Aperture round, with slightly thickerd rim and short triangular tooth at end of last chamber. Pores locally visible between longitudinal ribs. Chamber wall ornamented with closely spaced ribs.

Size: Length of test 620–700 μm. Largest width of test, in lateral view, 300–390 μm. Length of penultimate chamber 490–530 μm. Its width 95–110 μm.

Remark: Resembles *Triloculina inflata* D'ORBIGNY but inflata has somewhat more inflated chambers that are not ribbed.

Geographic and stratigraphic range: Occurs in Oligocene beds in the Paris Basin. In Hungary it is known from the "*Clavulina szabói*" Beds at Porva and from Lutetian beds at Weim-puszta. At Dudar, it is not too frequent in the Lutetian nummulitic-molluscan clayey sands.

Subfamilia: Miliolinae EHRENBERG, 1839
Genus: *Miliola* LAMARCK, 1804

Miliola brevidentata (LE CALVEZ, 1947)
Pl. IX, f. 1–4

1882. *Quinqueloculina longidentata*, TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 176. Pl. XIX. fig. 2. non Pl. XVIII. fig. 29, 30. Pl. XIX. fig. 1.
1947. *Quinqueloculina brevidentata* nom. nov. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 16. Pl. I. fig. 25–27.
1952. *Miliola brevidentata* (TERQUEM) [sic] — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 46.
1970. *Miliola brevidentata* (LE CALVEZ). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 44. fig. 12, 13.

Description: Studied material— 6 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, oval, almost round, in apertural view, more elongate elliptical, with rounded rim. Arrangement of chambers quinqueloculine. Chambers elongate and curved like a crescent in direction of long axis, almost round in cross-section. Final and penultimate chambers subequal in size, rim of chambers rounded. Sutures slightly curved and crescent-shaped where chambers meet. Sutures slightly curved and crescent-shaped where chambers meet. Aperture terminal, cribrate. Irregularly arranged, coarse pores of varying size visible on chamber wall.

Size: Length of test 650–850 μm, its width, in lateral view, 530–700 μm. Length of penultimate chamber 570–750 μm, its width 120–135 μm. Width of final chamber 140–150 μm.

Remark: The shape of the test, in lateral view, resembles that of *Miliola prisca* (D'ORBIGNY) but the apertural view of prisca is less compressed and its pores are arranged parallel to the long axis.

Geographic and stratigraphic range: Present in higher horizons of the Lutetian in the Parisian Basin and not too frequent in the Lutetian nummulitic-molluscan clayey sands.

Miliola disticha (TERQUEM, 1882)
Pl. IX, f. 5–6; Pl. X, f. 1

1882. *Quinqueloculina disticha*, TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 183. Pl. XX. fig. 7.
1882. *Quinqueloculina parisiensis*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 181. Pl. XIX. fig. 21.
1947. *Quinqueloculina disticha* TERQUEM. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 10.
1958. *Quinqueloculina parisiensis* D'ORBIGNY. — BATJES, D. A. J.: Inst. R. Sc. Nat. Belg. Mém. No. 143. p. 104.

1961. *Miliola disticha* (TERQUEM). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 162. Pl. V. fig. 3.
1970. *Miliola disticha* (TERQUEM). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 45. Pl. 7. fig. 2.

Description: Studied material—7 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, elongate oval, in apertural view, polygonal. Apices of polygon constituted by edges final whorl chambers. Sutures arranged in quinqueloculine pattern. Chambers elongate in direction of long axis, with protuberances in cross-section in correspondence with ribs. Final chamber much larger than the one preceding it. Sutures slightly curved, parallel to long axis, in accordance with chambers of quinqueloculine coil. Aperture terminal, cribrate. Pores large, of varying size and irregular arrangement. Chambers of last whorl ornamented with ribs parallel to long axis.

Size: Length of test 750–820 μm, its largest width, in lateral view, 420–520 μm. Length of penultimate chamber 620–640 μm, its width 80–90 μm.

Remark: The species described as *Quinqueloculina parisiensis* D'ORB. by M. TERQUEM is not considered to be identical with D'ORBIGNY's species. It resembles *Miliola pseudocarinata* LE CALVEZ by the shape of the test, but in carinata no ribs are observed on the chambers and the pores are arranged regularly in the direction of the long axis.

Geographic and stratigraphic range: Present in higher Lutetian horizons and in the Oligocene of the Paris Basin and in the Oligocene of Belgium. Rather common in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Miliola prisca (D'ORBIGNY, 1850)
Pl. X, f. 2–4

1850. *Quinqueloculina prisca*, D'ORB., — vol. 2. p. 410.
1882. *Quinqueloculina prisca*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 182. Pl. XX. fig. 1–4.
1905. *Quinqueloculina prisca* — FORNASINI, C.: Mem. Accad. Sci. Bologna, ser. VI. t. II. p. 68. pl. IV. fig. 5.
1947. *Miliola prisca* (D'ORBIGNY). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 31.
1956. *Miliola pseudoprisca* n. sp. — GULLENTOPS, F.: Mém. Inst. Géol. Louvain. Vol. 20. pt. 1. p. 13. pl. I. fig. 9.
1961. *Miliola prisca* (D'ORBIGNY). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 162. Pl. V. fig. 4, 5.
1970. *Miliola prisca* (D'ORBIGNY). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 45. Pl. 6. Fig. 1, 2. Pl. 46. fig. 4, 5.

Description: Studied material—10 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, squat elliptical, nearly circular, in apertural view, more elongate elliptical, but with strong rib visible where chambers meet. Chambers arranged in quinqueloculine pattern. Given the rather squat test, the chambers are less elongate and the last two chambers are subtriangular in cross-section. Last chamber scarcely larger than the one preceding it. Sutures slightly curved parallel to long axis with markedly saliant rib where chambers meet. Aperture terminal, cribrate. Along with the longitudinal axis there are irregularly arranged pores by and large equal in size with a spacing of about 5–6 μm on the chamber wall.

Size: Length of test 470–550 μm, its largest width in lateral view 410–450 μm. Length of penultimate chamber 460–480 μm, its width 150–170 μm.

Remark: This species was mentioned by D'ORBIGNY, as early as 1826, from the Paris Basin (p. 136), but was neither described nor figured by him (nom. nud.). His description of the species was given in 1850. TERQUEM (1882) gave both description and figures of it. It resembles *Miliola saxorum* (LAMARCK), but its test is more elongate and no riblike protuberance is visible where the chambers meet. It resembles, in addition, *Miliola strigillata* (D'ORBIGNY) but strigillata is more rounded and more finely porate.

Geographic and stratigraphic range: Present from the Cuisian up to the top of the Ludian at several localities in the Paris Basin and from the Middle Eocene up to the Oligocene in Belgium. At Dudar, rather common in the Lutetian nummulitic-molluscan clayey sands.

Miliola prisca (D'ORBIGNY) var. *terquemi* KAASSCHIETER, 1961
Pl. X, f. 5; Pl. XI, f. 1

1961. *Miliola prisca* (D'ORBIGNY) var. *terquemi* nov. var. — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 164. Pl. V. fig. 7.

Description: Studied material—3 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, elliptical, in apertural view, rhombic. Chambers arranged in quinqueloculine pattern. Final chambers triangular in cross-section with strong, deeply ribbed outer surface. Final chamber much larger than the one preceding it. Sutures slightly curved parallel to long axis. Aperture terminal, cribrate. Pores arranged regularly in direction of long axis, comparatively small, nearly equal in size and and rather widely spaced, about 10–12 μm apart. The chambers are externally ornamented by two or three strongly emergent ribs running parallel to the long axis and at the elongate apertural end of the last chamber there are several tiny ribst which do not extend over the whole length of the chamber. The pores between the ribs extending over the whole length of the chambers are elongate, slitlike.

Size: Length of test 650–970 μm, its largest width in lateral view 350–660 μm. Length of penultimate chamber 545–720 μm, its width 140–200 μ. Width of last chamber 150–200 μm.

Remark: Resembles *Miliola prisca* (D'ORBIGNY), but the last two chambers of prisca are subequal in size, their pores being larger and more closely spaced and no ribs are observed on the chamber wall around the aperture.

Geographic and stratigraphic range: Present in the Middle Eocene of Belgium and the Paris Basin. At Dudar, rather scarce in the Lutetian nummulitic-molluscan clayey sands.

Miliola pseudocarinata LE CALVEZ, 1970
Pl. XI, f. 2–3

1882. *Quinqueloculina carinata*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 173. Pl. 18. fig. 16, 17.

1947. *Miliola carinata* (TERQUEM). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 32. Pl. III. fig. 58–60. (Under the name of *Miliola robusta* n. sp.)

1970. *Miliola pseudocarinata* nov. nom. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 46. fig. 14–16.

Description: Studied material—5 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, oval, in apertural view flatter, not completely rounded ellipse. Chambers arranged in quinqueloculine patter, with 4 chambers visible on one side and 3 ones on other. Chambers elongate longitudinally and slightly curved, not completely rounded in cross-section, but slightly angular, rimmed. Last chamber somewhat larger than the one preceding it. Sutures slightly cirved subparallel to long axis. Aperture terminal, cribrate. Chamber surface wearing fine and closely spaced pores aligned longitudinally.

Size: Length of test 910–1050 μm, its largest width in lateral view 620–710 μm. Length of penultimate chamber 690–720 μm. Thickness of last chamber 120–135 μm.

Remark: I have seen no figure of *Quinqueloculina carinata* D'ORBIGNY, but my species is identical with TERQUEM's (1882) and LE CALVEZ' (1947, 1970), so I accept LE CALVEZ' point of view arguing that the figure given by TERQUEM is not identical with the figure D'ORBIGNY gave of *Quinqueloculina carinata* D'ORB. and that that was the reason why LE CALVEZ described it under a new name. LE CALVEZ appears to have mixed up in her work (1947) the figures of *Miliola carinata* (TERQUEM) and *Miliola robusta* n. sp. The drawing of *Miliola pseudocarinata* nov. nom. in her work of 1970 is identical with that given in her work of 1947, but because of the mixing-up the species is described under the name of *Miliola robusta* n. sp. No correction to eliminate this error has been done as yet, the less so, no reference to the earlier work has ever been made.

Geographic and stratigraphic range: Present from the upper part of the Lutetian up to the Oligocene at several localities in the Paris Basin. At Dudar, not too frequent in the Lutetian nummulitic-molluscan clayey marl.

Miliola saxorum (LAMARCK, 1804)

Pl. XI, f. 4–6

1804. *Miliolites saxorum* LAMARCK. — LAMARCK, J. B.: Ann. Mus. Hist. Nat., vol. 5. p. 352. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1807. *Miliolites saxorum* LAMARCK. — LAMARCK, J. B.: Ann. Mus. Hist. Nat., vol. 9. pl. 17. fig. 2. (teste: ELLIS–MESSINA Catalogue of Foram.)
1826. *(Quinqueloculina) saxorum*, LAM. — D'ORBIGNY, A.: Ann. Sci. Hist. Nat. Paris sér. 1. t. 7. p. 135. Pl. VII. (16) fig. 10–14.
1882. *Quinqueloculina saxorum*, LMK. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 181. Pl. XIX. fig. 22.
1905. *Pentellina pseudosaxorum* SCHLUMBERGER n. sp. — SCHLUMBERGER, M. CH.: Bull. Soc. Géol. France, sér. 4, vol. 5. p. 126. pl. II. fig. 36. pl. III. fig. 40. tf. 19–21.
1947. *Miliola pseudosaxorum* (SCHLUMBERGER). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 30.
1947. *Miliola saxorum* (LAMARCK). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 30.
1956. *Miliola pseudoprisca* n. sp. — GULLENTOPS, F.: Mém. Inst. Géol. Louvain. Vol. 20. pt. 1. p. 13. pl. I. fig. 8.
1958. *Quinqueloculina parisiensis* BATJES, non D'ORBIGNY — BATJES, D. A. J.: Inst. R. Sc. Nat. Belg. Mém. No. 143. p. 104. Pl. II. fig. 4.
1961. *Miliola saxorum* (LAMARCK). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 161. Pl. IV. fig. 25–27. Pl. V. fig. 1.

1964. *Miliola saxorum* (LAMARCK). — LOEBLICH, A.–TAPPAN, H.: Treatise Invert. Paleont. Part C. Protista 2. p. C 468. fig. 357/2, 3.
1970. *Miliola saxorum* LAMARCK. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 43. Pl. 6. fig. 3.

Description: Studied material — 15 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, long, elongate elliptical, in apertural view, rounded triangular. Chambers arranged in quinqueloculine pattern with 4 chambers visible on one side and 3 ones on other. Chambers long, elongate, slightly curved in a crescent shape. Chamber cross-section rounded. Final chamber somewhat larger than the one preceding it. Sutures slightly curved in direction of long axis. Aperture terminal, cribrate. Pores on chamber surface arranged parallel to long axis, being closely spaced and large. Pore spacing about 5–6 μm.

Size: Length of test 750–1370 μm, its largest width in lateral view 280–550 μm. Length of penultimate chamber 650–1210 μm.

Remark: I have not seen either the original description or the figure given by LAMARCK (1804, 1807), so I have borrowed the data from the ELLIS–MESSINA Foraminifera Catalogue. Our species resembles *Quinqueloculina birostris* (LAMARCK), but it differs from it by the fact that *Miliola saxorum* (LAMARCK) has a cribrate aperture and that there is no saliant and sharp-edged rib amid the pores arranged longitudinally on the chamber surface, unlike it is the case with *Q. birostris.*

Geographic and stratigraphic range: Present from the Cuisian up to the top of the Bartonian at several localities in the Paris Basin and from the Lutetian up to the Oligocene in Belgium. At Dudar, frequent in the Lutetian nummulitic-molluscan clayey sands.

Miliola strigillata (D'ORBIGNY, 1850)
Pl. XII, f. 1–3

1850. *Triloculina strigillata,* D'ORB. — D'ORBIGNY, A.: vol. 2. p. 409.
1882. *Triloculina strigillata,* D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 169. Pl. XVII. fig. 25.
1905. *Triloculina strigilata* — FORNASINI, C.: Mem. Accad. Sci. Bologna, ser. VI. t. II. p. 60. pl. I. fig. 10.
1905. *Pentellina strigillata* D'ORB. — SCHLUMBERGER, M. Ch.: Bull. Soc. Géol. Fr. sér. 4. vol. 5. p. 124. Pl. II. fig. 35, Pl. III. fig. 39.
1947. *Trillina strigillata* (D'ORBIGNY). — LE CALVEZ, Y.: Mém Carte Géol. Déta. Fr. p. 33.
1952. *Miliola strigillata* (D'ORBIGNY). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 47.
1961. *Miliola prisca* (D'ORBIGNY) var. *strigillata* (D'ORBIGNY). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147, p. 163. Pl. V. fig. 6.
1970. *Pentellina strigillata* (D'ORBIGNY). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 42. Pl. 8. fig. 1, 8. Pl. 46. fig. 10, 11.

Description: Studied material — 2 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test subcircular, in apertural view, elliptical. Chamber arrangement quinqueloculine, in five planes, with 3 chambers visible on one side and 4 ones on other. As a result of the quinqueloculine pattern the chambers are elongate in direction of the long axis, but in lateral view they are heavily inflated in accordance with the almost round test. Chamber surface rounded the final two chambers being nearly equal in size. Sutures more heavily curved in accordance with the more stout test. Aperture terminal, cribrate. Chamber surface porate with fine and closely spaced pores arranged longitudinally. Pore spacing 4–5 μm.

Size: Length of test 420–480 μm, its largest width in lateral view 480–520 μm. Length of penultimate chamber 330–360 μm.

Remark: D'ORBIGNY mentioned this species, already in 1826 (p. 134), from Valognes, but he gave neither a description, nor a figure thereof (nom. nud.). In 1850, D'ORBIGNY gave a description of the species and TERQUEM, in 1882, gave both description and figure. The species resembles *Miliola prisca* (D'ORBIGNY), but in prisca the chambers are a little bit longer, the outline is not completely elliptical and a strong rib is visible where the chambers meet, and the pores are larger.

Geographic and stratigraphic range: Present from higher parts of the Lutetian up to the Auversian at several localities in the Paris Basin and in the Lutetian of Belgium. Scarcely present in the Lutetian nummulitic-molluscan sands of Dudar.

Subfamilia: Tubinellinae RHUMBLER, 1906
Genus: *Articulina* D'ORBIGNY, 1826

Articulina nitida D'ORBIGNY, 1826
Pl. XII, f. 4–5

1826. *Articulina nitida,* NOB. — D'ORBIGNY, A.: Ann. Sci. Nat. Paris sér. 1. t. 7. p. 134 (300) Modèle No 22 1. livr.
1865. *Articulina nitida,* D'ORB. — PARKER, W. K.–JONES, T. R.–BRADY, H. B.: Ann. Mag. Nat. Hist. ser. 3. v. 16. p. 22. Pl. I. fig. 2.
1882. *Articulina nitida,* D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 150. Pl. XV. fig. 22–23. (non fig. 24).
1944. *Articulina nitida* D'ORBIGNY. — CUSHMAN, J. A.: Cushm. Lab. Foram. Res. Spec. Publ. No. 10. p. 2. Pl. I. fig. 1–5.
1947. *Articulina nitida* D'ORBIGNY. — LE CALVEZ, Y.: Mém. Carte. Géol. Déta. Fr. p. 35.
1961. *Articulina nitida* D'ORBIGNY. — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 157. Pl. IV. fig. 11.
1964. *Articulina nitida* D'ORBIGNY. — LOEBLICH, A.–TAPPAN, H.: Treatise, Invert. Paleont. Part C. Protista 2. p. C 478. fig. 365/6.
1970. *Articulina nitida* D'ORBIGNY. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 69. Pl. 4. fig. 6.

Description: Studied material—2 specimens. Wall calcareous, porcelaneous with microcrystalline pores. Shape of test, in lateral view, elongate, in apertural view, circular. Chambers arranged, in early stage, in milioline pattern, being coiled in five planes with 3 chambers visible on one side and 4 ones on other. In later stages, the chambers grow rectilinearly. At about half the length of test, the chambers are elongate, with a rounded rim, being slightly curved, in a crescent shape, in accordance with the milioline pattern of coil. The other half of the test consists of cylindrical chambers arranged uniserially. Sutures, in early stage, by and large parallel to long axis, to become, in rectilinear growth stage, perpendicular to long axis. Aperture at end of final chamber having a thickened, turned-out rim. Pores, closely spaced, large, arranged regularly in direction of long axis. Pore spacing 5–6 μm, pore size 8–10 μm. Ornamentation consists of longitudinal ribs. Rib spacing 10–15 μm.

Size: Length of test 810–850 μm, its widht, in lateral view, 210–230 μm. Length of coiled portion 380–410 μm. Length of last chamber 430–450 μm. Diameter of aperture 70–80 μm.

Remark: D'ORBIGNY, in 1826, quoted the species from the Paris Basin and he made a plaster mould of it. The plaster mould figures were published in 1865 by PARKER–JONES–BRADY. The shape of the test resembles *Articulina ornaticollis* LE CALVEZ but in the milioline coil stage of ornaticollis there are no longitudinal ribs on the chamber wall.

Geographic and stratigraphic range: Present in the Lower Eocene, the higher zones of the Lutetian and in the Oligocene of the Paris Basin. In Hungary it can be found, sporadically enough, in the Middle Eocene nummulitic-molluscan clayey sands of the Dudar Basin.

Subordo: ROTALIINA DELAGE et HÉROUARD, 1896
Superfamilia: **Nodosariacea** EHRENBERG, 1838
Familia: **Polymorphinidae** D'ORBIGNY, 1839
Subfamilia: Polymorphininae D'ORBIGNY, 1839
Genus: *Globulina* D'ORBIGNY in DE LA SAGRA, 1839

Globulina gibba D'ORBIGNY, 1826
Pl. XIII, f. 1–2

1826. *Polymorphina (Globuline) gibba*, NOB. — D'ORBIGNY, A.: Ann. Sci. Nat. Paris sér. 1. t. 7. p. 100. (266), Modèles, No. 63, 3. livr.
1846. *Globulina gibba*, D'ORBIGNY. — D'ORBIGNY, A.: Foram. Foss. Bass. Tert. Vienne. p. 227. Pl. XIII. fig. 13, 14.
1865. *Polymorphina (Globulina) gibba*, D'ORB. — PARKER, W. K.–JONES, T. R.–BRADY, H. B.: Ann. Mag. Nat. Hist. ser. 3. v. 16. p. 29. Pl. II. fig. 52.
1882. *Globulina gibba* D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 130. Pl. XIII. fig. 22–27.
1935. *Globulina gibba* D'ORBIGNY–CUSHMAN, J. A.: U. S. Geol. Surv. Prof. Paper. 181. p. 25. Pl. 9. fig. 18.
1942. *Globulina gibba* D'ORBIGNY. — CUSHMAN, J. A.–RENZ, H. H.: Contr. Cushm. Lab. For. Res. Vol. 18. part 1. p. 7. Pl. 2. fig. 4.
1946. *Globulina gibba* D'ORBIGNY. — BELLEN, R. C. van: Meded. de Geol. Stich. ser. C.-V-No. 4. p. 37. Pl. 3. fig. 4.
1946. *Globulina gibba* D'ORBIGNY. — CUSHMAN, J. A.: Cushm. Lab. Foram. Res. Spec. Publ. No. 16. p. 18. Pl. 4. fig. 16.
1948. *Polymorphina (Globulina) gibba* D'ORBIGNY. — DORREEN, J. M.: Journ. Paleont. Vol. 22. No. 3. p. 289. Pl. 37. fig. 7.
1950. *Globulina gibba* D'ORBIGNY. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 17.
1955. *Globulina gibba* D'ORBIGNY. — BHATIA, S. B.: Journ. of Paleont. Vol. 29. No. 4. p. 676. Pl. 67. fig. 19.
1955. *Globulina gibba* D'ORBIGNY. — KAASSCHIETER, J. P. H.: Verh. Kon. Ned. Akad. Wet. Nat., ser. 1. Vol. 21. No. 2. p. 67. Pl. 5. fig. 12.
1956. *Globulina gibba* D'ORBIGNY. — HAGUE, M.: Paleont. Pakistanica. Vol. I. p. 107. Pl. 30. fig. 4.
1958. *Globulina gibba* D'ORBIGNY. — BATJES, D. A. J.: Inst. R. Sc. Nat. Belg. Mém. No. 143. p. 121. Pl. IV. fig. 9.
1961. *Globulina gibba* (D'ORBIGNY). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 183. Pl. VIII. fig. 6, 7.
1970. *Globulina gibba* ORBIGNY, 1826. — KIESEL, Y.: Paläont. Abh. A. Bd. IV. Heft 2. p. 250. Pl. XI. fig. 12, 18.
1970. *Globulina gibba* D'ORBIGNY. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 84. Pl. 17, fig. 3, 4.
1982. *Globulina gibba* (D'ORBIGNY). — PETTERS, S. W.: Palaeontgr. Abt. A Bd. 179. p. 55. Pl. 8. fig. 11.

Description: Studied material – 10 specimens. Test hyaline, perforate, calcareous. Shape of test similar to sphere with pointed protuberance in one point. Both rather elongate and less elongate shapes possible. Chambers arranged spirally, heavily overlapping. Externally, only a few chambers are visible. They are onion-shaped at the external wall of the test, being angular towards its interior. They increase in size with the growth of the test. Sutures in one plane with test wall, difficult to discern, not too thick. Aperture at pointed end of test consisting of radially arranged portions. Wall surface covered by tiny, irregularly arranged and sparse pores.

Size: Length of test: 410–580 μm, its largest width in lateral view 380–520 μm.

Remark: Resembles *Globulina gibba* D'ORB. var. *puncta* D'ORB. and *G. gibba* D'ORB. var. *tuberculata* D'ORB. in both shape and size of test, but these two species have a sculptured test, with tubercles and nodes on the test wall.

Geographic and stratigraphic range: Species of extremely wide geographic and stratigraphic range, known from the Cretaceous up to the Present from different localities. In the Paris Basin it occurs from the Paleocene up to the Oligocene, in Germany from the Cretaceous up to the Upper Oligocene, in England from the Eocene up to the Present, in the Netherlands in the Eocene, in New Zealand in the Upper Eocene, in Alabama, U.S.A., in the Eocene. At Dudar, it is frequent in the Lutetian nummulitic-molluscan clayey sands.

Globulina gibba D'ORBIGNY var. *tuberculata* D'ORBIGNY, 1846
Pl. XIII, f. 3.

1846. *Globulina tuberculata*, D'ORBIGNY. — D'ORBIGNY, A.: Foram. Foss. Bass. Tert. Vienne. p. 230. pl. XIII. fig. 21, 22.
1882. *Globulina tuberculata*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 132. Pl. XIII. fig. 34.
1935. *Globulina gibba* D'ORBIGNY var. *tuberculata* D'ORBIGNY. — CUSHMAN, J. A.: U. S. Geol. Surv. Prof. Paper. 181. p. 26. Pl. 9. fig. 19–20.
1946. *Globulina gibba* D'ORBIGNY, var. *tuberculata* D'ORBIGNY. — BELLEN, R. C. van: Meded. de Geol. Stich. ser. C-V-No. 4. p. 38. Pl. 3. fig. 7.
1955. *Globulina gibba* D'ORBIGNY var. *tuberculata* (D'ORBIGNY). — BHATIA, S. B.: Journ. of Paleont. Vol. 29. No. 4. p. 676. pl. 67. fig. 20.
1963. *Globulina gibba tuberculata* D'ORBIGNY. — KÜMMERLE, E.: Abh. Hessisch. Land. f. Bodenf. Heft. 45. p. 39. Pl. 5. fig. 5.
1973. *Globulina tuberculata* D'ORBIGNY, 1846. — NAGYNÉ GELLAI Á.: Ann. Inst. geol. publ. hung. Vol. LV, fasc. 3. p. 462. t. IV. á. 16.

Description: Studied material—3 specimens. Test hyaline, perforate, calcareous. Shape of test spheroidal with rough, scabrous wall. Chambers invisible owing to strong ornamentation. Chambers onion-shaped when viewed from the outside, their walls forming an angle on the inside. Sutures not visible. Aperture seldom observable on heavily ornamented test. Radially aligned slits at end of chamber only seldom observable. Test wall covered by irregularly distributed pores. The whole spheroidal test is covered by strikingly emerging tubercles and nodes that are also perforate.

Size: Diameter of test 410–500 μm.

Remark: Test similar in shape to *Globulina gibba* D'ORBIGNY, but the wall of gibba is smooth, not ornamented.

Geographic and stratigraphic range: Species of wide geographic and stratigraphic range, known from Eocene to present-day deposits from several localities, from the Eocene to Pliocene of England, the Eocene, Oligocene and present-day deposits of the Netherlands, the Miocene of the Vienna Basin, the Middle Eocene of France, and the Eocene of the U.S.A. In Hungary it is known from Oligocene deposits in the Dorog Basin and, not too frequently, in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Genus: *Guttulina* D'ORBIGNY in DE LA SAGRA, 1839

Guttulina irregularis (D'ORBIGNY, 1846)
Pl. XIII, f. 4

1846. *Globulina irregularis*, D'ORBIGNY. — D'ORBIGNY, A.: Gide et Compe Paris, pp. 1–312. p. 226. Pl. XIII. fig. 9, 10.
1935. *Guttulina irregularis* (D'ORBIGNY). — CUSHMAN, J. A.: U. S. Geol. Surv. Prof. Paper 181. p. 24. Pl. 9. fig. 13–16.
1946. *Guttulina irregularis* (D'ORBIGNY). — CUSHMAN, J. A.: Cushm. Lab. Foram. Res. Spec. Publ. No. 16. p. 18. Pl. 4. fig. 12.
1950. *Guttulina irregularis* D'ORBIGNY. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 14.
1955. *Guttulina irregularis* (D'ORBIGNY). — BHATIA, S. B.: Jour. of Paleont. Vol. 29. No. 4. p. 676. Pl. 67. fig. 26.
1955. *Guttulina irregularis* (D'ORBIGNY). — KAASSCHIETER, J. P. H.: Verh. Kon. Ned. Akad. Wet. Nat., ser. 1, Vol. 21, No. 2. p. 66. Pl. 5. fig. 11.
1961. *Guttulina irregularis* (D'ORBIGNY). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No 147. pl. 181. Pl. VIII. fig. 2, 3.
1963. *Guttulina irregularis* (D'ORBIGNY). — KÜMMERLE, E.: Abh. Hessisch. Land f. Bodenf. Heft. 45. p. 37. Pl. 4. fig. 7.
1970. *Guttulina irregularis* (D'ORBIGNY, 1846). — KIESEL, Y.: Paläont. Abh. A. Bd. IV. Heft 2. p. 243. Pl. X. fig. 21.
1970. *Guttulina irregularis* (D'ORBIGNY). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 92. Pl. 20. fig. 3.

Description: Studied material—6 specimens. Test hyaline, perforate, calcareous. Shape, in lateral view, similar to heavily rounded triangle with depressed base. Apertural view also rounded triangular. Chambers arranged spirally around long axis in quinqueloculine pattern. Subsequent chambers largely overlapping the ones preceding them. Test consisting of a few chambers that are gradually more inflated and elongate in direction of long axis. Sutures on comparatively smooth test wall difficult to discern, by and large parallel to long axis. Aperture at end of last chamber consists of radially arranged pores. Test wall covered by closely spaced and extremely fine pores. At low magnification, these pores are invisible.

Size: Length of test 680–750 μm, its largest width, in lateral view, 570–710 μm.

Remark: The test resembles that of *Guttulina problema* (D'ORBIGNY), but the test of problema is more elongate, occasionally, the older chambers are jutting out of the test with a tapering chamber wall. Since *G. irregularis* (D'ORBIGNY) and *G. problema* (D'ORBIGNY) rather widely vary in shape of test and since both species abound in identical areas and the same beds, I have the feeling that the two species are one species, having been assigned to different species owing to variability in shape.

Geographic and stratigraphic range: Common species known from Cretaceous to present-day deposits of various localities, from the Eocene of Belgium, England, the Netherlands, France and Germany as well as from the Eocene of Alabama on the Gulf Coast. In England and France, it occurs in Cretaceous deposits as well. In the Vienna Basin and the Aquitanian Basin it is known from Miocene deposits. It is known from Miocene to Pliocene deposits in the Niger Delta, from Cretaceous to present-day deposits of England and from Paleocene to Oligocene deposits in the Paris Basin. At Dudar, it is rather common in the Lutetian nummulitic-molluscan clayey sands.

Superfamilia: **Discorbacea** EHRENBERG, 1838
Familia: **Discorbidae** EHRENBERG, 1838
Subfamilia: Discorbinae EHRENBERG, 1838
Genus: *Discorbis* LAMARCK, 1804

Discorbis bractifera LE CALVEZ, 1949
Pl. XIII, f. 5–6

1949. *Discorbis bractifera* n. sp. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 18. Pl. III. Fig. 39–41.
1970. *Rosalina bractifera* (LE CALVEZ). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 140. Pü. 29. fig. 6, 7.

Description: Studied material—3 specimens. Test hyaline, perforate, calcareous, planoconvex in shape. Dorsal side slightly convex, ventral side level. Test outline subcircular with rounded rim. Chambers arranged trochospirally. On the dorsal side, the chambers of all whorls are visible, on the ventral side, only those of the last whorl can be observed. Chambers angular rhomboidal in cross-section, final chamber on dorsal side being twice the size of the one preceding it. 6 chambers visible on ventral side, the youngest being larger and more inflated. Sutures on dorsal side slightly curved, on ventral side, radial, depressed. Aperture situated on umbilical side at edge of final chamber. This is a radial slit between the umbilical area and the edge of the test. On the umbilical side, in addition, accessory apertures can be found, too, being radially aligned where the chambers meet. Surface of the test covered by closely spaced pores. An exception to the rule is the middle part of the spiral side, where pores may be observed quite sporadically.

Size: Largest diameter of test 620–650 μm, smallest diameter of test 510–540 μm. Largest thickness of final chamber on spiral side 150–160 μm. Largest thickness of penultimate chamber on spiral side 105–110 μm.

Remark: Resembles *Discorbis propinqua* (TERQUEM) on ventral and dorsal side but differs form it in shape of test. *D. bractifera* LE CALVEZ has a test of more rounded outline, *D. propinqua* (TERQUEM) has a test of more elongate, outline, its final chamber being more inflated.

Geographic and stratigraphic range: Present in the Lutetian and the Auversian and Marinesian of the Paris Basin. Sparse in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Discorbis perplexa LE CALVEZ, 1949
Pl. XIV, f. 1–3

1882. *Rotalina elegans?* D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 75. Pl. VII. fig. 6.
1882. *Rotalina marginata*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 80. Pl. VIII. fig. 5.
1949. *Discorbis perplexa* nom. nov. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 21. Pl. II. fig. 18–20.
1961. *Discorbis perplexa* LE CALVEZ. — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 208.
1970. *Discorbis perplexa* LE CALVEZ. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 137. fig. 46–49.

Description: Studied material—10 specimens. Wall of test hyaline, perforate, calcareous. Shape of test planoconvex. Dorsal side conical, ventral side level, circular in outline. Edge sharp with glasslike transparent rim. Chambers arranged trochospirally. On dorsal side, all chambers visible, on umbilical side only chambers of last whorl observable. Chambers angularly rhomboidal in shape. On dorsal side, many chambers visible, chambers of last whorl by and large equal in size. 5 to 7 chambers observable on umbilical side, final chamber larger than the one preceding it. Sutures on umbilical side depressed, radial; on dorsal side, slightly emergent, curved. Aperture extending radially on umbilical side, at edge of final chamber, between umbilicus and edge of test. Secondary apertures available on ventral side, arranged radially among chambers. On the dorsal side, mainly towards the edges, comparatively large and sporadically distributed pores are found. Pores on umbilical side even more widely spaced. Glassy rim around edge of test not porous. On the ventral side, at the umbilicus, there is a nucleus (umbilical knob).

Size: Diameter of test 215–480 μm, its height 135–300 μm. Thickness of marginal rim 10–20 μm.

Remark: The two species mentioned by TERQUEM (1882), *Rotalina elegans* D'ORB. and *R. marginata* D'ORB., are not identical with D'ORBIGNY's species, however, they agree well both with LE CALVEZ' species and our specimens. *Discorbis perplexa* LE CALVEZ resembles *D. rotata* (TERQUEM) in size and shape of test, differring from it by the presence of a nucleus.

Geographic and stratigraphic range: Known from the Cuisian up to the top of the Marinesian in several Paris Basin localities, from the Lutetian of Belgium and, in abundance, from the Lutetian nummulitic-molluscan clayey sands of Dudar.

Discorbis propinqua (TERQUEM, 1882)
Pl. XIV, f. 4–6

1882. *Rotalina coarctata*, TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 76. Pl. VII. fig. 8.
1882. *Rosalina propinqua*, TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 99. Pl. X. fig. 14.
1949. *Discorbis propinqua* (TERQUEM). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 17. Pl. I. fig. 12–14.
1970. *Discorbis propinqua* (TERQUEM). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 133. Pl. 28. fig. 7.

Description: Studied material—2 specimens. Wall of test hyaline, perforate, calcareous. Shape of test planoconvex to concavo-convex. Dorsal side slightly convex, ventral side level or slightly concave. Equatorial section oval and rimmed. Periphery ending in keel. Chambers arranged trochospirally. On dorsal side, all chambers visible, on ventral side 5 chambers of final whorl observable. Chambers angled rhomboidal in shape. Last chamber larger, more inflated than the one preceding it. Sutures on spiral side curved, arcuate, on ventral side, radial, depressed. Aperture represented by radial opening at edge of final chamber, bordered by narrow lip slightly extending into dorsal side. Secondary apertures available on ventral side along radial septa, between periphery of test and its umbilical part. The whole surface of the test is covered by closely spaced, tiny pores. An exception to the rule is the middle part of the spiral side.

Size: Largest diameter of test 500–610 μm, its smallest diameter 370–470 μm.

Remark: It differs from *Discorbis rotata* (TERQUEM) by its not completely circular outline, its having a rim and by the extension of its aperture a little bit into the dorsal side.

Geographic and stratigraphic range: Present in Cuisian to Marinesian deposits at several localities in the Parisian Basin. Very sparse at Dudar in the Lutetian nummulitic-molluscan clayey sands.

Discorbis rotata (TERQUEM, 1882)
Pl. XIV, f. 7–8

1882. *Rotalina rotata* TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 83. Pl. VIII. fig. 13.
1949. *Discorbis rotata* (TERQUEM). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 19. Pl. I. fig. 15–17.
1970. *Discorbis rotata* (TERQUEM). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 134. Pl. 28. fig. 3.

Description: Studied material—3 specimens. Wall of test hyaline, perforate, calcareous. Shape of test conical, planoconvex. Umbilical side level, spiral side conical of sharp outline, equatorial section circular. Chambers arranged trochospirally. On ventral side, only chambers of final whorl visible, on dorsal side all chambers observable. Shape of chambers angled rhomboidal. 6 chambers by and large equal in size visible on ventral side. Many chambers slightly growing in size observable on dorsal side. Sutures on umbilical side radial, slightly depressed, on dorsal side, arcuate. Aperture on ventral side represented by radial opening at margin of last chamber, between umbilical area and perimeter of test. This part in our specimens is broken. On ventral side, secondary sutural apertures arranged radially between chambers. The wall of the test is covered by large, but distant pores.

Size: Diameter of test 300–420 μm, its height 200–280 μm.

Remark: Discorbis rotata (TERQUEM) resembles *D. perplexa* LE CALVEZ in the shape of its test, but it differs from perplexa by its lacking a nucleus in the middle part of the ventral side.

Geographic and stratigraphic range: Present in higher parts of the Lutetian and in the Auversian and Marinesian beds in the Paris Basin. Sparse in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Discorbis sp.
Pl. XV, f. 1–3

Description: Studied material—3 specimens. Wall of test hyaline, perforate, calcareous. Shape of test almost discoidal. Dorsal side slightly convex, ventral side level or slightly concave. Periphery of test rounded, circular, slightly lobate in outline. Chambers arranged trochospirally. On spiral side chambers of all whorls visible, on umbilical side only chambers of final whorl observable. Shape of chamber angularly rhomboidal. On the dorsal side, numerous chambers slightly increasing in size from earlier to later stages are visible. On umbilical side there are 5–7 chambers, the youngest one being twice the size of the one preceding it. Septa of spiral side slightly curved, those of umbilical side radial. Sutures on both sides slightly depressed. Aperture represented by opening at margin of last chamber, provided with slightly thickened lip running radially between umbilicus and periphery, on ventral side. Supplementary apertures available on ventral side at radial septa and in area closer to umbilicus. On the dorsal side closely spaced, coarse pores are found. Pores on ventral side irregularly distributed, sparse and varying in size. On the ventral side there is a nucleus (umbilical knob) at the umbilicus.

Size: Diameter of test 300–420 μm, its height 200–280 μm. Diameter of umbilical knob 20–25 μm.

Remark: It is *Discorbis vesicularis* LAMARCK that our species most resembles. The dorsal side of our specimens, however, is less convex and there is a nucleus on the umbilical side.

Geographic and stratigraphic range: Sparsely present in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Subfamilia: B a g g i n i n a e CUSHMAN, 1927
Genus: *Baggina* CUSHMAN, 1926

Baggina subconica (TERQUEM, 1882)
Pl. XV, f. 4–5

1882. *Rotalina subconica*, TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. **3**. t. 2. p. 61. Pl. IV. fig. 5a-c.
1882. *Valvulina ovalis*, TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 103. Pl. XI. fig. 10.
1949. *Valvulineria subconica* (TERQUEM). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 26. Pl. V. fig. 87–89.
1955. *Valvulineria subconica* (TERQUEM). — BHATIA, S. B.: Journ. of Paleont. Vol. 29 No. 4. p. 683. Pl. 67. fig. 2a, b.
1970. *Cancris subconicus* (TERQUEM). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. pp. 145–146. Pl. 43. fig. 6.
1983. *Cancris subconicus* (TERQUEM). — SETIAWAN, J. R.: Utrecht Micropal. Bull. 29. p. 117. pl. VIII. fig. 6.

Description: Studied material—3 specimens. Test hyaline, perforate, calcareous. Shape of test almost globular. Outline oval, periphery rounded. Spiral side convex, umbilical side less convex. Chambers arranged trochospirally. Test consists of a few rapidly growing chambers that are inflated, the last one being spherical. 5 chambers visible on umbilical side. Septa on spiral side slightly curved and depressed, on umbilical side, radial and more strongly depressed. Aperture situated on umbilical side, being represented by a wide opening at umbilicus. Test wall finely perforate. As a rule a nonperforate area is found on the final chamber around the aperture. In our specimens this is not the case.

Size: Largest diameter of test 680–700 μm. Smallest diameter of test 560–580 μm.

Remark: Its test resembles that of *Neocribrella globigerinoides* (PARKER et JONES), consisting of similarly arranged, inflated and spherical chambers. It differs from the afore-mentioned species by its aperture. The umbilical area of *N. globigerinoides* (PARKER et JONES) is closed by a large, wide, big-pored plate.

Geographic and stratigraphic range: Present from the Cuisian up to the top of the Marinesian in several localities in the Paris Basin, from the Eocene up to the Lower Oligocene in England. From Italy it is known from Priabonian beds. At Dudar, sparse in the Lutetian nummulitic-molluscan clayey sands.

Genus: *Cancris* DE MONTFORT, 1808

Cancris auris (LE CALVEZ, 1949)
Pl. XVI, f. 1–3

1949. *Anomalina auris* n. sp. — LE CALVEZ, Y: Mém. Carte Géol. Déta. Fr. p. 43. Pl. IV. fig. 66–68.
1961. *Anomalina auris* Y. LE CALVEZ. — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 215. Pl. XII. fig. 11.
1970. *Anomalina auris* LE CALVEZ. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 198. Pl. 44. fig. 4, 10.

Description: Studied material—5 specimens. Wall hyaline, perforate, calcareous. Shape of test biconvex oval, with a thickened, carinate rib at its periphery. Spiral side evolute, other side possibly with slightly open umbilicus. Chambers arranged trochospirally. Chambers angularly rhomboidal in shape, rapidly growing in size, comparatively low and wide. Older chambers on umbilical side deeply and strongly ribbed. Sutures strong, distinct and slightly depressed on both sides. Aperture situated on umbilical side. Wide slitlike opening at edge of last chamber, between periphery of test and umbilicus. At the umbilicus, a broad, liplike rim extends above the aperture as an extension of the last chamber. Wall of test densely and finely perforate, except for peripher keel and area around aperture. On umbilical side, older chambers radialy and deeply ribbed with ribs running between the periphery of test and umbilicus.

Size: Largest diameter of test 435–950 μm, its smallest diameter 350–700 μm. Largest thickness of final chamber 270–410 μm in case of test positioned with edge upright.

Remark: KAASSCHIETER's (1961) figure of *Cancris auriculus* (FICHTEL et MOLL) var. *primitivus* CUSHMAN et TODD resembles it, but its ventral side around the umbilicus carries tubercles at the end of the chambers.

Geographic and stratigraphic range: Present from the Cuisian up to the Marinesian beds of several localities in the Paris Basin. In Belgium and the Netherlands it is known from Middle Eocene outcrops. At Dudar, not too sparse in the Lutetian nummulitic-molluscan clayey sands.

Familia: **Glabratellidae** LOEBLICH et TAPPAN, 1964
Genus: *Glabratella* DORREEN, 1948

Glabratella ubiqua (LE CALVEZ, 1949)
Pl. XVI, f. 4–5

1949. *Discorbis ubiqua* nom. nov. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 23. Pl. II. fig. 27–29.
1970. *Glabratella ubiqua* (LE CALVEZ). — LE CALVEZ, Y.: Carhiers de Pal. C. N. R. Sc. p. 149. Pl. 35. fig. 7.

Description: Studied material—5 specimens. Wall of test hyaline, perforate, calcareous. Shape of test hemispherical. Periphery rounded, umbilical side flat, circular, spiral side convex, of low spire. Arrangement of chambers trochospiral, all chambers visible on ventral side, only chambers of final whorl observable on flat umbilical side. Chambers angled rhomboidal in shape, rapidly growing in size in proportion with the growth of test. 5–6 chambers visible on umbilical side, numerous chambers observable on dorsal side. On dorsal side, suture slightly convex like a rib, running spirally amid whorls. Suture amid chambers forms an angle of about 45° with suture amid whorls. Suture on umbilical side difficult to discern. Aperture small and round restricted to umbilicus on ventral side. Pores coarse, 6–8 μm in diameter, closely spaced on dorsal side. Pores on ventral side, 8–10 μm in size, only near umbilical area.

Size: Largest diameter of test 560–800 μm, its smallest diameter 560–660 μm.

Remark: LOEBLICH and TAPPAN (1964) distinguished between two forms of the genus Glabratella: a schizont form, i.e. a microspheric form B of asexual reproduction mechanism, and a gamont form A that is reproduced sexually by gametes. The schizont form is flatter and larger, the gamont form is smaller and more high-spired. Consequently our specimen is a schizont form. *Glabratella ubiqua* (LE CALVEZ) resembles the Discorbis species in shape of test. It differs from them by having only a simple aperture at the umbilicus and by its lacking the lap the Discorbis species have on the umbilical side.

Geographic and stratigraphic range: Present from the Cuisian up to the top of the Marinesian Beds at several localites. At Dudar, it occurs sporadically in the nummulitic-molluscan clayey sands.

Familia: **Asterigerinidae** D'ORBIGNY, 1839
Genus: *Asterigerina* D'ORBIGNY in DE LA SAGRA, 1839

Asterigerina bimammata (GÜMBEL, 1868)
Pl. XVII, f. 1–2

1868. *Rotalia bimammata* n. g. — GÜMBEL, C. W.: Abh. k. bayer. Akad. Wiss. X. Bd. II. Abt. p. 649. Pl. II. fig. 85a-c.
1882. *Rotalina bimammata*, GÜMB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. pp. 66–67. Pl. V. fig. 5–13.
1886. *Pulvinulina bimammata* GÜMB. — UHLIG, V.: Jb. k. k. geol. Reichsanst. Bd. 36. Heft 1. pp. 192–193. Pl. III. Fig. 7–8, Pl. V. fig. 4, 5, 8.
1967a. *Asterigerina bimammata* (GÜMBEL), 1868. — V. ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1965-ről p. 409. Pl. IX. fig. 8–10.

Description: Studied material—5 specimens. Wall of test hyaline, perforate, calcareous. Shape of test rotaloidal, biconvex, both dorsal and umbilical sides emergent. On dorsal side, chambers arranged spirally in 3–5 whorls. On umbilical side, secondary chamberlets observable, being arranged like the petals of a flower (a star-shaped rosette) around the umbilical plug. Un dorsal side, chambers angular rhomboidal, last two chambers by and large equal in size. On umbilical side, secondary chamberlets petaloid and equal in size. Sutures on dorsal side oblique or askew, on umbilical side by and large straight. The loop-shaped aperture lies at the edge of the last chamber. The wall of the test is covered by tiny, closely spaced pores of 2–3 μm size with a spacing of 6–8 μm. The test surface aroung the aperture is ornamented with salient tubercles of 12–16 μm size.

Size: Diameter of biconvex test 440–850 μm, its height 280–520 μm.

Remark: Resembles *Asterigerina rotula* (KAUFMANN) by the petaloid arrangement of its chambers, but differs from it because. *A. rotula* has a spiroconvex test, whilst *A. bimammata* (GÜMBEL) has a biconvex one.

Geographic and stratigraphic range: Occurs in the Eocene of the N Alps, in the Eocene flysch zone of the Bavarian Alps. Known from Lutetian localities in the Paris Basin. In Hungary, it was reported from the Lutetian and Priabonian deposits of the Bakony, Vértes and Buda Mountains and of the Esztergom Basin. At Dudar, not too frequent in the Lutetian nummulitic-molluscan clayey sands.

Asterigerina rotula (KAUFMANN, 1867)
Pl. XVII, f. 3–5

1867. *Hemistegina rotula* KAUFMANN. — KAUFMANN, F. J.: Beitr. Geol. Karte Schweiz Berne no. 5. p. 150. Pl. 8. fig. 19a-d. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1868. *Rotalia campanella* n. sp. — GÜMBEL, C. W.: Abh. k. bayer. Akad. Wiss. X. Bd. II. Abt. p. 650. Pl. II. fig. 86a-c.
1886. *Pulvinulina rotula* KAUFMANN. — UHLIG, V.: Jb. k. k. geol. Reichsanst. Bd. 36. Heft 1. pp. 193–195. Pl. III. fig. 5–6, Pl. V. fig. 6, 7.
1952. *Asterigerina rotula* (KAUFMANN). — GRIMSDALE, T. F.: Bull. Brit. Mus. (Nat. Hist.) Geol. Vol. I. No. 8. p. 238. Pl. 23. fig. 10–11, Pl. 24. fig. 1–2.
1957. *Asterigerina carinata* D'ORBIGNY. — SACAL, V.–DEBOURLE, A.–CUVILLIER, J.: Mém. Soc. Géol. Fr. (nouv. sér.) T. XXXVI. Fasc. 1. p. 43. pl. XIX. fig. 3.
1963. *Asterigerina bimammata rotula* (KAUFMANN 1867). — KIESEL, Y.–LOTSCH, D.: Geologie Jg. 12. B. 38. p. 22. Pl. X. fig. 1.
1967a. *Asterigerina rotula* (KAUFMANN), 1867. — V. ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1965-ről. p. 409. Pl. X. fig. 1–3.
1970. *Asterigerina rotula* (KAUFMANN) group. — NYÍRŐ R.: Ann. Hist. nat. Mus. Nat. Hung. Min. et Pal. T. 62. p. 75.

Description: Studied material—20 specimens. Test hyaline, perforated, calcareous. Shape of test rotaloid, spiroconvex. Dorsal side almost plain, umbilical side heavily emergent, conical. Chambers arranged spirally on dorsal side, in 3–5 whorls, each chamber being quite distinct. On umbilical side there are secondary chamberlets arranged in a petaloid rosette around the umbilical plug. On dorsal side chambers angled rhomboidal in outline, increasing in size with growth of test, there being no difference in size of final and penultimate chambers. On umbilical side secondary chamberlets of equal size arranged in petaloid pattern around umbilical plug. Along the edge of the test they are triangular. Sutures on dorsal side oblique, askew, on umbilical side almost straight. The aperture is slit- or loop-shaped opening on the umbilical side, its length does not reach up to the umbilical plug. The loop-shaped aperture is sometimes indented. The test wall is covered by tiny, closely spaced pores of 2–3 μm size with a spacing of 6–8 μm. Around the aperture there are strong, salient tubercles of about 15 μm size.

Size: Diameter of spiral side of test 680–1030 μm, its height 410–620 μm.

Remark: Resembles *Asterigerina bimammata* (GÜMBEL) by the rosette-shaped arrangement of the umbilical side, but differs from it by the shape of the test because the test of *A. bimammata* (GÜMBEL) is biconvex.

Geographic and stratigraphic range: Common in the Eocene flysch zone of the Bavarian Alps, in the Middle Eocene of the Aquitanian Basin. Present in the Middle and Upper Eocene of Iraq as well as in the Upper Eocene of Syria. In Hungary, it occurs in the Lutetian and Priabonian beds of the Transdanubian Central Range, the Bükk Mountains and the Esztergom Basin. Extremely abundant in the Lutetian nummulitic-molluscan clayey sands of the Dudar Basin.

Familia: **Epistomariidae** HOFKER, 1954
Genus: *Epistomaria* GALLOWAY, 1933

Epistomaria semimarginata (D'ORBIGNY, 1850)
Pl. XVII, f. 6–8

1850. *Rotalia semimarginata*, D'ORB., — D'ORBIGNY, A.: Vol. 2. p. 407. No. 1317.
1862. *Discorbina rimosa* PARKER and JONES. — CARPERTER, W. B.–PARKER, W. K.–JONES, T. R.: Ray. Soc. p. 205. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1865. *Discorbina rimosa* PARKER et JONES. — PARKER, W. K.–JONES, T. R.: Philos, Trans. Roy. Soc. p. 385. pl. 19. fig. 6a-c. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1882. *Rotalina semi-marginata*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 56. Pl. III. fig. 13–14. (non fig. 12.).
1906. *Turbinulina semimarginata* — FORNASINI, C.: Mem. Accad. Sci. Bologna, ser. VI. t. III. p. 68. Pl. IV. fig. 5.
1928. *Epistomella rimosa* (PARKER et JONES). — CUSHMAN, J. A.: Contr. Cushman. Lab. foram. Res. Vol. 4. pt. 1. p. 6. Pl. 1. fig. 9a-c.
1945. *Epistomaria semimarginata* (D'ORBIGNY). — APPLIN, E. R.–JORDAN, L.: J. Paleont. Vol. 19. No. 2. p. 144. Pl. 19. fig. 6a-c.
1949. *Epistomaria semi-marginata* (D'ORBIGNY). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 33.
1957. *Epistomaria semi-marginata* D'ORBIGNY. — SACAL, V.–DEBOURLE, A.–CUVILLIER, J.: Mém. Soc. Géol. Fr. (n. s.) T. XXXVI. Fasc. 1. p. 41. Pl. XVII. fig. 8.
1960. *Epistomaria semi-marginata* (D'ORBIGNY). — TODD, R.–LOW, D.: Geol. Surv. Prof. Paper. 260–x. p. 840. Pl. 256. fig. 8.
1964. *Epistomaria rimosa* (PARKER et JONES). — LOEBLICH, A.–TAPPAN, H.: Treatise Invert. Paleont. Part C. Protista 2. p. C 592. fig. 472/1–3.
1970. *Epistomaria rimosa* (PARKER et JONES). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 153. Pl. 32. fig. 1–3.

Description: Studied material—6 specimens. Wall of test hyaline, perforate, calcareous. Shape of test rotaloid, biconvex, growing markedly wide towards final chamber, when viewed perpendicularly to coil plane, owing to growing size of younger chambers. Arrangement of chambers trochospiral, evolute on dorsal side and involute on umbilical side. Early whorls of spiral side poorly visible, final whorl quite distinct. On the umbilical side only the chambers of the final whorl are visible. Chambers rapidly growing in size. Final chamber much larger and more inflated than the one preceding it. 9 chambers are observable in final whorl, on dorsal side. Suture line of septa depressed, radiate and curved on dorsal side, radiate and almost straight on umbilical side. The aperture is an interiomarginal slit situated on the margin of the final whorl, along the last septum. Issuing almost from the umbilicus, it extends towards the periphery of the shell and up to the dorsal side. On the frontal face of the final whorl there are two supplementary slitlike openings. In addition, they are present on both the spiral and the umbilical sides, along the sutures as well as on the umbilical side, parallel to the sutures. On the dorsal side, these apertures extend up to the periphery, on the ventral side they reach neither the umbilicus nor the periphery. Pores tiny, closely spaced.

Size: Largest diameter of shell 570–930 μm, smallest diameter 470–750 μm. In case of shell standing upright on its edge, thickness of last chamber 270–460 μm.

Remark: The species was first mentioned by D'ORBIGNY in 1826 (p. 110) from the Paris Basin (Grignon), under the name of *Turbinulina semi-marginata* (nom. nud.). Figs 13–14 from the figures of *Rotalina semi-marginata* D'ORB. described and figured by TERQUEM (1882) are identical with our species, f. 12 deviates from it. The figure published by FORNASINI (1906) from the unpublished plates of D'ORBIGNY is identical with that of our species. CUSHMAN (1928) established a new genus, Epistominella, the genoholotype of which is *Discorbina rimosa* PARKER et JONES, but its figure is identical both with that of the type species and with that of our species. LE CALVEZ, in 1949, still described it under the name of *Epistomaria semi-marginata* (D'ORBIGNY), by relying on the *Rotalia semi-marginata* species that had been mentioned in 1826 and described in 1850 by D'ORBIGNY. In 1970 she referred to it as *Epistomaria rimosa* (PARKER et JONES) and considered the two species to be identical. Notwithstanding this, she regarded the later-described specific name rimosa as the valid name of the species, because the type of *R. semi-marginata* D'ORB. 1850 had been lost, whilst *D. rimosa* PARKER et JONES 1862 had been replaced by a newly designated lectotype available in England. The specimens I have studied are identical with both species. So I accept the priority of D'ORBIGNY's specific name semimarginata, though *Discorbina rimosa* PARKER et JONES is referred to as the genotype of Epistomaria. Its shell resembles that of *Epistomaria separans* LE CALVEZ, but the pores of this species are larger and more distant and its final chamber is more inflated.

Geographic and stratigraphic range: The species occurs in the Cuisian, the higher horizons of the Lutetian and in the Auversian and Marinesian beds of the Paris Basin. It is present in the Lutetian of the Aquitanian Basin, in boreholes on Eniwetok Atoll of Marshall Islands and in the Lower Eocene limestones of W Pakistan. It is not too frequent on the Lutetian nummulitic-molluscan clayey sands of the Dudar Basin.

Superfamilia: **Rotaliacea** EHRENBERG, 1839
Familia: **Rotaliidae** EHRENBERG, 1839
Subfamilia: Rotaliinae EHRENBERG, 1839
Genus: *Rotalia* LAMARCK, 1804

Rotalia trochidiformis LAMARCK, 1804
Pl. XVIII, f. 1–2

1804. *Rotalites trochidiformis* LAMARCK. — LAMARCK, J. B.: Ann. Mus., Vol. 5. p. 184. (teste: ELLIS–MESSINA: Catalogue fo Foram.)
1882. *Rotalina trochidiformis*, LAMARCK. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 68. Pl. VI. fig. 1.
1882. *Rotalina saxorum*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 69. Pl. VI. fig. 4.
1949. *Rotalia trochidiformis* LAMARCK. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 32.
1952. *Rotalia trochidiformis* (LAMARCK). — BERMUDEZ, P. J.: Bol. de Geol. Vol. II. No. 4. p. 70. Pl. XII. fig. 1.
1957. *Rotalia trochidiformis* LAMARCK. — SACAL, V.–DEBOURLE, A.– CUVILLIER, J.: Mém. Soc. Géol. Fr. (n. s.) T. XXXVI. Fasc. 1. p. 40. Pl. XVI. fig. 7.
1964. *Rotalia trochidiformis* LAMARCK. — LOEBLICH, A.–TAPPAN, H.: Treatise, Invert. Paleont. Part. C. Protista 2. p. C 607. fig. 479/1, 480/1–3.
1970. *Rotalia trochidiformis* LAMARCK. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. pp. 159–160. Pl. 34. fig. 4, 5.

Description: Studied material—6 specimens. Test hyaline, perforate, calcareous. Shape of shell biconvex, lenticular. Outline circular, periphery carinate. Chambers arranged trochospirally. On dorsal side, chambers of all whorls visible, on umbilical side, those of final whorl being so. Chambers angled rhomboidal, growing in size with shell growth. On spiral side, whorls consisting of a multitude of chambers observable. Sutures, on spiral side, curved, on umbilical side, radial, slightly depressed. Apertures slitlike, radiate on umbilical side, on inner side of chambers. Shell wall coarsely porous throughout shell surface except septa and pillars and tubercles at umbilicus on umbilical side. Spiral side smooth. In central part of umbilical side, numerous granules and tubercles visible that may fuse laterally to surround cavities and canals.

Size: Diameter of shell 685–1460 μm, its height 480–900 μm.

Remark: I have not seem LAMARCK's (1804) original description, having had to restrict myself to the Foraminifera Catalogue. The species was emended by DAVIS (1932) what I could find again in the Foraminifera Catalogue only.

Geographic and stratigraphic range: Present in upper horizon of Lutetian in Paris and Aquitanian Basins. Not too rare in Lutetian nummulitic-molluscan clayey sands at Dudar, Hungary.

Rotalia tuberculata SCHUBERT, 1901
Pl. XVIII, f. 3–5

1901. *Rotalia papillosa* BRADY var. *tuberculata* m. — SCHUBERT, R. J.: Z. dtsch. geol. Ges. Bd. 53 p. 20. fig. 2–4.
1935. *Rotalia viennoti* GREIG. n. sp. — GREIG, D. A.: J. Paleont. Vol. 9. No. 6. p. 524. pl. 58. fig. 1–14.
1947. *Rotalia jabacoensis* CUSHMAN and BERMUDEZ. — CUSHMAN, J. A.–BERMUDEZ, P. J.: Cushm. Lab. Foram. Res. Contr. Vol. 23. p. 29. Pl. 10. fig. 1–3. (teste ELLIS–MESSINA: Catalogue of Foram.)

1954. *Neorotalia alicantina* n. sp. — COLOM, G.: Bol. Inst. geol. min. t. 66. p. 265. pl. VI. fig. 8–12.
1957. *Rotalia viennoti* GREIG. — SACAL, V.–DEBOURLE, A.– CUVILLIER, J.: Mém. Soc. Géol. Fr. (n. s.) T. XXXVI. Fasc. 1. p. 40. Pl. XVI. fig. 1–3.
1966. *Neorotalia tuberculata* (SCHUB.). — SZŐTS, E.: C. R. Somm. Séanc. Soc. Géol. France, Fasc. 8. p. 308.

Description: Studied material—10 specimens. Test hyaline, perforate, calcareous. Shape of test biconvex, lenticular. Outline circular, edge sharp or slightly rounded. Chambers arranged trochospirally. Arrangement difficult to discern owing to heavy ornamentation. Shape of chambers angularly rhomboidal, chamber size increasing with growth of test. Sutures, where visible on umbilical side of heavily ornamented test, radial and depressed. Aperture not visible. Whole surface of test covered by coarse, closely spaced pores of different size. Test strongly ornamented. Chamber walls carry salient tubercles and granules on both sides. These protuberances are also porous, though less so compared with the rest of the wall.

Size: Diameter of test 720–1200 μm, its height 480–715 μm.

Remark: This species was described, for the first time, by SCHUBERT (1901) who regarded it as a variety of *Rotalia papillosa* BRADY and referred to it as *R. papillosa* var. *tuberculata.* He gave a rather good figure and description of it. GREIG (1935) seems, in my opinion, to have described the same species as *Rotalia viennoti.* So SCHUBERT's description has priority, as pointed out by E. SZŐTS in 1966. *R. tuberculata* SCHUBERT is closely related to *R. papillosa* D'ORBIGNY rather than to *R. papillosa* BRADY as was believed by SCHUBERT (1901). *R. papillosa* was described by D'ORBIGNY from the Paris Basin as a fossil form, while BRADY's species is a now-living form. That this was the case I could get convinced of myself, since Mme LE CALVEZ had sent me topotypes of *R. papillosa* D'ORBIGNY from the Lutetian of the Paris Basin.

Geographic and stratigraphic range: In Italy, it occurs in Lower and Middle Eocene deposits; in SW Spain in Upper Ypresian—Lower Lutetian formations; in Cuba in the Upper Eocene; in France in the Lutetian of the Aquitanian Basin. In W Asia, it can be encountered from the Cretaceous up to the Oligocene at several localities: Cretaceous and Lutetian (N Iraq), Lutetian and Oligocene (Palestine), Lover and Upper Lutetian (W Persia), Eocene and Oligocene (Syria). At Dudar, it is rather frequent in the nummulitic-molluscan clayey sands.

Genus: *Pararotalia* LE CALVEZ, 1949

Pararotalia inermis (TERQUEM, 1882)
Pl. XIX, f. 1–3

1882. *Rotalina inermis,* TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 68. Pl. VI. fig. 1a-c.
1949. *Pararotalia inermis* (TERQUEM). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 32. Pl. III. fig. 54–56.
1964. *Pararotalia inermis* (TERQUEM). — LOEBLICH, A.–TAPPAN, H.: Treatise, Invert. Paleont. Part C. Protista 2. p. C 612. fig. 486/1–3.
1970. *Pararotalia inermis* (TERQUEM). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 163. Pl. 34. fig. 6, 7.

Description: Studied material—10 specimens. Test hyaline, perforate, calcareous. Shape of test varying from planoconvex to biconvex, though generally with more convex umbilical side. Periphery blunt; outline round; short spines on periphery of chambers. Chambers arranged trochospirally. On spiral side, all chambers visible, on umbilical side, only chambers of final whorl being so. Chambers angled rhomboidal in shape, chambers of final whorl spinate. On the spiral side, the chambers slightly grow in size, on the umbilical side, they are by and large equal. Sutures, on dorsal side, curved, on umbilical side, radial, strongly depressed. Aperture on umbilical side interiomarginal, extraumbilical. Provided with narrow lip, internal "tooth plate" it lies at margin of last chamber. The "tooth plate" may often be broken out in preservation, thus being observable in intact specimens only. Test wall covered by tiny pores. The umbilical side of the test is ornamented, in its central part, by a plug that may often be broken out. Around the periphery of the test, on the edge of the chambers, spines are observable.

Size: Diameter of test 270–750 μm, its height 150–340 μm. Diameter of umbilical plug 410–620 μm.

Remark: The test of *Pararotalia inermis* (TERQUEM) resembles that of *P. audouini* (D'ORBIGNY), but the umbilical side of this species is less convex, there are no spines on the periphery of the test and the umbilical plug is smaller.

Geographic and stratigraphic range: Known from higher horizons of the Lutetian and the Auversian and Marinesian beds of a good many of localities in the Paris Basin. Extremely abundant in the Lutetian nummulitic-clayey sands of Dudar.

Superfamilia: **Orbitoidacea** SCHWAGER, 1876
Familia: **Eponididae** HOFKER, 1951
Genus: *Eponides* DE MONTFORT, 1808

Eponides polygonus LE CALVEZ, 1949
Pl. XIX, f. 4–5

1949. *Eponides polygonus* n. sp. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 28. Pl. V. fig. 90–92.
1961. *Eponides polygonus* Y. LE CALVEZ. — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 210. Pl. XII. fig. 1.
1970. *Eponides polygonus* Y. LE CALVEZ. — NYÍRŐ R.: Ann. Hist. nat. Mus. Nat. Hung. Min. et Pal. T. 62. p. 76. Pl. II. fig. 1.
1970. *Eponides polygonus* LE CALVEZ. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 176. Pl. 37. fig. 1, 9.
1975. *Eponides polygonus* LE CALVEZ, 1949. — SAMUEL, O.: Západné Karp. sér. paleont. 1. p. 147. Pl. LXXXII. fig. 6.

Description: Studied material—7 specimens. Test hyaline, perforate, calcareous. Shape of test biconvex, umbilical side more convex compared with spiral side. Outline round, slightly lobate, with periphery ending in blunt carina. Chambers arranged trochospirally. On spiral side, chambers of all whorls visible, on umbilical side, only those of final whorl being so. Chambers angled rhomboidal in shape, slightly growing in size. Six chambers visible on umbilical side. Sutures curved on spiral side and almost radial and slightly depressed on umbilical side. Aperture interiomarginal, slitlike, situated on umbilical side, at edge of final chamber, between umbilical area and periphery of test. Test wall finely and densely porate.

Size: Diameter of test 480–1160 μm, its height 340–680 μm.

Remark: Resembles *Eponides toulmini* BROTZEN as far as its test is concerned, but *E. toulmini* BROTZEN has a more lobate test and its umbilical side is less convex.

Geographic and stratigraphic range: Known from the Cuisian up to the the top of the Marinesian beds of several localities in the Paris Basin, from the Middle Eocene of Belgium and the Netherlands and from the Upper Eocene of Czechoslovakia. In Hungary it occurs in the Lutetian of Weimpuszta, being rather frequent in the Lutetian nummulitic-molluscan sands at Dudar.

Familia: **Cibicididae** CUSHMAN, 1927
Subfamilia: Cibicidinae CUSHMAN, 1927
Genus: *Cibicides* DE MONTFORT, 1808

Cibicides carinatus (TERQUEM, 1882)
Pl. XX, f. 1–4

1882. *Truncatulina carinata*, TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. pp. 94–95. Pl. X. fig. 1–2.
1961. *Cibicides carinatus* (TERQUEM). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. pp. 221–222. Pl. XIV. fig. 6.
1970. *Cibicides carinatus* (TERQUEM, 1882). — KIESEL, Y.: Paläont, Abh. A. Bd. IV. Heft 2. p. 305. Pl. XVIII. fig. 17.
1970. *Cibicides carinatus* (TERQUEM). — NYÍRŐ R.: Ann. Hist. nat. Mus. Nat. Hung. Min. et Pal. T. 62. p. 77. Pl. II. fig. 4–5.

Description: Studied material—15 specimens. Test hyaline, perforate, calcareous. Test attached, thus somewhat varying in shape. Umbilical side slightly convex, spiral side varying from flat to concave in dependence on the quality of the substratum the test is attached to. Outline slightly lobate, round. Periphery blunt with narrow, glasslike transparent rib around. Chambers arranged trochospirally. Spiral side evolute, ventral side involute. Chambers angled rhomboidal in shape. Test consisting of a multitude of chambers. Final chamber more inflated than preceding ones. On umbilical side, only chambers of final whorl visible. On ventral side, sutures radial and depressed; on spiral side, arched. Aperture an interiomarginal opening with narrow lip at margin of last chamber, extending along spiral suture from ventral side well onto umbilical side. Whole surface of test, except glasslike transparent ribs around periphery densely covered by coarse pores.

Size: Longest diameter of test 650–1030 μm, shortest diameter 540–615μm Height of test 132–160 μm.

Remark: Resembles *Cibicides robustus* LE CALVEZ by its varied shape of test. Both species may widely vary in shape of test in dependence on what, kind of substratum the test is attached to. Differs from *C. robustus* LE CALVEZ species, lacking glasslike rib around periphery of test.

Geographic and stratigraphic range: Occurs in the Lutetian of the Paris Basin. Known from Lutetian and Bartonian deposits in Belgium. Present at some Eocene localities of Germany. In Hungary, it is found in the Middle Eocene of the Dorog Basin, being common to the Lutetian nummulitic-molluscan clayey sands of Dudar.

Cibicides robustus LE CALVEZ, 1949
Pl. XXI, f. 1–4

1949. *Cibicides robustus* n. sp. — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 47. Pl. IV. fig. 57–59.
1970. *Cibicides robustus* LE CALVEZ. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 183. fig. 69, 70, 71.

Description: Studied material–5 specimens. Test hyaline, perforate, calcareous. Shape of test varied depending on what kind of substratum the test is attached to. Spiral side flat or concave, umbilical side slightly convex. Periphery in earlier chambers blunt; in youngest chambers, rounded. Test uncoiled to some extent; in accordance with this, its outline may be round, oval or irregular. Chambers arranged trochospirally, involute on umbilical side, evolute on spiral side. Early chambers anguled rhomboidal in shape, younger ones peripherically rounded. Chambers tend to grown in size towards younger chambers, last chamber being strongly inflated. 7–8 chambers visible on umbilical side, chambers if 2–3 whorls being so on spiral side. On umbilical side, sutures radial and depressed; on dorsal side, arched and less depressed. Aperture, an interiomarginal opening on umbilical side, with narrow rim turning out. On the dorsal side, along the spiral suture, this feature extends deep and long inwards, extending well onto the umbilical side and becoming loop-like. Whole surface of test dotted with coarse, closely spaced pores varying from 10 to 15 μm in diameter.

Size: Longest diameter of test 890–1150 μm, shortest diameter 545–820 μm. Height of test 150–345 μm.

Remark: With its irregular and varied test, *Cibicides robustus* LE CALVEZ resembles *C. carinatus* (TERQUEM), but, in carinatus, there is a glasslike, non-perforate rib on the periphery of the test.

Geographic and stratigraphic range: Occurs in higher parts of the Lutetian and in the Auversian and Marinesian beds of the Paris Basin. Not too frequent in the nummulitic-molluscan clayey sands of Dudar.

Cibicides sublobatulus (GÜMBEL, 1868)
Pl. XXII, f. 1–3

1868. *Truncatulina sublobatula* n. sp. — GÜMBEL, C. W.: Abh. k. bayer. Akad. Wiss. X. Bd. II. Abt. p. 659. Pl. II. fig. 103a–c.
1886. *Truncatulina sublobatula* GÜMB. — UHLIG, V.: Jb. k. k. geol. Reichsanst. Bd. XXXVI. p. 659. Pl. II. fig. 22.
1904. *Truncatulina sublobatula,* GÜMBEL. — LEARDI, Z. in AIRAGHI.: Atti. Soc. Ital. Sci. Nat. Vol. XLIII. p. 166.
1967a. *Anomalina sublobatula* (GÜMBEL), 1868. — VITÁLISNÉ ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1965-ről p. 405. t. X. fig. 10–11.

Description: Studied material—10 specimens. Test hyaline, perforate, calcareous. Shape of test planoconvex. Umbilical side strongly convex, spiral side flat. Margin rounded, outline round. Chambers arranged trochospirally. Spiral side evolute, umbilical side involute. Chambers angularly rhomboidal in shape. On umbilical side, numerous chambers of final whorl visible, slightly growing in size towards youngers. On dorsal side, chambers of 1–2 whorls visible. Sutures by and large radial and sligthly depressed on both sides. Aperture, an interiomarginal opening with narrow lip on final chamber margin, along last suture which, on spiral side, extends along spiral suture, passing somewhat onto umbilical side. Test wall densely and coarsely porate.

Size: Longest diameter of test 380–630 μm, shortest diameter 280–520 μm. Height of test 205–275 μm.

Remark: As pointed out by GÜMBEL, this species resembles *Cibicides lobatus* (WALKER et JACOB).

Geographic and stratigraphic range: Occurs in the Eocene of Germany and Italy, being frequent in the nummulitic-molluscan clayey sands of Dudar in Hungary.

Genus: *Stichocibicides* CUSHMAN et BERMUDEZ, 1936

Stichocibicides cubensis CUSHMAN et BERMUDEZ, 1936
Pl. XXII, f. 4–5

1936b. *Stichocibicides cubensis* CUSHMAN and BERMUDEZ, n. sp. — CUSHMAN, J. A.–BERMUDEZ, P. J.: Contr. Cushm. Lab. For. Res. Vol. 12. p. 33. Pl. 5. fig. 19–21.
1952. *Karreria cubensis* (CUSHMAN y BERMUDEZ). — BERMUDEZ, P. J.: Bol. de Geol. Vol. II. No. 4. p. 56. Pl. VIII. fig. 7–8.
1964. *Stichocibicides cubensis* CUSHMAN et BERMUDEZ. — LOEBLICH, A.– TAPPAN, H.: Treatise on Invert. Paleont. Part. C. Protista 2. p. C 692. fig. 559/1–3.

Description: Studied material—5 specimens. Test hyaline, perforate, calcareous, attached to bottom, thus having flat spiral side and oval outline. At the meeting of the flat and convex sides there is a marginal keel 20–30 μm wide. In the early stage of development there are one or two trochospirally coiled whorls that are subsequently followed by uniserially arranged chambers. Early chambers angularly rhomboidal, younger ones inflated on umbilical side and flat on spiral side. Trochospirally coiled portion composed of about 5–7 chambers, coil followed by 2 to 4 uniserially arranged chambers. Youngest chamber larger, more inflated than the one preceding it. Sutures on spiral side slightly bent. On convex side, at trochospiral coil, straight, radial and depressed; in case of younger chambers, perpendicular to length of test, slightly bent, and also depressed. On umbilical side, aperture loop-like with narrow lip. Test wall coarsely perforate, pores on marginal keel quite occasional. Where spiral and ventral sides meet, test ornamented with marginal keel of slightly irregular, jagged outline.

Size: Length of test 550–1030 μm, greatest width 380–575 μm. Thickness of last chamber 205–260 μm, that of penultimate chamber 150–165 μm.

Remark: Stichocibicides differs from Rectocibicides in that the latter has a multiple aperture. Its test resembles that of *Karreria fallax* RZEHAK but this one lacks a keeled periphery.

Geographic and stratigraphic range: Occurs in the Eocene of Cuba. Not too frequent in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Familia: **Planorbulinidae** SCHWAGER, 1877
Genus: *Eoannularia* COLE et BERMUDEZ, 1944

Eoannularia eocenica COLE et BERMUDEZ, 1952
Pl. XXIII, f. 1–2

1952. *Eoannularia eocenica* COLE y BERMUDEZ. — BERMUDEZ, P. J.: Bol. de Geol. Vol. II, No. 4. p. 123. Pl. XXIV. fig. 12–14.
1969. *Eoannularia eocenica* COLE et BERMUDEZ, 1944. — V. ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1966-ról. p. 158. Pl. VII. fig. 10–13.

Description: Studied material—10 specimens. Test hyaline, perforate, calcareous, thin, fragile, of glassy lustre. Shape of test discoidal, flat to concavo-convex. Subsequent growth of chambers in annular rings. Spherical proloculus followed first by a few similar, trochospirally arranged chambers, then by many angular chambers arranged in subsequent cyclic annuli slightly growing in size towards younger chambers. Sutures visible amid both annular chamber rings and radially partitioned chambers. Because of the glasslike transparency of the test, this can be readily observed in spite of the fact that the suture line of the septa just slightly emerges from the plane of the test wall. On some chambers, circular or irregularly shaped aperture visible. Wall of test dotted with irregularly arranged, coarse pores, being occasionally ornamented with radial, slightly elevated ribs.

Size: Diameter of test 410–850 μm, height 40–65 μm.

Remark: The shape of the test resembles that of *Linderina brugesi* SCHLUMBERGER in its early stage of development, but in later stages the chambers of *Eoannularia eocenica* COLE et BERMUDEZ are angular, those of *L. brugesi* SCHLUMBERGER being raspberry-shaped.

Geographic and stratigraphic range: Known from the Eocene of Cuba. In Hungary, it occurs in the Lutetian of the Bakony Mountains and the Esztergom Basin, being quite frequent in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Genus: *Linderina* SCHLUMBERGER, 1893

Linderina brugesi SCHLUMBERGER, 1893
Pl. XXIII, f. 3

1893. *Linderina Brugesi* SCHLUMB. n. sp. — SCHLUMBERGER, M. CH.: Bull. Soc. Geol. France. Sér. 3. Tom. 21. pp. 121–123. fig. 3–5. Pl. III. fig. 7–9.
1952. *Linderina brugesi* SCHLUMBERGER. — BERMUDEZ, P. J.: Bol. de Geol. Vol. II, No. 4. p. 123. Pl. XXIV. fig. 8–11.
1964. *Linderina brugesi* SCHLUMBERGER. — LOEBLICH, A.–TAPPAN, H.: Treatise Invert. Paleont. Part C Protista 2. p. C 694. fig. 562/5–10.
1969. *Linderina brugesi* SCHLUMBERGER, 1893. — V. ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1966-ról p. 158. Pl. II. fig. 1–4.
1970. *Linderina brugesi* SCHLUMBERGER. — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 187. Pl. 39. fig. 5.

Description: Studied material—6 specimens. Test hyaline, perforate, calcareous. Shape of test lenticular, thicker at centre than on peripheries. Outline wavy. Chambers, in early stage, arranged trochospirally, in later stage, in annular rings, in planospiral succession. Arrangement of chambers, on both sides, most distinctly visible towards the margins. Many tiny chambers joining one another in raspberry pattern observable on test, slightly growing in size towards the youngest. On the periphery a series of small round chamberlets observable. Sutures semicircularly curved, visible on both sides of test, being more difficult to discern or possibly quite invisible in central part of test. Chambers pierced on either side by canal representing aperture. This circular or oval opening is visible mainly along the marginal series of chambers. Test wall irregularly porate.

Size: Diameter of test 430–575 μm, height 82–250 μm.

Remark: In early stage of development, the test resembles that of *Eoannularia eocenica* COLE et BERMUDEZ, but in later stage, its development is continuous in a Cycloclypeus pattern, whilst in *Linderina brugesi* SCHLUMBERGER the chambers join one another in a raspberry pattern.

Geographic and stratigraphic range: Occurs in higher horizons of the Lutetian, in the Auversian and Marinesian beds and the Upper Eocene of the Paris Basin. In Hungary, it is known from the Lutetian *Nummulites millecaput* Horizon as well as the Upper Eocene of the Bakony and the Esztergom Basin, being rather common in the Lutetian nummulitic-molluscan, clayey sands of Dudar.

Familia: **Acervulinidae** SCHULTZE, 1854
Genus: *Acervulina* SCHULTZE, 1854

Acervulina dudarensis n. sp.
Pl. XXIII, f. 4–5; Pl. XXIV, f. 1–4; Pl. XXV, f. 1–3

1973. *Acervulina* n. sp.? — SZŐTS, E.: C. R. somm. S. G. F., p. 114.

Holotypus: Stratigraphical and Paleontological Collection. Hungarian Geological Institute. No. E. 5139.
Stratum typicum: Sedimentary fill of larger gastropod shells (*Velates schmideli* CHEMN., *Campanile urkutense* MUN. CHALM., *Ampullina perusta* DEFR.) from nummulitic-molluscan clayey sands (2 m) overlying coal measures.
Locus typicus: Kossuth shaft, Dudar, Bakony Mountains.
Derivatio nominis: The name refers to the occurence of the species at Dudar, Bakony Mountains, Hungary.

Diagnosis: Test of irregular shape, attached, calcareous, finely perforate, consisting of numerous, but isometric, chambers. Aperture invisible. Wall of chambers and septa thin, finely perforate.

Description: Studied material—30 specimens. Test hyaline, perforate, calcareous. Shape of test extremely variable, concavo-convex. Species living attached to algal filaments, blades of seaweed, echinoderm spines or other kinds of substratum. In accordance with this, there is a longitudinal, groove-like depression at the attachment on one side of the test. Other side of test more or less convex, cigar-shaped or becoming to some extent irregular, slightly flattened. Outline generally oval or irregular. Surface of attachment sometimes almost round. In cases when a Posidonia blade is completely surrounded by the growth of the attached specimen, a cylindrical shape of test may seldom occur. The test largely varies in total length, from about 1000 to 3500 μm. Largest width of test 500–2000 μm. Largest height of test from surface of attachment 600–1000 μm. Chambers arranged irregularly as a pile (aggregate). In some thin section images one or two rather regular series of chambers arranged parallel to the attachment of the test can be observed. Test consisting of numerous tiny, irregular, but isometric, chambers nearly equal in size with infinitesimal growth observable in parallel with the growth of test. Chamber walls extremely thin, fragile, wall of the outermost series of chambers may often be broken out. Sutures irregular in behaviour and depressed. Septa between chambers thin and perforate. Aperture not observable, being replaced by perforations. Whole surface of test densely dotted with tiny pores 3–5 μm in diameter.

Size of holotype: Total length 2600 μm. Largest width of test 1100 μm.

Differential diagnosis: Fully corresponds to *Acervulina* sp., form found at the locality of Cauneille in France, the only difference being that the test of the French specimen is more recrystallized. Its varied, attached test corresponds in size range figures too to the specimens here studied. I have had the opportunity to study the material from Cauneille myself. It similar in shape and size of test to *Acervulina inhaerens* SCHULTZE, species known as a now-living form, but the wall of the test of inhaerens is dotted with large, coarse and round pores. Unfortunately, the published figure is an idealized drawing from which neither the shape of the chambers nor their arrangement can be gathered.

Remark: The spiral coil around the proloculus, characteristic feature given in the generic diagnosis (LOEBLICH et TAPPAN 1964), cannot be observed. Similarly in the generic diagnosis, coarse, large pores that may probably represent chamber walls broken out, are quoted by the author. As for me, I found the wall of the test to be dotted with tiny pores. At low magnification, this can be easily mistaken for a broken-out wall, feature quite common in the material I have studied myself. E. SZŐTS (1973) quotes *Acervulina* n. sp.? from Upper Lutetian deposits, from Cauneille locality in France. I saw the material he had collected from that locality and I found the Acervulina species occurring there to be identical with the *A. dudarensis* n. sp. described here.

Association: Since the species has been recovered from the sedimentary fill of large gastropod shells (*Velates schmideli* CHEMN., *Ampullina perusta* DEFR., *Campanile urkutense* MUN. CHALM.), conclusions as to the life habits of the species can be drawn (A. KECSKEMÉTI-KÖRMENDY, 1980. pp. 94–119). It seems to have lived under tropical climate, in agitated, shallow seawater with a salinity of 17 to 34‰. Shallow water depth is indicated by the presence of Nummulites species in high numbers, too. On the basis of green algae, E. KRIVÁN-HUTTER (1957) suggested a tropical-subtropical climate, a maximum water depth of 30 m, a heavy nearshore agitation of the environment and an argillaceous sandy bottom. The typical associated Foraminifera fauna includes *Pararotalia inermis* TERQUEM, *Clavulina parisiensis* D'ORB., *Fabiania cassis* (OPP.), *Nubecularia lucifuga* DEFR., *Asterigerina rotula* (KAUF.), etc.

Geographic and stratigraphic range: Known from deposits of allegedly Upper Lutetian age, from Cauneille, in France. At Dudar, it is very common in the Lutetian nummulitic-molluscan, clayey sands.

Genus: *Sphaerogypsina* GALLOWAY, 1933

Sphaerogypsina globula (REUSS, 1848)
Pl. XXV, f. 4

1848. *Ceriopora globulus* REUSS. — REUSS, A. E.: Naturw. Abh. Bd. 2, t. 1. p. 33. pl. 5. fig. 7. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1886. *Gypsina globulus* REUSS. — UHLIG, V.: Jb. k. k. geol. Reichsanst. Bd. 36. Heft 1. pp. 197–200. fig. 7–8.
1918. *Gypsina globulus* REUSS spec. — TRAUTH, F.: Denkschr. d. kais. Akad. d. Wiss. Bd. 95, p. 242. Pl. III. fig. 1.
1935. *Gypsina globulina* (REUSS). — CUSHMAN, J. A.: U. S. Geol. Surv. Prof. Paper. 181. p. 54. Pl. 23. fig. 4–5.
1937. *Gypsina globulus* (REUSS). — SILVESTRI, A.: Paleontogr. Italica. Vol. 32, suppl. 2. pp. 156–157. Tav. VIII. (V). fig. 1.
1954. *Gypsina globula* (REUSS). — COLOM, G.: Bol. Inst. geol. min. t. 66. p. 208. Pl. XV. fig. 11.
1957. *Sphaerogypsina globula* (REUSS). — PURI, H. S.: Florida Geol. Surv. Bull. No. 38. p. 143. Pl. 14, fig. 7. Pl. 15. fig. 9.
1960. *Gypsina globula* (REUSS). — TODD, R.–LOW, D.: Geol. Surv. Prof. Paper 260-X p. 853. Pl. 258. fig. 9.
1963. *Sphaerogypsina globulus* (REUSS). — BIEDA, F.: Inst. Geologiczny Prace. Tom. 37. pp. 45–46. Pl. III. fig. 6–10.
1963. *Sphaerogypsina globula* (REUSS 1848). — KIESEL, Y.–LOTSCH, D.: Geologie Jg. 12. B. 38. p. 17. Pl. VI. fig. 4.
1964. *Sphaerogypsina globulus* (REUSS). — LOEBLICH, A.–TAPPAN, H.: Treatise Invert. Paleont. Part. C. Protista 2. p. C 698. fig. 569/1–2.
1967a. *Sphaerogypsina globulus* (REUSS), 1847. — VITÁLISNÉ ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1965-ről pp. 407–408. Pl. VII. fig. 14. Pl. VIII. fig. 1–2.
1969. *Sphaerogypsina globula* (REUSS), 1847. — V. ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1966-ról p. 159. Pl. III., IV., V.
1970. *Sphaerogypsina globula* (REUSS). — NYÍRŐ R.: Ann. Hist. nat. Mus. Nat. Hung. Min. et Pal. T. 62. p. 78. Pl. II. fig. 9.

Description: Studied material—5 specimens. Test hyaline, perforate, calcareous. Chambers arranged irregularly on outer wall of globular test. Chambers, as viewed from the outside, vary from irregularly polygonal to subcircular in shape. Test consists of a lot of chambers with a diameter of 60–80 μm at outer wall of test. Sutures forming irregular meshwork on wall of globular test. Wall of test dotted with dense meshwork of tiny pores about 4–6 μm in diameter.

Size: Diameter of test 500–1010 μm.

Remark: The externally irregular arrangement of the chambers resembles to that of *Gypsina plana* (CARTER), but the test of this species is not globular.

Geographic and stratigraphic range: A common species of broad geographic and stratigraphic range, being quoted as occurring in deposits of Eocene to Modern age at various localities (Europe, Florida, Hawaii Island). It is known from the Oligocene and Miocene of Somalia. In Hungary it occurs in the *Nummulites brongniarti* Horizon in the Bakony, the Vértes, the Buda and the Bükk Mts, the Bicske "Embayment" and the Esztergom Basin, being rather common in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Familia: **Cymbaloporidae** CUSHMAN, 1927
Genus: *Fabiania* SILVESTRI, 1924

Fabiania cassis (OPPENHEIM, 1896)
Pl. XXVI, f. 1–5

1896. *Patella (Cymbiola) cassis* n. sp. — OPPENHEIM, P.: Z. dtsch. geol. Ges. Vol. 48. p. 55. Taf. II. fig. 2–3.
1924. *Fabiania cassis* (OPPENHEIM). — SILVESTRI, A.: Atti. Acc. Sci. Veneto — Trentina Ser. III. Vol. XIV. pp. 7–9.
1926. *Fabiania casson* (OPPENHEIM). — SILVESTRI, A.: Riv. Ital. Pal. Vol. 32. pp. 15–22. Pl. 1. fig. 2–6.
1936a. *Preudorbitolina cubensis* CUSHMAN and BERMUDEZ, n. sp. — CUSHMAN, J. A.–BERMUDEZ, P. J.: Contr. Cushman Found. For. Res. Vol. 12. p. 59. pl. 10. fig. 27–30.
1941. *Pseudorbitolina cubensis* CUSHMAN and BERMUDEZ. — COLE, W. S.: Florida Geol. Surv. Bull. No. 19. pp. 22–33. Pl. 2. fig. 5–11.
1942. *Pseudorbitolina cubensis* CUSHMAN and BERMUDEZ. — COLE, W. S.: Florida Geol. Surv. Bull. No. 20. pp. 18–19. Pl. 3. fig. 4. Pl. 5. fig. 1.
1944. *Pseudorbitolina cubensis* CUSHMAN and BERMUDEZ. — COLE, W. S.: Florida Geol. Surv. Bull. No. 26. pp. 35–36. Pl. 2. fig. 7. Pl. 8. fig. 14–15. Pl. 13. fig. 1–2.
1944. *Eodictyoconus cubensis* (CUSHMAN and BERMUDEZ), emend. COLE and BERMUDEZ. — COLE, W. S.–BERMUDEZ, P. J.: Bull. Amer. Pal. Vol. 28. No. 113. p. 6. Pl. I. fig. 1. Pl. II. fig. 1–12. Pl. III. fig. 1–5. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1945. *Eodictyoconus cubensis* (CUSHMAN and BERMUDEZ). — COLE, W. S.: Florida Geol. Surv. Bull. No. 28. p. 98. Pl. 12. fig. 10, 11.
1945. *Tschoppina cubensis* (CUSHMAN and BERMUDEZ) var. *pustolosa* KEIJZER. — KEIJZER, F. G.: Utrecht Univ. Geol. Geogr. Meded., ser. 2. No. 6, p. 214. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1948. *Fabiania cubensis* (CUSHMAN and BERMUDEZ). — CUSHMAN, J. A.: Harvard University Press Cambridge, Mass. p. 310. pl. 52. figs. 24–25.
1952. *Fabiania cubensis* (CUSHMAN y BERMUDEZ). — BERMUDEZ, P. J.: Bol. de Geol. Vol. II. No. 4. p. 102. Pl. XVIII. fig. 2–5.
1952. *Fabiania cubensis* (CUSHMAN and BERMUDEZ). — COLE, W. S.: U. S. Geol. Surv., Prof. Paper. 244. p. 14. Pl. 6. fig. 13–16.
1953. *Fabiania* sp. — SCHWEIGHAUSER, J.: Mém. Soc. pal. suisse. No. 70. Taf. 8. Fig. 10–11.
1953. *Fabiania saipanensis* n. sp. — COLE, W. S.–JOSIAN, B.: U. S. Geol. Surv. Prof. Paper. 253. p. 28. Pl. 15. fig. 1, 2.
1955. *Fabiania* sp. – NEUMANN, M.–BOULANGER, D.: Bull. Soc. Géol. France. Ser. 6. Tom. 5. pp. 305–309. Pl. XVIII. fig. 1–10.
1957. *Fabiania cubensis* (CUSHMAN and BERMUDEZ). — PURI, H. S.: Florida Geol. Surv. Bull. No. 38. pp. 128–129. Pl. 9. fig. 7.
1959. *Fabiania* cf. *cassis* SILVESTRI. — AUBOUIN, J.–NEUMANN, M.: Rev. Micropaléont. Vol. 2. No. 1. pp. 31–49. P. 2. fig. 2–3.
1961. *Fabiania cassis* SILVESTRI. — DIZER, A.: Rev. Micropaléont. Vol. 4. No. 2. pp. 80–84. Pl. 1. fig. 1–8. Pl. 2. fig. 1–3, 7.
1961. *Fabiania pentagonalis* n. sp. — DIZER, A.: Rev. de Micropaléont. Vol. 4. No. 2. pp. 80–84. Pl. 2. fig. 4–6.
1961. *Fabiania* sp. — DIZER, A.: Rev. de Micropaléont. Vol. 4. No. 2. pp. 80–84. Pl. 2. fig. 8.
1963. *Fabiania cubensis* (CUSHMAN et BERMUDEZ). — BIEDA, F.: Inst. Geologiczny Prace. Tom. 37. pp. 46–47. Pl. IV. fig. 1–2.
1964. *Fabiania cassis* (OPPENHEIM). — LOEBLICH, A.–TAPPAN, H.: Treatise, Invert. Paleont. Part C. Protista 2. p. C 701. fig. 574/3–5.
1966. *Fabiania cassis* (OPPENHEIM). — SZŐTS, E.: C. R. Somm. Séanc. Soc. Géol. France. Fasc. 8. p. 308.
1967. *Fabiania cassis* (OPPENHEIM). — HAGN, H.– WELLNHOFER, P.: Geol. Bavarica. Nr. 57. p. 228. Pl. I. fig. 1.
1969. *Fabiania cassis* (OPPENHEIM 1896) SILVESTRI, 1924. — V. ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1966-ról. pp. 160–163. Pl. VI. fig. 1–13, Pl. VII. fig. 1–9.

1970. *Fabiania cassis* (OPPENHEIM). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 188. Pl. 43. Fig. 5.

Description: Studied material—15 specimens. Test hyaline, perforate, calcareous. Shape of test of an extremely varied conical form. The cone may be flattened and regular and a transition between the two in dependence on the shape of the base with which the test is attached to the bottom. The shape of the base may be circular, pentagonal, elliptical and any possible transition in between. In axial section, test conical with obtusely rounded apex. Chambers in early stage of development arranged trochospirally. In later stage, concentrically, in conical shape. In early stage of development, there are three globose chambers in the adapical part of the cone. Proloculus about 100–150 μm in diameter. Later chambers in cyclical series of tiers, being subdivided by horizontal and vertical partitions. On dorsal side only cyclical series of tiers visible, axial chamber walls and proloculus being invisible except on abraded specimens. Wall of umbilical side and partitions imperforate, arrangement of chambers here invisible. Sutures visible only on dorsal side. Partitions between cyclic series of tiers and conically superimposed series of chambers quite distinct, while axial, vertical suture observable only on abraded specimens. On umbilical side of test, near periphery 3 to 9 round or oval regularly arranged perforations 0.3 to 0.5 μm size, varying in number in dependence on size and shape of basal side. Outer wall coarsely perforate with pores varying between 25 and 35 μm in size. On the wall of the basal side there are irregularly arranged, tiny pores.

Size: Longest diameter of test 1100–6850 μm, shortest diameter 950–4110 μm. Height of test 960–2750 μm.

Remark: OPPENHEIM (1896) described the species as a gastropod. SILVESTRI (1924) assigned it to corals. CUSHMAN (1948) was the first to assign them to forams. Characterized by a large size and an extremely wide range of variability, the genus was divided by earlier authors into several species. The test varies in shape in dependence on the kind of bottom the specimen in question is attached to. In accordance with this, the basal surface varies from circular to pentagonal or even oval in shape. Because of the frequent transitional forms, I consider these forms to represent different varieties of the species *Fabiania cassis* (OPPENHEIM).

Geographic and stratigraphic range: Present in Paleocene to Upper Eocene deposits of Italy, in the Middle and Upper Eocene of Panama, the Philippines, Cuba and Florida, in Upper Eocene allochtonous limestones in the Calcareous Alps. In France it was found in Lutetian deposits cut by boreholes. In Turkey and Greece it is known from several Lutetian localities. In Hungary, it occurs in the Middle Eocene of the N Bakony Mts, being rather common in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Genus: *Halkyardia* HERON-ALLEN et EARLAND in HALKYARD, 1918

Halkyardia minima (LIEBUS, 1911)
Pl. XXVII, f. 1–2

1911. *Cymbalopora radiata* HAG. var. *minima* nov. — LIEBUS, A.: Sitzber. Akad. Wiss. Wien. Bd. 120. Abt. 1. p. 952. Pl. III. fig. 7.
1918. *Linderina chapmani* HALKYARD. — HALKYARD, E.: Lit. Phil. Soc. Mem. Proc. vol. 62. pt. 2. no. 6. p. 110. Pl. 6. fig. 8–9. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1952. *Halkyardia minima* (LIEBUS). — BERMUDEZ, P. J.: Bol. de Geol. Vol. II. No. 4. p. 101. Pl. XVIII. fig. 9.
1955. *Halkyardia minima* (LIEBUS). — KAASSCHIETER, J. P. H.: Verh. Kon. Ned. Akad. Wet. Nat. ser. 1. Vol. 21. No. 2. p. 91. Pl. 8. fig. 1.
1964. *Halkyardia minima* (LIEBUS). — LOEBLICH, A.–TAPPAN, H.: Treatise Invert. Paleont. Part C. Protista 2. p. C 702. fig. 575/5.
1967. *Halkyardia minima* (LIEBUS). — HAGN, H.–WELLNHOFER, P.: Geol. Bavarica. Nr. 57. p. 229. Pl. III. fig. 1. Pl. IV. fig. 5.
1969. *Halkyardia minima* (LIEBUS). — CIMERMAN, F.: Rocz, pol. Tow. geol. Tom. 39. fasc. 1–3. pp. 298–299.
1969. *Halkyardia minima* (LIEBUS), 1911. — V. ZILAHY L.: M. Áll. Főldt. Int. Évi Jel. 1966-ról p. 160. Pl. II. fig. 5–10.
1970. *Halkyardia minima* (LIEBUS). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 189. Pl. 42. fig. 1, 7.
1970. *Halkyardia minima* (LIEBUS). — NYÍRŐ R.: Ann. Hist. nat. Mus. Nat. Hung. Min. et Pal. T. 62. p. 78. Pl. II. fig. 10.

Description: Studied material—10 specimens. Test hyaline, perforate, calcareous. Shape of test biconical, almost circular when viewed from dorsal side, peripheral margin wavy. In lateral view, dorsal side conical, umbilical side may vary from flat to slightly emergent. Apex of conical dorsal side rounded, margin blunt where dorsal and umbilical sides meet. Early chambers arranged irregularly or in raspberry pattern, later ones arranged in annular series. On dorsal side, earlier chambers invisible, annularly arranged later chambers small and numerous and quite distinct. Sutures, on dorsal side, semicircularly curved, being observed to form a vertical succession of well-arranged series. On dorsal side, fine, tiny pores visible, becoming more closely spaced and larger towards the margin. In slightly elevated area at centre of vertical side, pores somewhat coarser, 10–12 μm, ribs and hollows in between radiating from area dotted with smaller pores, 8–10 μm. Dorsal side smooth. In central part of ventral side, in some specimens, there is a slightly elevated, plug-like area, in other specimens, there is a hollow instead. This central area is surrounded by radially ribbed area. Ribs 40–50 μm thick, 40–45 μm apart.

Size: Diameter of test 285–560 μm, its height 205–360 μm. Diameter of umbilical plug 150–230 μm.

Remark: The test of *Halkyardia minima* (LIEBUS) resembles that of *H. maxima* CIMERMAN, but is smaller than that. The most noteworthy difference is that *H. maxima* has a concavo-convex or, less frequently, planoconvex test, while the test of *H. minima* is always biconvex, the dorsal side being more convex as compared to the ventral one.

Geographic and stratigraphic range: Present in the Marinesian beds of the Paris Basin. In Yugoslavia, it occurs in the Middle Eocene of Dalmatia; in Italy, from the top of the Paleocene to the base of the Priabonian; in Germany, in Upper Eocene allochtonous rocks. In Hungary, it is common in the Lutetian *Nummulites perforatus* Horizon, being abundant in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Familia: **Homotrematidae** CUSHMAN, 1927
Subfamilia: V i c t o r i e l l i n a e CHAPNA et CRESPIN, 1930
Genus: *Eorupertia* YABE et HANZAWA, 1925

Eorupertia cristata (GÜMBEL, 1868)
Pl. XXVII, f. 3–5

1868. *Truncatulina cristata* n. sp. — GÜMBEL, C. W.: Abh. k. bayer. Akad. Wiss. X. Bd. II. Abt., p. 660. Pl. II. fig. 105. a-b.
1886. *Rupertia incrassata* n. sp. — UHLIG, V.: Jb. k. k. geol. Reichsanst. Bd. 36. Heft 1. p. 185. Pl. IV. fig. 3–4., 6–9. (non fig. 5a-d).
1905. *Rupertia incrassata* UHLIG. — LEARDI, Z. in AIRAGHI: Att. Soc. Ital. Sci. Nat. 44. pp. 101–103. Pl. I. fig. 1–3., 10–11.
1905. *Rupertia Uhligi* n. sp. — LEARDI, Z. in AIRAGHI: Att. Soc. Ital. Sci. Nat. 44. pp. 103–105. Pl. I. fig. 4–6., 8–9.
1952. *Eorupertia incrassata* (UHLIG) var. *laevis* var. nov. — GRIMSDALE, T. F.: Bull. brit. Mus. nat. Hist. Vol. I. No. 8, p. 239. Pl. 20. fig. 15–21.
1955. *Eorupertia cristata* (GÜMBEL) 1868. — HAGN, H.: Paläont. Z. Bd. 29. 1/2. pp. 50–59. Pl. 4. fig. 1–7. Pl. 5. fig. 1–13. Pl. 6. fig. 1–4.
1967. *Eorupertia cristata* (GÜMBEL). — HAGN, H.–WELLNHOFER, P.: Geol. Bavarica. Nr. 57. p. 231. Pl. IV. fig. 1.
1967a. *Rupertia incrassata* UHLIG, 1886. — V. ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1965-ről. p. 408. Pl. VIII. fig. 5–7.

Description: Studied material—5 specimens. Test hyaline, perforate, calcareous. Shape of test conical, elongate in direction of spiral coil, subcylindrical, periphery angular. Attached with spiral side, varying from circular to oval in outline. May be flat or slightly concave. Chambers, in early stage of development, arranged trochospirally, later chambers coiled about axial hollow, being slightly rounded. Chambers rhomboidal in form, growing in size from early chambers towards later ones. On dorsal side, as a rule, all chambers visible; on umbilical side, only 5–6 chambers of final whorl being so. Sutures slightly curved, difficult to discern owing to coarsely porate, locally strongly tuberculate wall of test. Aperture, on umbilical side, a slitlike interiomarginal opening with lip at margin of last chamber, along final suture. Wall coarsely and densely perforate. Pores varying from 10 to 15 μm in diameter. Wall of some chambers ornamented, on umbilical side, with large globose tubercles 50 to 80 μm in diameter, some of them perforate. In some places, no ornamentation on chamber surface.

Size: Diameter of test 960–1950 μm, height of test 750–1370 μm.

Remark: H. HAGN (1955) revided GÜMBEL's species from the Bavarian Alps. The material studied by HAGN had also derived from the Bavarian Alps. As a result of his studies, he placed GÜMBEL's *Truncatulina cristata* in the genus Eoruperta. Its test resembles that of *E. magna* (LE CALVEZ), but this one has a less conical test, there being no tuberculate ornamentation on its wall surface.

Geographic and stratiraphic range: Present in the Eocene Stockletten Marl of the Bavarian Alps, in the Upper Eocene of the Carpathians in Poland and the Eocene of Italy. It occurs in the Middle Eocene of Iraq, E Arabia and Turkey as well as in Upper Eocene limestones in Germany, redeposited from the Calcareous Alps. In Hungary it occurs in the *Nummulites fabianii* Horizon of the Bükk Mountains, being not too frequent in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Eorupertia magna (Le Calvez, 1949)
Pl. XXVIII, f. 1–4

1949. *Gyroidinella magna* n. sp. — Le Calvez, Y.: Mém. Carte Géol. Déta. Fr. p. 27. Pl. VI. fig. 103–105.
1961. *Gyroidinella magna* Y. Le Calvez — Kaasschieter, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 244. Pl. XVI. fig. 14.
1964. *Eorupertia magna* (Y. Le Calvez). — Loeblich, A.–Tappan, H.: Treatise Invert. Paleont. Part C. Protista 2. p. C 709. fig. 582/1–3.
1970. *Gyroidinella magna* Le Calvez. — Le Calvez, Y.: Cahiers de Pal. C. N. R. Sc. p. 189.

Description: Studied material—5 specimens. Test hyaline, perforate, calcareous. Shape of test conical. Test attached with spiral side to bottom, attachment area varying from circular to oval in shape. Periphery slightly angular and rounded, where spiral and umbilical sides meet. Chambers arranged, in early stage of development, trochospirally, later chambers coiled spirally about axial hollow. Shape of chambers angularly rhomboidal, all chambers being well observable on spiral side. On umbilical side 6–10 chambers of final whorl visible. Chambers grow in size with growth of test, the final chamber being the biggest. Sutures on spiral side slightly curved, thick, quite distinct. Since the chamber wall is often broken out, the thickness and the degree of perforation of the septa can be readily observed. On umbilical side, suture straight, radial and slightly depressed. Aperture interiomarginal, representing a slitlike opening with narrow lip, extending at margin of final chamber from umbilical area towards the margins. Both wall of test and internal septa dotted with closely spaced, large pores 14 to 18 μm in diameter. Umbilical area of ventral side oriented with axial pillars connected by canals.

Size: Longest diameter of test 930–3700 μm, shortest diameter 710–2050 μm, height 545–1230 μm.

Remark: The genus Gyroidinella which Loeblich et Tappan (1964) included in the genus Eorupertia had been described by Le Calvez (1949). In 1970, Le Calvez placed the species again in the genus Gyroidinella. The test of *Eorupertia magna* (Le Calvez) is similar to that of *E. cristata* (Gümbel), but the test of this species is more irregular, more uncoiled, more highspired and the wall of the test is locally tuberculate.

Geographic and stratigraphic range: Present in higher zones of the Lutetian in the Paris Basin, in the Middle Eocene of Belgium and the Eocene of Izrael. Not too frequent in the Lutetian nummulitic-molluscan clayey sands of Dudar.

Superfamilia: **C a s s i d u l i n a c e a** D'ORBIGNY, 1839
Familia: **Nonionidae** SCHULTZE, 1854
Subfamilia: C h i l o s t o m e l l i n a e BRADY, 1881
Genus: *Nonion* DE MONTFORT, 1808

Nonion scaphum (FICHTEL et MOLL, 1978)
Pl. XXIX, f. 1–2

1798. *Nautilus scapha* FICHTEL et MOLL. — FICHTEL, L.–MOLL, J.: Test. Michr. p. 105. Pl. 19. fig. d-f. (teste: ELLIS–MESSINA: Catalogue of Foram.)
1846. *Nonionina communis*, D'ORBIGNY. — D'ORBIGNY, A.: Foram. Foss. Bass. Tert. Vienne. p. 106. Pl. V. fig. 7, 8.
1882. *Nonionina communis*, D'ORB. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 42. Pl. II. fig. 6a-c.
1955. *Nonion scaphum* (FICHTEL and MOLL). — BHATIA, S. B.: Journ. of Paleont. Vol. 29. No. 4. p. 677. Pl. 66. fig. 3a, b.
1961. *Nonion scaphum* (FICHTEL and MOLL). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 204. Pl. X. fig. 14, Pl. XI. fig. 5.
1970. *Florilus scaphus* (FICHTEL et MOLL, 1798). — KIESEL, Y.: Paläont. Abh. A. Bd. IV. Heft 2. p. 282. Pl. XV. fig. 6.
1970. *Nonion commune* (D'ORBIGNY). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. p. 191. Pl. 27. fig. 5.

Description: Studied material—7 specimens. Test hyaline, perforate, calcareous. Shape of test, in lateral view, slightly elongate, oval, slightly tapering at the top. In an upright position with the test standing on its edge, the oval shape is strongly widening with the final chamber at the top, being more compressed at the base. Periphery rounded. Chamber arrangement planospiral, involute. Test formed of numerous chambers gradually increasing in size as added. Chambers externally rounded. Sutures quite distinct, radial, slightly curved and depressed. Aperture an equatorial interiomarginal slit situated symmetrically at margin of final chamber along final suture. Wall finely porate.

Size: Longest diameter of test 300–530 μm, its shortest diameter 205–350 μm. Thickness of final chamber in test standing on its edge 110–260 μm.

Remark: In his revision of the smaller Foraminifera of the Vienna Basin, MARKS (1901) pointed out that *N. scaphum* (FICHTEL et MOLL) and *Nonion commune* (D'ORBIGNY) were synonyms and suggested, by virtue of priority, the specific name *N. scaphum* (FICHTEL et MOLL). His suggestion was accepted by KASSCHIETER and is corroborated by my own results.

Geographic and stratigraphic range. Widespread, being known from a lot of localities. Present in modern sediments of the Adriatic Sea. Occurs from Eocene to Present in England, from Paleocene to Oligocene in the Paris Basin, in the Eocene of Belgium and the Netherland and the Miocene of the Vienna Basin. At Dudar, it is rather common in the Lutetian nummulitic-molluscan clayey sands.

Familia: **Anomalinidae** CUSHMAN, 1927
Subfamilia: A n o m a l i n i n a e CUSHMAN, 1927
Genus: *Hanzawaia* ASANO, 1944

Hanzawaia producta (TERQUEM, 1882)
Pl. XXIX, f. 3–5

1882. *Truncatulina producta*, TERQ. — TERQUEM, M.: Mém. Soc. Géol. Fr. sér. 3. t. 2. p. 92. Pl. IX. fig. 20–21.
1949. *Cibicides productus* (TERQUEM). — LE CALVEZ, Y.: Mém. Carte Géol. Déta. Fr. p. 47. Pl. IV. fig. 69–71.
1961. *Hanzawaia producta* (TERQUEM). — KAASSCHIETER, J. P. H.: Inst. Roy. Sc. Nat. Belg. Mém. No. 147. p. 226. Pl. XIII. fig. 13.
1970. *Hanzawaia producta* (TERQUEM, 1882). — KIESEL, Y.: Paläont. Abh. A. Bd. IV. Heft 2. p. 3, 7. Pl. XXI. fig. 2.
1970. *Hanzawaia producta* (TERQUEM). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. pp. 201–202. Pl. 44. fig. 3, 9.
1970. *Hanzawaia producta* (TERQUEM). — NYÍRŐ R.: Ann. Hist. nat. Mus. Nat. Hung. Min. et Pal. T. 62 p. 80. Pl. II. fig. 16–17.

Description: Studied material—8 specimens. Test hyaline, perforate, calcareous. Shape of test planoconvex, plain on one side, convex on other. Outline oval, slightly lobate. Periphery slightly blunt and keeled. Chamber arrangement trochospiral. On spiral side, elevated laps on lower margin of chamber partially or completely overlapping chambers of previous whorl and commonly coalescing over entire central area. Umbilical side involute. Chambers rhomboidal in shape, varying in size from older to younger. Youngest chamber on umbilical side strongly inflated, convex. Aperture an arch on periphery extending like a loop onto convex involute side, but also laterally continuous with supplementary openings under umbilical flaps of final chamber on spiral side. Wall of test strongly, densely perforate, except for central flaps of spiral side, sutures and peripheral keel.

Size: Largest diameter of test 300–500 μm, its shortest diameter 260–370 μm, its height 135–220 μm.

Remark: Differs from Cibicides by the presence of spiral flaps on the test of *Hanzawaia producta* (TERQUEM).

Geographic and stratigraphic range: Known from Cuisian to Marinesian beds at several Paris Basin localities and from the Eocene of Belgium, Germany and the Netherlands. In Hungary, it occurs in the Lutetian of Weimpuszta. At Dudar, it is not too frequent in the Lutetian nummulitic-molluscan clayey sands.

Superfamilia: **R o b e r t i n a c e a** REUSS, 1850
Familia: **Ceratobuliminidae** CUSHMAN, 1927
Subfamilia: C e r a t o b u l i m i n i n a e CUSHMAN, 1927
Genus: *Lamarckina* BERTHELIN, 1881

Lamarckina erinacea (KARRER, 1868)
Pl. XXX, f. 1–2

1868. *Pulvinulina erinacea* KARR. — KARRER, F.: Sitz. Math. Nat. Akad. Wiss. Bd. 58. Abt. I. p. 187. Taf. V. fig. 6.
1964. *Lamarckina erinacea* (KARRER). — LOEBLICH, A.–TAPPAN, H.: Treatise, Invert. Paleont. Part C. Protista 2. p. C 769. fig. 631/4.

1970. *Lamarckina erinacea* (KARRER). — LE CALVEZ, Y.: Cahiers de Pal. C. N. R. Sc. pp. 203–204. Pl. 37. fig. 7.

Description: Studied material—4 specimens. Test hyaline, perforate, calcareous. Shape of test plano-convex. Spiral side convex, umbilical side almost plain. Equatorial section subcircular. Periphery blunt with very thick keel. Chambers arranged trochospirally. On spiral side, chambers of all whorls visible, on umbilical side only those of final whorl observable. Chambers rapidly growing in size, initially angled rhomboidal in shape, to become later increasingly more inflated. Youngest chamber hemispherical. Test consisting of a few chambers. On umbilical side, final chamber almost completely occupying half of area. Sutures on spiral side curved and heavily depressed, on ventral side radial and slightly depressed. Aperture situated on umbilical side. At umbilicus, a few chambers surround the deep and vaulted aperture. Spiral side irregularly, finely porate. Ventral side sporadically porate. Dorsal side heavily pitted and tuberculate, ventral side smooth and bright.

Size: Largest diameter in apertural view 410–440 μm, smallest diameter 380–410 μm, diameter of aperture 80–90 μm, height of test 230–250 μm.

Remark: The test of *Lamarckina erinacea* (KARRER) resembles that of *L. ovula* LE CALVEZ, but this one has a smooth dorsal side lacking tubercles. In addition, similar forms are *L. halkyardi* CUSHMAN and *L. hispida* COREYELL et EMBICH, forms figured by SACAL–DEBOURLE–CUVILLIER (1957) from the Upper Eocene of the Aquitanian Basin.

Geographic and stratigraphic range: Known from one or two localities in the Cuisian and Marinesian beds of the Paris Basin. In Yugoslavia it was found in Miocene deposits. At Dudar, rather sparse in Lutetian nummulitic-molluscan clayey sands.

Subfamilia: Epistomininae WEDEKIND, 1937
Genus: *Lamarckina* BERTHELIN, 1881

Schlosserina asterites (GÜMBEL, 1868)
Pl. XXX, f. 3–5

1868. *Rosalina asterites* n. sp. — GÜMBEL, C. W.: Abh. bayer. Akad. Wiss. X. Bd. II. Abt. p. 658. pl. 2. fig. 101a-c.
1875a. *Discorbina asterites* GÜMB. — HANTKEN, M.: Jb. geol. Anst. Bd. 4. p. 75.
1886. *Pulvinulina concentrica* PARKER et JONES. — UHLIG, V.: Jb. k. k. geol. Reichsanst. Bd. 36. Heft 1. p. 190. pl. 3. fig. 3, 4.
1954. *Schlosserina asterites* (GÜMBEL). — HAGN, H.: Contr. Cuch. Found. Foram. Res. Vol. V. Part 1. p. 18. Pl. 3. fig. 15 a, b, Pl. 4. fig. 1, 2.
1964. *Schlosserina asterites* (GÜMBEL). — LOEBLICH, A.–TAPPAN, H.: Treatise. Invert. Paleont. Part C. Protista 2. p. C 777. fig. 640/1.
1967a. *Stomatorbina torrei* (CUSHMAN et BERMUDEZ), 1937. — V. ZILAHY L.: M. Áll. Földt. Int. Évi Jel. 1965-ről. p. 404. Pl. VII. fig. 1–5.
1983. *Schlosserina asterites* (GÜMBEL). — SETIAWAN, J. R.: Utrecht Micropal. Bull. 29. p. 134. pl. XV. fig. 1.

Description: Studied material—8 specimens. Wall hyaline, perforate, calcareous. Shape biconvex, low-spired. Test outline round with keeled periphery. Dorsal side convex, ventral side flat or slightly concave and involute. Chambers arranged trochospirally. All chambers on the dorsal side are visible, though in the central area the chambers are partially hidden by the heavily thickened suture. On ventral side, only chambers of final whorl visible. Chambers angled rhomboidal in shape, growing in size from oldest towards youngest. On dorsal side, final whorl composed of six chambers. On ventral side 6–7 chambers visible, final chamber being heavily inflated as compared to preceding ones. Umbilicus narrow and deep. On dorsal side, sutures limbate, slightly arcuate, extending on to peripheries, resulting in keeled periphery. On ventral side, sutures between chambers straight, radial and deep. Aperture multiple. Primary aperture on umbilical side a narrow slit at base of final chamber. Secondary apertures on ventral side of each chamber, close to periphery of test and parallel to it, being filled with lighter shell material. In addition, there are radially arranged openings along the septa on the ventral side. Finally, several pores can be observed on the final chamber face. Now and there they appear already on the surface of earlier chambers. Pore diameter 20–40 μm.

Size: Largest diameter of test 610–1750 μm, smallest diameter 480–1250 μm, height 275–725 μm.

Remark: On GÜMBEL's original figure a small umbilical plug on the ventral side can be seen which may be either a cavity-fill or an error of drawing. This species of GÜMBEL was revised by H. HAGN (1954). The appearance on earlier chambers of ventral pores is not mentioned in his description of the species. V. UHLIG (1886) gave a good description of this species which he referred to as *Pulvinulina concentrica* PARKER et JONES, but it is not identical with PARKER's original species which was described as a now-living form from Shetland Island. It corresponds, however, very well to the specimens studied by the present writer. *Schlosserina asterites* (GÜMBEL) is strikingly similar to *Stomatorbina torrei* (CUSHMAN et BERMUDEZ). The main difference between the two is that asterites has a multiple system of apertures and that there are pores on the ventral side of the final chamber and that the septa on the dorsal side are a little more inflated. Thus the two species may be identical. LOEBLICH et TAPPAN discussed the two genera separately. X-ray analysis has detected the presence of calcite in the wall of Schlosserina with traces of aragonite in some parts of it, whilst the wall of Stomatorbina is composed of aragonite. The number of specimens available is not enough for settling the question definitively.

Geographic and stratigraphic range: Occurs in the Eocene Stockletten Marl of the Bavarian Alps, in the Eocene of the Polish Carpathians, and the Priabonian of Italy. In Hungary it is common to the Upper Lutetian and the Priabonian *Nummulites fabianii* Horizon in the Bakony, Bükk and Esztergom areas. In addition, it was reported from the "*Clavulina szabói*" Beds. At Dudar, not too frequent in Lutetian nummulitic-molluscan clayey sands.

3. Biostratigraphic interpretation

The nummulitic-molluscan clayey sand of Dudar forms the basal part of the Mór Siltstone Formation, being separated by a transitional layer of 30 to 50 cm thickness from the coal measures assigned to the Tatabánya Formation. It is overlain by limestones that commonly vary in thickness (main nummulitic limestone: Szőc Limestone Formation) and that are readily divisible into biostratigraphic horizons, being followed, in turn, by a marl layer abounding with planktonic organism (Mór Siltstone Formation).

Data concerning the age of the clayey sands from Dudar studied by me are to be found in works of several authors.

E. Szőts (1956) divided the Middle Eocene into Londonian, Lutetian and Bartonian stages and assigned the "molluscan–nummulitic clayey sands" of Dudar to the Londonian.

The age of the upper seam of the coal measures of Dudar was determined as Upper Lutetian (Kopek–Kecskeméti 1964a, b, 1965a, b, Kopek–Kecskeméti–Dudich 1965, 1966, Kopek–Dudich–Kecskeméti 1971a, b, Kopek 1980). The clayey sand that follows almost immediately above the former should be assigned to the same stratigraphic unit.

L. Strausz (1966) considered the same formation, by relying on the gastropodal fauna from it, to be Lutetian in age, too.

I have attempted to assess the clayey sand layer under consideration biostratigraphically—for lack of planktonic Foraminifera—by relying on the time ranges of the benthonic forms. Although most of the benthonic forams can be used primarily for paleoenvironmental interpretations, some species or groups may well be of biostratigraphic value. The more species are understood in terms of time range, the higher certainty and precision may be achieved in our assessment of the possible age of the formation being studied.

For a clarification of the chronostratigraphic units involved, let us present, in a separate table (Table 1), those planktonic and nannoplanktonic biozones within the Eocene that have found an ever widening and ever more general use. The radiometric dates of the particular time units within the table derive from the work of Hardenbol–Berggren (1978). The chronostratigraphic classification and the planktonic and nannoplanktonic biozones have been borrowed from the compilation of Bignot and Cavelier (in Pomerol 1981). In the afore-mentioned volume the authors gave the planktonic zones in a synthesized form based on Bolli (1966), Berggren (1971) and Stainforth et al. (1975)—classification that has found widest acceptance on a worldwide scale. Some of the above zones could be identified in Hungary as well (L. Vitális–Zilahy 1967b, 1971, K. Horváth–Kollányi 1983).

Bignot and Cavelier (in Pomerol 1981) divided the Middle Eocene, on the basis of Martini's (1971) nannoplankton studies, into Lutetian and Bartonian stages. This view stemmed from the fact that it had been ascertained that the original stratotype of the Lutetian represented only the lower interval of the Middle Eocene. Within this one, Martini (1971) could prove by nannoplanktonic results (NP 17 zone) that the Bartonian stage postdated the Lutetian, but that it predated the Priabonian. Thus, the Bartonian is now regarded as belonging to the upper part of the Middle Eocene.

In the Parisian basin, the Auversian, Marinesian and Ludian formations that had formerly been looked at as independent stages (Pomerol 1962, 1973, 1981, Pomerol et al. 1965, Le Calvez 1970), were identified with the Bartonian and assigned to the Upper Eocene, similarly to the case of the Bartonian which, at that time, was still being regarded by all as Upper Eocene. A recent argument in favour of the Middle Eocene assignation of the Bartonian is the fact that Bigg (1982), while studying the Auversian profile of Le Guepelle, identified Middle Eocene planktonic forams—*Truncorotaloides pseudodubius* (Bandy) (=*T. rohri* Brönnimann et Bermudez) and *Morozovella spinulosa* (Cushman).

With a view to the foregoing, I accept to opinion suggesting that the Middle Eocene is divided into Lutetian and Bartonian stages and it is in this sense that the terms under consideration will hereinafter be referred to.

In Table 2 the time ranges, based on the available literature, of all the benthonic species identified by me from the nummulitic—molluscan clayey sands of Dudar are summarized.

The stage names are used as given in Table 1.

All species recovered from the studied material have been figured in the succession of their appearance. The stratigraphic range of some species is uncertain, since they derived from localities which had been described long ago and which may have changed in stratigraphic assignment which I have been unable to check.

As obvious from the tabulation, the fauna of Dudar is Middle Eocene in age, belonging rather to the middle part of this stratigraphic unit.

This opinion is supported by the presence of *Valvulina pupa* D'ORB., *V. guillaumei* LE CALVEZ, *Miliola brevidentata* (LE CALVEZ), *Discorbis rotata* (TERQUEM), *Rotalia trochidiformis* LAMARCK, *Cibicides robustus* LE CALVEZ which are hitherto known solely from the middle Middle Eocene.

To approach the problem from a different direction, I have carried out the study of borehole Dudar 240 which intersected with no interruption the whole sequence overlying the coal measures. The results are listed in Table 3. In the borehole the coal measures (Tatabánya Formation) is overlain, between 268.3–268.7 m, by the nummulitic—molluscan sands (Mór Siltstone Formation) studied by me. Above it the so-called main nummulitic limestone (Szőc Limestone Formation) follows with a continuous transition up to 218.0 m. Last to follow is the foraminiferal marl (Mór Siltstone Formation) up to 145.3 m.

This sequence exhibits, typically enough, the Eocene stratigraphy in the Dudar basin. The limestone and the marl may considerably vary in thickness in dependence on whether a marginal or a basinal facies is being dealt with. The limestone facies within the basin may be completely replaced by foraminiferal marls that may attain even 120–140 m in thickness (SZŐTS 1956), whereas in the marginal zone of the basin a limestone sequence about 100 m thick (SZŐTS 1956) may be encountered.

In the borehole, in the 268.3–268.7 m interval, a faunal assemblage similar to the one recoverable from the decanted clay can be found, but it is much more scant and more poorly preserved than this one. In the rock mainly thicker-walled forms can be found which occur very frequently in the gastropod shellfill, e.g. *Halkyardia minima* (LIEBUS), *Pararotalia inermis* (TERQUEM), *Clavulina parisiensis* D'ORB.; forms of thinner shell wall are sparsely represented: *Cibicides carinatus* (TERQUEM), *Discorbis perplexa* LE CALVEZ, etc.

The main nummulitic limestone almost 50 m thick above the clayey sand has not been analyzed for smaller Foraminifera. The larger Foraminifera recovered from the limestone and the gastropod shells: *Nummulites puschi* D'ARCHIAC, *N. majzoni* KECSKEMÉTI, *N. iohannis* KECSKEMÉTI, *N. zircensis* KECSKEMÉTI, *N. variolarius* (LAMARCK) etc., suggest that both the nummulitic—molluscan clayey sand and this part of the Szőc Limestone Formation represent the upper part of the Middle Eocene (oral communication by T. KECSKEMÉTI).

The limestone is overlain with a continuous transition by the foraminiferal marl of the Mór Siltstone Formation (218.0–145.3 m). Higher up the borehole, the planktonic forams are becoming gradually more significant, along with the benthonic ones, which they will finally outnumber.

To make it more clear, I have shown in Table 4 the stratigraphic ranges of the planktonic forams occurring in borehole Dudar 240, the data having been taken from the relevant literature.

From 218.0 m higher upwards, the planktonic forams characteristic of the Middle Eocene and getting extinct at the top of the Middle Eocene such as *Truncorotaloides topilensis* (CUSHMAN), *T. rohri* BRÖNNIMANN et BERMUDEZ, *Globorotalia spinuloinflata* (BANDY) and *G. spinulosa* CUSHMAN, etc. gradually appear. The same holds true of *Globigerina theka mexicana barri* BRÖNNIMANN appearing as late as the top of the Middle Eocene *Globigerinatheka subconglobata* Zone. Thus the conclusion can be drawn for certain that even the 218.0–170.6 m interval of this borehole cannot be older than the upper part of the Middle Eocene *Globigerinatheka subconglobata* Zone.

Between 170.6 and 155.2 m, the planktonic forams are found in ever growing numbers of species and specimens. Upper Eocene forms such as *Globigerina corpulenta* SUBBOTINA and *Globigerinatheka subconglobata luterbacheri* BOLLI gradually appear too, but these species are still concurring with forms getting extinct at the top of the Middle Eocene such as *Truncorotaloides rohri* BRÖNNIMANN et BERMUDEZ, *T. topilensis* (CUSHMAN), *Globorotalia spinulosa* CUSHMAN, *G. spinuloinflata* (BANDY), *G. bullbrooki* BOLLI, *G. lehneri* CUSHMAN et JARVIS, etc. The concurrence of the afore-listed species indicates that this interval of the borehole must belong to the *Truncorotaloides rohri* Zone.

From 155.2 m onwards, the forms getting extinct at the top of the Middle Eocene disappear and the species *Globigerinatheka semiinvoluta* (KEIJZER) appears. Both the appearance and the extinction of this species fall into the lower zone of the Upper Eocene, i.e. into the *Globigerinatheka semiinvoluta* Zone. Along with it, several Upper Eocene forms such as *Globigerinatheka index tropicalis* (BLOW et BANNER), *Globorotalia cerroazulensis cerroazulensis* (COLE), and *Globigerina gortanii praeturritillina* BLOW et BANNER, etc. appear, too.

This is by and large the same as the Upper Eocene *Isthmolitus recurvus* Zone (above 155.2 m) described from borehole Dudar 240 in BÁLDI–BEKE 1971 which begins a little bit above the Middle Eocene—Upper Eocene boundary.

SAMUEL (1972) elaborated the planktonic Foraminifera fauna from several Bakony Mts boreholes, including Dudar 240. In the light of the results arrived at he believed to have discovered at the Middle/Upper Eocene boundary in the Bakony Mts the *Turborotalia (A.) rotundomarginata* Subzone established by SUBBOTINA (1953). In his opinion, the species *Truncorotaloides* ex gr. *rohri* BRÖNNIMANN et BERMUDEZ and *Globigerapsis mexicana* (CUSHMAN) [=*Globigerapsis semiinvoluta* (KEIJZER)] occur together. This means that he postulated the non-extinction of the Truncorotaloides species in latest Mid-Eocene time in the Bakony Mts, arguing that they are still present at the base of the Upper Eocene. The upper boundary of the Middle Eocene in borehole Dudar 240 is drawn by him at 178.0 m which is probably due to the afore-mentioned caus es. The fact is, however, that there is no other literature reference to the occ ur rence of Truncorotaloides species in Upper Eocene deposits and even the probability of their local survival in what is now the Bakony Mts is infinitesimal. In modern syntheses the lower boundary of the Upper Eocene is reckoned from the extinction of the Truncorotaloides species and the first appearance of *Globigerinatheka semiinvoluta* (KEIJZER), respectively.

By the way, my own studies have not confirmed the above suggestions of SAMUEL, as the fauna of samples from both below and above 178.0 m is nearly the same, there being nothing to justify their separation.

All in all, let us conclude that the rock enclosing the studied foraminiferal fauna, i.e. the nummulitic—molluscan clayey sand belonging to the lower part of the Mór Siltstone Formation, is dated, in terms of benthonic smaller forams, as the middle of the Middle Eocene. This would correspond, with high probability, to the *Morozovella lehneri* (=*Globorotalia lehneri)* Zone.

This assignation is supported by the age of the overlying formations, too. The limestone grading out of the clayey sand marks, even in terms of the larger foraminiferal record, the upper Middle Eocene *Nummulites perforatus* Horizon (oral communication by T. KECSKEMÉTI). The age of the foraminiferal marl grading out of this, similarly with no break in sedimentation, van be verified by planktonic forams and it does certainly not predate the *Morozovella lehneri* Zone, but its uppermost interval already belongs to the Upper Eocene *Globigerinatheka semiinvoluta* Zone. Exact zonal boundaries could be traced only at the Middle/Upper Eocene boundary and at the base of the *Truncorotaloides rohri* Zone. The limestone and the lower part of the foraminiferal marl belong very probably to the *Morozovella lehneri* and *Orbulinoides beckmanni* Zones, but no precision to their exact position therein can be added.

4. Paleoecological interpretation

The soundest base for paleoecological conclusions from the composition of the fossil material is provided by studies on now-living faunal associations. By virtue of the principle of actualism similar faunal composition is with high probability the reflection of similar paleoenvironments.

The habitat of benthonic Foraminifera is characterized by particular physical, chemical and biological factors. Physical factors are water depth, temperature, light penetration, water movement and type of bottom. The chemical factors include the salinity of the seawater, the distribution of the chemical elements, etc. Finally, the biological factors include food and possibilities for its recharge, symbiotic organisms, parasites, scavengers, etc.

Their is a wealth of literature devoted to the ecology of now-living Foraminifera. This is owed mainly to oceanographic research that has gradually grown in intensity since the 1960's.

In compiling this work I have used primarily the syntheses of PHLEGER (1960), PHLEGER–PARKER (1951) and MURRAY (1968a, b, 1973) as well as M. HORVÁTH's dissertation submitted in 1980 for acquisition of the academic degree of candidate for D. Sc.

The ecological interpretation of the fossil material was handicapped by two things. On the one hand, the fact that the benthonic forams studied were recovered from a particular lithostratigraphic unit (the basal 1–2 m of the Mór Siltstone Formation) rather than a particular profile. On the other hand, that these forams derived from the shell-fill of larger gastropods. This second fact may have led to some change, though by no means significant, in the composition of the fauna.

The nummulitic—molluscan clayey sand intersected by borehole Dudar 240 in the 268.3–268.7 m interval above the coal measures yielded a foraminiferal assemblage essentially identical with the one discussed here, but much more scant and more poorly preserved. From this fact two conclusions can be drawn: 1. the forams and the gastropods are geologically coeval, 2. the gastropod shells prevented the forams from being affected by tear and wear, fracturing and postdepositional dissolution—processes that must have been significant given the presence of shells that were agitated together with the paleoenvironment.

To check any possible winnowing effect, I sought to determine, whenever allowed by the material, the differences in faunal composition correlatable with the different gastropod species. The differences however, have proved to be infinitesimal: now significant difference in the proportions of the same foraminiferal species silted into the shells of the particular gastropod species could be found.

Analytical techniques

Because of the very nature of the material studied only relative frequency values as related to the whole material could be determined. Expressed in percentages, these values give the ratios of the individual species relative to the total number of specimens.

In addition to this, the amount of the material has enabled me to determine the absolute frequency by relying on the shell-fill of a few *Velates schmideli* and *Campanile urkutense* specimens, i.e. from a total of 5 grams of decanted material. Here too, the per cent distribution of the species was indicated.

The numbers of specimens of the species have enabled the calculation of the per cent distribution of three suborders: Textulariina, Miliolina and Rotaliina which is shown in a triangular diagram plotted as proposed by MURRAY (1973) (Fig. 3).

The paleoenvironment can be readily identified by using the FISHER index (FISHER et al. 1943), as proposed by MURRAY (1973):

$$\alpha = \frac{n_1}{x},$$

where x = a constant value less than one
$n_1 = N(1-x)$
N = size of population

Having known the numbers of species and specimens, I read off the result from MURRAY's (1968b, 1973) diagram (Fig. 4).

In addition, the per cent distribution of the sessile forams anchored to the bottom or fixed to plants can be determined, too.

Analytical results

The per cent distribution of the species identified is given in Table 5.

The per cent distribution of the suborders Textulariina, Miliolina and Rotaliina, as calculated from the numbers of specimens of the species, is plotted in form of a triangular diagram after MURRAY (1973) (Fig. 3). Here three dots are given. One of them represents the per cent composition of the fauna as a whole, the other two dots show the percentages of the fauna deriving from the shellfill of the gastropod species *Velates schmideli* and *Campanile urkutense.*

As suggested by the percentages of the three suborders, all three dots representing the fauna of Dudar are located within the "coastal lagoon" field.

The whole fauna is dominated by Rotaliina sharing 67.93%, the share of Textulariina is rather subordinate, 5.72%, that of Miliolina being 26.35%.

Frequent among the species are: *Pararotalia inermis* (TERQUEM) 17.01%, *Cibicides* 12.43%, *Acervulina dudarensis* n. sp. 10.91%, *Asterigerina rotula* (KAUFMAN) 10.9%. Relatively frequent are, in addition, *Quinqueloculina seminulum* (LINNÉ) 8.15% and *Nubecularia lucifuga* DEFRANCE 6.38%.

The planktonic Foraminifera are missing from the fauna. The benthonic, assemblage is represented by comparatively high numbers of specimens and by a high diversity, the FISHER index being $\alpha = 10$ (Fig. 4).

The share of the species attached to the bottom or to plants (attached forms) is 30.73%.

Modern counterparts

It is in the chapter on the Mediterranean Sea in J. W. MURRAY's superb monograph (1973) that the greatest number of data that might serve as modern analogies for our case can be found. In the E Mediterranean, in an algal mat environment down to a maximum of 10 water depth, a similar foraminiferal association occurs (Crete island, N part of the Aegean Sea). This algal environment provides a habitat favourable for Foraminifera, because it does not only provide plenty of food for them, but the conditions it offers for their reproduction are excellent, too.

On the Province Coast (BLANC–VERET 1969 in MURRAY 1973) an intricate web of Posidonia (seaweed) blades provides a favourable habitat. *Nubecularia lucifuga* DEFRANCE, Cibicides species and the genus Acervulina are to be found on this coast in approximately the same percentage as it is the case with the fauna of Dudar. Posidonia live beneath the sublittoral zone, being most abundant at 15 m depth, though, in waters well penetrated by the sunlight it may be found down to 50 m (B. GÉCZY 1972).

Judging by observations made in modern environments (MURRAY 1968a, 1973), the ecological data of the most abundant genera from the fauna of Dudar are as follows:

Acervulina live in normal marine environments, in temperate inner shelf areas, from 0 to 60 m depth.

Asterigerina inhabit normal seawater, living on the surface of bottom deposits, in tropical—subtropical environments, in inner shelf areas.

Cibicides live in normal seawater, attached to plants, the bottom, bivalves or other living animals, under climates ranging from cold to tropical, from 0 to 2000 m depth.

Discorbis occur in normal seawater, under climates above 12 °C, in the 0–50 m depth range of inner shelf areas.

Quinqueloculina are associated with environments with a salinity above 32‰, living on sandy bottoms and attached to plants, from temperate to tropical climatic zones (though some species endure cold water as well), from 0 to 40 m, on inner shelfs and in hypersaline lagoons.

Rotalia are associated with seawaters of a salinity of 36 to 38‰, at temperatures of 14–25 °C, in the depth range of 0–40 of inner shelf areas.

Paleoecological conclusions

As shown by MURRAY (1973), one of the possibilities for an ecological evaluation of the fauna is provided by the diversity index α. In case of marine lagoons, the value of α varies between 4 and 11, but in euhaline lagoons it is higher than 7.5. In addition, the subordinate role of Textulariinae is conspicuous. The water depth in these lagoons attains a maximum of 25 m, being, in average, about 10 m. In the studied material the value of α is 10, consequently, it belongs to the euhaline marine lagoon (20 m water depth) category. The same circumstance is suggested in the studied material by the low amount of Textulariinae (5.72%).

That the faunal assemblage is indicative of a normal coastal lagoon can be read off the triangular diagram (Fig. 3), too. The same result is given by the percentages calculated from 5 g of weighed decantation residue recovered from the shellfill of *Velates schmideli* and *Campanile urkutense*. A possible explanation for this fact is that the gastropods lived in the same biotope as the forams and that postmortal washing caused no substantial separation. This suggestion is supported by the fact that the shellfill does not differ from the enclosing rock—both are clayey sands.

In the context of the gastropod fauna, L. STRAUSZ (1966) suggested an environment having a salinity slightly below the normal, a weak agitation of the water and the presence of a wellsheltered basin portion.

In the light of the results of her green algal studies, E. KRIVÁN–HUTTER (1957) postulated, for the same environment, a tropical-subtropical climate, a water depth of a maximum of 30, heavy agitation of the water along the shoreline and a clayey-sandy bottom.

With a view to the foregoing, our interpretation of the paleoenvironment may be summarized as follows: the forams lived in a seawater of normal salinity under a tropical-subtropical climate, in presence of an algal, seaweeds-overgrown bottom, in the shallow-sublittoral zone, at a water depth of 10–20 m in lagoons sheltered from heavy wave action, where the presence of medium to coarse-grained sands suggests a nearby coastline.

Given the specifically rich fossil assemblage, no significant freshwater influence can be reckoned with. The lagoon may have communicated with the open sea, whence a seawater recharge may have been arriving.

5. Paleobiogeographic interpretation

In the Dudar area the abundance of the benthonic smaller foraminifera fauna of the Middle Eocene, Bartonian, nummulitic-molluscan clayey sands provides superb possibilities for comparisons with faunas from other regions. No paleobiogeographic study based on benthonic smaller forams has ever been made in the study area, but the conclusions based on other fossil groups and the paleogeographic and geohistoric syntheses available in the relevant literature have provided a lot of help in my evaluation of the results arrived at.

T. KECSKEMÉTI (1980) pointed out that the Upper Lutetian Nummulites fauna of the Bakony belongs, in terms of paleogeographic position and faunal composition, to the northern margin of the Mediterranean faunal province. As a result of the so-called "Perforatus regression", the ties of kinship with the E Atlantic Aquitanian Basin became more pronounced in Late Lutetian time, whilst the connections with the Parisian Basin were infinitesimal.

L. STRAUSZ (1966) elaborated the gastropodal fauna of the nummulitic—molluscan clayey sands studied by the present writer, too. (The benthonic smaller Foraminifera derive from the shell-fill of these gastropod.) Of the 100 molluscan species suitable for comparison, 40 were found by L. STRAUSZ, to be common with the fauna of the Paris Basin, where they occur mainly in Middle or Middle-Upper Eocene deposits. He compared the same fauna with the Eocene fauna of Italy (Monte Postale: Lower Lutetian; Ronca, Ilarione: Upper Lutetian localities) and as a result of this work, he found a total of 48 species in common.

As far as the benthonic smaller foraminifera fauna under study is concerned, I could compare it primarily to the fauna of the Paris Basin. This is due to the fact that the Paris Basin deposits are best exposed, having been studied for the longest time and most profoundly, of all the occurrences of similar age. The processing of the forams occurring there has been carried on on a large scale since the beginning of this century (A. D'ORBIGNY 1826, M. TERQUEM 1882, Y. LE CALVEZ 1947, 1949, 1950, 1952, 1970). Y. LE CALVEZ (1970), in her work devoted to the Paleogene Foraminifera of the Paris Basin, published hundreds of SEMGs that can be used excellently for identification purposes. No similarly rich and well-documented synthesis concerning areas lying nearer Hungary is known to me in the literature available.

My first attempt at a comparison was reported in the paper I presented at the Second Symposium on Benthonic Foraminifera and published in the Benthos '83 Proceedings (K. HORVÁTH–KOLLÁNYI 1984). In the present chapter I want to present and expound in detail the results of further studies of the reported material.

In Table 6 the occurrence of the species in common with the Dudar locality in various stratigraphic horizons of the Paris Basin is given. My studies have led to the result that of the 63 species described from Dudar, 47 are common with the Paris Basin fauna which constitutes 68.4% of the total fauna. As obvious from the tabulation, the correspondence is the strongest with Zone IVa in the Paris Basin, which is identical with ABRARD's (1925) *Cerithium giganteum* and *Orbitolites complanatus* zones. A marked role in this coincidence is played by the very similar lithofacies of the two formations.

Judging by the pronounced likeness between the Paris Basin fauna and the studied fauna of Dudar, there must have been some communication between the two regions.

As E. DUDICH and G. KOPEK (1980) pointed out, the Late Lutetian transgression reached the Bakony area from the SW, having crossed Istria and S Austria (region of Guttaring) and the Zala Basin. In the Dudar basin the Late Lutetian marshland (upper browncoal measures) was invaded by the *Nummulites perforatus* transgression—a process during which connections with areas farther to the NE and with the sea branch S of Lake Balaton came into being.

The benthonic foraminiferal assemblage of Dudar shows Mediterranean faunal characteristics. Its habitat was the N shelf zone of the Mediterranean Sea which intruded from a SW direction progressively into the present-day subbasins. Its connections with the N faunal province are traceable along a roundabout line westwards, through what is now Istria, Italy and the Aquitanian Basin and then the Paris Basin on the one hand and trough the Russian Platform on the other (T. BÁLDI 1982).

Additional data confirming the foregoing are offerred by a comparison of the Lutetian smaller Foraminifera fauna of the locality of Cauneille in the Aquitanian Basin with the fauna of Dudar. From the afore-mentioned locality E. SZŐTS (1973) described a rich benthonic and planktonic foraminiferal assemblage and has given me the fossil material for study. While studying it I could identify 18 species in common with the Dudar fauna, as follows: *Globulina gibba* D'ORB., *Guttulina irregularis* (D'ORB.), *Baggina subconica* (TERQ.), *Asterigerina bimammata* (GÜMB.), *A. rotula* (KAUFM.), *Rotalia tuberculata* SCHUBERT, *Pararotalia inermis* (TERQ.), *Cibicides carinatus* (TERQ.), *C. robustus* LE CALV., *C. sublobatulus* (GÜMB.), *Eoannularia eocenica* COLE et BERMUDEZ, *Acervulina dudarensis* n. sp., *Sphaerogypsina globula* (REUSS), *Fabiania cassis* (OPP.) *Halkyardia minima* (LIEBUS), *Eorupertia cristata* (GÜMB.), *E. magna* (LE CALV.), *Schlosserina asterites* (GÜMB.).

I made an attempt to compare the Dudar material with the similarly rich fossil assemblage of the Bavarian Alps as well. I had the opportunity to study the material of several localities from the Bavarian Alps as well: Eitel-Graben, Kressen-Graben, Küchbach-Gebiet, Höll-Graben Südlich Bad Adelholzen, etc. (collection sampled by M. BÁLDI-BEKE). When studying it I had to realize soon that the faunal composition was completely different, that there was no form in common: a fact probably due to differences in faunal province. The hundreds of species described from the localities in the Bavarian Alps too include only five species that can be found at Dudar as well. Here they are: *Asterigerina bimammata* (GÜMB.), *A. rotula* (KAUFM.), *Cibicides sublobatulus* (GÜMB.), *Eorupertia cristata* (GÜMB.), *Schlosserina asterites* (GÜMB.).

Having compared the faunas from Dudar, the Aquitanian Basin (Cauneille), the Paris Basin and the Bavarian Alps, I have the feeling that while of the 63 species of the Dudar fauna 5 are common with the fauna of the Bavarian Alps, the Dudar species in common with the fauna of the Aquitanian Basin are 18, the ones in common with the Paris Basin being 47 in number. The 18 species in common with the Aquitanian Basin include the five species that occur in the Bavarian Alps as well. Should the faunal exchange have occurred through the Paris Basin, so the fauna of the Bavarian Alps ought to be represented there in an even higher percentage. I have found no reference of this kind in the literature available to me.

The marked divergence from the fauna of the Bavarian Alps also supports the idea suggesting the existence in Lutetian time of a northern flysch sea, where the Eocene sediments of the Bavarian Alps were deposited, and the existence farther to the SW, with a landmass in between, of a vast Tethyan shelf zone. It was in a NE-directed gulf of this shelf sea that the whole Eocene of the Transdanubian Central Range was formed (T. BÁLDI 1982). This is how the marked divergence of the Eocene faunas in Slovakia and the Transylvanian Basin, both regions being comparatively near, from their counterpart of Dudar can be explained, for, the Dudar area was occupied by gulfs of the northern flysch sea and these had no direct communication with the Bakony area.

S u m m a r i z i n g the foregoing, let us conclude that the analytical results on benthonic smaller forams that were never studied from this point of view heretofore corroborate the paleogeographic interpretation postulated by relying on fossil groups and geological evidence, suggesting that the Middle

Eocene deposits of the Bakony Mountains (and of the Transdanubian Eocene area, respectively) were laid down in the N shelf zone of the Tethys. The existence of a direct faunal connection with areas farther to the N and E (Slovakia, Bavarian Alps, Transylvania) can be precluded. It is to the Paris Basin that the resemblance of the benthonic smaller foraminifera fauna is most striking. This resemblance is much more pronounced than it is the case with the molluscs and even more so as compared to the larger forams that are particularly sensitive to the facies.

The striking likeness of the benthonic smaller foraminifera fauna to its Paris Basin counterpart confirms the postulated direct marine communication with the Paris Basin which was probably maintained through the N shelf of the Tethys, the Aquitanian Basin and the eastern margin of the Atlantic Ocean.

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TÁBLÁK – PLATES

I. tábla — Plate I

1—3. *Textularia minuta* TERQUEM

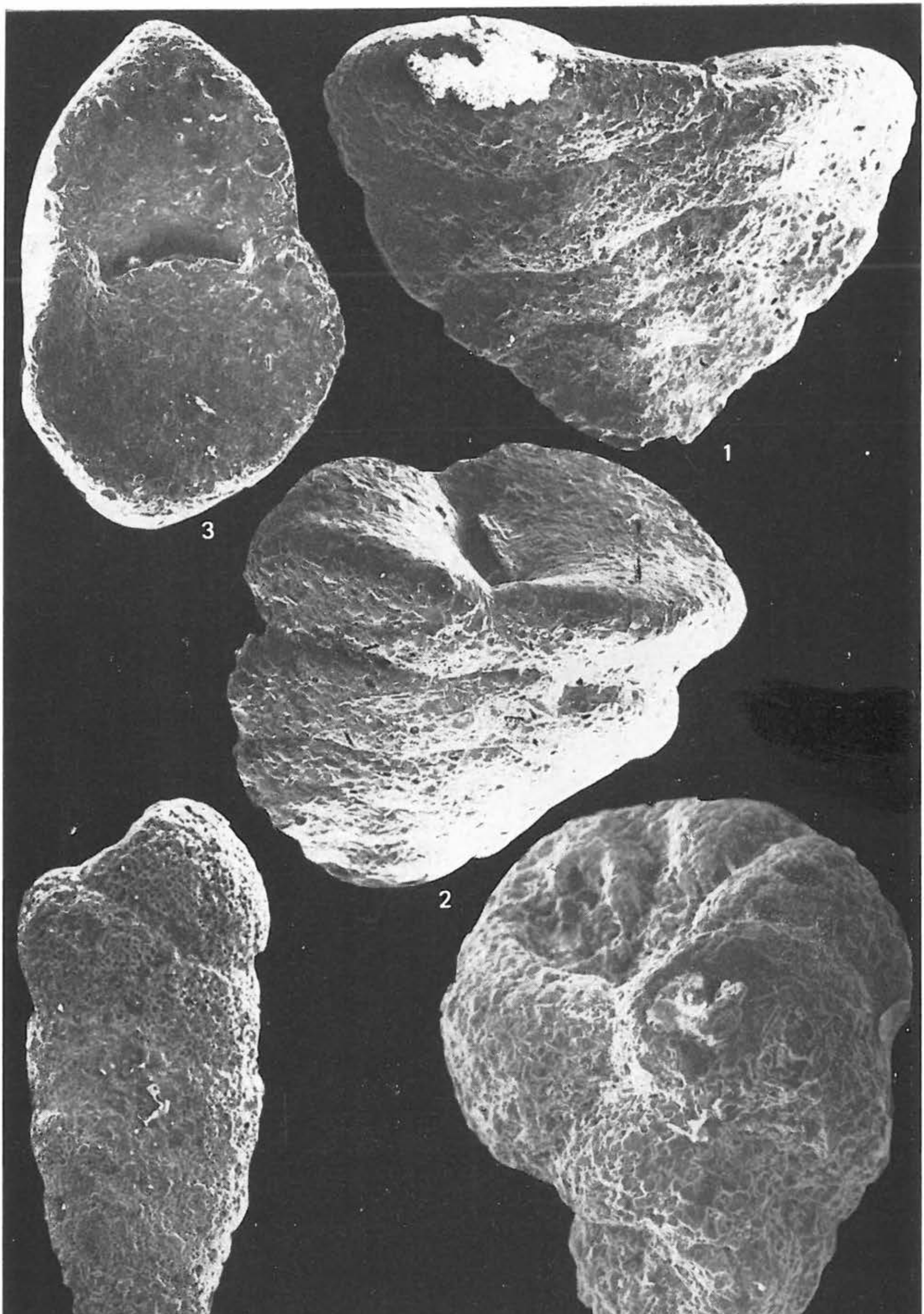
1. A ház oldalnézete a biszeriálisan rendezett kamrákkal. — Lateral view of test with chambers of biserial pattern. 60×
2. Az előző példány kissé megdöntve. Jól látszik a keskeny peremmel ellátott szájnyílás is. — The same specimen, slightly tilted. Note the aperture provided with a narrow peristome. 78×
3. Az előző példány szájnyílás felőli nézete a két utolsó kamrával és a résszerű szájnyílással. — Apertural view of the same specimen with the last two chambers and the slot-like aperture. 78×

4. *Textularia* sp. 48×

A ház oldalnézete a biszeriálisan rendezett kamrákkal. — Lateral view of test with chambers of biserial pattern.

5. *Valvulina guillaumei* LE CALVEZ. 78×

A házon láthatók a korai triszeriálisan rendezett kamrák, valamint a kitekeredett kamrák által körülvett szájnyílás. — The early chambers of triserial pattern and the aperture surrounded by the uncoiled chambers.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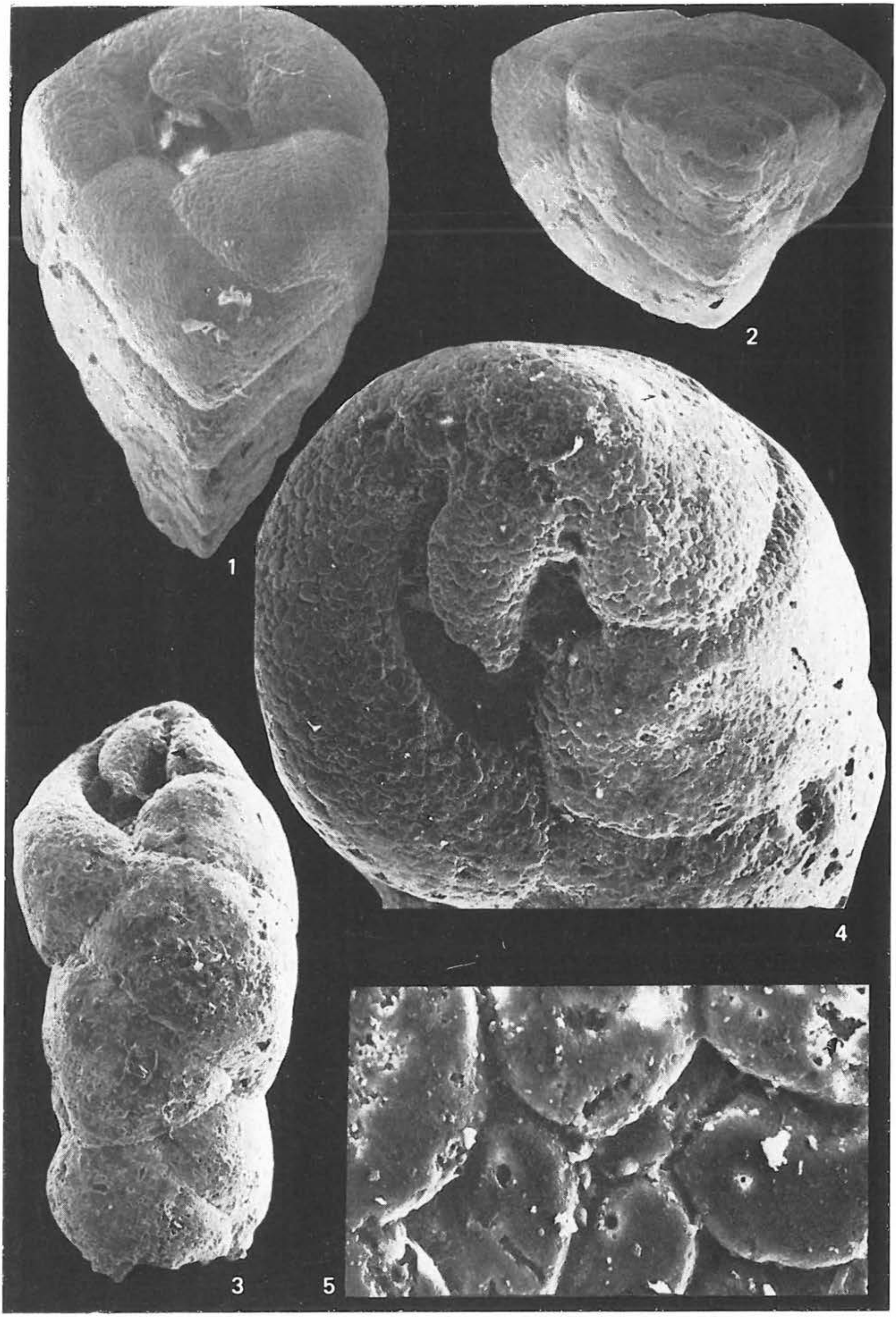
II. tábla — Plate II

1–2. *Valvulina limbata* TERQUEM. 60×

1. A szájnyílás oldalnézete a triszeriális kamrákkal, valamint a szájnyílás a valvuláris foggal. — Lateral view of the aperture with the triserial chambers, and the aperture with the valvular tooth.
2. A szájnyílással ellentétes oldal nézete a legidősebb kamrákkal. — The same specimen from the side opposite to the aperture, with the initial chambers.

3–5. *Valvulina pupa* D'ORBIGNY

3. A ház oldalnézete a szájnyílással. — Lateral view of test with the aperture. 40×
4. Kinagyított részlet a szájnyílásban látható nagy valvuláris foggal. — Enlarged detail of the same specimen with a large valvular tooth visible in the aperture. 86×
5. A házfal kinagyított részlete, ahol az agglutinált szemcsék láthatók. — Enlarged detail of the wall, where agglutinated grains are observable. 1000×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III. tábla — Plate III

1—2. *Valvulina triangularis* D'ORBIGNY. 60×

1. A ház oldalnézete a triszeriális és a spirálisan felcsavart kamrákkal. — Lateral view of test with the triserial and the spirally coiled chambers.
2. Az előző példány szájnyílás felőli nézete a szájnyílással és a kisméretű foggal. — Apertural view of the same specimen with the aperture and small sized tooth.

3—4. *Clavulina parisiensis* D'ORBIGNY

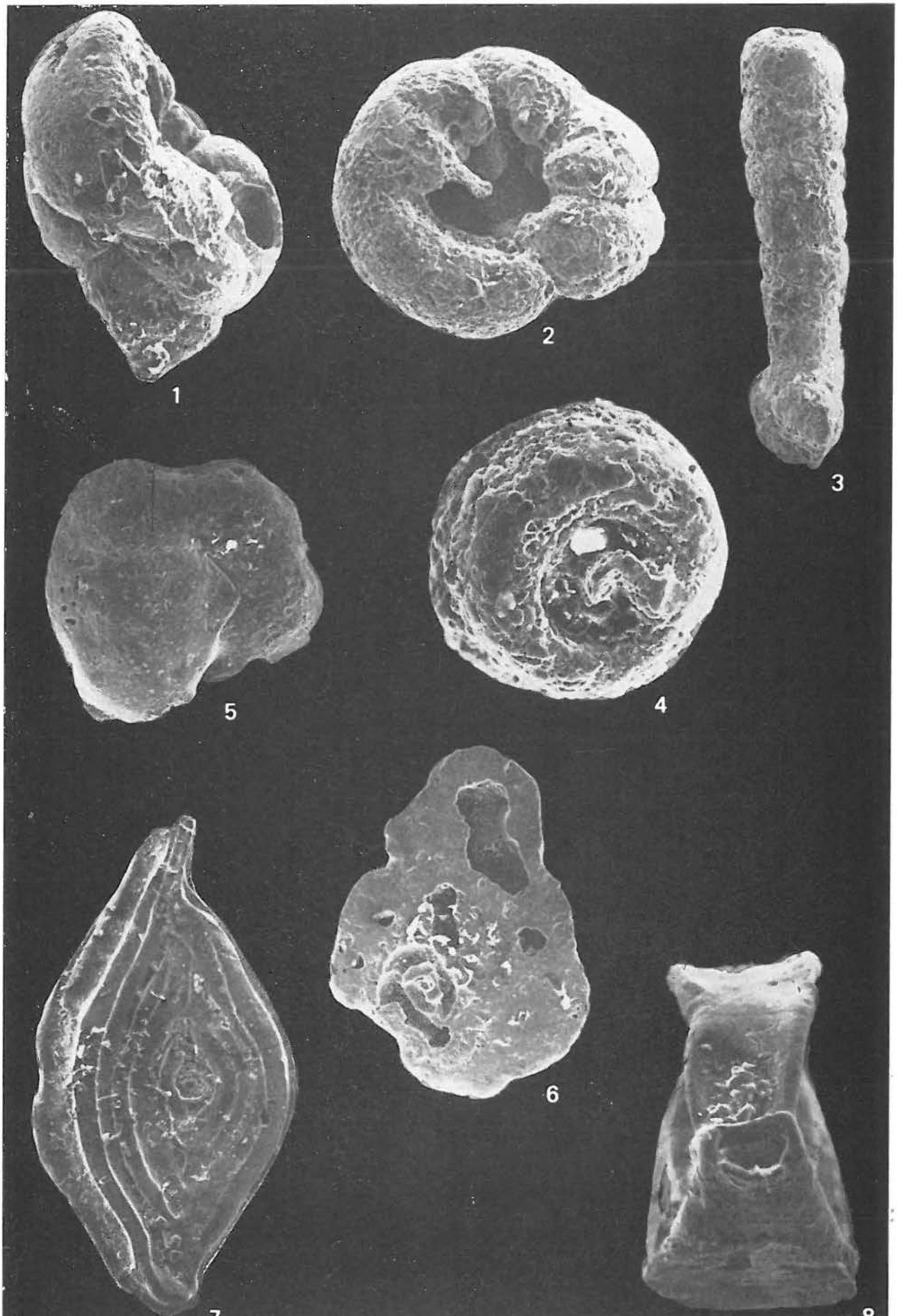
3. A ház oldalnézete a triszeriális és uniszeriális kamrákkal. — Lateral view of test with the triserial and uniserial chambers. 40×
4. Az előző példány szájnyílása a foggal. — Aperture of the same specimen with the tooth. 100×

5—6. *Nubecularia lucifuga* DEFRANCE. 40×

5. A ház háti oldala. — Dorsal view of test.
6. A ház köldökoldala, ahol a kezdeti planospirálisan felcsavart kamrák láthatók. — Umbilical view of test, where the planispirally coiled initial chambers can be seen.

7—8. *Spiroloculina bicarinata* D'ORBIGNY

7. A ház oldalnézete. — Lateral view of test. 40×
8. Az előző példány szájnyílás felőli nézete. — Apertural view of the same specimen. 200×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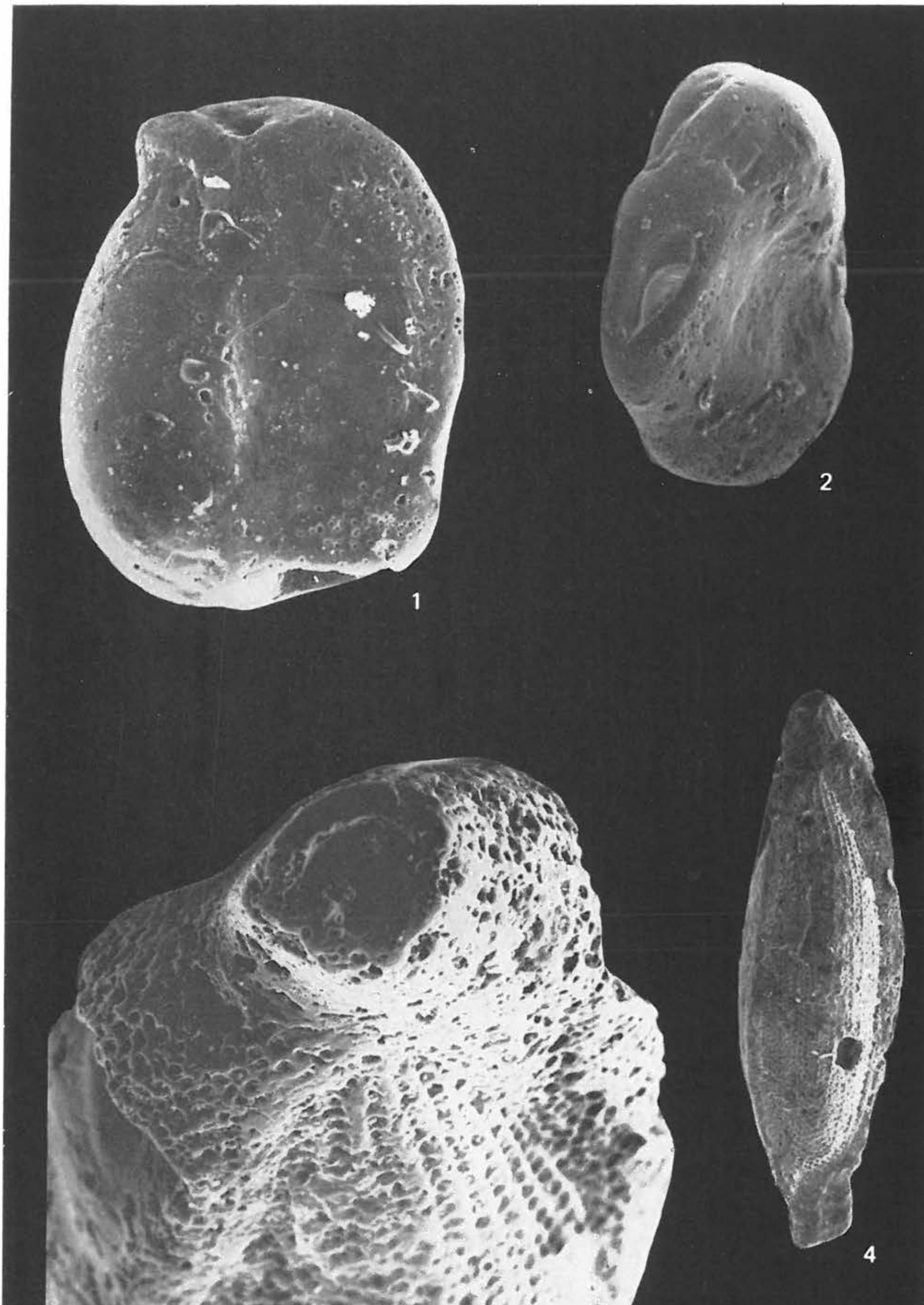
IV. tábla — Plate IV

1—2. *Vertebralina laevigata* TERQUEM. 150×

1. A ház oldalnézete. — Lateral view of test.
2. Az előző példány szájnyílás felőli nézete a hosszú csepp alakú szájnyílással. — Apertural view of the same specimen with the aperture in form of a long droplet.

3—4. *Quinqueloculina birostris* (LAMARCK)

3. A képen a szájnyílás látható a foggal, valamint a hossztengellyel párhuzamosan rendezett pórusok. — The aperture with the tooth and the pores parallel to the longitudinal axis. 200×
4. A ház oldalnézete. — Lateral view of test. 48×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V. tábla — Plate V

1—2. *Quinqueloculina lippa* LE CALVEZ. 100×

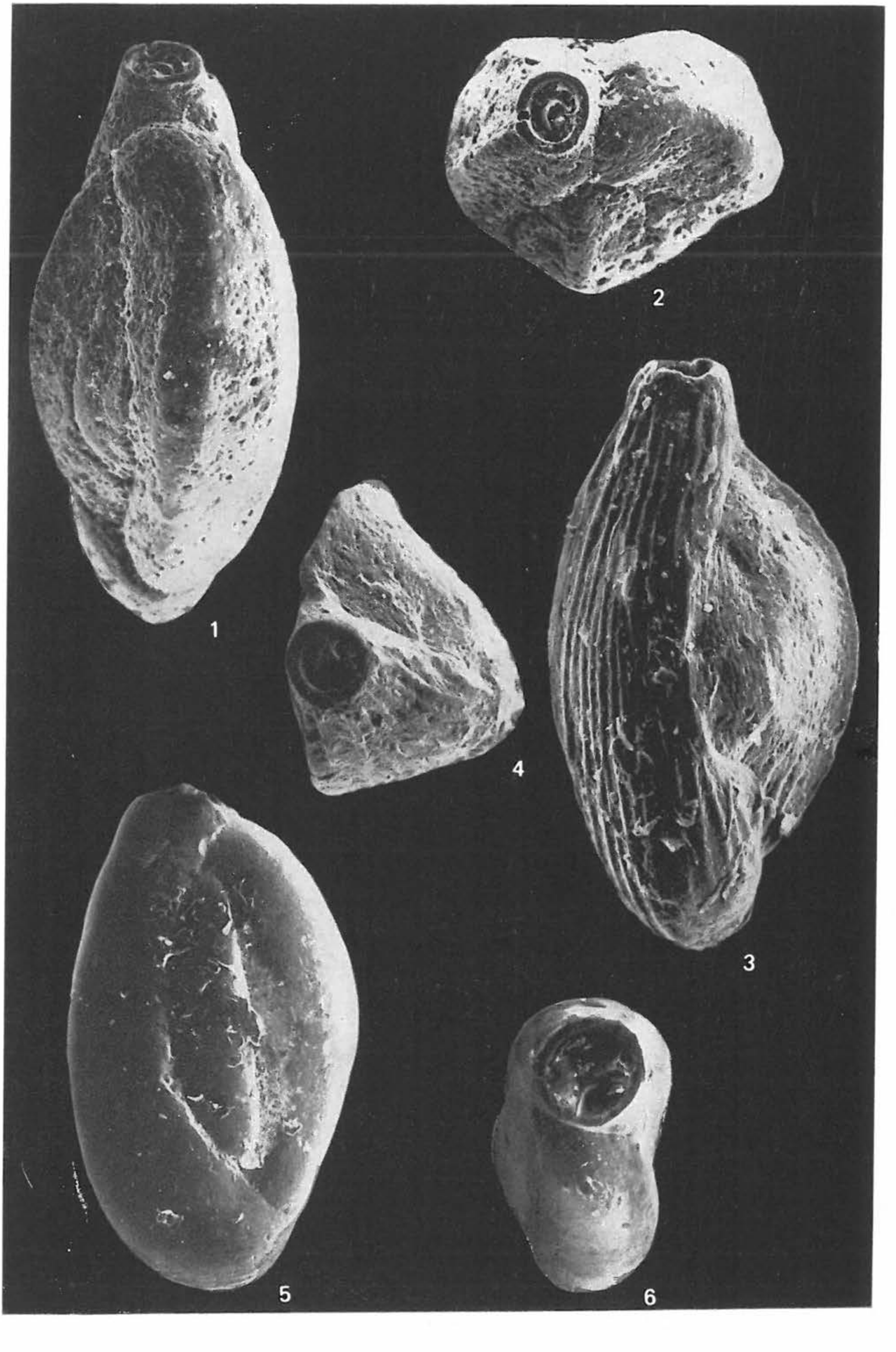
1. A ház oldalnézete. — Lateral view of test.
2. Az előző példány felülnézete a szájnyílással és a foggal. — Top view of the same specimen with the aperture and the tooth.

3—4. *Quinqueloculina parisiensis* D'ORBIGNY. 100×

3. A ház oldalnézete. — Lateral view of test.
4. Az előző példány felülnézete, ahol a szájnyílás látható a foggal. — Top view of the same specimen, where the aperture with the tooth can be seen.

5—6. *Quinqueloculina seminulum* (LINNÉ). 54×

5. A ház oldalnézete. — Lateral view of test.
6. Az előző példány felülnézete a szájnyílással és a foggal. — Top view of the same specimen with the aperture and the tooth.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VI. tábla — Plate VI

1. *Quinqueloculina seminulum* (LINNÉ). 200×

   A képen a szájnyílás kinagyított képe látható a nagy háromszögletű foggal. — Enlarged image of the aperture with the large triangular tooth.

2–3. *Pyrgo bulloides* (D'ORBIGNY). 60×

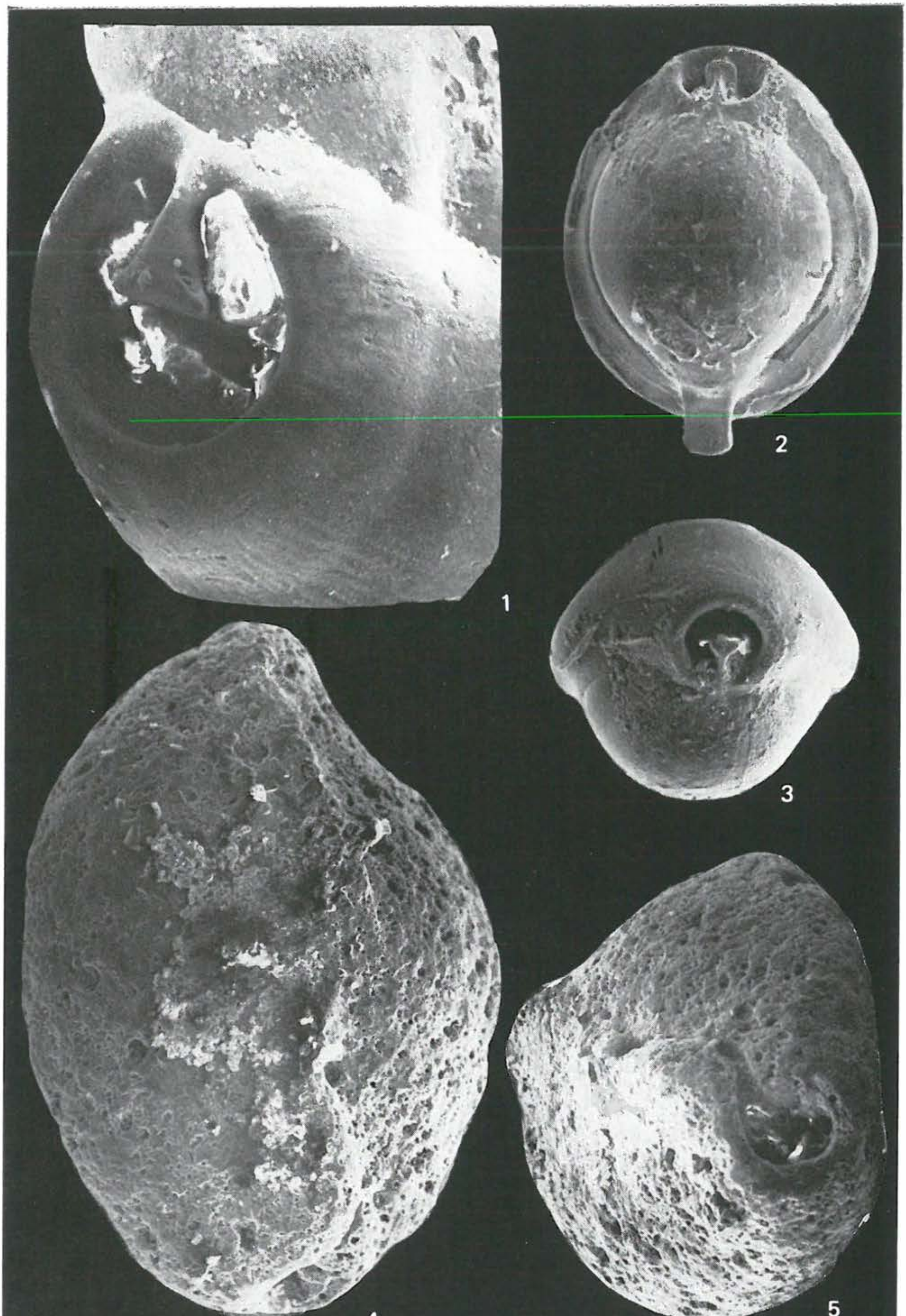
   2. A ház oldalnézete. — Lateral view of test.

   3. Az előző példány felülnézete, ahol a szájnyílás látható a foggal. — Top view of the same specimen, with the aperture and tooth.

4–5. *Pyrgo simplex* (D'ORBIGNY). 78×

   4. A ház oldalnézetben. — The test in lateral view.

   5. Az előző példány felülnézete, melyen a szájnyílás látható. — Top view of the same specimen with the aperture.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VII. tábla — Plate VII

1–2. *Triloculina angularis* D'ORBIGNY. 100×

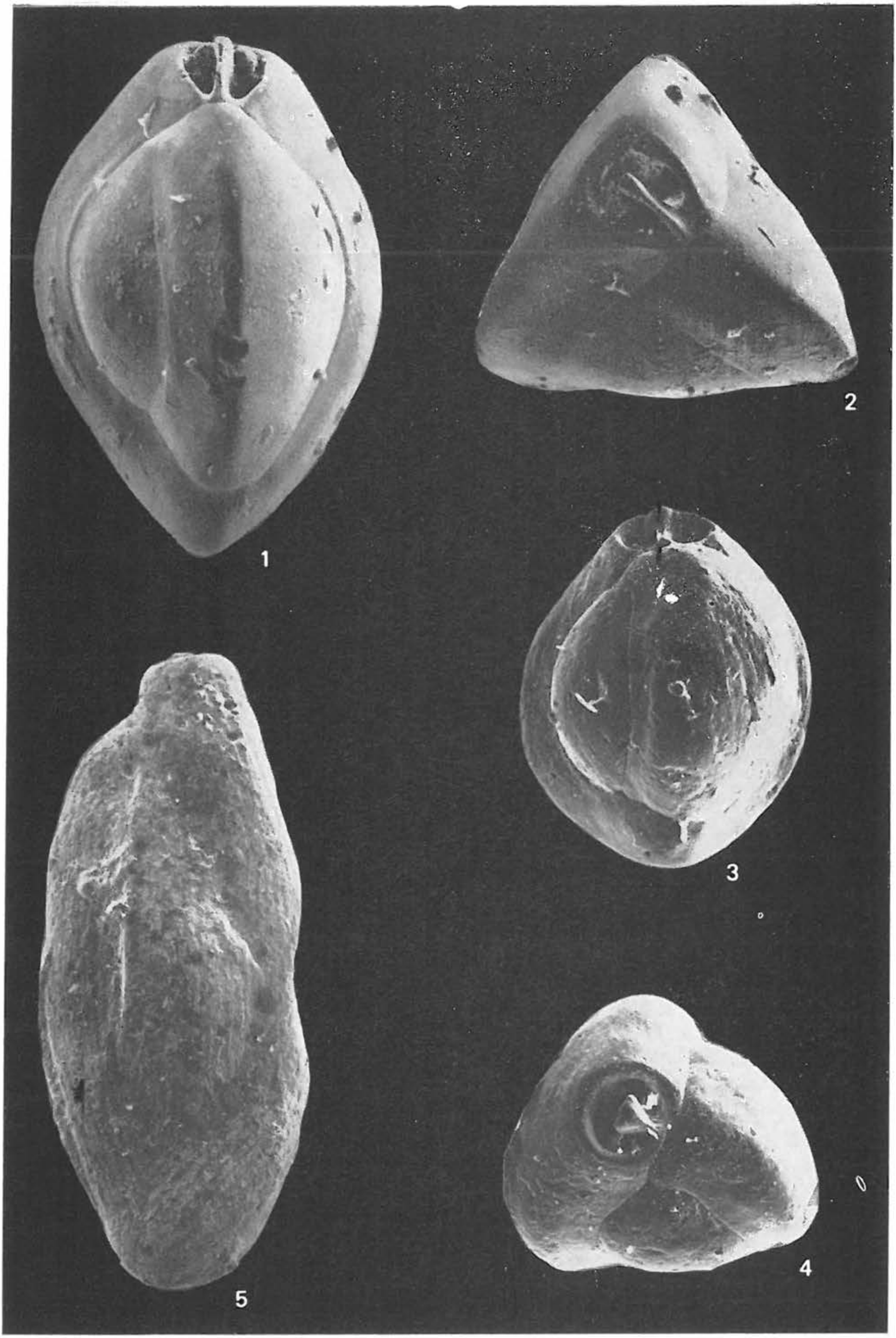
1. A ház oldalnézete. — Lateral view of test.
2. Az előző példány felülnézete a szájnyílással és a hosszú, megnyúlt, enyhén kiszélesedő foggal. — Top view of the same specimen with the aperture and the elongated and slightly widening tooth.

3–4. *Triloculina austriaca* D'ORBIGNY. 100×

3. A ház oldalnézete. — Lateral view of test.
4. Az előző példány felülnézete, ahol a szájnyílás látható a rövid kiszélesedő foggal. — Top view of the same specimen, where the aperture with the short, widening tooth can be seen.

5. *Triloculina cylindrica* D'ORBIGNY. 40×

A ház oldalnézete, ahol a kamrák hosszanti finom bordázottsága látható. — Lateral view of test, where the fine longitudinal ribbing of the chambers can be seen.



VIII. tábla — Plate VIII

1. *Triloculina cylindrica* d'Orbigny. 200×

   Az előző példány (VII. tábla 5. ábra) szájnyílása a nagy ipszilon alakú foggal. — Aperture of the same specimen (Plate VII Fig. 5) with the large Y-shaped tooth.

2—3. *Triloculina lecalvezae* Kaasschieter

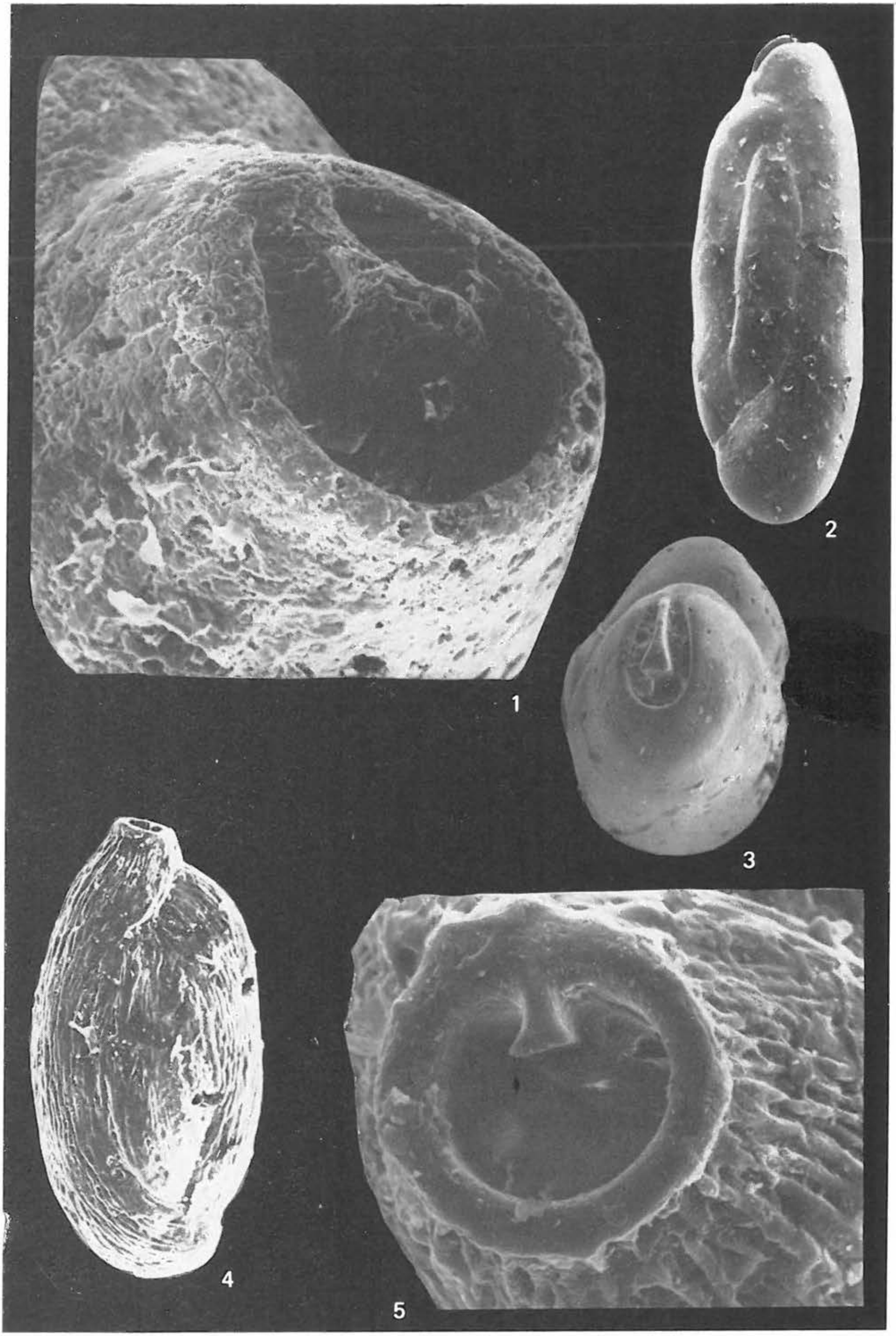
   2. A ház oldalnézete, ahol három kamra látható. — Lateral view of test, where three chambers can be seen. 48×

   3. Az előző példány felülnézete a szájnyílással és a hosszú, kiszélesedő foggal. — Top view of the same specimen with the aperture and the long, widening tooth. 100×

4—5. *Triloculina porvaensis* Hantken

   4. A ház oldalnézete, ahol a kamrák hosszanti bordázottsága jól látható. — Lateral view of test: the longitudinal ribbing of the chambers is quite distinct. 100×

   5. Az előző példány felülnézete a szájnyílással és a rövid kiszélesedő foggal. — Top view of the same specimen with the aperture and the short, widening tooth. 600×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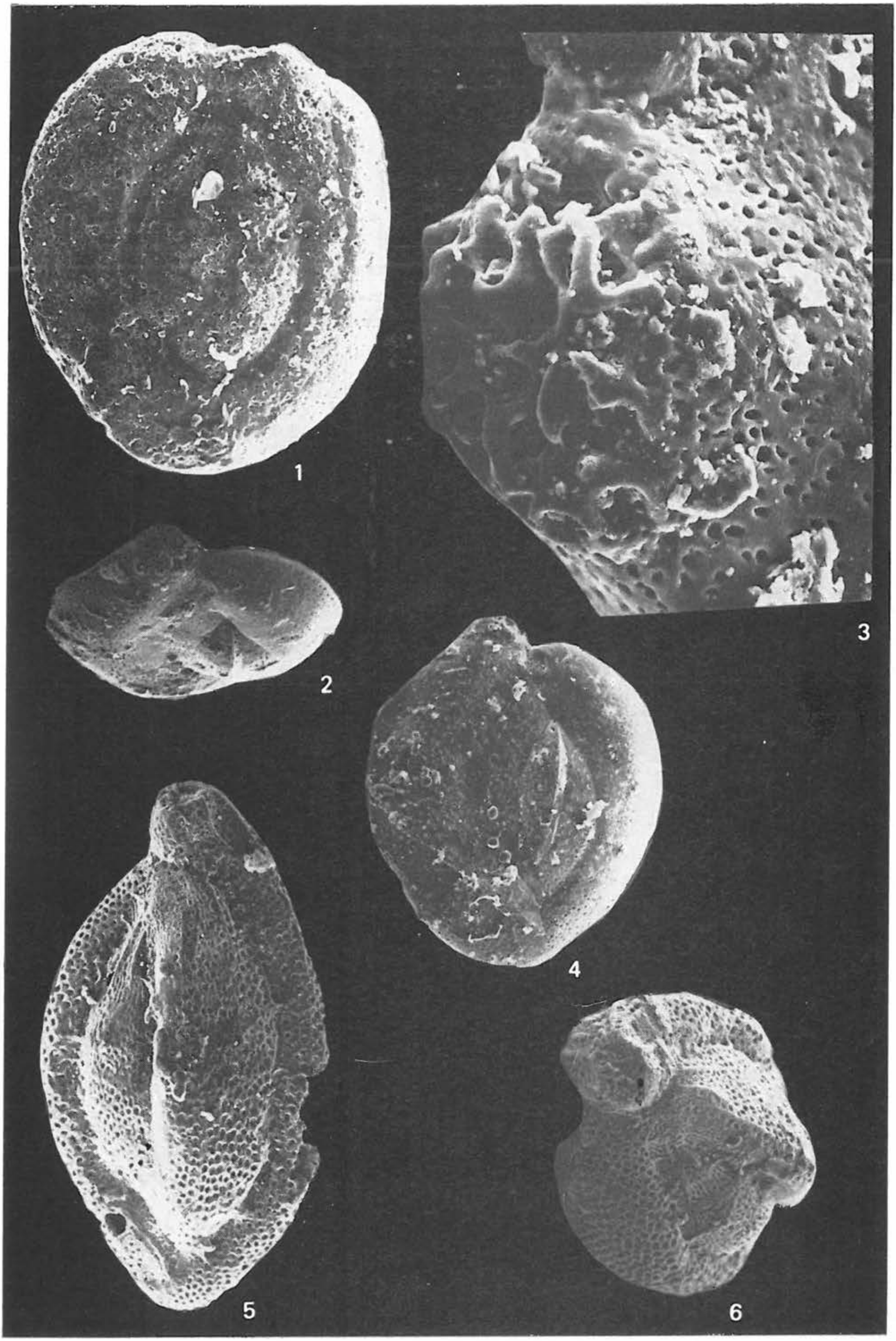
IX. tábla — Plate IX

1–4. *Miliola brevidentata* (LE CALVEZ)

1. A ház oldalnézete. — Lateral view of test. 100×
2. A ház felülnézete, ahol a szájnyílás is látható. — Top view of test, in which the aperture can be seen, too. 60×
3. Az előző példány kinagyított szitaszerű szájnyílása. — Cribrate aperture of the same specimen. 400×
4. Az előző példány oldalnézete. — Lateral view of test. 60×

5–6. *Miliola disticha* (TERQUEM). 100×

5. A ház oldalnézete. — Lateral view of test.
6. Az előző példány felülnézete, ahol a szájnyílás és a kamrák szögletes körvonala látható. — Top view of the same specimen, where the aperture and the angular outline of the chambers can be seen.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X. tábla — Plate X

1. *Miliola disticha* (TERQUEM). 400×

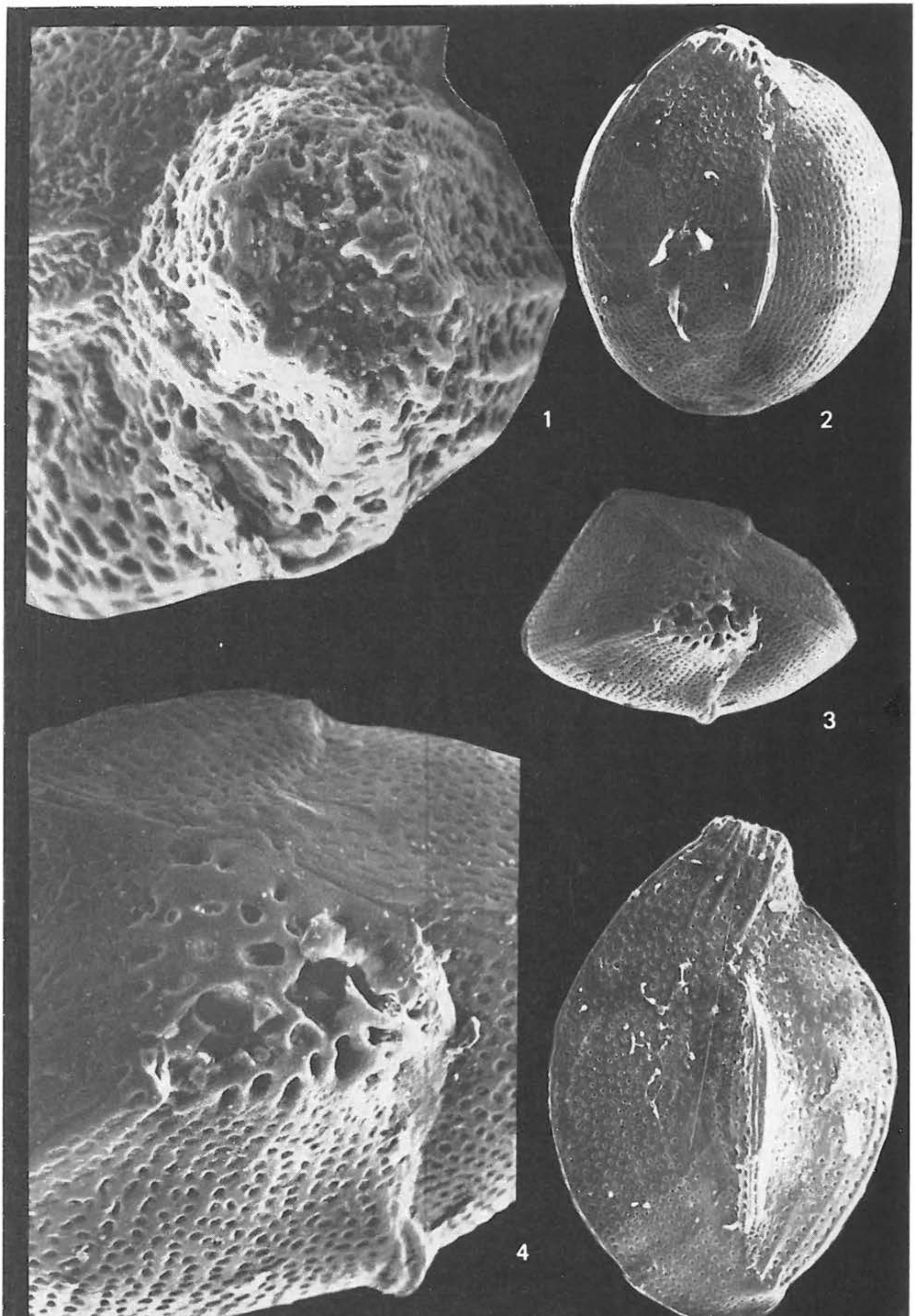
   Az előző példány (IX. tábla, 6. ábra) kinagyított szitaszerű szájnyílása, ahol a hossztengellyel párhuzamos bordák is megfigyelhetők. — Enlarged cribrate aperture of the same specimen (Plate IX Fig. 6) where the ribs parallel to the longitudinal axis are observable, too.

2—4. *Miliola prisca* (D'ORBIGNY)

   2. A ház oldalnézete, ahol jól láthatók a hossztengellyel párhuzamosan rendezett pórusok. — Lateral view of test, where the pores parallel to the longitudinal axis are quite distinct 100×
   3. Az előző példány felülnézete. — Top view of the same specimen. 100×
   4. Az előző példány kinagyított szitaszerű szájnyílása. — Enlarged cribrate aperture of the same specimen. 300×

5. *Miliola prisca* (D'ORBIGNY) var. *terquemi* KAASSCHIETER. 100×

   A ház oldalnézete. — Lateral view of test.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XI. tábla — Plate XI

1. *Miliola prisca* (d'Orbigny) var. *terquemi* Kaasschieter. 100×

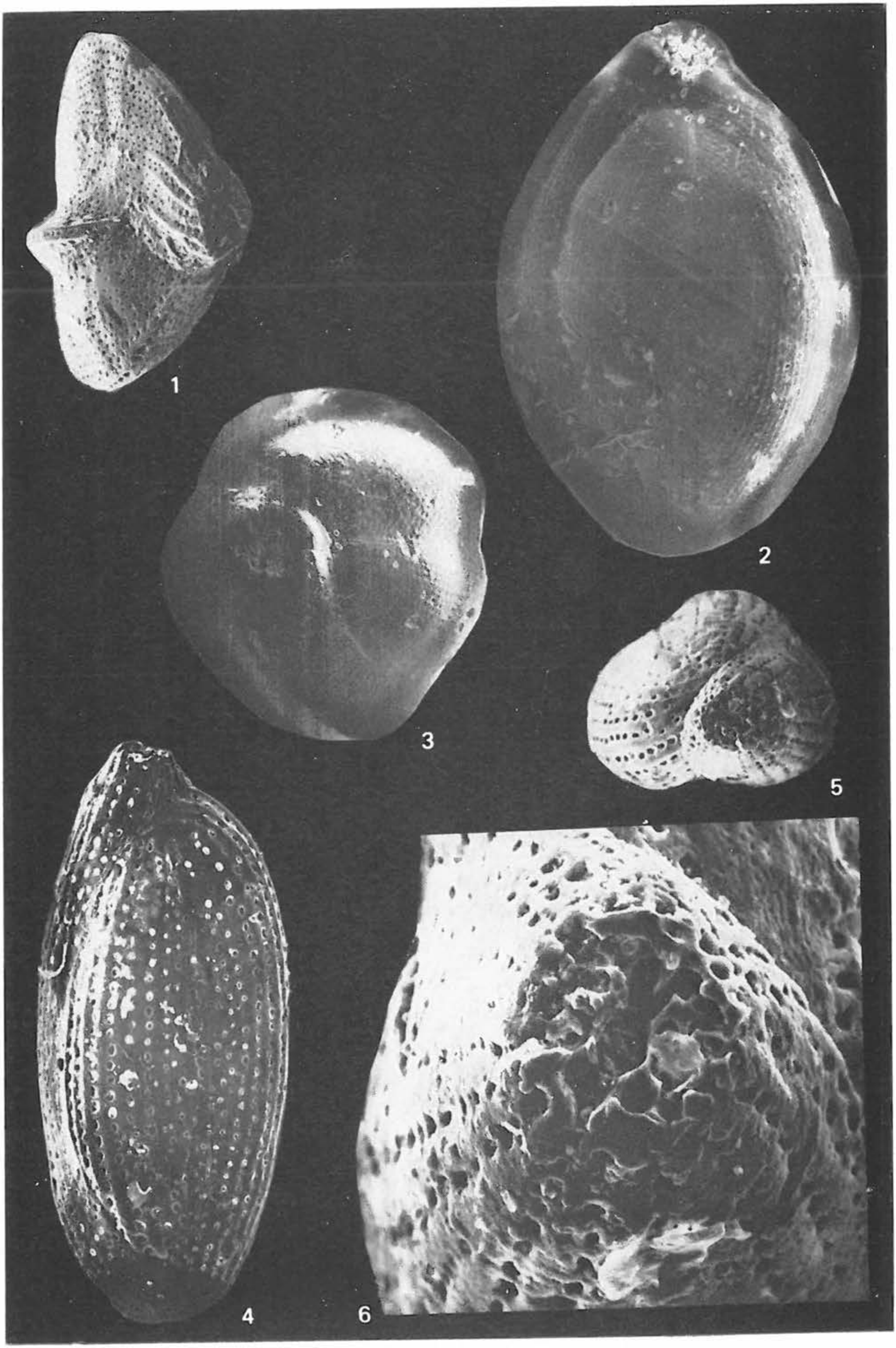
   Az előző példány (X. tábla, 5. ábra) felülnézete, melyen a törött szájnyílás látható. Jól megfigyelhető a kamrán az erősen kiemelkedő borda, valamint a szájnyílás körüli apróbb bordák. — Top view of the same specimen (Plate X, Fig. 5) in which the broken aperture can be seen. The chamber is deeply ribbed, smaller ribs around the aperture.

2—3. *Miliola pseudocarinata* Le Calvez. 78×

   2. A ház oldalnézete, ahol jól megfigyelhetők a ház hossztengelyével párhuzamosan rendezett pórusok. — Lateral view of test, where the pores parallel to the longitudinal axis of the test are quite distinct.
   3. Az előző példány felülnézete, ahol a ház karéjos körvonala és szitaszerű szájnyílása látható. — Top view of the same specimen, where the lobate outline and cribrate aperture of the test are visible.

4—6. *Miliola saxorum* (Lamarck)

   4. A ház oldalnézete a hossztengellyel párhuzamosan rendezett pórusokkal. — Lateral view of test with pores parallel to the longitudinal axis. 100×
   5. Az előző példány felülnézete. — Top view of the same specimen. 100×
   6. Az előző példány kinagyított szitaszerű szájnyílása. — Enlarged, cribrate aperture of the same specimen. 400×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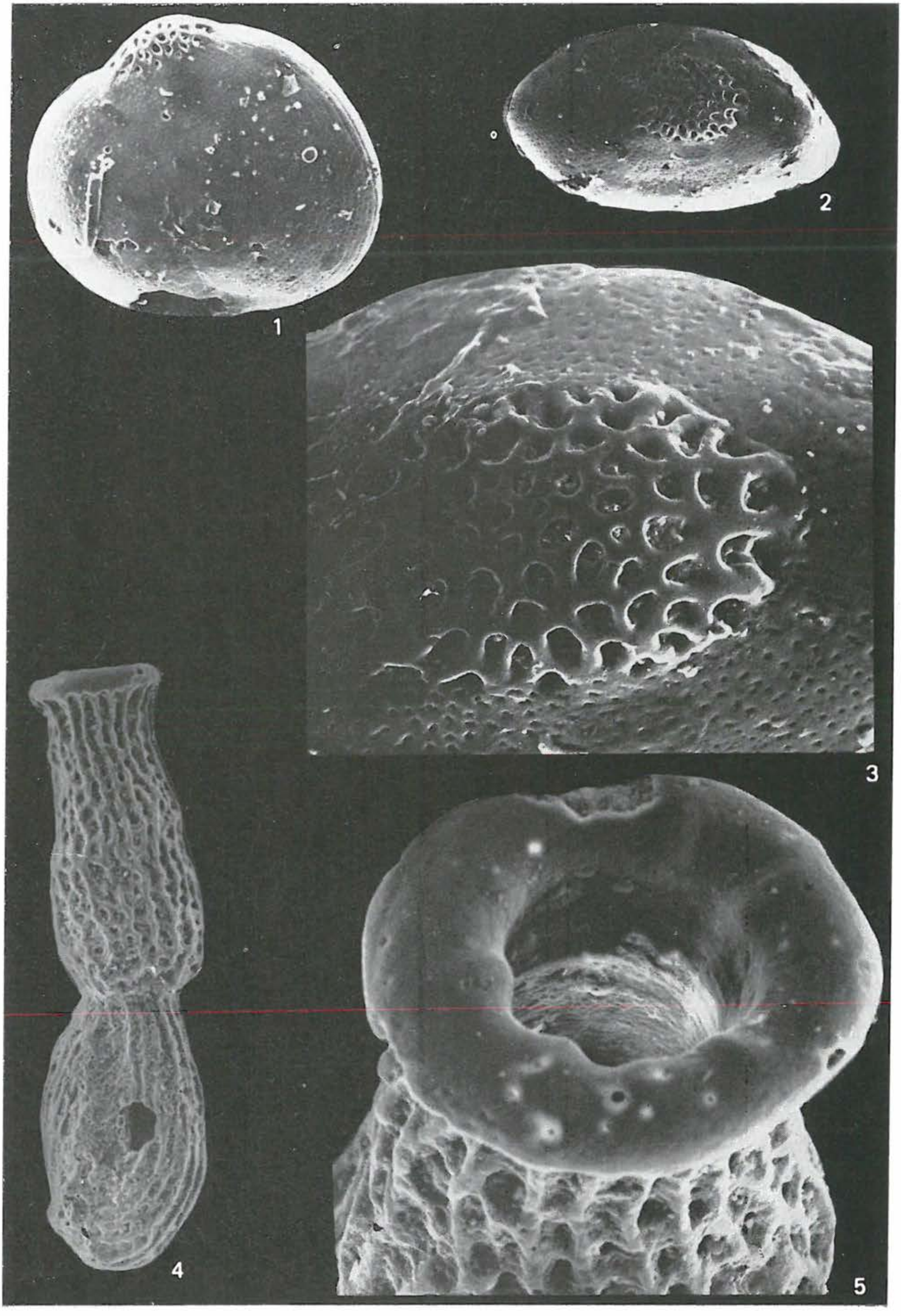
XII. tábla — Plate XII

1—3. *Miliola strigillata* (d'Orbigny)

1. A ház oldalnézete, ahol jól láthatók a hossztengellyel párhuzamosan, szabályosan rendezett pórusok. — Lateral view of test, where the pores aligned parallel to the longitudinal axis are quite distinct. 100×
2. Az előző példány felülnézete, ahol jól látható a ház körvonala és szájnyílása. — Top view of the same specimen. 100×
3. Az előző példány kinagyított szitaszerű szájnyílása. — Enlarged, cribrate aperture of the same specimen. 400×

4—5. *Articulina nitida* d'Orbigny

4. A ház oldalnézete, ahol a kamrák hosszanti bordái és pórusai láthatók. — Lateral view of test, where the longitudinal ribs and pores of the chambers can be seen. 100×
5. Az előző példány kinagyított szájnyílása. — Enlarged aperture of the same specimen. 400×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XIII. tábla — Plate XIII

1—2. *Globulina gibba* D'ORBIGNY. 100×

1. A ház oldalnézete, ahol az apró, finom pórusok figyelhetők meg. — Lateral view of test, where the tiny, fine pores are observable.
2. Az előző példány kissé megdöntve, ahol a radiálisan elhelyezkedő résszerű nyílások láthatók. — The same specimen tilted, where the radially aligned slot-like foramina can be seen.

3. *Globulina gibba* D'ORBIGNY var. *tuberculata* D'ORBIGNY. 100×

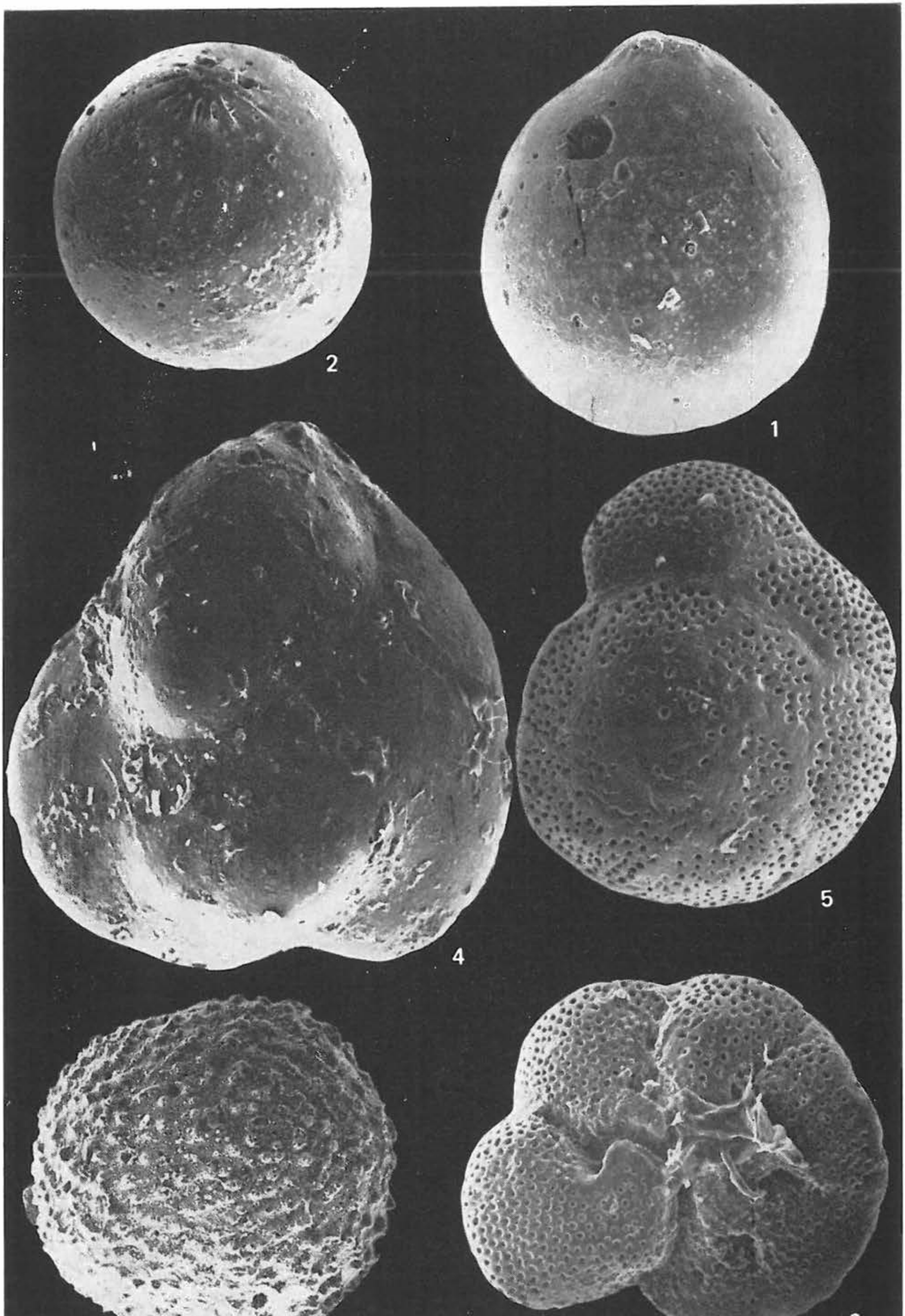
A ház oldalnézete, az erősen díszített házfallal. — Lateral view of test, with ornamented wall.

4. *Guttulina irregularis* (D'ORBIGNY). 100×

A ház oldalnézete. — Lateral view of test.

5—6. *Discorbis bractifera* LE CALVEZ. 100×

5. A ház spirális oldala. — Spiral view of test.
6. A ház köldökoldala az utolsó kamra pereménél levő szájnyílással és kiegészítő nyílásokkal a kamrák találkozásánál. — Umbilical view of test with the aperture at the margin of the last chamber and with supplementary apertures.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XIV. tábla — Plate XIV

1–3. *Discorbis perplexa* LE CALVEZ

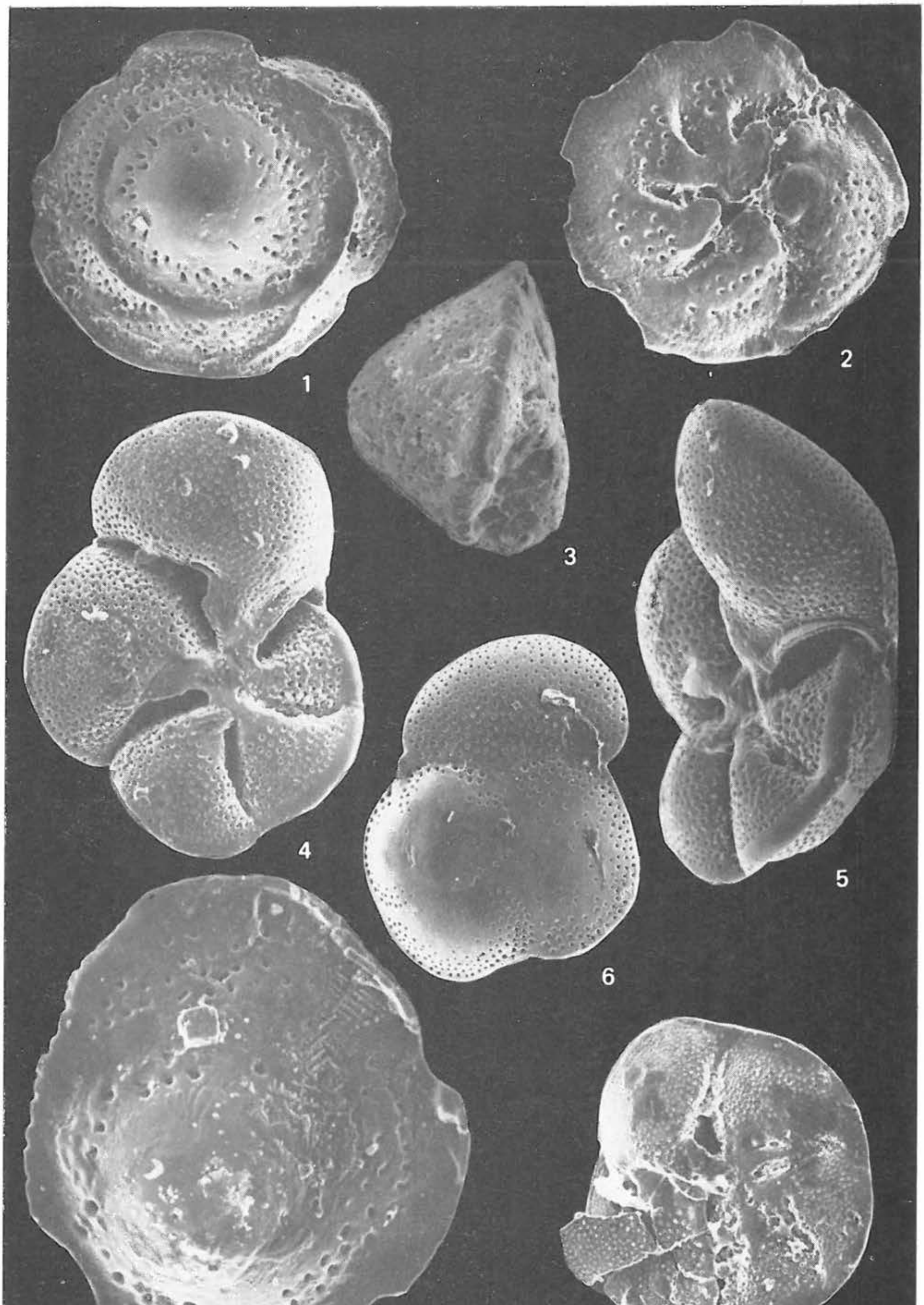
1. A ház spirális oldala a jól látható kamravarratvonallal. — Spiral view of test with the suture. 78×
2. A ház köldökoldala, ahol a szájnyílás, a járulékos nyílások és a nucleus látható. — Umbilical view of test, where the aperture, the supplementary apertures and the nucleus. 100×
3. A kúp alakú ház oldalnézete. — Lateral view of the conical test. 100×

4–6. *Discorbis propinqua* (TERQUEM)

4. A ház köldökoldala a szájnyílással és járulékos nyílásokkal. — Umbilical view of test with the aperture and the supplementary apertures. 100×
5. Az előző példány kissé megdöntve, melyen jól látható a keskeny peremmel ellátott résszerű szájnyílás. — The same specimen tilted, the slot-like aperture with a narrow peristome. 120×
6. A ház spirális oldala. — Spiral view of test. 100×

7–8. *Discorbis rotata* (TERQUEM)

7. A ház spirális oldala a ritkán elhelyezkedő pórusokkal. — Spiral view of test with the few pores. 200×
8. A ház köldökoldala a szájnyílással és radiális járulékos nyílásokkal. — Umbilical view of test with the aperture and radial supplementary apertures. 100×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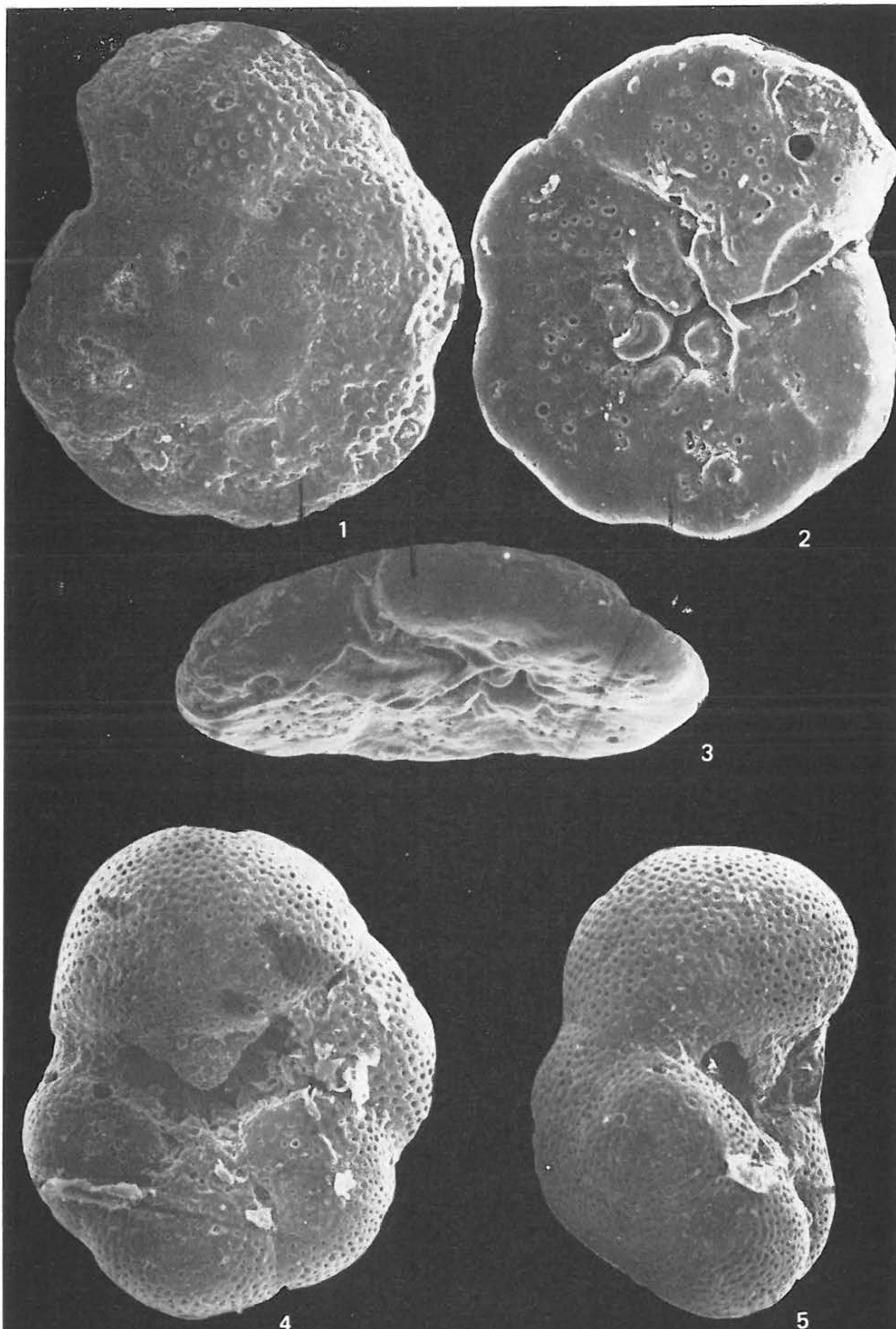
XV. tábla — Plate XV

1—3. *Discorbis* sp. 200×

1. A ház spirális oldala. — Spiral view of test.
2. A ház köldökoldala a szájnyílással, a járulékos radiális nyílásokkal és a nucleusszal. — Umbilical view of test with the aperture, the radial supplementary apertures and the nucleus.
3. Az előző példány oldalnézete, ahol látható a szájnyílás az enyhén megvastagodott ajakkal. — Lateral view of the same specimen, where the aperture with the slightly swollen lip is observable.

4—5. *Baggina subconica* (Terquem). 100×

4. A ház köldökoldala a szájnyílással. — Umbilical view of test with the aperture.
5. Az előző példány oldalnézete, ahol a felfújt utolsó kamra jól megfigyelhető. — Lateral view of the same specimen, where the inflated last chamber is quite distinct.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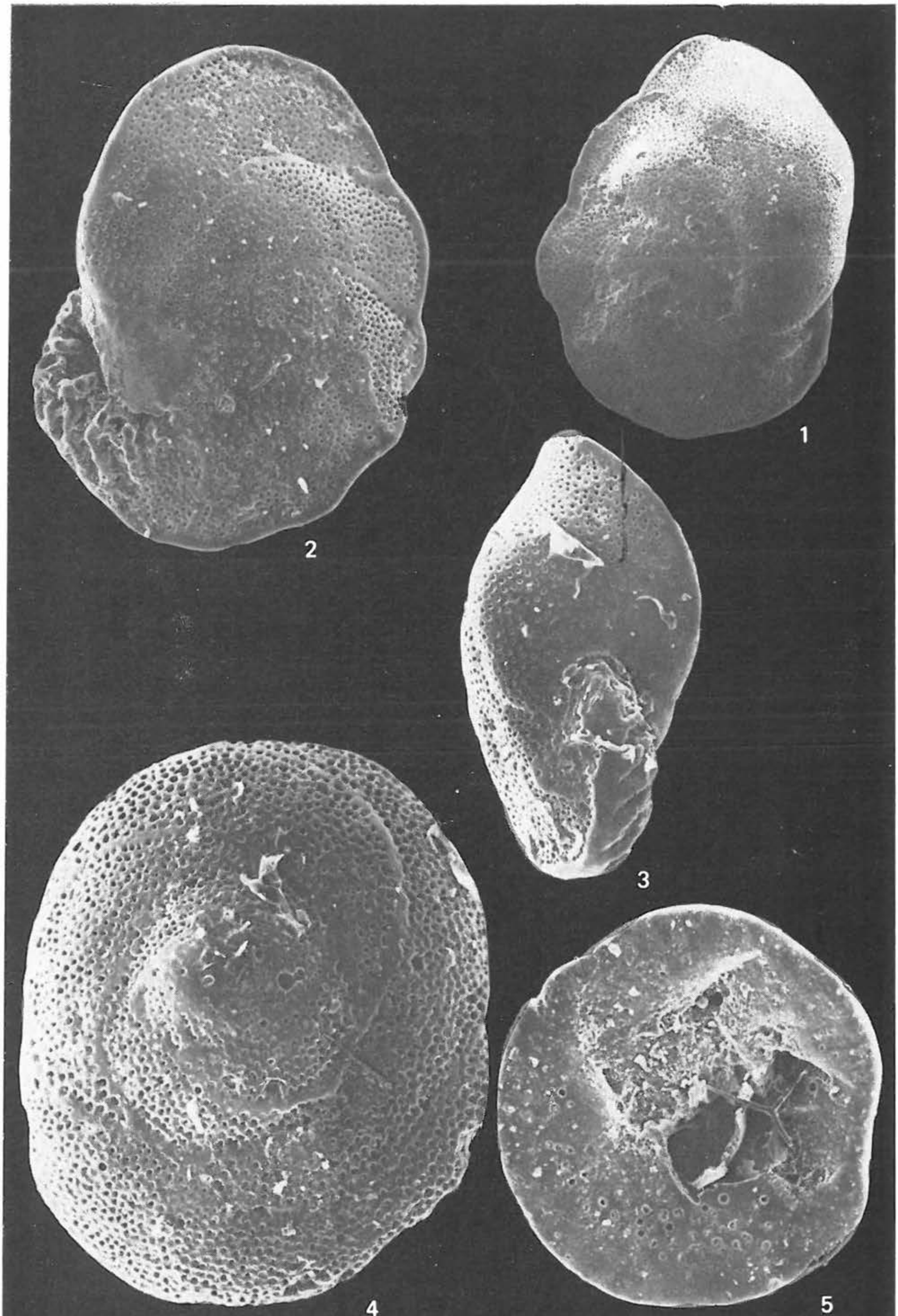
XVI. tábla — Plate XVI

1—3. *Cancris auris* (LE CALVEZ)

1. A ház spirális oldala. — Spiral view of test. 60×
2. A ház köldökoldala. Jól látható a szájnyílás és a fölé húzódó utolsó kamra nyúlványa. A szájnyílás körül sugárirányú, kiemelkedő bordák figyelhetők meg. — Umbilical view of test. Note the aperture and the last chamber process overlapping it. Around the aperture radial ribs are observable. 86×
3. Az előző példány az élére állítva, ahol a felfújt utolsó kamra körvonala és a szájnyílás egy része látható. — Lateral view with the inflated last chamber and a part of the aperture. 100×

4—5. *Glabratella ubiqua* (LE CALVEZ). 100×

4. A ház spirális oldala, jól látható az enyhén kidomborodó kamravarratvonal. — Spiral view of test. Note the slightly convex suture line.
5. A ház köldökoldala a szájnyílással és a ritkán elhelyezkedő, nagyméretű pórusokkal. — Umbilical view of test with the aperture and the large, sparsely distributed pores.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XVII. tábla — Plate XVII

1—2. *Asterigerina bimammata* (GÜMBEL). 48×

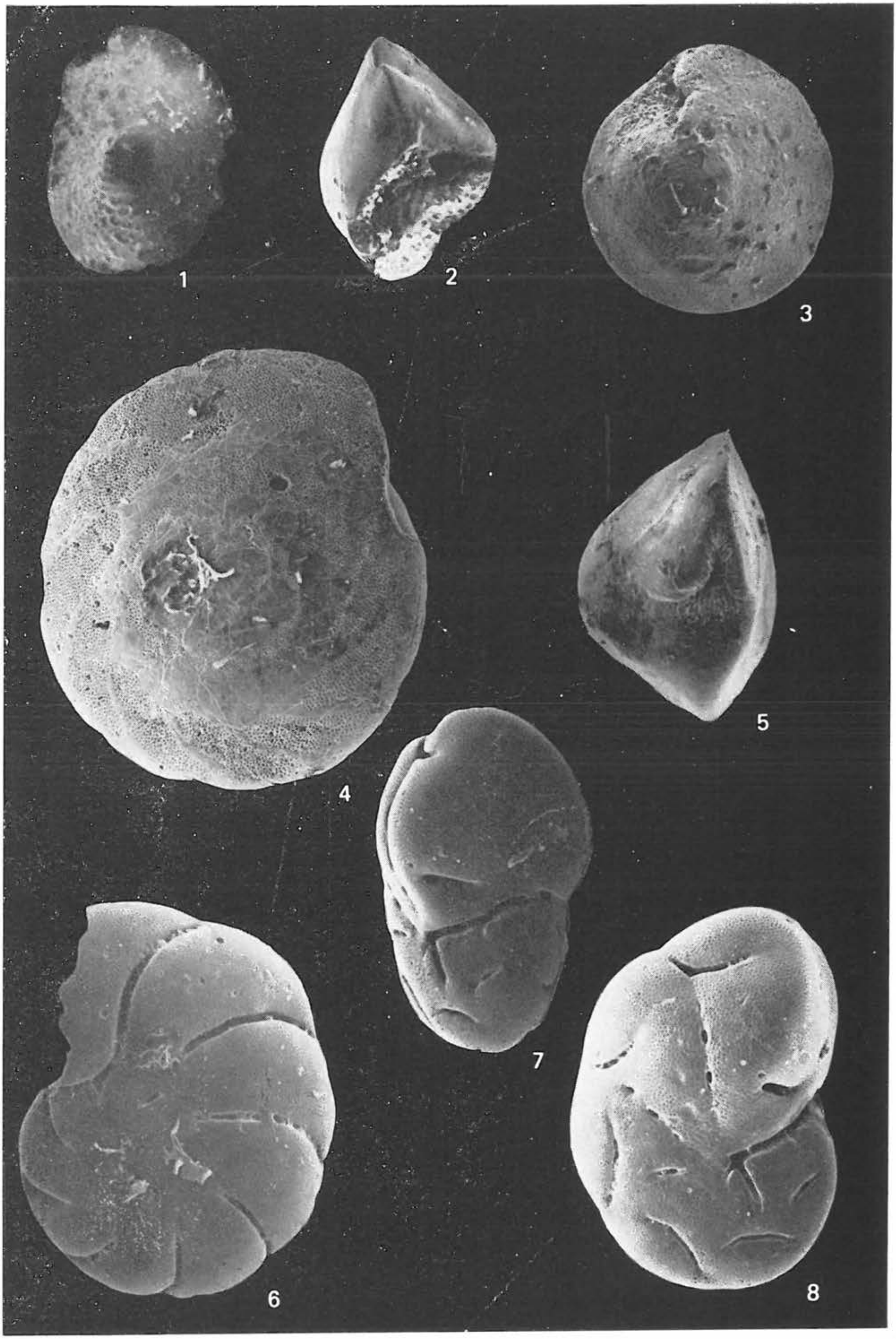
1. A ház köldökoldala. — Umbilical view of test.
2. Az előző példány kissé döntve, ahol a szájnyílás látható. — The same specimen tilted, the aperture being visible.

3—5. *Asterigerina rotula* (KAUFMANN)

3. A ház kúpos köldökoldala. — Conical, umbilical view of test. 48×
4. A ház spirális oldala az enyhén megvastagodott kamravarratvonallal. — Spiral view of test with the slightly swollen suture line. 60×
5. A ház élére állítva, ahol a szájnyílás látható. — Test standing on its carina, the aperture being visible. 48×

6—8. *Epistomaria semimarginata* (D'ORBIGNY). 60×

6. A ház háti oldala a kamrák találkozásánál levő kiegészítő nyílásokkal. — Dorsal view of test with the supplementary apertures.
7. Az élére állított háznál a szájnyílás, valamint az utolsó kamra felületén levő kiegészítő nyílás látható. — Lateral view, supplementary apertures on the last chamber.
8. Az előző példány köldökoldala. Jól láthatók a szájnyílás és a kiegészítő nyílások sugarasan, ill. a szegéllyel párhuzamos helyzetben. — Umbilical view of the same specimen. With the aperture, the supplementary and accessory apertures radially and parallel to the peristome.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XVIII. tábla — Plate XVIII

1—2. *Rotalia trochidiformis* LAMARCK

1. A ház háti oldala, ahol az összes kamra látható. — Dorsal view of test with all chambers visible. 60×

2. A ház köldökoldala a sugárirányú résszerű nyílásokkal, valamint a köldök körüli bütykökkel, oszlopokkal. — Umbilical view of test with radially oriented slot-like apertures as well as periumbilical tubercles and columns. 48×

3—5. *Rotalia tuberculata* SCHUBERT

3. A ház köldökoldala. Helyenként láthatók a kamrák és a kamravarratvonal sugárirányú lefutása. A ház többi részén az erős díszítettség ezeket elfedi. — Umbilical view of test. In some places, the radial orientation of the chambers and suture line can be observed. Over the remaining part of the test they are concealed by the heavy sculpture. 60×

4. A biconvex ház oldalnézete. — Lateral view of biconvex test. 60×

5. A 3. ábrán levő példány kinagyított házfala. Megfigyelhetők a falból erősen kiemelkedő bütykök, melyek szintén perforáltak. — Enlarged wall of the specimen shown in Fig. 3. Note the tubercles, similarly perforated, markedly emerging from the wall. 400×


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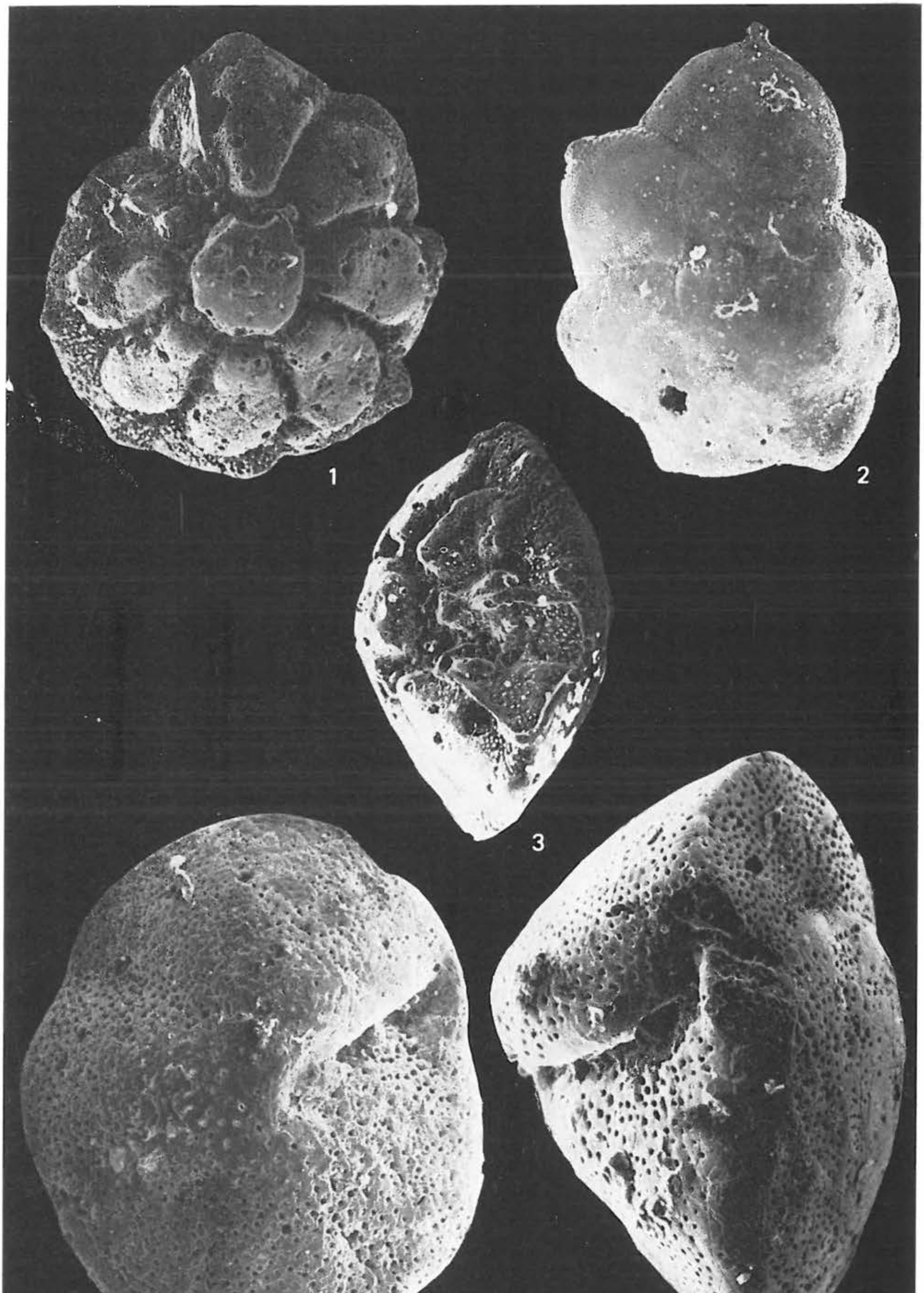
XIX. tábla — Plate XIX

1—3. *Pararotalia inermis* (TERQUEM). 100×

1. A ház köldökoldala. Jól láthatók a sugaras lefutású kamrák és a nagyméretű köldökdugó. — Umbilical view of test. Note the distinct chambers of radial orientation and the large umbilical plug.
2. Az előző példány oldalnézete. A szájnyílás gyengén látható és kissé törött. — Lateral view of the same specimen. The aperture is poorly observable, slightly broken.
3. A ház spirális oldala. Megfigyelhetők az utolsó kanyarulat kamráin levő tüskék. — Spiral view of test. Note the spines on the chambers of the last whorl.

4—5. *Eponides polygonus* LE CALVEZ. 100×

4. A ház köldökoldala, ahol az utolsó kamra pereménél levő résszerű szájnyílás látható. — Umbilical view of test where the slot-like aperture at the margin of the last chamber can be seen.
5. Az előző példány oldalnézete, ahol a kúpszerű ventrális oldal és a szájnyílás látható. — Lateral view of the same specimen, where the conical ventral side and the aperture are observable.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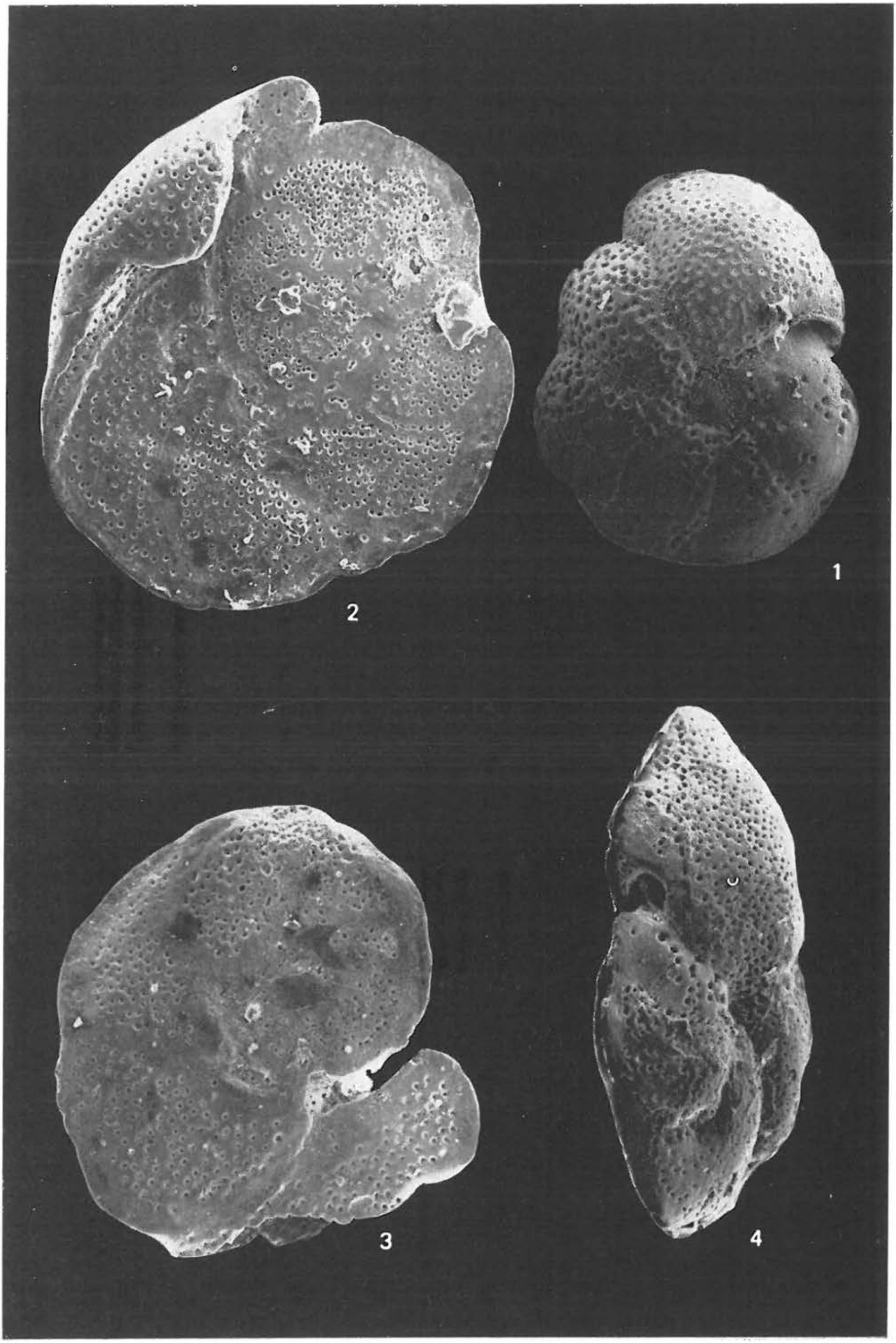
XX. tábla — Plate XX

1—4. *Cibicides carinatus* (Terquem)

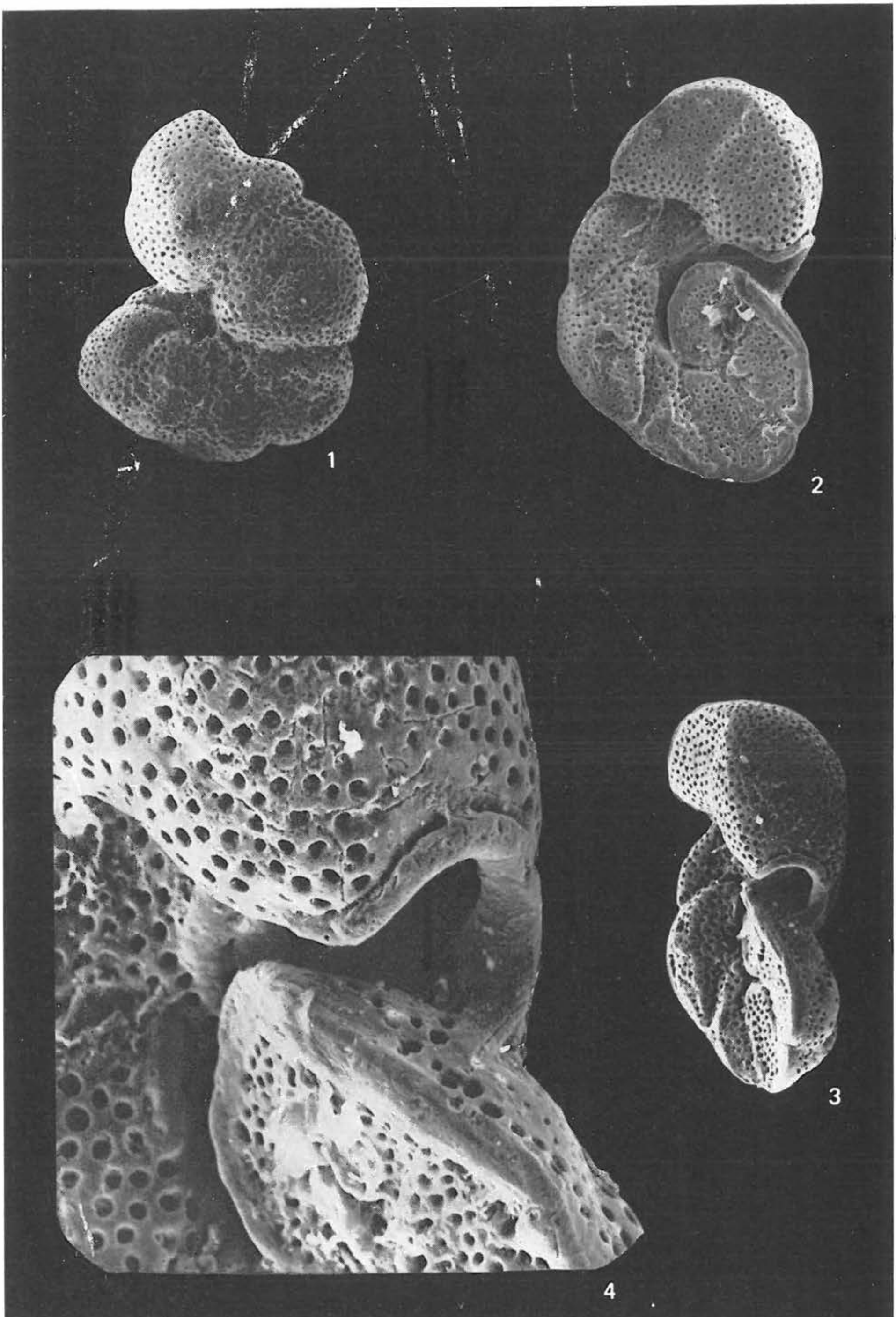
1. A ház köldökoldala, ahol a keskeny ajakkal ellátott szájnyílás látható. — Umbilical view of test, the aperture with a narrow lip. 100×
2. A ház spirális oldala. Megfigyelhető, hogy a spirális oldal felülete homorú, mivel a példány nem teljesen sík aljzatra nőtt rá. — Spiral view of the test attached side. 72×
3. A ház háti oldala, ahol megfigyelhető a spirális sutura mentén elhelyezkedő résszerű szájnyílás. — Dorsal view of test, where the slot-like aperture along the spiral suture can be seen. 100×
4. A ház oldalnézete, ahol a viszonylag lapos kamrák és a spirális oldalról átnyúló szájnyílás látható. — Lateral view of test, where the relatively flat chambers and the aperture transient from the spiral side are visible. 100×



XXI. tábla — Plate XXI

1—4. *Cibicides robustus* LE CALVEZ.

1. A ház köldökoldala az enyhén kitekeredő kamrákkal. — Umbilical view of test with the slightly uncoiled chambers. 60×
2. A ház spirális oldala. Jól látható a feltapadási felület, a kitekeredő kamrák és a spirális sutura mentén elhelyezkedő szájnyílás. — Spiral view of test attached the uncoiled chambers and the aperture along the spiral suture. 60×
3. Az előző példány kissé megdöntve. Megfigyelhető a köldökoldalra áthúzódó szájnyílás és a korábbi kamrák élesebb pereme. — The same specimen tilted. Note the aperture extending well into the umbilical area and the more sharp-edged margin of the earlier chambers. 60×
4. Az előző példány kinagyított szájnyílása az enyhén kiforduló ajakkal. — Enlarged aperture of the same specimen with the slightly swollen lip. 200×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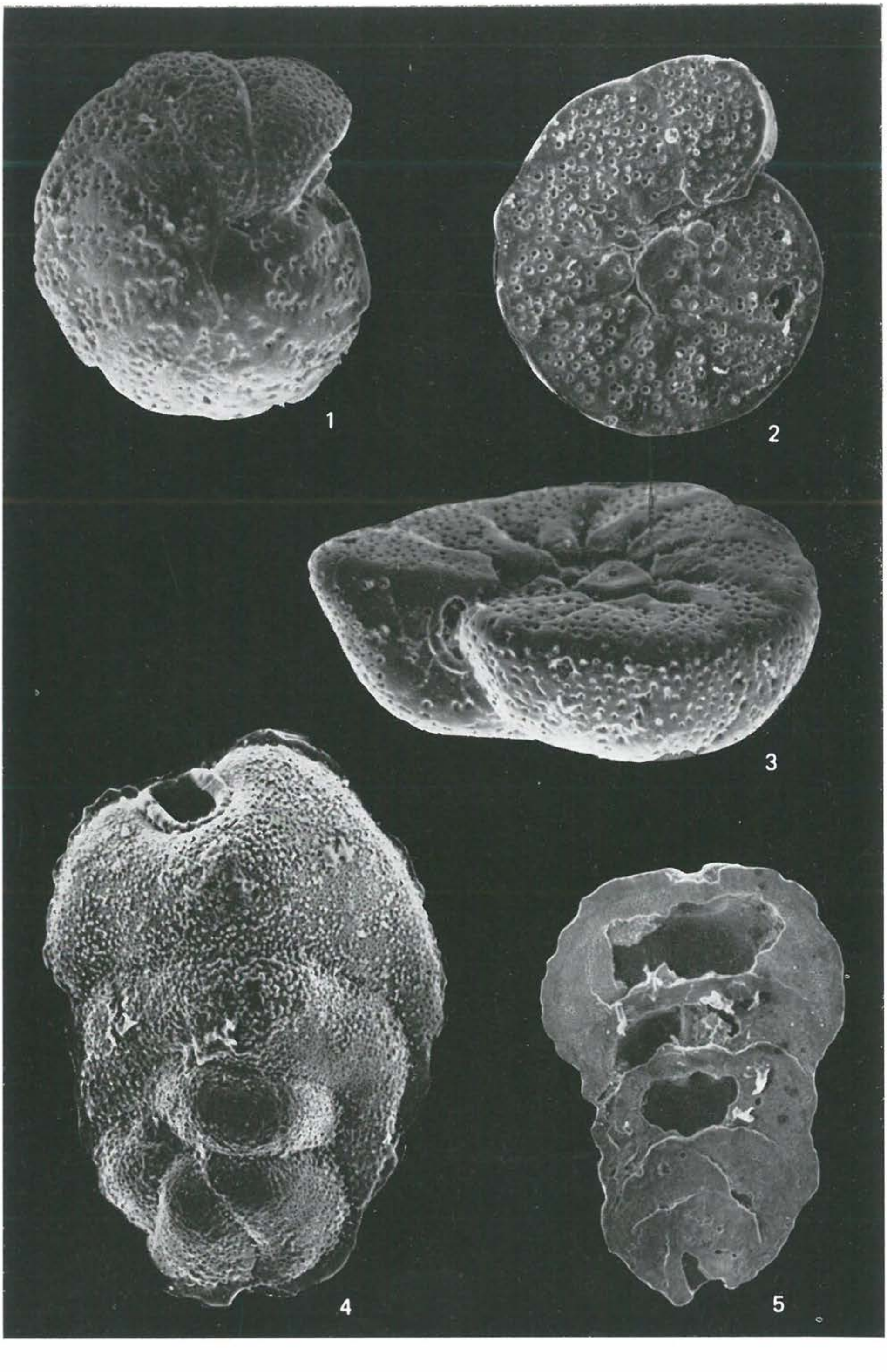
XXII. tábla — Plate XXII

1–3. *Cibicides sublobatulus* (GÜMBEL)

1. A ház köldökoldala. — Umbilical view of test. 100×
2. A ház háti oldala. Megfigyelhető a spirális sutura mentén elhelyezkedő szájnyílás és a durva pórusok. — Dorsal view of test. Note the aperture along the spiral suture and the course pores. 100×
3. Az előző példány oldalnézete a köldökoldalra áthúzódó szájnyílással. — Lateral view of the same specimen with the aperture extending well into the umbilical area. 150×

4–5. *Stichocibicides cubensis* CUSHMAN et BERMUDEZ

4. A ház köldökoldala, ahol a korai trochospirálisan felcsavart, majd az egy sorba rendezett kamrák is megfigyelhetők. Jól látszik az utolsó kamra végénél levő keskeny ajakkal ellátott szájnyílás. — Umbilical area of test, where both the trochospirally coiled early chambers and the uniserially aligned ones can be observed. Note the distinct, narrow-lipped aperture at the end of the last chamber. 100×
5. A fennőtt ház spirális oldala, ahol az utolsó kamrák fala kitöredezett. — Spiral view of an attached test, the wall of the last chambers is broken. 60×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XXIII. tábla — Plate XXIII

1–2. *Eoannularia eocenica* COLE et BERMUDEZ

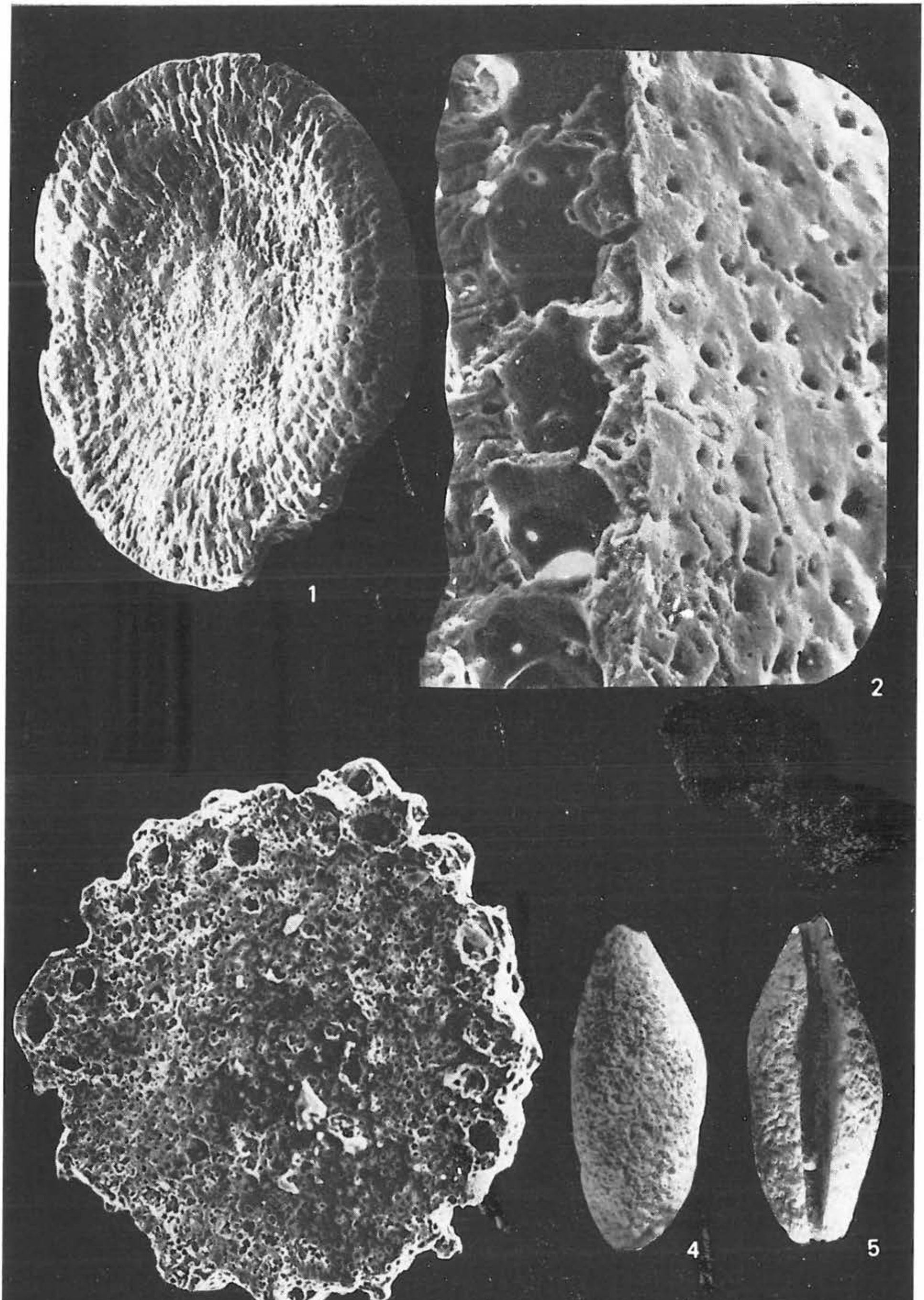
1. A korong alakú ház egyik oldala. — Side of a discoidal test. 100×
2. Az ábrán egy kettétört ház keresztmetszete látható. Megfigyelhető a kamrák alakja, a ház fala és a ház magassága, valamint a durva, szabálytalan eloszlású pórusok. — Cross-section of a broken shell. Note the shape of the chambers, the wall and the height of the test and the coarse, irregularly distributed pores. 600×

3. *Linderina brugesi* SCHLUMBERGER. 150×

Megfigyelhető a lencseszerű ház egyik oldala. Jól látható a kerek vagy ovális peremi kamrasor a nyílásaival, valamint a szabálytalanul elszórt pórusok. — One side of a lenticular test. Note the distinct round or oval marginal series of chambers with their aperture and the irregularly scattered pores.

4–5. *Acervulina dudarensis* n. sp. 17×

4. Holotypus. A képen a fennőtt ház felfújt oldala látható. Fénymikroszkópos felvétel. — Holotype. Inflated side of the attached test. Light micrograph.
5. Holotypus. Az előző példány másik oldala, ahol látszik a résszerű feltapadás felület. Fénymikroszkópos felvétel. — The other side of the same specimen where the slot-like adhesion surface can be observed. Light micrograph.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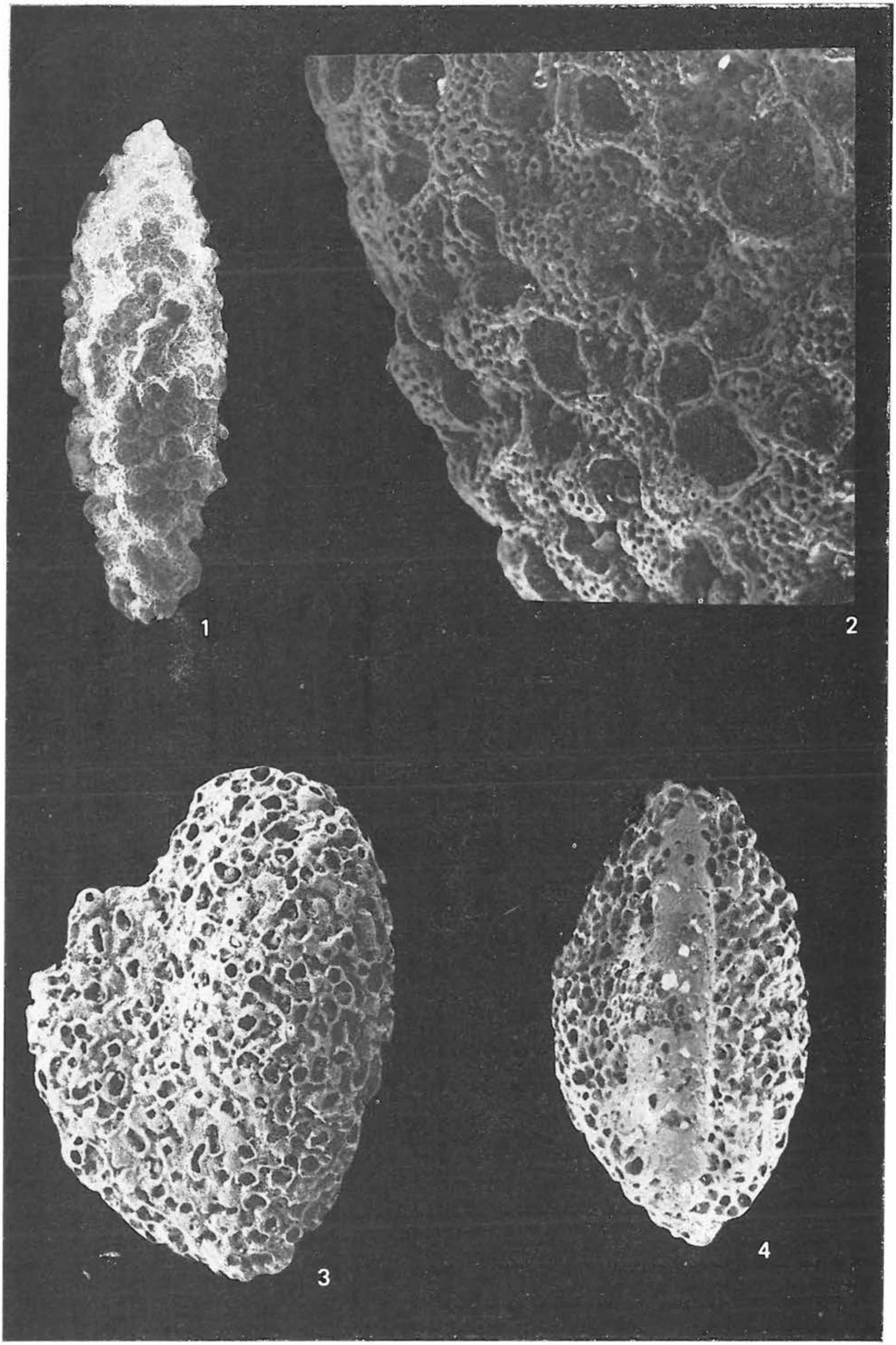
XXIV. tábla — Plate XXIV

1—4. *Acervulina dudarensis* n. sp.

1. A ház domború oldala, ahol a rendszertelenül elhelyezkedő kamrák házfala nincs kitöredezve. — Convex side of test, where the wall of the irregularly distributed chambers is unbroken. 60×
2. A 3. ábrán levő példány kinagyított házfala, ahol megfigyelhetők a finom pórusok, helyenként a kitöredezett kamrafalak és a vékony septumok. — Enlarged wall of the specimen shown in Fig. 3, where the fine pores and locally, the broken chamber-walls and the thin septa are observable. 200×
3. A képen egy szabálytalanabb példány domború oldala látható, kitöredezett kamrafalakkal. — Convex side of a rather irregular specimen with broken chamber walls. 48×
4. A ház feltapadási felülete. — Surface of adhesion of test. 48×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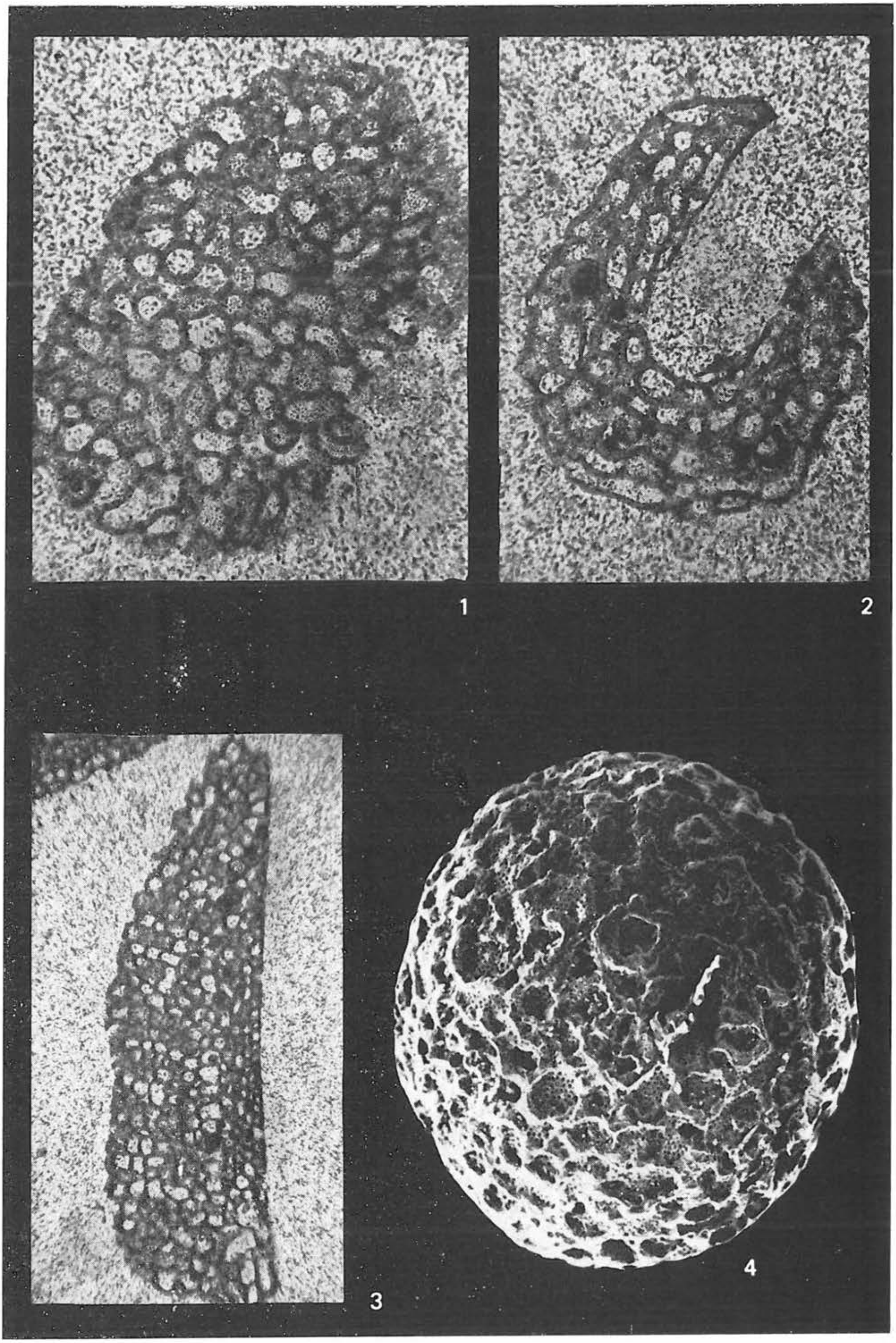
XXV. tábla — Plate XXV

1–3. *Acervulina dudarensis* n. sp.

1. A ház csiszolati képe a szabálytalanul rendezett izometrikus kamrákkal. — Thin section of test with the irregularly distributed isometric chambers. 83×
2. A feltapadásra merőleges csiszolati kép, ahol a feltapadás körül 1–2 szabályos kamrasor látható. — Thin section perpendicular to the adhesion surface, where 1–2 regular chamber series are visible around the adhesion surface. 83×
3. A feltapadással párhuzamos csiszolati kép. — Thin section parallel to adhesion. 45×

4. *Sphaerogypsina globula* (Reuss). 72×

A gömb alakú ház felszínén szabálytalan hálózatot alkotó kamravarratvonal figyelhető meg. — On the surface of the spherical test a suture line forming an irregular network can be observed.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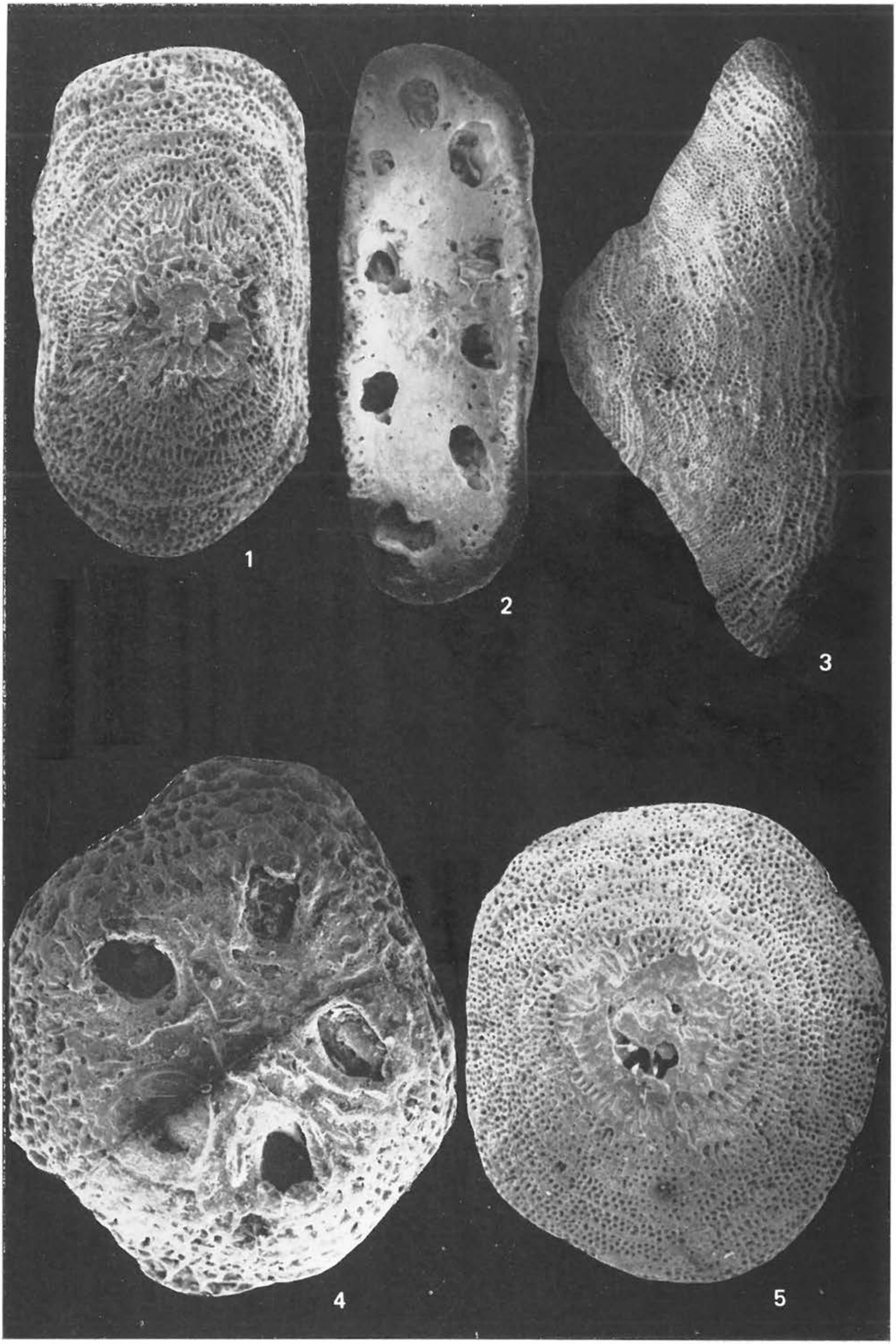
XXVI. tábla — Plate XXVI

1–5. *Fabiania cassis* (Oppenheim)

1. A ház hátoldala. Megfigyelhetők a gyűrűszerűen rendezett kamrasorok. — Dorsal view of test. Note the chamber series of ring-like pattern. 30×
2. Az ovális alakú ház köldökoldala, a peremek mentén elhelyezkedő kör alakú nyílásokkal. — Umbilical view of oval test with circular apertures along the margin. 15×
3. Az előző példány oldalnézete. Megfigyelhető a kúp alakú ház és a körkörösen, egymás fölött elhelyezkedő varratvonalak. — Lateral view of the same specimen. Note the conical test and the vertical succession of concentric suture lines. 15×
4. Az ötszögletű bázisalappal rendelkező ház köldökoldala öt kör alakú nyílással. —Umbilical view of a test having a pentagonal basal plane with five circular foramina. 30×
5. A képen a majdnem ötszögletű alappal bíró ház hátoldala látható. Két gömbszerű kezdőkamra is megfigyelhető a ház csúcsánál. — Dorsal view of subpentagonally based test. At the apex of the test, two spheroidal initial chambers can also be observed. 30×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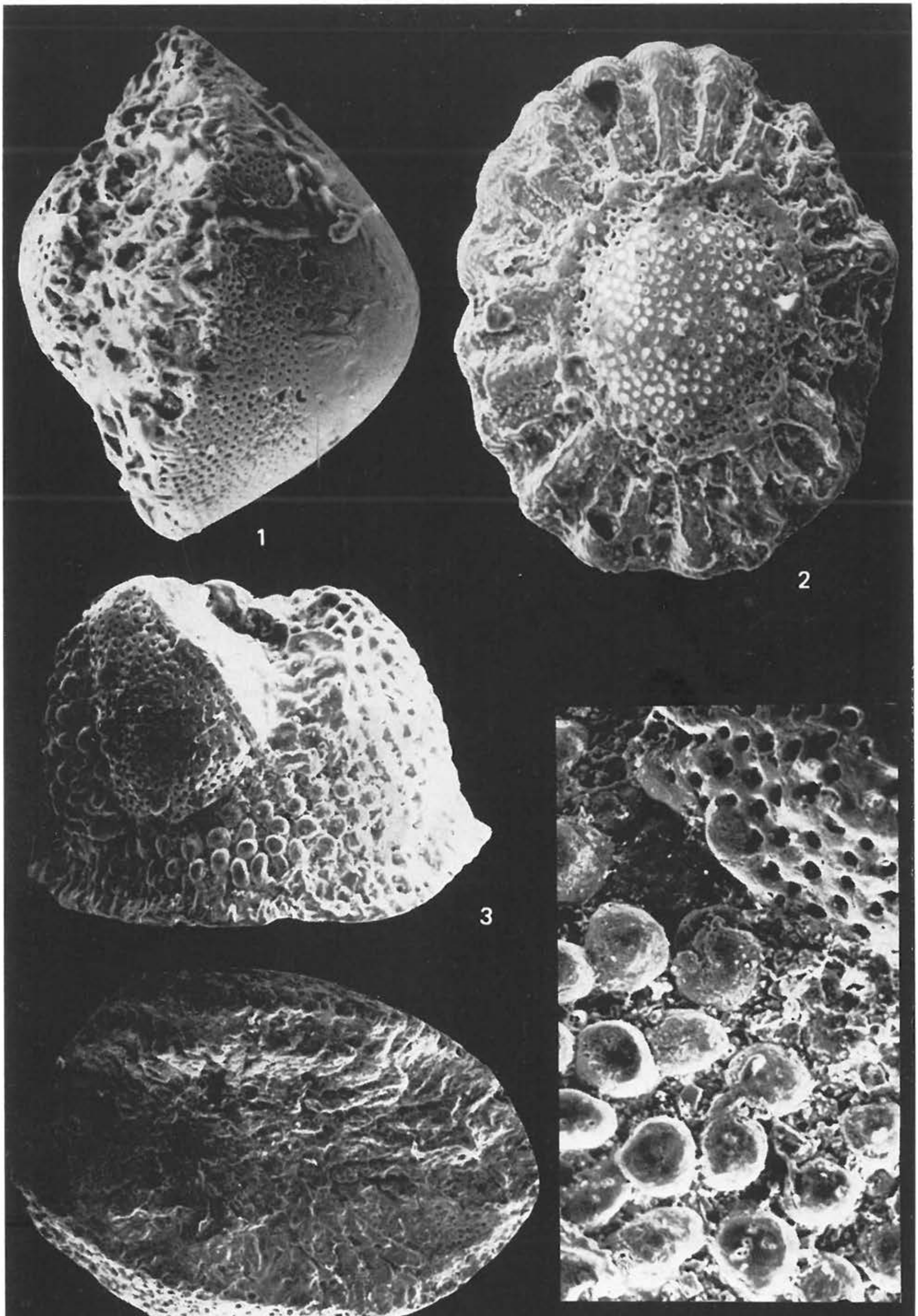
XXVII. tábla — Plate XXVII

1—2. *Halkyardia minima* (LIEBUS)

1. A ház köldökoldala középen egy dugószerű képződménnyel és körülötte sugarasan bordázott résszel. — Umbilical view of test with a plug-like feature at the centre and with a radially ribbed area around it. 130×
2. A ház oldalnézete. Látható a kúpos háti oldal, valamint a hasi oldalon kiemelkedő köldökdugó. — Lateral view of test. Note the conical dorsal area and salient umbilical plug on the ventral side. 150×

3—5. *Eorupertia cristata* (GÜMBEL)

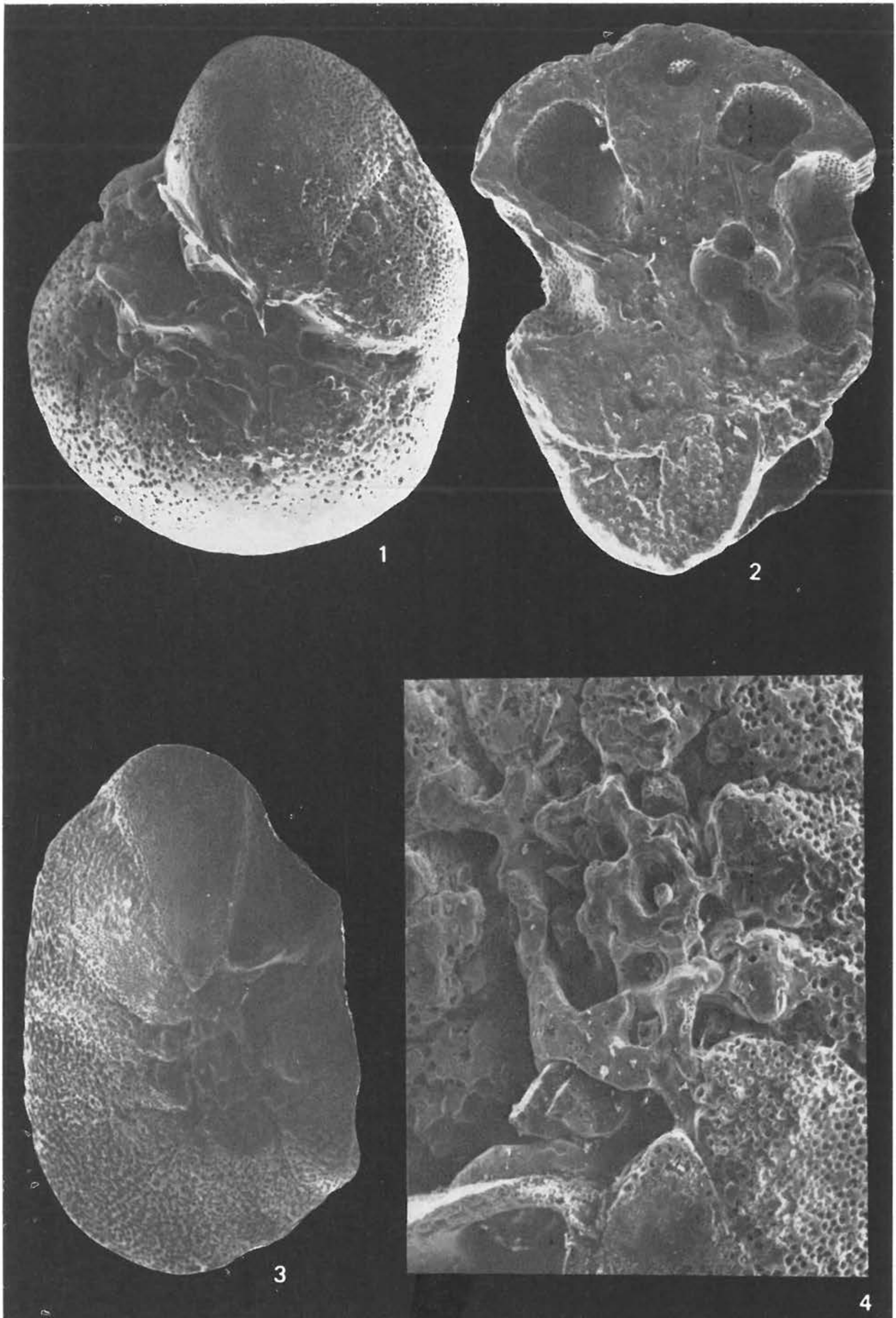
3. A ház oldalnézete. Látható az élben végződő perem, a helyenként bütykös, helyenként sima felszín. — Lateral view of test. Note the edged margin and the locally tuberculate, locally smooth surface. 40×
4. A ház fennőtt oldala. A fala enyhén konkáv. — Attached part of test. Its wall is slightly concave. 36×
5. A 3. ábrán látható példány kinagyított házfala. Az egyik kamra felszínén erősen kiemelkedő bütykök láthatók, a másik kamra felülete sima, csak a pórusok figyelhetők meg. — Enlarged wall of the specimen shown in Fig. 3. On the surface of one of the chambers highly emergent tubercles can be seen, the surface of the other chamber is smooth, just pores being observable on it. 150×



XXVIII. tábla — Plate XXVIII

1—4. *Eorupertia magna* (LE CALVEZ)

1. A ház köldökoldala. Középen láthatók a csatornákkal összekötött oszlopszerű képződmények. — Umbilical view of test. Note the columnar structures connected by channels in the middle. 54×
2. A fennőtt ház spirális oldala. A kamrák fala kitöredezett, így megfigyelhetők a septumok. — Spiral view of attached test. The chamber walls are broken, so the septa are visible. 40×
3. A ház köldökoldala. Az előzőnél megnyúltabb példány. — Umbilical view of test. A specimen more elongate as compared to the former. 20×
4. Az 1. ábrán levő példány középső oszlopszerű részének kinagyítása. Jól láthatók az oszlopokat összekötő csatornák. — Enlarged, column-like detail from the specimen shown in Fig. 1. Note the distinct channels connecting the columns. 60×



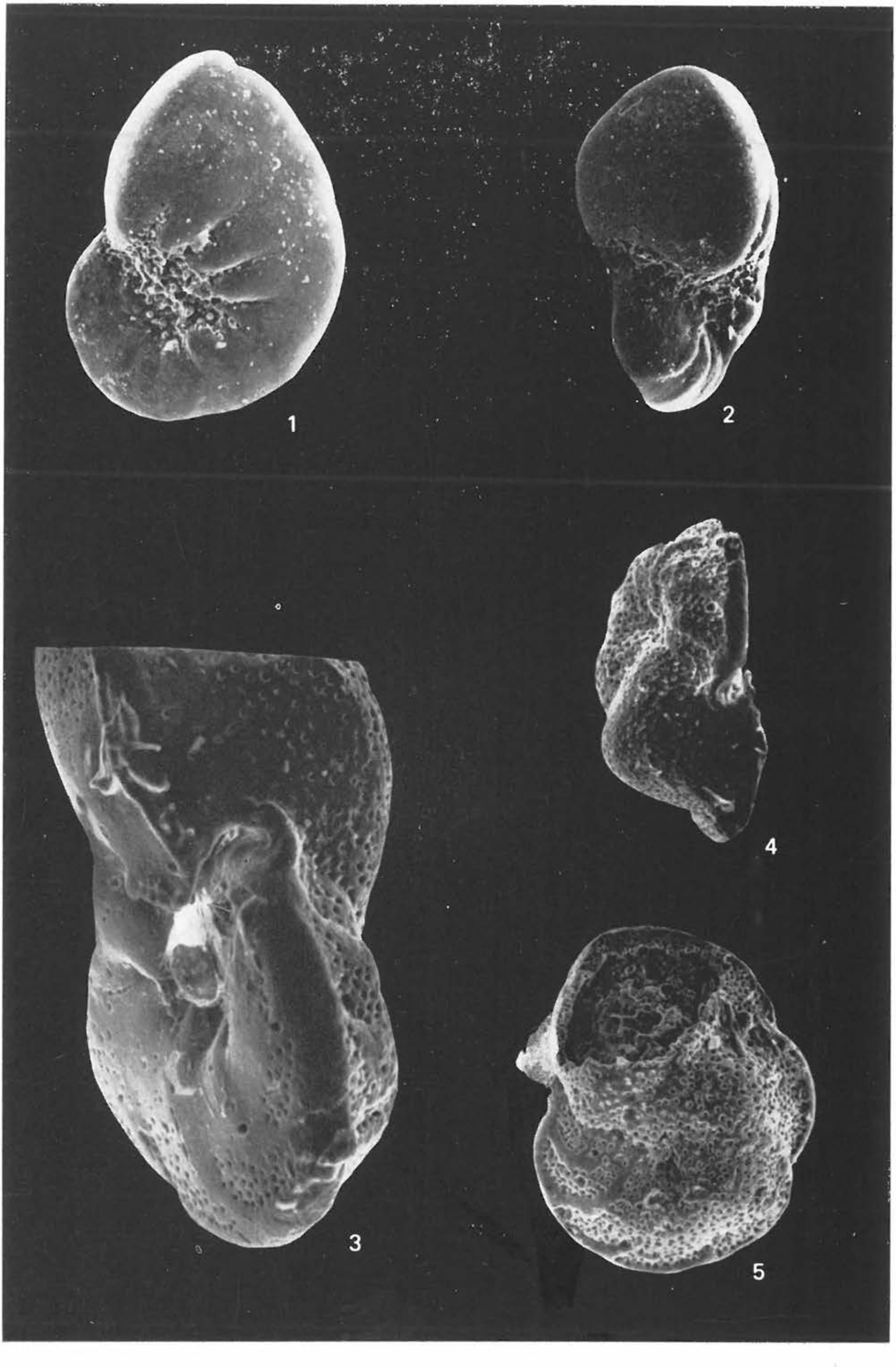
XXIX. tábla — Plate XXIX

1–2. *Nonion scaphum* (Fichtel et Moll) 100×

1. A ház oldalnézete, ahol az apró pórusok láthatók. — Lateral view of test, where tiny pores are visible.
2. Az előző példány kissé megdöntve az élén áll. Látható az utolsó kamra pereménél levő szájnyílás. — The same specimen a slightly tilted, standing on its carina.

3–5. *Hanzawaia producta* (Terquem)

3. A képen az élére állított ház hurokszerű szájnyílása látható. — Looped aperture of a test standing on its carina. 200×
4. Az előző példány teljes képe. — Total view of the same specimen. 100×
5. A ház köldökoldala a kidomborodó, megvastagodott varratvonallal. — Umbilical area of test with the swollen, convex suture. 100×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XXX. tábla — Plate XXX

1–2. *Lamarckina erinacea* (KARRER)

1. A ház oldalnézete, ahol a bütykös háti oldal és a sima köldökoldal is látható. — Lateral view of test, where both the tuberculate dorsal area and the smooth umbilical area are visible. 150×
2. Az előző példány köldökoldala a kerek nyílással. — Umbilical view of the same specimen with the circular foramen. 120×

3–5. *Schlosserina asterites* (GÜMBEL). 40×

3. A ház köldökoldala. Jól látható a szájnyílás és a járulékos nyílások. — Umbilical view of test. Note the distinct aperture and supplementary apertures.
4. A ház dorzális oldala a megvastagodott varratvonallal. — Dorsal view of test with the swollen suture.
5. A 3. ábrán levő példány élére állítva. Látható a szájnyílás és a megvastagodott perem. — The specimen from Fig. 3 positioned as standing on its carina. Note the aperture and the swollen peristome.