今金地域研究

第5号

論説

1999

今金町教育委員会

今金地域研究　第5号　1-9ページ，1999
Bulletin of the studies in Imakane district, no. 5 p. 1-9, 1999

ピリカカイギュウの復元

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Restration of the Pirika Sea-cow

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Key words：ピリカカイギュウ，レプリカ，復元，前提，工程，
Pirika Sea-cow, Replica, Restration, Preconditions, Process

1．はじめに

1983年に発見され，84年春に発掘された海牛化石は「ピリカカイギュウ」と名付けられ，研究に付されることとなった．発掘の記録と入念な地質調査に基づいた研究成果は，発掘から十年を待たずに『美利河産海牛化石発掘調査報告書』（美利河海牛化石調査研究会，1992）として見事にまとめられたが，ピリカカイギュウ自体についてはその成果がわかりやすい形で町民の元に届けられずにいた．発掘時には町民の高い関心を喚起し，少なからぬ公費を費やし，町民の博物館建設への大きな期待を好機の波に乗せることができなかったのは，この発掘に携わった者ひとりひとりの責任であることを真摯に受け止めなければならない．筆者も発掘に関わった一人としてその責任を強く感じていた．ちょうどその折，同じ思いを抱いていた今金町教育委員会の能條　歩学芸員（当時）と筆者との間にピリカカイギュウの復元に関する話が持ち上がり，当時筆者が所属していた沼田町自然史研究室と「沼田化石研究会」の技術を活かして復元を実施する計画が急速に進展した．これがピリカカイギュウ復元のきっかけである．

私たちの思いはピリカカイギュウを深遠なる闇の淵に葬り，再び眠らせてはならないということ，そして，本研究の成果品であるピリカカイギュウの復元レプリカを地元今金町の皆さんに見ていただき，改めて世界最大級の希有なる標本を有する町の住人であることを実感していただければという思いに尽きる．

以下に，ピリカカイギュウ復元の前提およびその工程について記述する．

2．復元の前提

1）　同定・分類

復元にあたってはその前提になる事項がいくつかある．その第一は，産出した化石が体のどこの部

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位に当たるかということである．この作業を同定という．一般に哺乳類には左右対称におよそ50種200個の骨があり，どれひとつ同一のものはない．したがって，注意深く観察すれば，必然的に本来の部位が判明することになる．産出部位が明らかになれば，欠損部あるいは欠落部位が明確になる．同定の結果，本標本の産出部位は頭骨，第１～第７頚椎，第１，第２胸椎，左第１～第７肋骨，右第５～第７肋骨，左右の肩甲骨，左右の上腕骨，左右の前腕骨（橈骨，尺骨），左の手根骨（３点）の合計で29点であった（美利河海牛化石調査研究会，1992）（第1図）．

海牛類は始新世に地球上に登場して以降，水中生活に急速に適応し後肢を減退，消失していった海生哺乳類の一グループである．したがって，本種は後肢を構成している13種，60個の骨格をすでに失っている．ゆえに，産出した29点は総数で140点あまりになる海牛類全身骨格のおよそ20%ということになる．死後水中に漂い，腐乱，沈降，分解あるいは海岸に漂着し，波などによって物理的に破壊されることが多い海生哺乳類の産出例としては本標本は究めて良い保存状態を示す．

次に，産出した動物は何か，という問題が出てくる．この仕事を分類という．これに関しては，最終的な研究の成果を待たなくてはならないが，次の事項を確認し，最低限必要な分類を実施した．

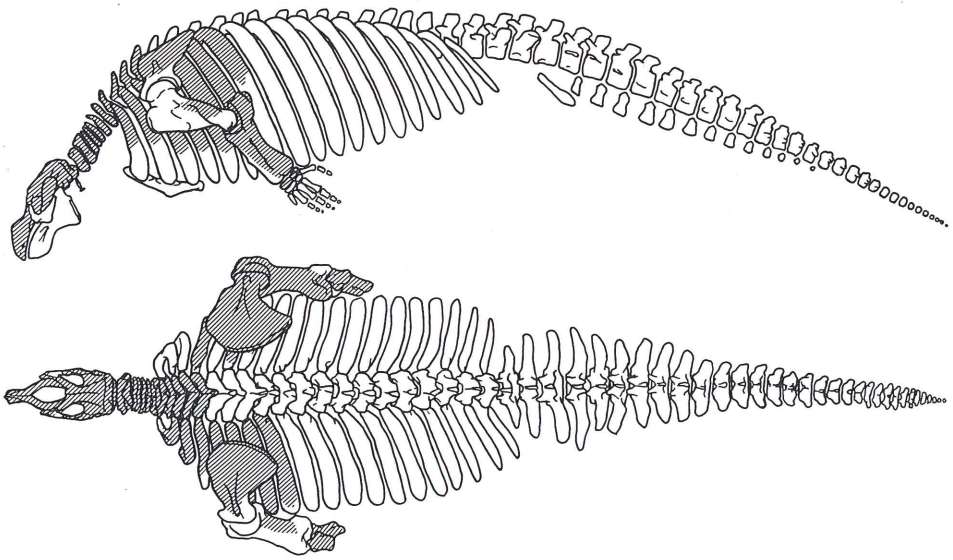
a.　脊椎動物（門）か？⇨Yes：脊椎が産出している．

b.　哺乳類（綱）か？⇨Yes：脊椎の椎体面が前後とも平坦であり，成長期間に期限のある事を示す骨端線を観察することができる．

c.　海牛目か？⇨Yes：海牛類は海生哺乳類の中で唯一の草食動物であり，大きな体を水中に沈め，浮力とのバランスを取るために肥厚化した肋骨を獲得した．それゆえ，海牛類の肋骨は緻密で重く，太い楕円形～円形の断面を持つ．

さらに低次の分類については，産出年代である後期更新世（およそ1.2Ma:Ma=百万年前；能條ほか，印刷中）という時代も考慮し，ジュゴン科・ヒドロダマリス亜科・ヒドロダマリス属と判断した．その根拠は，ピリカカイギュウの産出年代の前後にあたる前期鮮新世（およそ4～5Ma）からはヒドロダマリス属のタキカワカイギュウ（*Hydrodamalis spissa*）が発見されており（Furusawa, 1988），更新世から完新世（1768年絶滅）まではステラーカイギュウ（*H. gigas*）の生息が確認されていることによる．

ヒドロダマリス属の属性には体躯の大型化（体長７～10メートル）と機能歯の消失が挙げられる．また，ヒドロダマリス属の中でもっとも派生的な形質をもつステラーカイギュウには寒冷化に適応した形質として指骨の消失が記載されている（Steller,1899）．



第1図　ピリカカイギュウの産出部位　斜線部が産出した部位

ピリカカイギュウは，タキカワカイギュウ，ステラーカイギュウに匹敵する大型の骨格を持ち，上顎骨および前顎骨には歯を収める歯槽が観察できないことからヒドロダマリス属の属性を示している．ただし，本標本は手根骨を有することから掌骨（中手骨，指骨）の存在する可能性があると判断して，前腕骨の遠位端に合わせた掌骨を作製することとした．

2)　体長の推定

体長を確定する骨格の要素は頭蓋骨および脊椎の数とその大きさである．頭骨については産出した化石からほぼ完全に復元することができる．脊椎の数については，これまでにその数が確定されている以下の資料を参考にした．

Dusisiren jordani（UCMP77037）=C7，T21，L3，S1，Ca32（Domning, 1978）

Hydrodamalis spissa（TMNH0001）=C7, T19, L3, S1, Ca13+（Furusawa, 1988）

H. gigas（TMNH0002）=C7, T19, L3, S1, Ca32-34（Kaiser, 1974）

〈略号〉

UCMP:University of California Museum of Paleontology

TMNH:Takikawa Museum of Art and Natural History

C:頚椎，T:胸椎，L:腰椎，S:仙椎，Ca:尾椎

検討の結果，ピリカカイギュウの脊椎について，頚椎は哺乳類の一般的な属性として7個，胸椎は中新世から完新世にかけて21個から19個に減少する傾向があり，ピリカカイギュウの産出年代に近いステラーカイギュウ（*H. gigas*）の胸椎が19個であることからこれと同じ19個を，また，腰椎3個と仙椎1個は海牛類の一般的な形質であることから，これらの数値を採用した．尾椎にはかなりの個体差があり，復元した段階で仙椎から最後尾の尾椎に向け全体の大きさを漸移的に減少させていき，30個前後になるよう復元を試みた．

3)　性差

雌雄の別については，現生種においても骨格からは明瞭に区別できないとされるが，Marsh（1980）によるとジュゴンでは雄が雌に比べると大きな牙（門歯）を持つため，牙を収める前顎骨前位端の幅が広くなる傾向を示すとされる．この点から本標本を観察すると，本標本の前顎骨は幅が狭く，むしろ前方に向けて細くなること，また，その先端に歯槽の空洞などが観察されないことから雌と判断した．また，雌の形質として仙椎の横突起遠位端が椎体腹側縁よりも下方に達する傾向があるという指摘がされている（Domning, 1978）ことから，本標本の仙椎についてもこの形質に基づいて復元した．

3．復元の工程

上記の要件を前提とし，概ね次の通りピリカカイギュウの復元を行った．

1)　産出部位標本のレプリカ作製

産出した部位のレプリカについては事前に今金町において作製されたものを借用し，使用した．

2)　産出部位レプリカの欠損・欠落部の複製（第2図）

産出した部位の欠損・欠落部の復元については陥没や亀裂など周囲の形状で復元が可能なものについては紙粘土を埋めて整形した．残存部が微小であり形状の復元が困難なものは，形態復元の参考資料としてほぼ完全に産出しているヒドロダマリス亜科ドゥシシーレン属のヨルダニカイギュウ（*Dusisiren jordani*：UCMP77037）とヒドロダマリス属のタキカワカイギュウ（*H. spissa*：TMNH0001）およびステラーカイギュウ（*H. gigas*：TMNH0002）の形状を参考にその概形をウレタンで作製し，レプリカに接着した後，表面を紙粘土で整形し復元した．

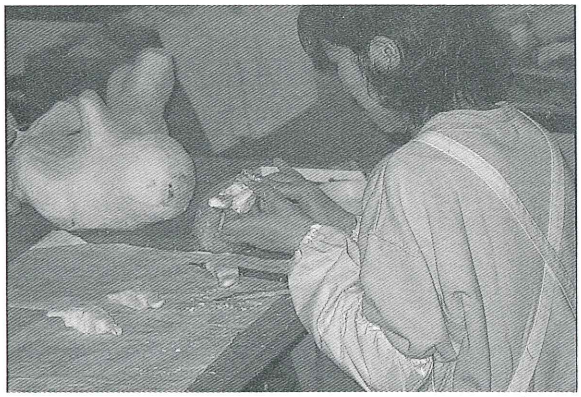
第2図　産出部位（頚椎）の復元　灰白色の部分が産出部位のレプリカ．白色部分が紙粘土による復元．沼田町自然史研究室の前で，自然乾燥による乾燥作業．

3)　欠落部位の復元

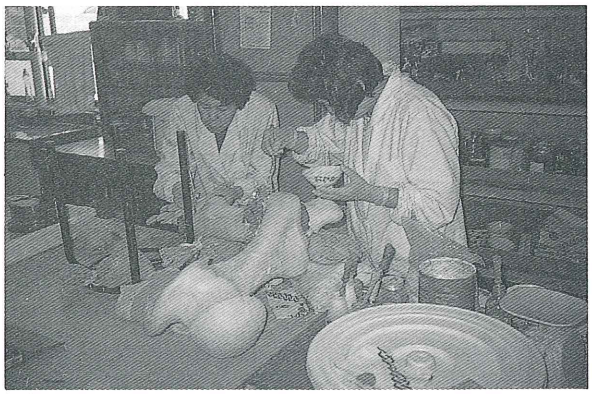
欠落した産出部位については，前工程において完成した産出部位の復元模型を参考に，推定した脊椎や肋骨の個数などに基づいてサイズや形状などが自然に漸移するよう復元を行った．欠落部位の復元についても欠損部分の復元同様，概形をウレタンで成形し（第3図），表面を紙粘土で整える方法を採用した．紙粘土は乾燥させても収縮の小さなものを使用し，仕上げなどでは必要に応じて水を加え，粘性を下げたものを使用する．紙粘土は天日あるいは乾燥器などを用いて充分に乾燥させる．作業の進行を早めるためにドラフト内に乾燥器を入れ，強制的に乾燥させる方法もある．ただし，この場合には，整形した資料を乾燥器に近づけすぎるとウレタンが膨張破裂して本体を破損することがあるので注意を要する（第4図）．表面の仕上げには数種類の紙やすり（#80, #150, #240）を用い，最終的になめらかな表面になるまで紙粘土の塗布，乾燥，磨きを繰り返えす（第5図）．

第３図　タキカワカイギュウの脊椎のウレタン模型と紙粘土による成形作業

第４図　ドラフトを利用した乾燥



第5図　紙やすりによる整形



第6図　ポリエステル樹脂による成形

次に各部位の復元について概説する.

《頭蓋骨》

産出したピリカカイギュウの頭骨は吻部と脳頭蓋に分離していたが，欠損する部分が少なかったのでほぼ完全に復元することができた．ただし，吻部の傾斜角度は食性との関連が指摘されており，機能歯を持たず浅い海で海藻類を主食としていたステラーカイギュウと本標本との間に形質的な大きな相違が見られないことから，吻部の傾斜についても同程度のものと判断し，復元した．完全に欠落している下顎骨については，頭骨に残る下顎関節窩から吻端までの長さを基準にステラーカイギュウの下顎骨の形状を参考にして復元した.

《脊　椎》

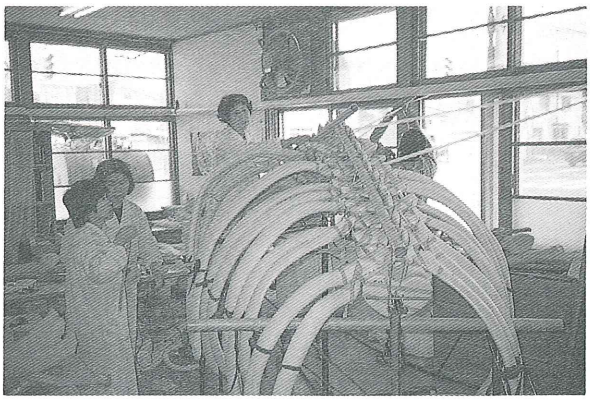
欠落する第３胸椎以降の脊椎については，産出したピリカカイギュウの脊椎の計測値がタキカワカイギュウの値の115～130％の値を示すことから，タキカワカイギュウにおいて産出している脊椎のうち第３胸椎から第14尾椎までのレプリカをウレタンで成形し，既存のピリカカイギュウの脊椎と漸移するよう必要箇所に紙粘土を塗布して形状を整えた（第３図）．第15尾椎以降についてはウレタンを適当な大きさに成形し，既存の標本を参考に全体で30個前後で形状が自然に収束するように紙粘土で整形した.

尾椎腹側に関節するV字骨は，尾椎腹側の関節窩を観察することでその大きさと数を推定することができるが，ピリカカイギュウは尾椎を産出していないのでタキカワカイギュウ（*H. spissa*：TMNH0001）の尾椎と32個のほぼ完全な尾椎といくつかのV字骨を産出しているヨルダニカイギュウ（*D. jordani*：UCMP77037）の尾椎を参考に製作した.

《肋　骨》

ピリカカイギュウの肋骨は左側の保存が良く，第１～第７肋骨が産出している．脊椎同様，産出部位の復元を完成した後，第８から第19肋骨をタキカワカイギュウの肋骨のウレタン模型を元に復元を行った．ただし，ピリカカイギュウの第１～第７肋骨の大きさは脊椎とは逆にタキカワカイギュウの60～90％の値で，内外に偏平で薄くなる傾向を示すことから，ウレタンで型を抜いたタキカワカイギュウの肋骨をカッターややすりで削るなどして形状を整えた後，表面に紙粘土を塗布した．一般湾曲および頭尾方向，軸方向の捻れについてはウレタンをバーナーで温めたながら力を加え，前後のものと形状を合わせた．右側の肋骨は復元した左側と対称となるようタキカワカイギュウのウレタン模型を元に製

第7図　鉄柱，鉄骨の設計，製作．胸部を支える支柱の固定作業



第8図　仮組み立て

作した.

《胸　骨》

海牛類の胸椎は分類上重要な形質を持つ部位であるが，ピリカカイギュウは胸骨を産出しなかったため，産出年代が最も近いステラーカイギュウの胸骨を参考に作製し，復元した.

《前　肢》

前肢は右側のものの保存が良いのでこれを元に大きさと形状が類似するステラーカイギュウを参考にして復元し，左側のものを対称的に作製した.

ピリカカイギュウは発掘時に３個の手根骨の存在が確認されている．掌骨（指骨，中手骨）については，存在の有無が確認されていないものの手根骨があることから復元を試みた.

前腕骨の遠位関節面を基準に近位手根骨の頭尾径，内外径を設定し，現生するジュゴンあるいはマナティーの掌骨を参考にウレタンで作製し，表面を紙粘土で仕上げた.

《寛　骨》

中新世以降の海牛類は後肢の要素のうち寛骨のみを残す．寛骨は退化した一対の棒状の骨で，産出例は究めて少ないことからタキカワカイギュウあるいはヨルダニカイギュウを参考に作製した.

4)　複製作業（第6図）

紙粘土による成形が完成したら，その表面に離型剤を塗り，乾燥させた後，レプリカ作りの工程に入れる．レプリカはシリコンゴムによる型取り（母型作り）とポリエステル樹脂による成形の２つの工程からなる．成形後アクリル系顔料による着色を行うこともあるが，今回はポリエステル樹脂に直接同系樹脂の顔料を混ぜ，同一色のレプリカを作製した．レプリカ作製の工程については西村（1984）に詳しい解説がある.

5)　鉄骨支柱の設計・製作（第7図）

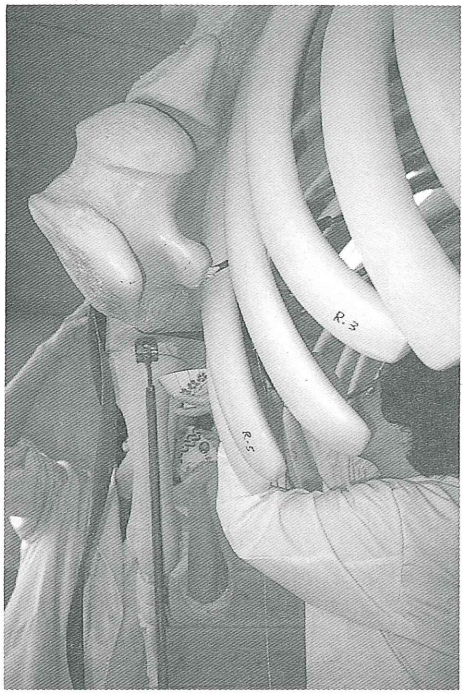
ピリカカイギュウは脊椎の大きさがタキカワカイギュウを上回ることから，事前にかなり大型の復元模型になることが推測できたので，鉄骨支柱は頭蓋骨の「頭部」，頚椎から胸椎までの脊椎と肋骨および前肢が付属する「胸部」および腰椎から尾椎までの「尾部」の３部に分けて組み立てられるよう設計した.

脊柱は椎体の中央に鉄管を貫通させ，椎間をポリエステル樹脂で埋め，組み立てた際に外部から鉄管が見えないよう配慮した．頭部は脊柱の鉄管に当たる位置に鉄管の内径に一致する鉄筋を埋設，固定し，脊椎の鉄管に差し込んだ後，背腹方向に穴を貫通させ，ピンで止めた．胸部と尾部はそれぞれ２本の支柱で自立させ，展示スペースの多様性を考慮し，連結せず分離させて組み立てた．胸部と尾部の脊柱を支える２本の支柱はそれぞれ上下に高さが調節でき，頭部と尾部の高さを変えても展示ができるよう，支軸を矢状面に対し垂直方向になるようジョイントを加工した．また，狭い出入り口をもつ建物へも搬入ができるよう，胸郭を支える鉄筋は取り外しができるよう加工し，脊柱の鉄管から伸ばした胸郭の鉄筋を支持する支柱も左右に開閉できるよう連結させた.

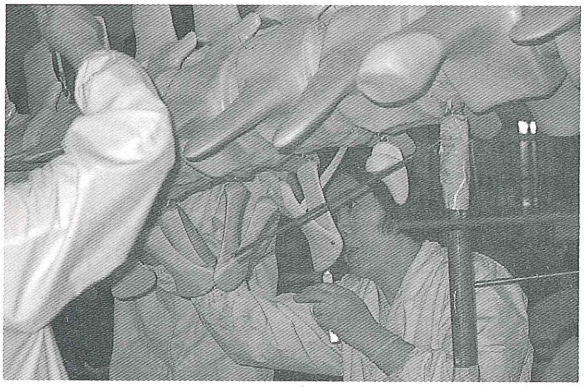
6)　仮組立，本組立（第8図）

仮組み立ては背椎を鉄管に通してテープなどで仮に固定し，大きさ，湾曲，傾斜などが全体にバランスがとれているか確認を行う．前後の関係が不自然なレプリカはポリエステル樹脂の削除あるいは添付を行い，仮組み立てした状態で修正を行う.

脊椎の中でも頚椎から胸椎の部分が完成したら肋骨を関節させ仮に固定し，脊椎同様の調整を行う．かなり大きな修正が必要な場合は，レプリカの原形となる資料を作り直す方が手間を省くことができる．以上の作業がすべて完了したら支柱や鉄枠にそれぞれの位置を直接印し，一旦取り外した後順序良



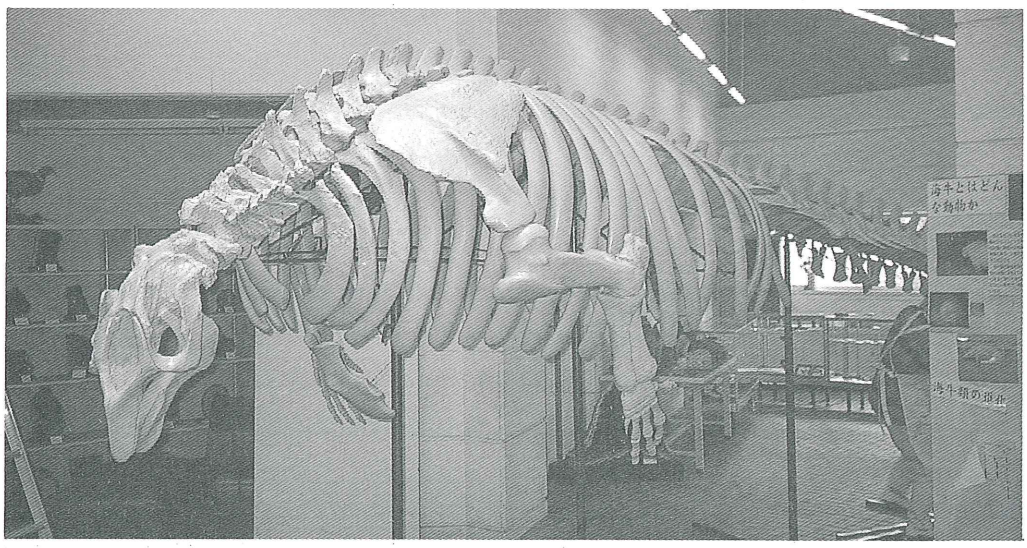
第9図　前肢の関節の固定



第10図　V字骨の固定

くポリエステル樹脂を用いて接着をしていく．前肢の位置と肩甲骨，上腕骨，前腕骨および掌骨のそれぞれの角度を設定したら，関節部をポリエステル樹脂で固定する（第9図）．前肢は一定の位置に固定されるよう肩甲骨内側にフックを掛けるリングを，上腕骨の内側に鉄筋を入れる穴を二つバランス良く開け，支柱から鉄筋を伸ばしてこれらに接続できるように先端を加工する．V字骨は尾椎と関節させ接着しておく（第10図）．肋骨と胸椎との関節は，胸椎の横突肋窩にリングを肋骨頭あるいは肋骨結節にフックの長さが調節できるよう長めの鉄線を埋めて固定し，全体にバランスがとれる位置でフックを作った．肋骨遠位端の固定は，胸郭の湾曲にあわせた鉄筋に通すことのできる円筒形の鉄管に径が2mm程度の針金を溶接したものを肋骨本数分（片側19個）通し，ねじで固定できるよう加工しておく．肋骨遠位端の内側に胸郭に沿わせた鉄筋に当たる位置に針金と同じ径の穴を開けこれに上記の鉄管を移動させて針金を入れ，固定した．

以上の作業が終了するとレプリカが完成する（第11図）．



第11図　完成したピリカカイギュウ

4．終わりに

本来，化石資料の復元組立は研究成果の最終工程としてなされるべきものである．今回，その成果を待たずに復元組立に着手したのは異例とも言え，独断専行の誹りを逸れないかもしれない．また，復元の前提となった項目についても，異なった意見をもつ方もあるかと思う．しかし，敢えてここにピリカカイギュウの全体像を復元展示した意図は，前述した通り，ピリカカイギュウの世界的な価値を少しでも町民の方に感じていただきたいという願いに尽きる．ここに実施した復元に関する責任はすべて筆者にある．今後，さまざまな分野の方からご叱正，ご指摘いただければ幸いである．

「ピリカカイギュウ」という名は正式には未だ仮の名（通称）に過ぎない．その形態的な特徴を記載し，特異な形質を認め，新種であることが確認された種にのみ新種名が付され，和名として独自の名称が与えられるのである．残念ながらピリカカイギュウは公表の機会を逸したまま，未だ堂々とその名を口にすることができない．万一，同様の特徴を有する海牛類が別の場所から産出し，逸早く別の名を付けて記載分類を公表した場合にはピリカカイギュウは幻の海牛となってしまうのである．これに類する話はいくつもある．特に有名なのは「アパトサウルス」に名前を譲る羽目になった「ブロントサウルス」である．ピリカカイギュウがブロントサウルスと同じ憂き目に遭わぬよう願わずにはいられない．

同時に，めでたく新種として記載登録され，晴れて世界にその名を名乗る時が来たときには，世界的な協定である“安全な保管”と“公正な公開”の義務を模式標本を所有する関係機関は実行しなければならないことも胆に銘じておいてほしい．その時こそ，今金町に博物館が不可欠の施設として創設されるときであろうと密かに期待している．

謝辞　復元という作業は膨大なエネルギーを必要とする発掘と繊細さと根気が要求されるクリーニング作業によって標本が準備されなければ始まらない．発掘とクリーニングに携われた今金町をはじめとするすべての方々に敬意とともに感謝申し上げる．

ピリカカイギュウの復元は沼田町自然史研究室および沼田化石研究会のスタッフの創意と工夫が随所に活かされている傑作である．日夜アイデアの創出に努力いただいた石田ミヨ氏，河島東代恵氏，辻　優子氏，小坂恵子氏，谷口真弓氏，篠原　暁学芸員，また，われわれの技量のおよばない鉄骨の設計と施工についてご尽力いただいた㈲高田車両の高田　勲氏に記して厚くお礼申し上げる．

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今金地域研究　第5号　11-48ページ，1999
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Foraminifera from the Kuromatsunai and Setana Formations in southwestern Hokkaido, Japan -Preliminary report-

Ayumu NOJO[1)]

Key words : foraminifera, Kuromatsunai Formation, Setana Formation, Pliocene, Pleistocene, southwestern Hokkaido.

1. Introduction

Neogene to Quaternary deposits distributed along the Japan Sea side in Hokkaido, implying a history of development and changes of the Japan Sea, are one of most important subjects for the study to understand geological and geographical frameworks of the present Japanese Islands. In spite of these facts, there have not been enough data about the environmental changes of these areas, near the northern end of the Japan Sea areas, or around the Oshima Peninsula.

The Oshima Peninsula in southwestern Hokkaido is regarded geologically as the northern extension of the "Green Tuff" region of the Inner Zone of the Northeast Japan (e.g. Kato et al. eds., 1990). The peninsula has extensive distributions of the Neogene and Quaternary deposits which unconformably overlie pre-Tertiary sedimentary and igneous rocks. This region has been one of stratigraphical standards of the Neogene in Hokkaido since the study by Nagao and Sasa (1933).

Neogene to Pleistocene marine sediments in this region are generally classified into the following ascending-ordered formations, Kunnui, Yakumo, Kuromatsunai, and Setana (Nagao and Sasa, 1933). These formations are well exposed in middle to northern parts of the peninsula. Such stratigraphy first proposed by Nagao and Sasa (1933) has been accepted, but recent biostratigraphical data reveal that the Setana Formation should be of Pleistocene age (e.g. Nojo et

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al., in press). General relationships among these formations are as follows: from the Kunnui to Kuromatsunai Formation they contact conformably each other, but they are clinounconformably overlain by the Setana (e.g. Nagao and Sasa, 1933; Matsui et al., 1955; Hashimoto et al., 1963; Oka and Mitani, 1981; Nojo et al., 1994).

There are a few reports on microfossils in the Kuromatsunai and Setana Formations. In particular, despite abundant yieldings of foraminifera from the Setana Formation, there have not been so many reports on foraminifera (Asano, 1936a, b, 1937, 1939; Asano and Nakamura, 1937; Shirai, 1959, 1960; Masatani and Ohkura, 1980MS; Takahashi et al., 1980MS; Tsuchi and Ibaragi, 1982; Tsubakihara et al., 1989; Nojo et al., 1997), and we have only chronostratigraphical data by Nojo et al.(in press), which are related to paleoenvironmental changes on the basis of micropaleontological analyses.

The rock materials for this study were sampled from the formations in northern to middle part of the Oshima Peninsula, and were analyzed in 1994 to 1998 by the author when he was a curator of Imakane Borad of Education. Some data of these works have been reported by Nojo et al. (1997: Tab. 1). This study is preliminaly report and list of foraminifera from the Kuromatsunai and Setana Formations to indicate a history of paleoenvironmental changes. The author mainly describes about some occurrences of foraminfera (Tab. 2) and shows their fuanal list with plates in this report. A detailed discussion about paleoenvironmental changes is left for another opportunity.

Table 1 Foraminifera from the Kuromatsunai and Setana Formation in Imakane area (after Nojo et al., 1997)

Sample number (Kmu: Sakkurubetsu Pyro. Mem., Kms: Okusawa Sand. Mem, Ss: Setana F.)	Kmu-1	Kmu-2	Kmu-3	Kmu-4	Kmu-5	Kms-1	Ss-1	Ss-2
Planktonic Foraminifea								
Globigerina bulloides d'Orbigny	+	+	+	+		+	+	
Globigerina quinqueloba Natland			+					
Globigerina sp.							+	
Globigerinita glutinata (Egger)				+				
Globigerinita uvula (Ehrenberg)		+					+	
Neogloboquadrina incompta (Cifelli)	+	+	+	+			+	
Neogloboquadrina pachyderma (Ehrenberg) (dextral)	+	+	+	+			+	+
Neogloboquadrina pachyderma (Ehrenberg) (sinistral)	+	+	+	+			+	+
Benthic Formainifera								
Ammonia sp.								+
Angulogerina kokozuraensis Asano			+	+				
Angulogerina sp.		+						
Asterononion hamadaense Asano			+	+				
Bolivina decussata Brady				+				
Bolivina spp.		+	+					
Bolivinita quadrilatera (Schwager)	+							
Buccella frigida (Cushman)			+	+				
Buccella tenerrima (Bandy)		+						
Buccella sp.			+					
Bulimina sp.								+
Cibicides lobatulus (Walker & Jacob)			+					+
Cibicides refulgens de Montfort		+						
Cibicides subdepressus (Asano)		+		+				+
Cibicides spp.	+			+				
Cribroelphidium yabei (Asano)			+					+
Cribroelphidium sp.								+
Dyocibicides perforata Cushman & Valentine	+							
Elphidium crispum (Linné)		+						+
Elphidium excavatum (Terquem) forma *clavata* (Cushman)			+	+				
Elphidium jenseni (Cushman)		+						
Elphidium subarcticum Cushman				+				
Elphidium spp.		+						+
Epistominella pulchella Husezima & Maruhasi		+		+				
Epistominella spp.		+						+
Eponides ? spp.		+		+				
Fissurina annectens (Burrows & Holland)			+					
Fissurina baccata (Hellon-Allen & Earland)	+							
Fissurina marginata (Montagu)	+	+	+	+			+	
Fissurina orbignyana Seguenza				+				

Sample number (Kmu: Sakkurubetsu Pyro. Mem., Kms: Okusawa Sand. Mem, Ss: Setana F.)	Kmu-1	Kmu-2	Kmu-3	Kmu-4	Kmu-5	Kms-1	Ss-1	Ss-2
Benthic Foraminifera								
Fissurina cf. *rizzae* Seguenza				+				
Fissurina cf. *subquadrata* Parr		+						
Fissurina sp.			+					
Glabratella spp.		+					+	
Globocassidulina bisecta Nomura	+	+	+	+				
Globocassidulina jamesoni (McCullock)				+				
Globocassidulina spp.			+			+		
Guttulina yabei Cushman & Ozawa							+	
Globulina sp.				+				
Guttulina spp.	+	+		+			+	+
Hanzawaia nipponica Asano				+				+
Heterolepa praecincta (Karrer)				+				
Heterolepa subhaidingerii (Parr)			+					
Islandiella japonica (Asano & Nakamura)	+		+				+	+
Islandiella norcrossi (Cushman)		+						
Islandiella setanaensis (Asano & Nakamura)	+		+				+	+
Islandiella sublimbata (Asano & Nakamura)	+	+	+	+		+	+	+
Islandiella yabei (Asano & Nakamura)		+	+	+			+	+
Islandiella spp.	+	+					+	
Lagena acuticosta Reuss	+							
Lagena apiopleura Loeblich & Tappan			+					
Lagena striata (d'Orbigny)	+							
Lagena spp.	+			+				
Lenticulina sp.	+							
Melonis pompilioides (Fichtel & Moll)	+							
Melonis uchioi Hasegawa	+							
Nonion sp.		+						
Nonionellina labradorica (Dawson)			+	+				
Oolina striatopunctata (Parker & Jones)				+				
Oridorsalis umbonatus (Reuss)	+							
Planoglabratella subopercularis (Asano)	+							
Polystomellina discorbinoides Yabe & Hanzawa		+						
Pseudoparrella takayanagii (Iwasa)			+					
Pullenia apertura Cushman			+					
Pyrgo ezo Asano					+			
Stilostomella sp.	+							
Uvigerina akitaensis Asano				+				
Uvigerina juncea Cushman & Todd	+							
Uvigerina schencki Asano			+					
Uvigerina spp.								

Table 2 Foraminifera from the Kuromatsunai and Setana Foramtions

Sampling horizon	Upper Kuromatsu-nai F.	Lower Setana F.	Upper Setana F.
Planktonic Foraminifera			
Globigerina bulloides d'Orbigny	A	A	A
Globigerina quinqueloba Natland	R	C	F
Globigerinita glutinata (Egger)	F	F	F
Globigerinita uvula (Ehrenberg)	R	VR	F
Globigerinoides ruber (d'Orbigny)	-	-	R
Globorotalia inflata (d'Orbigny)	C	C	VR
Grobigerina spp.	-	-	R
Neogloboquadrina cf. asanoi (Maiya, Saito, and Sato)	VR	-	-
Neogloboquadrina dutertrei (d'Orbigny)	VR	-	-
Neogloboquadrina incompta (Cifelli)	C	A	A
Neogloboquadrina pachyderma(D) (Ehrenberg)	F	A	C
Neogloboquadrina pachyderma(S) (Ehrenberg)	F	C	C
Neogloboquadrina sp.	-	VR	R
Gen. et sp. indet.	VR	R	VR
TOTAL COUNTED	296	308	5035
Benthic Foraminifera			
Alabamina japonica (Asano)	VR	-	-
Ammonia beccarii (Linné)	-	VR	-
Ammonia ketienziensis (Ishizaki)	-	VR	-
Ammonia inflata (Seguenza)	-	R	-
Ammonia takanabensis (Ishizaki)	-	VR	-
Ammonia spp.	-	VR	R
Angulogerina hughesi (Galloway and Wissler)	R	VR	R
Angulogerina kokozuraensis Asano	R	-	R
Anomalina rostata (Brdy)	-	-	VR
Anomalinella spp.	-	-	R
Anomalinoides globulosus (Chapman & Parr)	VR	-	R
Astacolus hyalacrulus Loeblich and Tappan	VR	-	VR
Astrononion aomoriense Asano	-	VR	-
Astrononion hamadaense Asano	-	F	R
Astrononion spp.	R	-	VR
Bolivina decussata Brady	F	-	R
Bolivina sp. A	VR	R	R
Bolivina spp.	R	-	R
Brizalina alata (Seguenza)	-	-	VR
Brizalina spp.	-	-	R
Buccella frigida (Cushman)	VR	R	R
Buccella makiyamai (Chiji)	VR	R	C
Buccella nipponica (Husezima & Maruhasi)	-	VR	R
Buccella tanaii (Uchio)			R
Buccella tenerrima (Bandy)	R	-	C
Buccella spp.	VR	VR	R
Bulimina cf. imamurai Tai	R	-	-
Buliminella elegantissima (d'Orbigny)			F
Cancris auriculus (Fichtel & Moll)			VR
Chrysalidinella dimorpha (Brady)			VR
Cibicides cf. kamadai Asano			VR
Cibicides lobatulus (Walker & Jacob)	A	A	F
Cibicides refulgens de Montfort	C	C	C
Cibicides subdepressus (Asano)	R	F	R
Cibicides tani Iwasa and Kikuchi	F	R	R
Cibicides spp.	R	R	R
Cibicidoides pachydermus (Rzehak)	R	-	VR
Cornuspira involvens (Reuss)			R
Cribloelphidium oregonense (Cushman & Grant)	-	-	VR
Cribroelphidium yabei (Asano)			R
Cribrolinoides curta (Cushman)			VR
Cycloforia contorta (d'Orbigny)	-	VR	R
Cystammina pauciloculata (Brady)	VR	-	-
Discorbinella araucana (d'Orbigny)	R	VR	F

Sampling horizon	Upper Kuromatsu-nai F.	Lower Setana F.	Upper Setana F.
Benthic Foraminifera			
Discorbinella bertheloti (d'Orbigny)	-	-	R
Discorbinella spp.	R	-	VR
Eilohedra spp.	R	-	-
Elphidiella arctica (Parker & Jones)	C	-	-
Elphidium aculeatum (d'Orbigny)	-	-	VR
Elphidium advena (Cushman)	-	-	VR
Elphidium bartletti Cushman	R	F	R
Elphidium crispum (Linné)	F	F	F
Elphidium excavatum (Terquem) forma clavata Cushn	-	R	F
Elphidium frigidum Cushman	R	-	R
Elphidium hanzawai Asano	-	VR	-
Elphidium incertum (Williamson)	-	-	VR
Elphidium janseni (Cushman)	VR	-	R
Elphidium macellum (Fichtel & Moll)	VR	-	-
Elphidium subarcticum Cushman	-	F	C
Elphidium subgranulosum Asano	-	-	F
Elphidium subincertum Asano	-	R	-
Elphidium translucens Natland	-	-	R
Elphidium spp.	F	VR	R
Epistominella pulchella Husezima & Maruhasi	R	VR	R
Epistominella spp.	VR	-	R
Eponides? sp.	R	-	R
Fissurina annectens (Burrows & Holland)	-	-	R
Fissurina cf. annectens (Burrows & Holland)	VR	-	-
Fissurina lacunata (Burrows & Holland)	-	-	R
Fissurina lucida (Williamson)	-	-	R
Fissurina marginata (Walker & Boys)	R	R	F
Fissurina obscurocostata Galloway & Wisser	VR	-	R
Fissurina orbignyana Seguenza	R	-	VR
Fissurina cf. rizzae Seguenza	-	-	R
Fissurina semimarginata (Reuss)	VR	R	-
Fissurina cf. subquadrata Parr	-	-	R
Fissurina spp.	R	VR	R
Gavelinopsis praegeri (Heron-Allen & Earland)	-	-	R
Gavelinopsis spp.	R	-	R
Glabratella cf. aurantista Seiglie & Bermúdes	-	-	R
Glabratella murabilis panamensis Seiglie & Bermúdes	-	-	R
Glabratella pulvinata (Brady)	-	-	R
Glabratella sp. A	-	-	R
Glabratella sp. B	-	-	R
Glabratella spp.	VR	-	R
Glandulina ovula d'Orbigny	-	-	-
Globocassidulina bisecta Nomura	F	R	R
Globocassidulina canalisuturata Eade	-	R	-
Globocassidulina neobrocha	-	-	R
Globocassidulina spp.	F	R	F
Guttulina spp.	VR	-	R
Gyroidina spp.	-	-	R
Hanzawaia nipponica Asano	R	VR	R
Haynesina sp.	-	-	R
Heronallenia sp.	-	-	VR
Heterolepa subhaidingerii (Parr)	-	-	R
Heterolepa sp.	VR	-	-
Islandiella helenae Feyling-Hassen & Buzas	-	-	R
Islandiella islandica (Nørbang)	F	-	-
Islandiella japonica (Asano & Nakamura)	F	C	R
Islandiella norcrossi (Cushman)	-	-	R
Islandiella sublimbata (Asano & Nakamura)	A	A	F
Islandiella yabei (Asano & Nakamura)	F	F	-
Islandiella spp.	-	R	R

Table 2 Foraminifera from the Kuromatsunai and Setana Foramtions (continued)

Sampling horizon	Upper Kuromatsu-nai F.	Lower Setana F.	Upper Setana F.
Benthic Foraminifera			
Karreriella baccata japonica Asano	-	VR	-
Karreriella spp.	R	-	R
Lagena acuticosta (Reuss)	-	-	VR
Lagena apiopleura (Loeblich & Tappan)	VR	VR	R
Lagena sulcata spicata Cushman & McCulloch	-	-	R
Lagena sp.	-	-	VR
Lenticulina nikobarensis (Schwager)	-	-	VR
Lenticulina sp.	-	-	VR
Melonis pacificus (Cushman)	VR	-	VR
Melonis uchioi Hasegawa	-	-	VR
Melonis spp.	VR	-	-
Miliolinella circularis (Bornemann)	-	-	R
Miliolinella spp.	-	-	R
Neoconorbina stachi (Asano)	-	VR	-
Neoeponides procerus (Brady)	-	R	R
Neoeponides spp.	VR	-	-
Nodosarina? sp.	-	-	VR
Nonion japonicus Asano	-	-	R
Nonion spp.	R	VR	R
Nonionella stella Cushman &Moyer	-	-	R
Nonionoides grateloupi (d'Orbigny)	-	-	VR
Oolina carteri Albani and Yassini	VR	-	-
Oolina costata (Williamson)	-	-	VR
Oolina melo d'Orbigny	-	VR	R
Oolina striatopunctata (Parker & Jones)	-	-	VR
Oolina sp.	-	-	VR
Oridosalis umbonatus (Reuss)	-	-	VR
Oridosalis cf. umbonatus (Reuss)	VR	-	-
Osangularinella umbonifera (Cushman)	VR	-	-
Paracassidulina sulcata Belford	-	-	R
Pararotalia nipponica (Asano)	-	-	R
Patellina corrugata Williamson	-	VR	R
Patellinella hanzawai Asano	-	-	R
Pateoris hauerinoides (Rhmbler)	-	-	F
Planoglabratella australensis (Heron-Allen & Earland)	-	-	R
Planoglabratella opercularis (d'Orbigny)	-	-	R
Planoglabratella pateriformis (Brady)	-	-	R
Planoglabratella subopercularis (Asano)	R	R	F
Planoglabratella? sp. C	-	-	VR
Polystomellina discorbinoides Yabe & Hanzawa	-	VR	R
Poroeponides cribrorepondus Asano & Uchio	-	-	R
Pseudononion japonicum Asano	-	VR	R
Pseudononion spp.	-	VR	VR
Pseudoparrella naraensis Kuwano	VR	-	F
Pseudoparrella takayanagii (Iwasa)	VR	R	F
Pseudoparrella spp.	-	-	R
Pseudopolymorphina sp.	-	-	VR
Pullenia apertura Cushman	VR	-	-
Pyrgo ezo Asano	VR	-	-
Pyrgo fornasinii Chapman & Parr	-	R	-
Quinqueloculina agglutinata Cushman	-	-	R

Sampling horizon	Upper Kuromatsu-nai F.	Lower Setana F.	Upper Setana F.
Benthic Foraminifera			
Quinqueloculina akneriana d'Orbigny	R	R	R
Quinqueloculina costata d'Orbigny	-	-	R
Quinqueloculina elongata Natland	-	-	R
Quinqueloculina kuromatunaiensis Asano	-	-	R
Quinqueloculina sawanensis Asano	-	-	R
Quinqueloculina seminulum (Linné)	-	VR	R
Quinqueroculina vulgaris d'Orbigny	-	R	R
Quinqueloculina cf. vulgaris d'Orbigny	-	-	VR
Quinqueloculina yezoensis Asano	-	-	R
Quinqueloculina sp. B			R
Quinqueloculina sp. C	-	-	R
Quinqueloculina sp. F	-	-	R
Quinqueloculina sp. G	-	-	R
Quinqueloculina sp. H	-	-	R
Quinqueloculina spp.	R	R	F
Rectobolivina rephanus (Parker & Jones)	-	-	VR
Rosalina australis (Parr)	VR	VR	R
Rosalina bradyi (Cushman)	VR	VR	F
Rosalina isabelleana d'Orbigny	-	-	R
Rosalina vilardeboana d'Orbigny	-	-	R
Rosalina spp.	R	VR	R
Sigmohauerina sp.	-	-	VR
Sigmoidella pacifica Cushman & Ozawa	-	-	VR
Sigmoidella spp.	VR	-	-
Sigmoilina sigmoidea compressa Cushman	-	R	-
Sigmoilina sp.	-	-	VR
Sigmomorphina spp.	-	VR	-
Sigmomorphina semitecta terquemiana (Fornasini)	-	-	R
Sigmomorphina trilocularis (Bagg)	VR	-	-
Sigmovirgulina sp.	-	-	VR
Sphaeroidina japonica Brady	VR	-	-
Sphaeroidina spp.	-	-	-
Spirillina limbata Brady	-	-	VR
Spirillina vivipara Ehrenberg	-	-	R
Spirillina sp.	-	-	VR
Spiroloculina hadai Thalmann	-	-	R
Spiroloculina sp.	-	-	VR
Spiroplectammina sp. A	-	-	R
Spiroprectammina sp.	-	-	VR
Spiroplectinella wrightii (Silvestri)	-	-	R
Textularia conica d'Orbigny	-	-	VR
Textularia spp.	-	-	R
Triloculina rotunda d'Orbigny	-	VR	-
Triloculina suttuensis Asano	-	-	R
Triloculina tricarinata d'Orbigny	-	-	VR
Triloculina sp. A	-	-	VR
Uvigerina juncea Cushman	-	VR	-
Uvigerina spp.	VR	-	-
Valvulineria hamanakoensis (Ishiwada)	-	-	VR
Valvulineria japonica Asano	-	VR	-
Gen. et sp. indet.	R	F	F
Total counted	869	780	4652

A: 80.5-13.5%, C: 13.5-4.5%, F: 4.5-1.5%, R: <1.5%, VR: two or less occurrences, -: no occurrence

2. Faunal Reference List

Foraminiferal species from the Kuromatsunai and Setana Formations are alphabetically listed below, under the categories of planktons and benthos. The selected species are illustrated with scanning electron micrographs in Plates 1 to 12. The original references are given for species. Additional references are selected from those with helpful remarks and illustrations about the species from the areas studied in this report. All specimens are catalogued and deposited in Department of Science Education, Iwamizawa College, Hokkaido University of Education.

Planktonic Foraminifera

Globigerina bulloides d'Orbigny

Globigerina bulloides d'Orbigny, 1826, Ann. Sci. Nat., Paris, ser. 1, v. 7, p. 277, Modéle nos. 17, 76; Brady, 1884, Voy. Challenger, Rep., Zool., v. 9, p. 593, pl.79,figs. 7a-c.

Globigerina quinqueloba Natland

Globigerina quinqueloba Natland, 1938, Bull. Scripps Inst. Oceanogr., Tech. Ser., v. 4, no. 5, p. 149, pl. 6, figs. 7a-c.

Globigerinita glutinata (Egger)

Globigerina glutinata Egger, 1893, Abhadle. K. Bayer. Akad. Wiss. Munchen, CLII, v. 18, p. 371, pl. 13, figs. 19-21.

Glonbigerinita glutinata (Egger), Parker, 1962, Micropal. v. 8, no. 2, p. 246, pl. 9, figs. 1-16.

Globigerinita uvula (Ehrenberg)

Pylodexia uvula Ehrenberg, 1861, K. Preuss., Akad. Wiss. Berlin, Monatsber., p. 276, 277, 308.

Globigerinita uvula (Ehrenberg), Parker, 1962, Micropal., v. 8, no. 2, p. 252, pl. 8, figs. 14-26.

Globigerinoides ruber (d'Orbingy)

Globigerina rubra d'Orbigny, 1839, *in* Sagra, R. de la, Hist. Ohys. Pol. Nat. Cuba, Foraminiferes, p. 82, pl. 4, figs. 12-14.

Globigerinoides rubra (d'Orbingny) (sic.), Cushman, 1927, Cushman Lab. Foram. Res., Contr., v. 3, pt. 1, p. 87, pl. 19, figs. 6a-c.

Globorotalia inflata (d'Orbigny)

Globigerina inflata d'Orbigny, 1839, *in* Barker-Webb and Berthelot, Hist. Nat. Canaries, v. 2, pt. 2, Zool., p. 134, pl. 2, figs. 7-9.

Globorotalia inflata (d'Orbigny), sensu strict, Maiya Saito and Sato, 1976, *in* Takayanagi and Saito eds. Progress in Micropaleontology, Micropal. Press, p. 408, pl. 2, figs. 5-7.

Neogloboquadrina cf. *asanoi* (Maiya, Saito, and Sato)

cf. *Globoquadrina asanoi* Maiya, Sato, and Saito, 1976, Progress in Micropaleontology. p.

409, pl. 3, figs. 1a-c, 2a-c, 3.

cf. *Neogloboquadrina asanoi* (Maiya, Saito, and Sato), Thompson, 1980, Init. Rep. DSDP. v. 56-57, pl. 3, figs. 10-12.

Neogloboquadrina dutertrei (d'Orbigny)

Globigerina dutertrei d'Orbigny, 1839, Foraminiferés, p. 84, pl. 4, figs. 19-21.

Neogloboquadrina dutertrei (d'Orbigny), Rögl and Bolli, 1973, Init. Rep. DSDP, v. 27, 743-767, pl. 9, figs. 1-3, 7-10; pl. 17, figs. 1-6.

Neogloboquadrina incompta (Cifelli)

Globigerina incompta Cifelli, 1961, Cushman Found. Foram. Res., Contr., v. 12, pt. 3, p. 84, pl. 4, figs 1-7.

Neogloboquadrina incompta (Cifelli), Rogl and Bolli, 1973, Init. Repts. DSDP, v. 15, p. 571, pl. 10?

Neogloboquadrina pachyderma (Ehrenberg)

Aristerospira pachyderma Ehrenberg, 1861, K. Preuss. Akad. Wiss, Berlin, Monatsber. p. 276, 277, 303.

Globigerina pachyderma (Ehrenberg), Brady, 1884, Voy. Challenger, Rep., Zool., v. 9, p. 600, pl. 114, figs. 19, 20.

Neogroboquadrina pachyderma (Ehrenberg), Rogl and Bolli, 1973, Init. Repts. DSDP, v. 15, p. 571, pl. 11, figs. 2-6; pl. 16, fig. 12.

Benthic Foraminifera

Alabamina japonica (Asano)

Pseudoparrella japonica Asano, 1949, Jour. Paleont., 23 (4), p430, fig. 2, Nos. 2-4.

Alabamina japonica (Asano), Takayanagi and Hasegawa, 1987, Checklist and bibliography of post-Paleozoic foraminifera established by Japanese workers, 1890-1986, p. 39.

Ammonia beccarii (Linné)

Nautilus beccarii Linne, 1758, Syst. Nat., se. 10, p. 710.

Ammonia beccarii (Linne), Fizzell and Keen, 1949, Jour. Pal., v. 23, no. 1, p. 106.

Ammonia ketienziensis (Ishizaki)

Steblus ketienziensis Ishizaki, 1948, Acta Geol. Taiwan, 2 (1), 59, pl. 1, figs. 2a-c.

Ammonia ketienjiensis (Ishizaki), Huang, 1964, Micropaleont. v. 10, no. 1, p. 53, pl. 1, figs. 13a-c.

Angulogerina hughesi (Galloway and Wissler)

Uvigerina hughesi Galloway and Wissler, 1927, Jour. Pal., v. 1, p.76, pl. 12, figs. 5a, b.

Angulogerina hughesi (Galloway and Wissler), Asano, 1950, Pacific Sci. v. 4, no. 2, p. 19, figs. 91-93.

Angulogerina kokozuraensis Asano

Angulogerina kokozuraensis Asano, 1949, Jour. Pal., v. 23 no. 4, p. 428, text-fig. l, nos. 50-53; 1950, Illust. Cat.Japan. Tert. Small. Foram., pt. 2, p. 19, figs- 94-96.

Trifarina kokozuraensis (Asano), Matoba, 1967, Tohoku Univ., Sci. Rep., 2nd ser. (Geol.) ,

v.38, no.2, p. 257, pl. 26, fig.3.

Anomalinella rostrata (Brady)

Truncatulina rostrata Brady, 1881, Quart. Jour. Micr. Sci., n. s., v. 21, p. 65.

Anomalinella rostrata (Brady), Cushman, 1927, Cont. Cushman Labo. Foram. Res., v. 3, p. 93.

Anomalinoides globulosus (Chapman and Parr)

Anomalina grosserugosa Brady, 1884, Challenger Foram., p.675, pl. 94, figs. 4, 5.

Anomalina globulosa Chapman and Parr, 1937, Austr. Antarct. Exp. 1911-14, Sci. Rep., ser. C, 1 (2), p.117.

Astacolus hyalacrulus Loeblich and Tappan

Astacolus hyalacrulus Loeblich and Tappan, 1953, Smithsonian Misc. Coll. v. 121, no. 7, p.52, pl. 9, figs. 1-4.

Astrononion aomoriense Asano

Astrononion aomoriense Asano, 1950, Illust. Cat. Japan. Tert. Small. Foram., pt.1, p. 5, figs. 25, 26.

Astrononion hamadaense Asano

Astrononion hamadaense Asano, 1950, Illust. Cat. Japan. Tert. Small. Foram., pt.1, p.6, figs. 29-31.

Bolivina decussata Brady

Bolivina decussata Brady , 1881, Quart. Jour. Micr. Sci., n.s., v. 21, p. 28; 1884,Voy. Challenger, Rep., Zool., v. 9, p. 423, pl. 53, figs. 12-13.

Bolivina sp.A

This form is identified to *Bolivina* sp. A of Hasegawa (1979), and is similar to *Bolivina decussata* Brady in its outline, but differs from it in less developed, and rounded lobes on the wall surface.

Bolivinita quadrilatera (Schwager)

Textularia quadrilatera Schwager, 1866. Novara Exp. Geol. Theil., 2, p. 253, pl. 7, fig. 10.

Bolivina quadrilatera (Schwager), Asano, 1938, Jour. Geol. Soc. Japan, 45, p. 607, pl.16, fig. 10.

Brizalina alata (Seguenza)

Vulvulina alata Seguenza, 1862, Atti Accad. Gioenia Sci. Nat., 2 (18), p. 115, pl. 2, figs.5, 5a.

Bolivina alata (Seruenza), Cushman, 1937, Cushman Lab. Foram., Res. Spac. Publ., 9, p. 106, pl.13, figs. 3-11.

Brizalina alata (Seguenza), Belford, 1966, Bureau of Mineral Resources, Geol. and Geophysics, Bull. 79.

Buccella frigida (Cushman)

Pulvinulina frigida Cushman, 1922, Canada Biol. Contr., no. 9 (1921), p. 12.

Buccella frigida (Cushman), Andersen, 1952, Washington Acad. Sci., Jour., v. 42, no. 5, p. 144, figs. 4-6.

Buccella kuromatsunaiensis Shirai, 1960, Jour. Fac. Sci. Hokkaido Univ., Ser. IV, vol. X, 537-543, pl. 2, figs. 2a-c.

Buccella makiyamai Chiji

Eponides schreibersii Morishima and Chiji (not of Reuss), 1952, Mem. Coll. Sci., Univ. Kyoto, ser. B, v. 20, no. 2, pl. 2 (XIII), figs. 6a-c.

Buccella makiyamae (sic.) Chiji, 1961, Prof. J. Makiyama, Mem. Vol., Kyoto, p. 234, text-figs. 2a-c, pl. l, figs. 13-14.

Buccella nipponica (Husezima and Maruhasi)

Discorbis nipponica Husezima and Maruhasi, 1944, Jour. Shigenkagaku Kenkyusho (Res. Inst. Nat. Resour., Japan), v. l, no. 3, p. 397, pl. 34. figs. 9a-c.

Buccella nipponica (Husezima and Maruhasi) , Hasegawa, 1979, Tohoku Univ., Sci. Rep., 2nd ser. (Geol), v. 49, no. 2, p. 144, pl. 7, figs. 4a-d.

Buccella tanaii (Uchio)

Eponides tanaii Uchio, 1951, Jour. Geol. Soc. Japan, 57, p. 376, pl. 5, fig. 8.

Buccella tanaii (Uchio), Takayanagi and Hasegawa, 1987, Checklist and bibliography of post-Paleozoic foraminifera established by Japanese workers, 1890-1986, p. 19.

Buccella tenerrima (Bandy)

Rotalia tenerrima Bandy, 1950, Paleont., vol. 24, Tulsa, Okula., p. 278, pl. 42, fig. 3.

Eponides frigidus (Cushman) , Cushman and Todd, 1947, (not *Pulvinulina frigida* Cushman, 1922), Cushman Lab. Foram. Res. Spec. Publ. v. 23, p. 71, pl. 8, fig. 7.

Buccella inusitata Andersen, 1952, Washington Acad. Sci., Jour., v. 42, no. 5, p. 148, figs.10-11.

Buccella tenerrima (Bandy), Feyling-Hanssen, 1976, Maritime Sediments Spec. Publ. 1, p. 353, pl. 1, fig. 8-10; pl. 2, fig. 10-12.

Bulimina cf. *imamurai* Tai

cf. *Bulimina imamurai* Tai, 1959, Hiroshima Univ., Jour. Sci. ser. C, v. 2, no. 4, p. 387, pl. 40, fig. 3.

Buliminella elegantissima (d'Orbigny)

Bulimina elegantissima d'Orbigny, 1839, Voy. Amer. Mérid., Foraminiféres, v. 5, pt,. 5, p. 51, pl. 7, figs. 13, 14.

Buliminella elegantissima (d'Orbigny), Cushman, 1919, U.S. Nat. Mus., Proc., v. 56, p. 606.

Cancris auriculus (Fichtel and Moll)

Nautilus auriculus Fichtel and Moll, 1789, Testacea microscopica, p. 105, pl. 20, figs. a-f; 1803 var. a, p. 108, pl. 20, figs. a-c; var. b, p. 110, pl. 20, figs. d-f.

Cancris auricula (Fichtel and Moll) (sic.), Cushman, 1927, Bull. Scripps Inst. Oceanogr., Tech. Ser., v. 1, no. 10, p. 164, pl. 5. flag. 10.

Chrysalidinella dimorpha (Brady)

Chrysalidina dimorpha Brady, 1881, Quart. Jour. Micr. Sci., n. s., v. 21, p. 24; 1884, Voy. Challenger, Rep., Zool., v. 9, p. 388, pl. 46, figs. 20-21.

Chrysalidinella dimorpha (Brady), Schubert, 1908, Neues Jb. Min. Geol. Pa,1., Beil.-Bd. 25, p. 242.

Cibicides cf. *kamadai* Asano

cf. *Cibicides kamadai* Asano, 1951, Illust. Cat. Japan. Tert. Small. Foram., pt. 13, p. 17, figs. 33-35.

Cibicides lobatulus (Walker and Jacob)

Nautilus lobatulus Walker and Jacob, 1789, Adams Essays, p. 642, pl. 14, fig. 36.

Cibicides lobatula (Walker and Jacob) (sic.), Cushman, 1931, U.S. Nat. Mus., Bull. 104, pt. 8, p. 118, pl. 21, figs. 3a-c.

Cibicides refulgens de Montfort

Cibicides refulgens de Montfort, 1808, Conch. Syst., v. l, p. 122.

Truncatulina refulgens (Montfort), Brady, 1884, Voy. Challenger, Rep., Zool., v. 9, p. 659, pl. 92, figs. 7-9.

Cibicides subdepressus (Asano)

Planulina subdepressa Asano (sic.), 1951, Illust. Cat. Japan. Tert. Small. Foram., pt. 13, p. 15, figs. 16-18.

Cibicides subdepressus (Asano), Takayanagi and Hasegawa, 1987, Checklist and bibliography of post-Paleozoic foraminifera established by Japanese workers, 1890-1986, p. 37.

Cibicides tani Iwasa and Kikuchi

Cibicides tani Iwasa and Kikuchi, 1954, Paleont. Soc. Japan, Trans. Porc., N. S., no. 16, p. 193, text-figs. 8a-c.

Cibicidoides pachydermus (Rzehak)

Truncatulina pachyderma Rzehak, 1886, Die Foraminiferenfauna der Neogenformation der Umgeburg von Mähr.-Osturf. Naturf. Ver. Brünn, Verh., Bruenn [Brno, Czechoslovakia], vol. 24 (1885), p. 87, pl. 1, fig. 5a-c.

Truncatulina pseudoungeriana Cushman, 1922, U.S. Geol. Surv. Prof. Pap., 129 E, p.97, pl. 20, fig. 9.

Cibicidoides pachyderma (sic.), van Morkhoven, 1986, Cenozoic Cosmopolitan Deep-Water Benthic Foraminifera, p. 68-71, pl. 22.

Cornuspira involvens (Reuss)

Operculina involvens Reuss, 1849, Denkschr. Akad. Wiss., Wien, vol. 1, p. 370, pl. 45, fig. 20.

Cornuspira involvens (Reuss), Barker, 1960, SEPM, Spec. Publ., 9, pl. 11, figs. 1-3.

Cribroelplhidium oregonensis (Cushman and Grant)

Elphidium oregoense Cushman and Grant (sic.), 1927, San Diego Soc. Nat. Hist., Trans., V, no.6, 79, viii, 3.

Cribroelphidium yabei (Asano)

Elphidium yabei Asano, 1938, Geol. Soc. Japan, Jour., v. 45, no. 538, p. 589, pl. 14, figs. 9-10.

Cribroelphidium yabei (Asano), Asano, 1950, Illust, Cat. Japan. Tert. Small. Foram., pt. l, p. 11, figs. 64-65.

Cribrolinoides curta (Cushman)

Quinqueloculina disparilis d'Orbigny var. *curta* Cushman, 1917, U.S. Nat. Mus. Bull. v. 71, no. 6, p.49, pl. 14, fig. 2.

Cribrolinoides curta (Cushman), Cusuman and Leroy, 1939, Contr. Cushman Lab. Foram. Res., v. 15, no. 1, p. 17, pl. 3, figs. 1-11; pl. 4, figs. 1-13.

Cycloforia contrta d'Orbigny

Cycloforia contrta d'Orbigny, 1846, Foram. Foss. Viene, p. 298, pl. 20, figs. 4-6.

Cystammina pauciloculata (Brady)

Trochammina pauciloculata Brady, 1879, Quaterly Jour. Microscopical Science, new ser. 19, p. 58, pl. 5, figs. 13, 14.

Ammpchilostoma pauciloculata (Brady), Eimer and Fickert, 1899, Zeitschriftf Wissenschaftiliche Zoologie 65, p. 692.

Cystammina pauciloculata (Brady), Galloway, 1933, A Manual of Foraminifera. p. 186, pl. 16, fig. 12.

Discorbinella araucana (d'Orbigny)

Rosanila araucana d'Orbigny, 1839,

Discorbinella araucana (d'Orbigny), Jones, 1994, Challenger Foraminifera, p. 93, pl. 86, figs. 10, 11.

Discorbinella bertheloti (d'Orbigny)

Rosalina bertheloti d'Orbigny, 1839, *in* Barker-Webb and Berthelot, Hist. nat.Canaries,v. 2, pt. 2, Zool., p. 135, pl.,1. figs.28-30

Discorbinella bertheloti (d'Orbigny), Loeblich and Tappan, 1964, Treatise on Inbertebrate Pal., Moore R.C., ed., pt. C, Protista, 2, v. 2, p. C575, figs. 453.

Dyocibicides perforata Cushman and Valentine

Dyocibicides perforata Cushman and Valentine, 1930, Contr. Stanford Geol. Dept., v. l, no. l, p. 31, pl. l0, figs. 3a-c.

Elphidiella arctica (Parker and Jones)

Polystomella arctica Parker and Jones, 1864, *in* Brady, Trans. Linn. Soc. London, Zool., v. 24, p. 471, pl. 48, fig. 18.

Elphidium arcticum (Parker and Jones), Cushman, 1930, U. S. Nat. Mus. Bull. 104, pt. 7, p. 27, pl. 11, figs. 1-6.

Elphidiella arctica (Parker and Jones), Cushman, 1939, U. S. Geol. Surv. Prof. Pap. 191, p. 65, pl. 18, figs. 11-14.

Elphidium aculeatum (d'Orbigny)

Polystomella aculeata d'Orbigny (sit.), 1846, Foraminiferes fossiles du Bassin Tertiare de Vienne (Autriche). Gide et Comp. p. 131, pl. 6, figs. 27-28.

Elphidium aculeatum (d'Orbigny), Thalmann, 1932, Ecologae Geologicae Helvetiae, v. 25, 293-312.

Elphidium advena (Cushman)

Polystomella advena Cushman, 1922, Carnegie Inst. Washington, Publ. 311, p. 56, pl. 9, figs. 11, 12.

Elphidium advenum (sit.), Cushman, 1930, U.S. Nat. Mus., Bull. 104, pt. 7, p. 25, pl. l0, figs. l, 2.

Elphidium articulatum (d'Orbigny)

Polystomella articulata d'Orbigny, 1839, Amer. Merid., Foraminiféres, v. 5, pt. 5, p. 30, pl. 3, figs. 9, l0.

Elphidium articulatum (d'Orbigny), Cushrnan, 1930, U.S. Nat. Mus., Bull. 104, pt. 7, p. 26, pl. l0, figs. 6-8.

Elphidium bartletti Cushman

Elphidium bartletti Cushman, 1933, Smithsonian Misc. Coll., v. 89, no. 9., p. 4, pl. 1, figs. 9a, b.

Elphidium bartletti Cushman, Loeblich and Tappan, 1953, Smithsonian Misc. Coll., v. 121, no. 7, p. 96, pl. 18, figs. 10-14.

Elphidium crispum (Linné)

Nautilus crispum Linné, 1758, Syst, Nat., ed. 10, p. 709.

Elphidium crispum (Linné), Cushman and Grant, 1927, San Diego Soc. Nat. Hist. Trans., v. 5, no. 6, p. 73, pl. 7, figs. 8a, b.

Elphidium excavatum (Terquem) forma *clavata* Cushman

Elphidium incertum (Wllliamson) var. *clavatum* Cushman, 1930, U. S. Nat. Mus., Bull. 104, pt. 7, p. 20, pl. 7, figs. 10a, b.

Elphidium decipiens (Costa), Hada, 1931, Tohoku Imp. Univ. Scl., Rep., 4th, ser. v. 6, no.3, p. 126, text-figs. 83a, b.

Elphidium hughesi foraminosun Cushman, Asano, 1950, Illust. Cat. Japan. Tert. Small. Foram., pt. 1, p. 8, text-figs. 46, 47.

Elphidium clavatum Cushman, Loeblich and Tappan, 1953, Smith. Misc. Coll., v. 121, no. 7, p. 98, pl. 19, figs. 8-10.

Elphidium excavatum (Terquem) forma *clavata* Cushman, Takayanagi, 1955, Tohoku Univ., Inst., Geol., Pal., Contr., no. 45. p. 42, pl. 1, fig. 25.

Elphidium frigidum Cushman

Elphidium frigidum Cushman, 1933, Smithsonian Misc. Coll., vol. 89, no. 9, p. 5, pl. 1, fig. 8.

Elphidium hanzawai Asano

Elphidium hanzawai Asano, 1939, Jour. Geol., Soc., Japan. v. 46, no 551, 426, figs. 3, 4a, b.

Elphidium incertum (Williamson)

Polystomella umbilicatula var. *incerta* Williamson, 1858, Recent Foraminifera of Great Britain, p. 44, pl. 3, fig. 82a.

Elphidium incertum (Williamson), Macfadyen, 1932, Geol. Mag., vol. 69, no. 821, pl. 35, figs. 6a, b.

Elphidium jenseni (Cushman)

Polystomella macella (Fichtel and Moll) var., Jensen, 1904, Linnean Soc. New South Wales Proc., v. 29, p. 817, pl. 23, fig. 4.

Polystomella jenseni Cushman, 1924, Carnegie Inst. Washington, Publ. 342, p. 49, pl.16, figs. 4 (?), 6.

Elphidium jenseni (Cushman), Cushman, 1933, U.S. Nat. Mus., Bull. 161, pt. 2, p. 48, pl. 11, figs. 6, 7.

Elphidium macellum (Fichtel and Moll)

Elphidium macellus (Fichtel and Moll) var., 1798, Testacea microscopia, aliaque minuta ex generibus Argonauta et Natutilus, ad naturam picta et descripta. p. 68, pl. 10, figs. h, i, k.

Elphidium macellum var. tumidocamerale Bogdanowicz, 1932, Oil Geol., Inst., Leningrad, Trans., ser. A, fasc. 22, II, i, 2, text-figs. 9, 10.

Elphidium macellum (Fichtel and Moll), Cushman, 1939, Geol. Surv. prof. paper, 191, p. 51, pl. 14, figs. 1-3

Elphidium subarcticum Cushman

Elphidium subarcticum Cushman, 1944, Cushman Lab. Foram. Res., Spec,. Publ., no.

12, p. 27. pl. 3, figs. 34, 35.

Elphidium nakanokawaense Shirai, 1960, Jour. Fac. Sci. Hokkaido Univ., Ser. IV, vol. X, 537-543, pl. 1, figs. 4a-b, 5a-b.

Elphidium subgranulosum Asano

Elphidium subgranulosum Asano, 1938, Jour. Geol. Soc. Japan, 45, p. 586, pl. 14, figs. 4a, b.

Elphidium subincertum Asano

Elphidium subincertum Asano, 1951, Illust. Cat. Japan Tert. Small Foram., pt. 1, p. 10, figs. 56, 57.

Elphidium translucens Natland

Elphidium translucens Natland, 1938, Scripps Inst. Oceanogr. Bull., Tech. ser., v. 4, p. 144, pl. 5, figs. 3, 4.

Epistominella pulchella Husezima and Maruhasi

Epistominella pulchella Husezima and Maruhasi, 1944, Jour. Shigenkagaku Kenkyusho (Res. Inst. Nat. Resour., Japan), v. l, no. 3, p. 398, pl. 34, figs. l0a-c.

Fissurina annectens (Burrows and Holland)

Lagena annectens Burrows and Holland, 1895, *in* Jones, Parker and Brady, 1985, Palaeontogr. Soc., London, Part II, p. 203, pt. vii, II.

Fissurina annectens (Burrows and Holland), Barker, 1960, Spc.Publ., Soc. Economic Paleontlogists and Mineralogists, 9.

Fissurina baccata (Hellon-Allen and Earland)

Lagena orbignyana var. *baccata* Hellon-Allen and Earland, 1922, Terra Nova Exped., Zool., VI, no. 2, p. 162, pt. vi, figs. 15, 16.

Fissurina baccata (Hellon-Allen and Earland), Jones, 1994, Challenger Foram., Pl. 59, Fig.20.

Fissurina lacunata (Burrows and Holland)

Lagena castrensis Brady (not of Schwager), 1884, Voy. Challenger, Rep. Zool., v. 9, p.485, pl. 60, figs. 1, 2.

Lagena lacunata Burrows and Holland, 1895, *in* Jones, T.R., Palaeontogr. Soc. London, p. 205, pl. 7, fig. 12.

Fissuriua orbignyana lacunata (Burrows and Holland), Asano, 1938, Tohoku Imp. Univ., Sci. Rep., 2nd ser. (Geol.), v. 19, no. 2, p. 219, pl. 27, figs. 27, 28.

Fissurina lucida (Williamson)

Entosolenia marginata (Montagu) var. *lucida* Williamson, 1848, Ann. Mag. Nat. Hist., ser. 2, v. l, p. 17, pl. 2, fig. 17.

Fissurina lucida (Williamson), Loeblich and Tappan, 1953, Smithsonian Misc. Coll., v. 121, no. 7, p. 76, pl. 14, fig. 4.

Fissurina marginata (Montagu)

Vermiculum marginatum Montagu, 1803, Testacea Britannica, p. 524.

Fissurina marginata (Montagu), Loeblich and Tappan, 1953, Smithsonian Misc. Coll., v. 121, no. 7, p. 77, pl. 14, figs. 6-9.

Fissurina obscurocostata Galloway and Wissler

Fissurina obscurocostata Galloway and Wissler, 1927, Jour. Pal., v. l, p. 52, pl. 9, fig. l.

Fissurina orbignyana Seguenza

Fissurina orbignyana Seguenza , 1862, Foram. monotal. Mioc. Messina, p. 66, pl. 2, figs. 24, 26.

Fissurina cf. *rizzae* Seguenza

cf. *Fissurina rizzae* Seguenza, 1862, Foram. monotal., Mioc. Messina, p. 72, pl. 2, fig. 50.

Fissurina semimarginata (Reuss)

Lagena sp. (Nos. 64-65) von Schlict, 1870. Die Foraminiferen Septarienthones Pielzpuhl, p. 11, pl. 4, figs. 4-6, 10-12.

Lagena marginata Williamson var. *semimarginata* Reuss, 1870, Sitzb. Akad. Wiss. Wien, v. 62, pt. 1, p. 468.

Fissurina semimarginata (Reuss), Barker, 1960, Spc.Publ., Soc. Economic Paleontlogists and Mineralogists, 9.

Fissurina cf. *subquadrata* Parr

cf. *Fissurina subquadrata* Parr , 1954, Roy. Soc. Victria, Proc., n. s., LVI, pt. 2, 203, ix, 5.

Gavelinopsis praegeri (Heron-Allen and Earland)

Discorbina praegeri Heron-Allen and Earland, 1913, Royal Irish Acad., Proc., v. 31, pt. 64, p. 122, pl. 10, figs. 8-10.

Gavelileopsis praegeri (Heron-Ailen and Earlalld), Hofker, 1951, Siboga Exped., Mon. IV, pt. 3, p. 485. figs. 332-334.

Glabratella cf. *aurantista* Seiglie and Bermúdez

cf.*Glabratella aurantista* Seiglie and Bermúdez, 1965, Monographia de la familia de foraminíferos Glabratellidae, Geos, 1965, no. 12,

Glabratella mirabiris panamensis Seiglie and Bermúdez

Glabratella mirabiris panamensis Seiglie and Bermúdez , 1965, Geos, 12, p. 33, pl. 6, a-b, 7, 8.

Glabratella pulvinata (Brady)

Discorbina pulvinata Brady, 1884, Rept. on the Sci. Reslt. of the Voy. of the H. M. S. Challenger during the years 1873-1876, Zoology, v. 9,

Glabratella pulvinata, (Brady), Barker, 1960, SEPM Spec. Publ., 9, pl. 88, figs. 10a, b.

Glabratella sp.A

This species is somewhat resembles *G. crassa* Hofker but differs from it in having more rounded and inflated chambers, and five to six chambers in final whorl.

Glabratella sp.B

This species is characterized in having planoconvex test with low trochospiral coiling and wiht long spines in its periphery.

Glandulina ovula d'Orbigny

Glandulina ovula d'Orbigny, 1846, Foram. Foss. Bass. Tert. Vienne, p. 29, pl. 1, figs. 6, 7.

Globocassidulina bisecta Nomura

Globocassidulina bisecta Nomura, 1983, Tohoku Univ. Sci. Rep., 2nd ser. (Geol), v. 53, no. 1, p. 73-77, pl. 2,figs. 2,3; pl. 14, figs. 8-12; pl. 15, figs. 1-5.

Globocassidulina jamesoni (McCulloch)

Cassidulina (?) *jamesoni* McCulloch, 1977, Quantitative obserbations on Recent foram. tests, with emphasis on the eastern Pacific, p. 390, pl. 164, figs. 15a-c.

Globocassidulina jamesoni (McCulloch), Nomura, 1983, Tohoku Univ. Sci. Rep., 2nd ser. (Geol), v. 54, no. 1, p. 33, 34, pl. 3, figs. 7a-c, 8a, b; pl. 19, figs. 1, 2.

Globocassidulina canalisuturata Eade

Globocassidulina canalisuturata Eade,1967, N.Z. Jour. Mar. Freshwater Res., 1. no. 4, p. 440, fig. 3 (5-7), fig. 5 (7, 8).

Globocassidulina neobrecha Nomura

Globocassidulina neobrecha Nomura,1983, Tohoku Univ. Sci. Rep., 2nd ser. (Geol), v. 53, no. 1, p. 67-68, pl. 1,figs. 16a-c; pl. 19, figs. 3-6.

Guttulina yabei Cushman and Ozawa

Guttulina yabei Cushman and Ozawa, 1929, Japan ,Jour. Geol. Gcogr., v. 6, nos. 3-4, p. 68, pl. 13, flg. 2, pl, 14, fig. 6.

Hanzawaia nipponica Asano

Hanzawaia nipponica Asano, 1943, Jour. Geol. Soc. Japan, v. 51, no. 606, p. 98, pl. 4, figs. 1-2.

Heterolepa praecincta (Karrer)

Rotalia praecinctus Karrer, 1868, Sitz. Akad. Wiss. Wien, v. 58, p. 189, pl. 5, fig. 7.

Truncatulina praecincta Cusuman, 1915, U.S. Nat. Mus. Bull., v. 71, no. 5, p. 39, pl. 26, fig. 2. *Eponides praecinctus* (Karrer), Asano, 1951, Illust. Cat. Japan Tert. Small Foram., pt. 14, p. 11, figs. 30-32.

Heterolepa subhaidingerii (Parr)

Cibicides subhaidingerii Parr, 1950, Foraminifera, Rep. B.A.N.Z. Antarctic Rese. Exp. 1929-1931, Ser. B. (Zoology and Bontany), 5, p. 364, pl. 15, fig.7.

Heterolepa subhaidingerii (Parr), Tappan and Loeblich, 1982, Synopsis and Classification Living Organisms, pl. 53, fig. 10.

Islandiella helenae Feyling-Hanssen and Buzas

Cassidulina teretis Tappan, Loeblich and Tappan (not of Tappan, 1951), 1953, Smithsonian Misc. Coll., v. 121, no. 7, p. 121, pl. 24, figs. 3. 4.

Islandiella helenae Feyling-Hanssen and Buzas, 1976, Jour. Foram. Res., v. 6, no. 2, p. 155, figs. 1-4.

Islandiella islandica (Nørbang)

Cassidulina islandica Nørbang, 1945, Foraminifera. *in* the Zoology of Iceland. v.2, p. 42, text-figs. 7, 8d-f.

Islandiella islandica (Nørbang), Nørbang, 1958, Vidensk. Medd. Dansk Natur-hist. Foren., v. 120, p. 27, 28, pl. 6, figs. 1a, b, 2-5, pl. 7, figs. 6a,b, 7a, b,

Islandiella japonica (Asano and Nakamura)

Cassidulina japonica Asano and Nakamura, 1937, Japan Jour. Geol. Geogr., v. 14, nos. 3-4, p. 144, pl. 13, figs. l, 2.

Islandiella japonica (Asano and Nakamura), Troitskaja, 1970, Usloviya obitaniya i raspredelenie foraminifer v Yaponskom More (semeistva Elphidiidae, Cassidulinidae i Islandiellidae). In Fursenko A.V. ed., Obstchie voprosy izucheniya mikrofauny Sibiri, dalinego vostoka i drugikh raionov. Instituta Geologii i Geofiziki, Akademiya Nauk SSSR, Sibirskoe Otdelenie, Trudy, vol. 71, p.150, pl. 6, figs. 3,4.

Islandidlla norcrossi (Cushman)

Cassidulina norcrossi Cnshman, 1933, Smithsonian Misc. Coll., v. 89, no. 9, p. 7, pl. 2, figs. 7a-c.

Islandiella norcrossi (Cushman), Nørbang, 1958, Dansk Naturh. Foren. Kobenhavn Vidensk. Meddel., v. 120, p.26.

Islandiella setanaensis (Asano and Nakamura)

Cassidulina setanaensis Asano and Nakamura, 1937, Japan Jour. Geol. Geogr., v. 14, nos. 3-4, pl. 13, figs. 7a,b

Islandiella setanaensis (Asano and Nakamura) , Nomura, 1983, Tohoku Univ. Sci. Rep., 2nd ser. (Geol), v. 53, no. 1, p. 1-101, pl. 3, fig. 6, pl.4, figs. 3,4, pl. 10, fig. 11, pl.11, fig. 1-3; 1983, Tohoku Univ. Sci. Rep., 2nd ser. (Geol), v. 54, no. 1, p. 5, pl. 1, figs. 3a-c.

Islandiella sublimbata (Asano and Nakamura)

Cassidulina sublimbata Asano and Nakamura, 1937, Japan Jour. Geol Geogr., v. 14, nos. 3-4, p. 146, pl. 14, figs. 3, 4a, b.

Islandiella sublimbata (Asano and Nakamura), Nomura, 1983, Tohoku Univ. Sci. Rep., 2nd ser. (Geol), v. 53, no. 1, pl. 3, fig. 7, pl. 4, fig. 2, pl. 5, fig. 7, pl. 9, figs. 1-8; 1983, Tohoku Univ. Sci. Rep., 2nd ser. (Ge0l), v. 54, no. 1, p. 9, pl. 1, figs. 6-8.

Islandiella yabei (Asano and Nakamura)

Cassidulina yabei Asano and Nakamura. 1937, Japan. Jour. Geol. Geogr., v. 14, nos. 3-4, p. 145, pl. 14, figs. 1a, b.

Islandiella yabei (Asano and Nakamura), Nomura, 1983, Tohoku Univ. Sci. Rep., 2nd ser. (Geol), v. 53, no. 1, pl. 3, fig. 1; pl. 4, fig. 7; pl. 9, figs. 9-12, pl. 10, figs. 1-3.

Karreriella baccata (Schwager) *japonica* Asano

Karreriella baccata (Schwager) *japonica* Asano, 1938, Japanese Jour. Geol. Geogr., v.15, nos. 1-2, p. 90, pl. 10, figs. 1a-c.

Lagena acuticosta Reuss

Lagena acuticosta Reuss, 1861, Sitz. Akad. Wiss. Wier., v. 44, no. 1, p. 305, pl. 1, fig. 4.

Lagena apiopleura Loeblich and Tappan

Lagena apiopleura Loeblich and Tappan, 1953, Smithsonian Misc. Coll., v. 121, no. 7, p. 59, pl. l0, figs. 14, 15.

Lagena striata (d'Orbigny)

Oolina striata d'Orbigny, 1839, Voy. Amer. Merid., Foralminiféres, v. 5, pt. 5, p. 21, pl. 5, fig. 12.

Lagena striata (d'Orbigny), Asano, 1938, Tohoku Imp. Univ., Sci. Rep., 2nd ser. (Geol.), v. 19, p. 217, pl. 27, fig. 26; pl. 28, fig. 28.

Lagena sulcata spicata Cushman and McCulloch

Lagena sulcata var. *spicata* Cushman and McCulloch, 1950, Allan Hancock Pacific Exped., v. 6, no. 6, p. 360, pl. 48, figs. 3-7.

Lenticulina nikobarensis (Schwager)

Cristellaria nikobarensis Schwager, 1886, Novara Exp. Geol. Thell., 2, p. 243, pl. 6, fig. 87.

Robulus nikobarensis (Schwager), Asano, 1938, Sci. Rep. Tohoku Univ. ser. 2, 19 (2), p. 204, pl. 28, figs. 5, 6; pl. 29, fig. 8.

Lenticulina nikobarensis (Schwager), Loeblich and Tappan, 1988, Foraminiferal genera and their classification. p. 405. Pl. 446, figs. 9, 10.

Melonis pompilioides (Fichtel and Moll)

Nautilus pompilioides Fichtel and Moll, 1798, Testacea microscopica, p. 31, pl. 2, figs. a-c.

Melonis etruscus Montfort, 1808, Conch. Syst., p. 67.

Melonis pompilioides (Fichtel and Moll), Voloshinova, 1958, Mikrofauna SSSR, Sbornik 9, VNIGRI, Trudy, p. 149, pl. 3, fig. 1

Melonis uchioi Hasegawa

Melonis uchioi Hasegawa, 1991, Trans. Proc. Palaeont. Soc. Japan, N.S., no. 164, p. 1003.

Melonis pacificus (Cushman)

Nonion umbilicatula var. *pacifica* Cushman, 1924, Carnegie Inst. Wash., v. 342, p. 48, pl. 16, fig. 3.

Nonion pacificum Cushman, 1939, U.S. Geol. Surv., Prof. paper v. 191, p.25, pl. 6, fig. 25.

Melonis pacificus (Cushman), Hasegawa, 1979, Tohoku Univ., Sci. Rep., 2nd ser. (Geol), v. 49, no. 2, p. 151.

Miliolinella circularis (Bornemann)

Triloculina circularis Bornemann, 1855, Zeit. deutsch. Geol. Ces., v. 7, p. 349, pl. 19, fig. 4

Miliolinella circularis (Bornemann), Asano, 1951, Illust. Cat. Japan. Tert. Small. Foram., pt. 6, p. 9, figs. 65-67.

Neoconorbina stachi (Asano)

Discopulvinulina stachi Asano, 1951, Illust. Cat. Japan Tert. Small. Foram., pt. 14, p. 7, figs. 46-48.

Neoconorbina stachi (Asano), Matoba, 1970, Tohoku Univ., Sci. Rep., 2nd ser. (Geol), v. 42, no. 2, p. 57, pl. 4, flgs. 6a-c.

Neoeponides procerus (Brady)

Pulvinulina procera Brady, 1884, Voy. Challenger, Rep., Zool., v. 9, p. 698, pl. 105, figs. 7a-c. *Neoeponides procerus* (Brady), Reiss, 1960. Israel Geol. Surv., Bull. no. 29, p. 17.

Nonion japonicus Asano

Nonion japonicum Asano (sic.) , 1938, Jour. Geol. Soc. Japan, v. 45, no. 593, pl. 15(4), figs. 1, 2.

Nonionella stella Cushman and Moyer

Nonionella miocenica Cushman var. *stella* Cushman and Moyer, 1930, Cushman Lab. Foram. Res., Contr., v. 6, pt. l, p. 56, pl. 7, figs. 17a-c.

Nonionellina labradorica (Dawson)

Nonionina labradorica Dawson, 1860, Canad. Nat., v. 5, p. 191, text-fig. 4.

Nonionellina labradorica (Dawson), Voloshinova, 1958, Mikrofauna SSSR, Sbornik 9, VNIGRI, Trudy, no. 115, p. 142.

Nonionoides grateloupi (d'Orbigny)

Nonionina grateloupi d'Orbigny, 1826, Annales des Sciences Naturelles v. 7, p. 294,

Nonionoides grateloupi (d'Orbigny), Saidova, 1975, Bentosnye Foraminifery Tikhogo Okeana, 3 vol., p. 248.

Oolina carteri Albani and Yassini

Oolina carteri Albani and Yassini, 1989, Aust. J. Mar. Freshw. Res., v. 70, p. 385, fig. 3r-s.

Oolina costata (Williamson)

Entosolenia costata Williamson, 1858, Recent Foraminifera Great Britain, p. 9, pl. 1, fig.

18.

Lagena costata (Williamson), Cushman, 1923, U.S. Nat. Mus. Bull. v. 104, pt.4, p.12, pl.1, fig. 16, pl. 2, figs. 1, 2 (not pl. 3, fig. 8)

Oolina costata (Williamson), Parker, 1952, Bull. Mus. Comp. Zool., v. 106, no. 9, p. 409, pl. 4, figs. 20,21.

Oolina melo d'Orbigny

Oolina melo d'Orbigny, 1839, Voy. Amer. Merid., Foraminiféres, v. 5, pt. 5, p. 20, pl. 5, fig. 9.

Oolina striatopunctata (Parker and Jones)

Lagena sulcata (Walker and Jacob) var. *striatopunctata* Parker and Jones, 1865, Philos. Trans. Roy. Soc. London, v. 155, p. 350, pl. 13, figs. 25-27.

Entosolenia striatopunctata (Parker and Jones) Dawson, 1870, Can. Nat., n.s., v. 5, p. 178, fig. 11. *Lagena striatopunctata* Parker and Jones, Brady, 1878, Ann. Mag. Nat. Hist., ser. 5, v. 1, p. 434, pl. 20, fig. 3.

Oolina striatpunctata (Parker and Jones) Loeblich and Tappan, 1953, Smithsonian Misc. Coll. v. 121, no. 7, p. 74, pl. 12, figs. 2-5.

Oridorsalis umbonatus (Reuss)

Rotalia umbonata Reuss, 1851, Deutsch. geol. Gesell., Zeischr., v. 3, p. 75, pl. 5, figs. 35a-c.

Oridorsalis umbonatus (Ruess), Parker, 1964, Jour. Pal., v. 38, no. 4, p. 626, pl. 99, figs. 4-6.

Osangulariella umbonifera (Cushman)

Pulvinulinella umbonifera Cushman, 1933, Cushman Lab. Foram. Res., Contr., 9, 90.

Osangulariella umbonifera (Cushman), Jones, 1994, Challenger Foraminifera, p. 99, pl. 95, figs. 9, 10.

Paracassidulina sulcata Belford

Paracassidulina sulcata Belford, 1966, Bur. Min. Resour. Aust. Rep., no. 79, p. 142, 144, pl. 24, figs. 11-14, text-fig. 16, nos. 7, 8.

Pararotalia nipponica (Asano)

Rotalia nipponica Asano, 1936, Jour. Soc. Japan, v. 43, no. 515, p. 614, pl. 30, figs. 2a-c.

Pararotalia nipponica (Asano), Ujiie, 1966, Palaeont. Soc. Japan, Trans. Proc., N.S.m no. 61, p. 192, text-figs. 1-3; pl. 24, figs. 1-7; pl. 25, figs. 1-5.

Patellina corrugata Williamson

Patellina corrugata Williamson, 1858, Rec. Foram. Gt. Britain, p. 46, pl. 3, figs. 86-89.

Patellinella hanzawai Asano

Patellinella hanzawai Asano, 1936, Jour. Geol. Soc. Japan, v. 43, no. 515, p. 613, pl. 31, figs. 3a-c.

Pateoris hauerinoides (Rhumbler)

Quinqueloculina subrotunda (Montagu) forma *hauerinoides* Rhumbler, 1936, Foram. der Kieler Bucht, Teil II-Ammodisculinidae bis Textulinidae, v. 1, no. 1, p. 206, 217, 226, text-figs. 167, 208-212.

Pateoris hauerinoides (Rhumbler) Loeblich and Tappan, 1953, Smithsonian, Misc. Coll. v. 121, no. 7, p. 42, pl. 6, figs. 8-12, text-figs. 1A, B.

Planoglabratella australensis (Heron-Allen and Earland)

Discorbis australensis Hellon-Allen and Earland, 1932, Discovery Repts., IV, 416.

Glabratella australensis (Heron-Allen and Earland), Loeblich and Tappan, 1964, Treatise on Invertebrate. p. 588.

Planoglabratella opercularis (d'Orbigny)

Rosalina opercularis d'Orbigny, 1839, Foraminiféres, p. 93, pl. 3, figs. 24, 25.

Discorbis opercularis Cushman, 1915, U.S. Nat. Mus. Bull., vol. 71, no. 5, p. 18, pl. 11, fig. 3.

Planolabratella opercularis (d'Orbigny), Seiglie and Bermúdes, 1965, Geos, 1965, no. 12, 15-65.

Planoglabratella patelliformis (Brady)

Discorbina patelliformis Brady, 1884, Rept. on the Sci. Reslt. of the Voy. of the H. M. S. Challenger during the years 1873-1876, Zoology, v. 9,

Glabratella patelliformis (Brady), Seiglie and Bermúdez, 1965, Monographia de la familia de foraminíferos Glabratellidae, Geos, 1965, no. 12,

Planoglabratella subopercularis (Asano)

Discorbis subopercularis Asano, 1951, Illust. Cat. Japan Tert. Small Foram., pt. 14, p. 3, figs. 17-19.

Glabratella subopercularis (Asano), Matoba, 1970, Tohoku Univ., Sci. Rep., 2nd ser. (Geol.), v. 42, no. l, p. 54, pl. 5, figs. Sa-c.

Planolabratella subopercularis (d'Orbigny), Seiglie and Bermúdes, 1965, Geos, 1965, no. 12, 15-65.

Planoglabratella ? sp. C

This species resembles *Planoglabratella subopercularis* (Asano). but differs from it in havng less number of chambers in final whorl.

Polystomelina discorbinoides Yabe and Hanzawa

Polystomdlina discorbinoides Yabe and Hanzawa , 1923, Japan Jour. Geol. Geogr., v. 2, p. 99, text-flgs. a-c.

Poroeponides cribrorepandus Asano and Uchio

Poroeponides cribrorepandus Asano and Uchio, 1951, Illust. Cat. Japan. Tert. Small. Foram., pt. 14, p.18, figs. 134, 135.

Pseudononion japonicum Asano

Pseudononion japonicum Asano, 1936, Jour. Geol. Soc. Japan, v. 43, no. 512, p. 347, text-figs. a-c.

Pseudoparrella naraensis Kuwano

Pseudoparrella naraensis Kuwano, 1950, Jour. Geol. Soc. Japan, v. 56, no. 657, p. 317, text-figs. 6a-c.

Pseudoparrella takayanagii (Iwasa)

Epistominella takayanagii lwasa, 1955, Jour. Geol. Soc. Japan, v. 61, no. 712, p. 16, text-figs. 4a-c.

Epistominella suttsuensis Shirai, 1960, Jour. Fac. Sci. Hokkaido Univ., Ser. IV, vol X, 537-543, pl. 2,figs. 3a-c.

Pseudoparrella takayanagii (Iwasa), Hasegawa, 1979, Tohoku Univ., Sci. Rep., 2nd ser.

(Geol), v. 49, no. 2, p. 153, pl. 5, figs. 7a-c.

Pseudopolymorphina suboblonga Cushman and Ozawa

Pseudopolymorphina suboblonga Cushman and Ozawa, 1930, U.S. Nat. Mus., Proc., v. 77, p. 91, pl. 23, figs. 3a-c.

Pullenia apertura Cushman

Pullenia apertura Asano (not of Cushman, 1927), 1951, Illust. Cat. Japan. Tert. Small. Foram., pt. 12, p. l0, figs. 3, 4.

Pyrgo ezo Asano

Pyrgo ezo Asano, 1938, Japanese Jour. Geol. Geogr., v.15, nos. 1-2, p.93, pl. 9, figs. 1-4, 6.

Pyrgo fomasinii Chapman and Parr

Pyrgo fomasinii Chapman and Parr, 1935, Roy. Soc. W. Australia, Jour., XXI, p. 5.

Quinqueloculiua agglutinata Cushman

Quinqueloculiua agglutinata Cushman, 1917, U.S. Nat. Mus., Bull. 71, pt. 6, p. 43, pl. 9, figs. 2a-c.

Quinqueloculina akneriana d'Orbigny

Quinqueloculina akneriana d'Orbigny, 1846, Foram. Foss. Bas. Vienne, p. 290, pl. 18, figs. l6-21.

Quinqueloculina costata d'Orbigny

Quinqueloculina costata d'Orbigny, 1826, Ann. Sci. Nat., v. 7, p. 301. no. 3.

Quinqueloculina elongata Natland

Quinqueloculina elongata Natland, 1938, Bull. Scripps Inst. Oceanogr. Tech. Ser., v. 4, no.5, p. 141, pl. 4, fig. 5.

Quinqueloculina kuromatunaiensis Asano

Quinqueloculina kuromatunaiensis Asano, 1936, Jour. Geol. Soc. Japan, v. 43, no. 515, p. 621, pl. 32, figs. 4a-d.

Quinqueloculina sawanensis Asano

Quinqueloculina sawanensis Asano, 1951, Illust. Cat. Japan. Tert. Small. Foram., pt. 6, p. 6, figs. 40-42.

Quinqueloculina seminulum (Linné)

Serpula seminulum Linné, 1758, Syst. Nat., ed. l0, p. 786.

Quinqeloculina seminulum (Linné), d'Orbigny, 1826, Ann. Sci. Nat., Paris, ser. l, v. 7, . 303, no. 4.

Quinqueloculina vulgaris d'Orbigny

Quinqueloculina vulgaris d'Orbigny, 1826, Ann. Sci. Nat., v. 7, p. 302, no. 33.

Quinqueloculina cf. *vulgaris* d'Orbigny

cf. *Quinqueloculina vulgaris* d'Orbigny , 1826, Ann. Sci. Nat., v. 7, p. 302, no. 33.

Quinqueloculina yessoensis Asano

Quinqueloculina yessoensis Asano, 1936, Jour. Geol. Soc. Japan. 43, p. 620, pl. 32, figs. 3a-c.

Quinqueloculina sp.B

This species is somewhat similar to *Quinqueloculina elongata* Natland of Asano (1950) in its outline, but is distinguished from it by more inflated chmbers and coarsely perforated wall.

Quinqueloculina sp.C

This species is somewhat similar to *Quinqueloculina contrta* d'Orbigny, but is distinguished by more rounded outline, short size, and apertural view.

Quinqueloculina sp.F

This form is similar to *Quinquelocilina yessoensis* Asano, but is differs from it in having a broadly oval test with more sharply angled periphery in apertural view. This is also similar to *Quinqueloculina kuromatunaiensis* Asano, but is distinguished in having angled periphery of chambers.

Quinqueloculina sp.G

This form is somewhat similar to Quinqueloculina elongata Natland, but is distinguished from it by its triangular appearance in apertural view.

Quinqueloculina sp.H

This form is similar to *Quinqueloculina hasimotoi* Asano, but differs from it in having a test without apertural protrusion.

Rectobolivina raphanuss (Parker and Jones)

Uvigerina (*Sagrina*) *raphana* Parker and Jones, 1865, Roy. Soc. London Philos. Trans, v. 155, p. 364, pl. 18, figs. 16, 17.

Rectobolivina raphana (sic.) (Parker and Jones), Loeblich and Tappan, 1964, Treatise on Invertebrate Pal., Moore, R.C., ed., pt. C, Protista 2, v. 2, p. C533, figs. 438 (9-11).

Rosalina australis (Parr)

Discorbis australis Parr, 1932, Roy. Soc. Victoria, Proc., XLIV (n.s.) p. 227, pl. xxii, 31.

Rosalina australis (Parr), Jones, 1994, Challenger Foram., pl. 87, figs. 5-7.

Rosalina bradyi (Cushman)

Discorbina globularis Brady (not of d'Orbigny, 1826), 1884, Voy. Challenger, Rep., Zool., v. 9, p. 86, figs. 8a-c.

Discorbina globularis var.*bradyi* Cushman, 1915, U.S. Nat. Mus., Bull. 71, pt. 5, p. 12, pl. 8, figs. 1a-c.

Rosalina bradyi (Cushman), Hornibrook and Vella, 1954, Micropal., v. 8, no. l, p. 26.

Rosalina globularis d'Orbigny

Rosalina globularis d'Orbigny , 1926, Ann. Sci. Nat., Paris, ser. l, v. 7, p. 271, no. l, pl. 13, figs. 1-14; Modele no. 69.

Rosalina isabelleana d'Orbigny

Rosalina isabelleana d'Orbigny, 1839, Foraminiféres. p. 43, pl. 6, figs. 10-12.

Rosalina vilardeboana d'Orbigny

Rosalina vilardeboana d'Orbigny, 1839, Voy. Amer. Merid., Foraminiféres, v. 5, pt. 5, p. 44, pl. 6, figs. 13-15.

Rosalina vilardeboana d'Orbigny

Rosalina vilardeboana d'Orbigny , 1839, Voy. Amér. Mérid., Foraminiféres, v. 5, pt. 5, p. 44, pl. 6, figs. 13-15.

Sigmoidella pacifica Cushman and Ozawa

Sigmoidella (*Sigmoidina*) *pacifica* Cushman and Ozawa, 1928, Cushman Lab. Foram. Res., Contr., v. 4, p. 19, pl. 2, fig. 13.

Sigmoilina sigmoidea (Brady) *compressa* Cushman

Sigmoilina sigmoidea (Brady) *compressa* Cushman, 1946, Contr. Cushman Lab. Foram. Res., 22, no. 2, p. 32, pl. 5, figs. 10-12.

Sigmomorphina semitecta terquemiana (Fornasini)

Polymorphina amygdaloides Reuss var. *terquemiana* Fornasini, 1902, Mem. Accad. Inst. Sci. Bologna, ser. 5, no. 9, p. 72, fig. 25.

Sigmomorphina semitecta (Reuss) var. *terquemiana* Cushman and Ozawa, 1930, U.S. Nat. Mus. Proc., v. 77, no. 6, p. 129, pl. 33, figs. 4, 5; pl. 34, figs. 2, 3; pl. 35, fig. 1.

Sigmomorphina trilocularis (Bagg)

Polymorphina trilocularis Bagg, 1912, U. S. Geol. Surv. Bull., 513, p. 75, pl. 20, figs. 15-18.

Sigmomorphina trilocularis (Bagg), Cushman and Ozawa, 1930, U. S. Nat. Mus. Proc., v. 77, no. 6. p. 136, pl. 36, fig. 5.

Sphaeroidina japonica Asano

Sphaeroidina japonica Asano, 1953, Tohoku Univ., Inst. Geol. Paleont., Short Papers, no. 5, p. 17, pl. 2, figs. 43, 44.

Spirillina limbata Brady

Spirillina limbata Brady, 1879, Quart. Jour. Microscopic Sci., n.s., vol. 19, p. 64, pl. 8, figs. 26a, b.

Spirillina vivipara Ehrenberg

Spirillina vivipara Ehrenberg, 1843, Phys. Ab. K. Akad. Wiss. Berlin, 1841 (1), p. 323, 422, pl. 3, VII, fig. 41.

Spiroloculina hadai Thalmann

Spiroloculina costata Hada, 1931, Tohoku Univ. Sci. Rep., 4th ser., Biol., v. 6, no. 1, p. 84, text-figs. 37a,b.

Spiroloculina hadai Thalmann, 1933, Jour. Paleont., v. 7, no. 30, p. 354.

Spiroplectammina sp.A

This form somewhat similar to*Textularia candeiana* d'Orbigny, but has a test with planispirally arranged chambers in the early portion.

Spiroplectinella wrightii (Silvestri)

Spiroplecta wrightii Silvestri, 1903, Accad. Pont. Nuovi Lincei, Atti, LVI, p. 59, pl. 1x, figs. 1-6.

Textularia conica d'Orbigny

Textularia conica d'Orbigny, 1839, Foraminiféres, p. 143, pl. 1. figs. 19, 18.

Triloculina rotunda d'Orbigny

Triloculina rotunda d'Orbigny, 1826, Ann. Sci. Nat. v. 7, p. 299, no. 4.

Triloculina suttuensis Asano

Triloculina suttuensis Asano, 1936, Jour. Geol. Soc. Japan, v. 43, no. 515, p. 621, pl. 33, figs. 2a-c.

Triloculina tricarinata d'Orbigny

Triloculina tricarinata d'Orbigny, 1826, Ann. Sci. Nat., 7, p. 299, no. 7.

Uvigerina akitaenesis Asano

Uvigerina akitaenesis Asano, 1950, Illust. Cat. Japan. Tert. Small. Foram. pt. 2, p. 14, figs 60-62.

Uvigerina juncea Cushman and Todd

Uvigerina juncea Cushman and Todd, 1941, Cushman Lab. Foram. Res., Contr., XVII, p. 78, pl. xx, 4-11.

Uvigerina schencki Asano

Uvigerina schencki Asano, 1950, Illust. Cat. Japan. Tert. Small. Foram. pt. 2, p. 17, figs. 74, 75.

Valvulineria hamanakoensis (Ishiwada)

Anomalina hamanakoensis Ishiwada, 1958, Geol. Surv. Japan Rep., no. 180, p. 18, text-figs. 3a-c; pl. 1, 24-27.

Valvulineria hamanakoensis (Ishiwada), Matoba, 1970, Tohoku Univ., Sci. Rep., 2nd ser. (Geol.), v. 42, no. 1, p. 63, pl. 4, figs. 12, 13.

Valvulineria japonica Asano

Valvulineria japonica Asano, 1951, Illust. Cat. Japan. Tert. Small. Foram. pt. 14, p. 7, figs. 49-51.

Acknowledgments

The author would like to expresses his deep gratitude to Associate Professor Shiro Hasegawa of the Laboratory of Geosphere Science, Graduate School of Environmental Earth Science, Hokkaido University, for his encouragement and advice during the course of this study. The author also wishes to thank Professor Yoshihiro Togo and Associate Professor Akihiko Suzuki of the Department of Earth Science, Iwamizawa College, Hokkaido University of Education, for their suggestions concerning various aspects of the present study. Sincere thanks are due to Dr. Yoshinori Hikida of Nakagawa Museum, Mr. Hiroyuki Takata, Mr. Takuya Itaki, and Mr. Jun'ichi Uchida of the Laboratory of Geosphere Science, Graduate School of Environmental Earth Science, Hokkaido University for their encouragement, and help in collecting references.

Deep appreciation is expressed to Mr. Yasuhumi Terasaki, the chief curator of the Imakane Board of Education, for his kind intentions during the course of this study.

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Plates (Scale bar = 100μm)

Planktonic Foraminifera (Plate 1)

1. *Globigerina bulloides* d'Orbigny, 2. *Globigerina quinqueloba* Natland,

3. *Globigerinita uvula* (Ehrenberg), 4. *Globigerinita glutinata* (Egger),

5. *Globorotalia inflata* (d'Orbibny), 6. *Globigerinoides ruber* (d'Orbingy),

7-9. *Neogloboquadrina incompta* (Chifelli), 10-11. *Neogloboquadrina pachyderma* (Ehrenberg)

Benthic Foraminifera (Plate 2-12)

Plate 2

1. *Angulogerina kokozuraensis* (Asano), 2. *Uvigerina akitaenesis* Asano,

3. *Uvigerina schencki* Asano, 4. *Uvigerina juncea* Cushman and Todd,

5. *Rectobolivina rephanus* (Parker and Jones), 6. *Buliminella elegantissima* (d'Orbigny),

7. *Bolivinita quadrilatera* (Schwager), 8. *Spiroplectammina* sp. A, 9. *Bolivina* sp. A,

10. *Bolivina decussata* Brady, 11. *Spirillina limbata* Brady,

12. *Cancris auriculus* (Fichtel and Moll)

Plate 3

1. *Oolina melo* d'Orbigny, 2-3. *Lagena apiopleura* Loeblich and Tappan,

4. *Oolina costata* (Williamson), 5. *Fissurina lacunata* (Burrows and Holland),

6. *Lagena striata* (d'Orbigny), 7. *Oolina striatopunctata* (Parker and Jones),

8. *Lagena acuticosta* Reuss, 9. *Fissurina baccata* (Hellon-Allen and Earland),

10. *Fissurina orbignyana* Seguenza, 11. *Fissurina* cf. *rizzae* Seguenza,

12. *Fissurina annectens* (Burrows and Holland), 13. *Fissurina cf. subquadrata* Parr,

14. *Fissurina marginata* (Montagu)

Plate 4

1. *Cibicides lobatulus* (Warker and Jacob), 2-3. *Cibicides refulgens* de Montfort,

4-5. *Cibicides subdepressus* (Asano), 6. *Heterolepa subhaidingerii* (Parr),

7. *Anomalinoides globulosus* (Cushman and Parr),

8. *Dyocibicides perforata* Cushman and Valentine

Plate 5

1. *Buccella frigida* (Cushman), 2. *Buccella makiyamai* (Chiji), 3. *Buccella tenerrima* (Brady),

4. *Patellinella hanzawai* Asano, 5. *Hanzawaia nipponica* Asano, 6. *Rosalina australis* (Parr),

7. *Rosalina bradyi* (Cushman), 8. *Guttulina yabei* Cushman and Ozawa

Plate 6

1. *Elphidium subgranulosum* Asano, 2. *Elphidium frigidum* Cushman,

3-5. *Elphidium subarcticum* Cushman, 6-7. *Elphidium crispum* (Linné),

8. *Polystomelina discorbinoides* Yabe and Hanzawa, 9. *Elphidium jenseni* (Cushrnan),

10. *Cribroelphidium yabei* (Asano), 11. *Cribroeplhidium oregonensis* (Cushman and Grant)

Plate 7

1, 8. *Astrononion hamadaense* Asano,

2. *Elphidium excavatum* (Terquem) forma *clavata* Cushman,

3. *Nonion japonicus* Asano, 4. *Melonis uchioi* Hasegawa, 5. *Pullenia apertura* Cushman,

6. *Melonis pompilioides* (Fichtel and Moll), 7. *Lenticulina nicobarebsis* (Schwager),

9. *Nonionellina labradorica* (Dawson)

Plate 8

1. *Planoglabratella*? sp. C, 2. *Planoglabratella australensis* (Hellon-Allen and Earland),

3. *Planoglabratella opercularis* (d'Orbigny), 4. *Planoglabratella subopercularis* (Asano),

5. *Glabratella mirabiris panamensis* Seiglie and Bermúdez,

6. *Planoglabratella patelliformis* (Brady), 7-8. *Glabratella* sp. A,

9. *Glabratella pulvinata* (Brady), 10. *Glabratella* sp. B

Plate 9

1. *Planoglabratella subopercularis* (Asano), 2. *Epistominella pulchella* Husezima and Maruhasi,

3. *Ammonia beccarii* (Linné), 4. *Islandidlla norcrossi* (Cushman),

5. *Islandiella japonica* (Asano and Nakamura), 6. *Islandiella yabei* (Asano and Nakamura),

7. *Islandiella helanae* Feyling-Hanssen and Buzas,

8. *Islandiella sublimbata* (Asano and Nakamura),

9. *Pseudoparella takayanagii* (Iwasa), 10. *Pseudoparella naraensis* Kuwano

Plate 10

1. *Quinqueloculina* sp.G, 2. *Pateoris hauerinoides* (Rhunbler),

3. *Quinqueloculina costata* d'Orbigny, 4. *Quinqueloculina kuromatunaiensis* Asano,

5. *Quinqueloculiua agglutinata* Cuslunan, 6. *Quinqueloculina* sp.F

Plate 11

1. *Cycloforia contrta* (d'Orbigny), 2. *Quinqueloculina akneriana* d'Orbigny,

3. *Quinqueloculina* sp. C, 4. *Cribrolinoides* curta (Cushman), 5. *Quinqueloculina* sp. B,

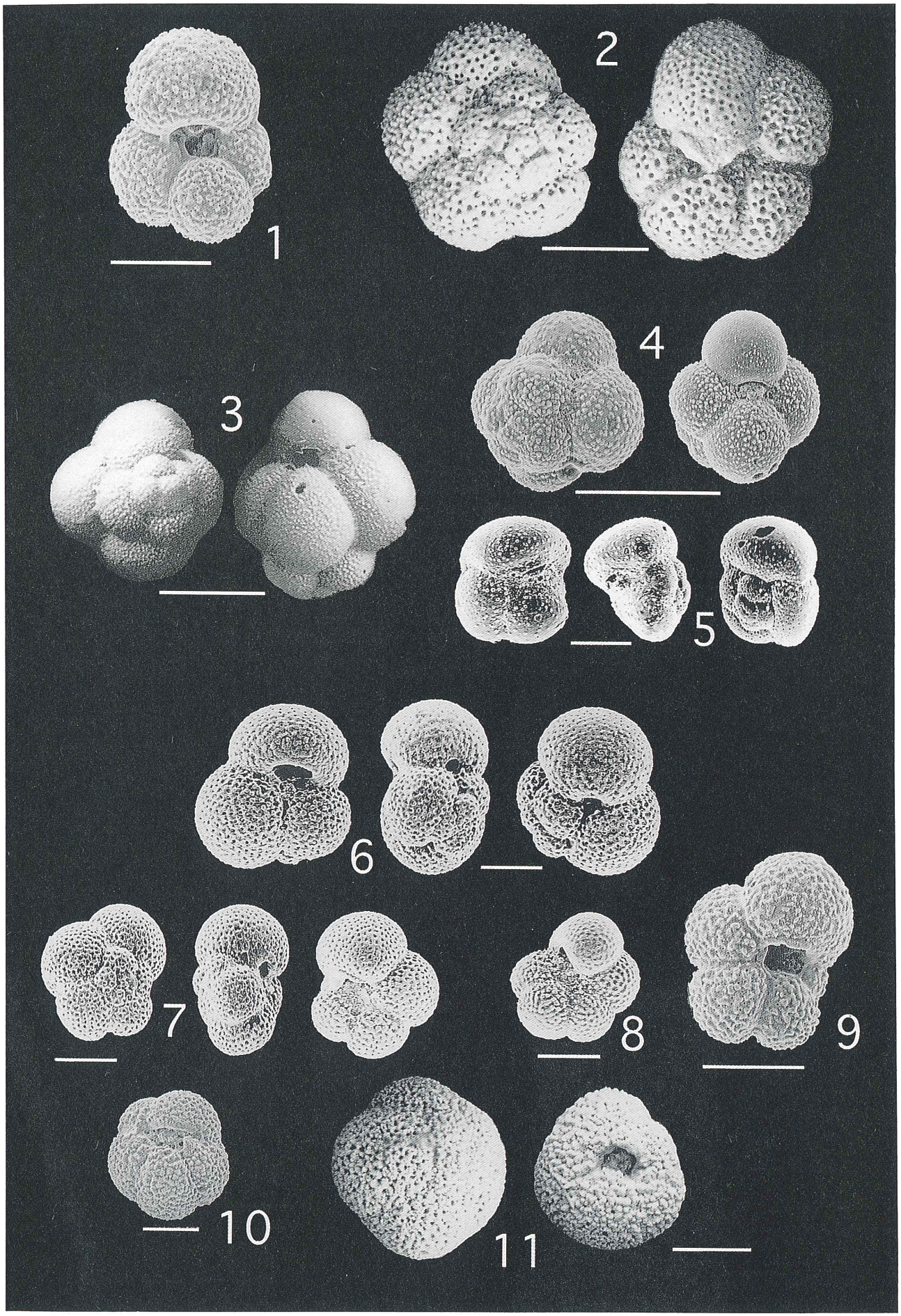
6. *Quinqueloculina yessoensis* Asano

Plate 12

1. *Quinqueloculina akneriana* d'Orbigny, 2. *Quinqueloculina sawanensis* Asano,

3. *Triloculina suttuensis* Asano, 4. *Triloculina tricarinata* d'Orbigny, 5-6. *Pyrgo ezo* Asano

Plate 1



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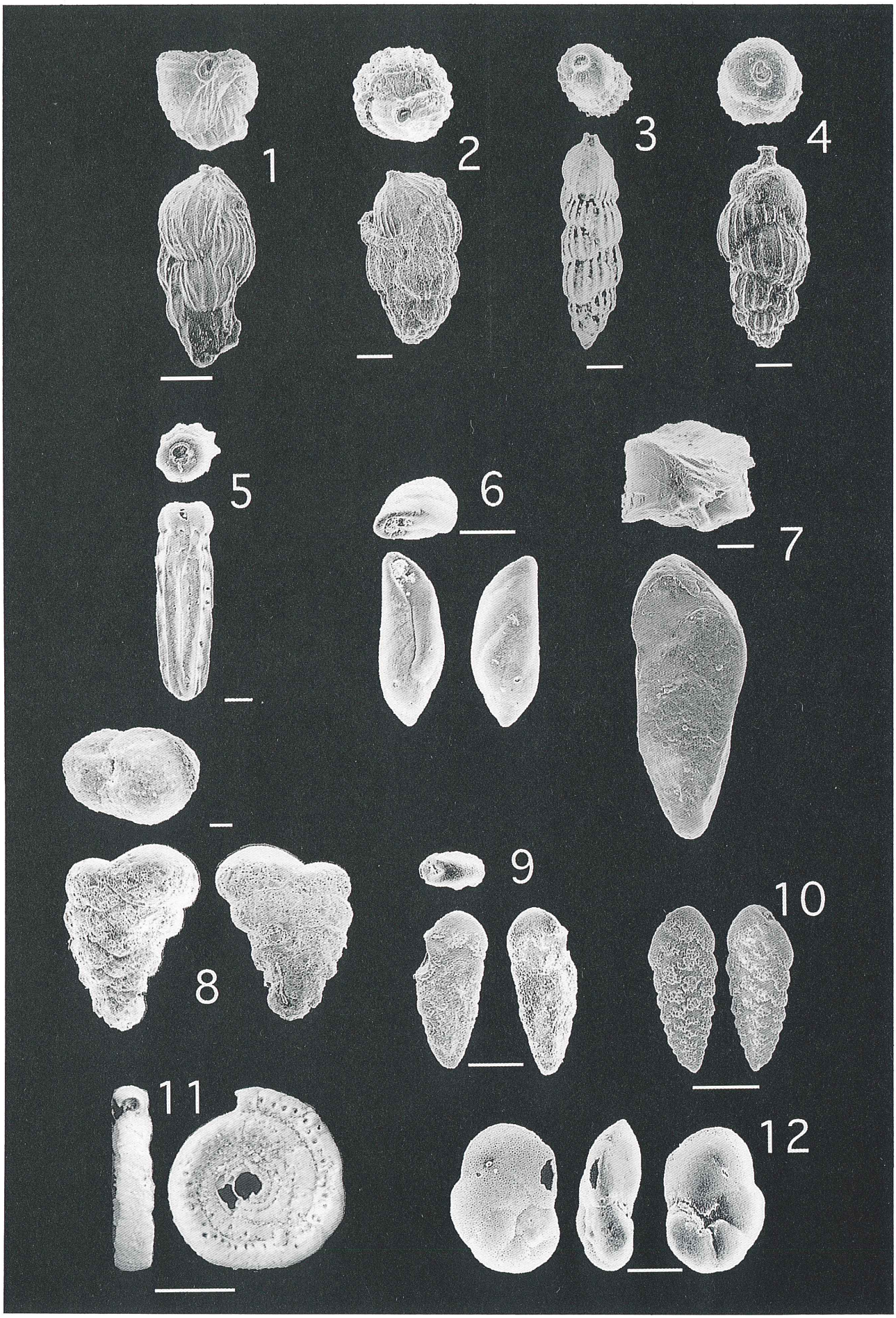

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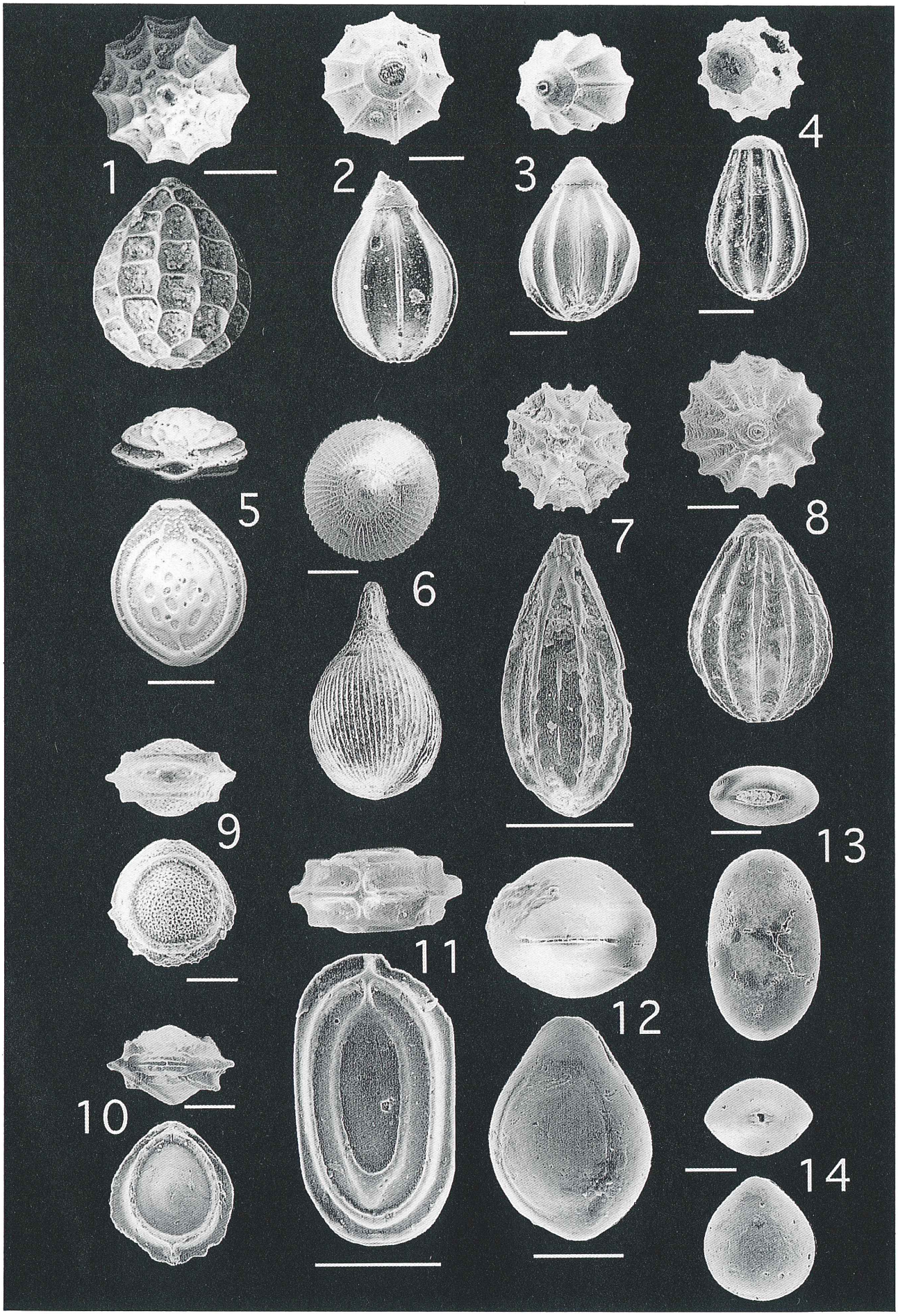

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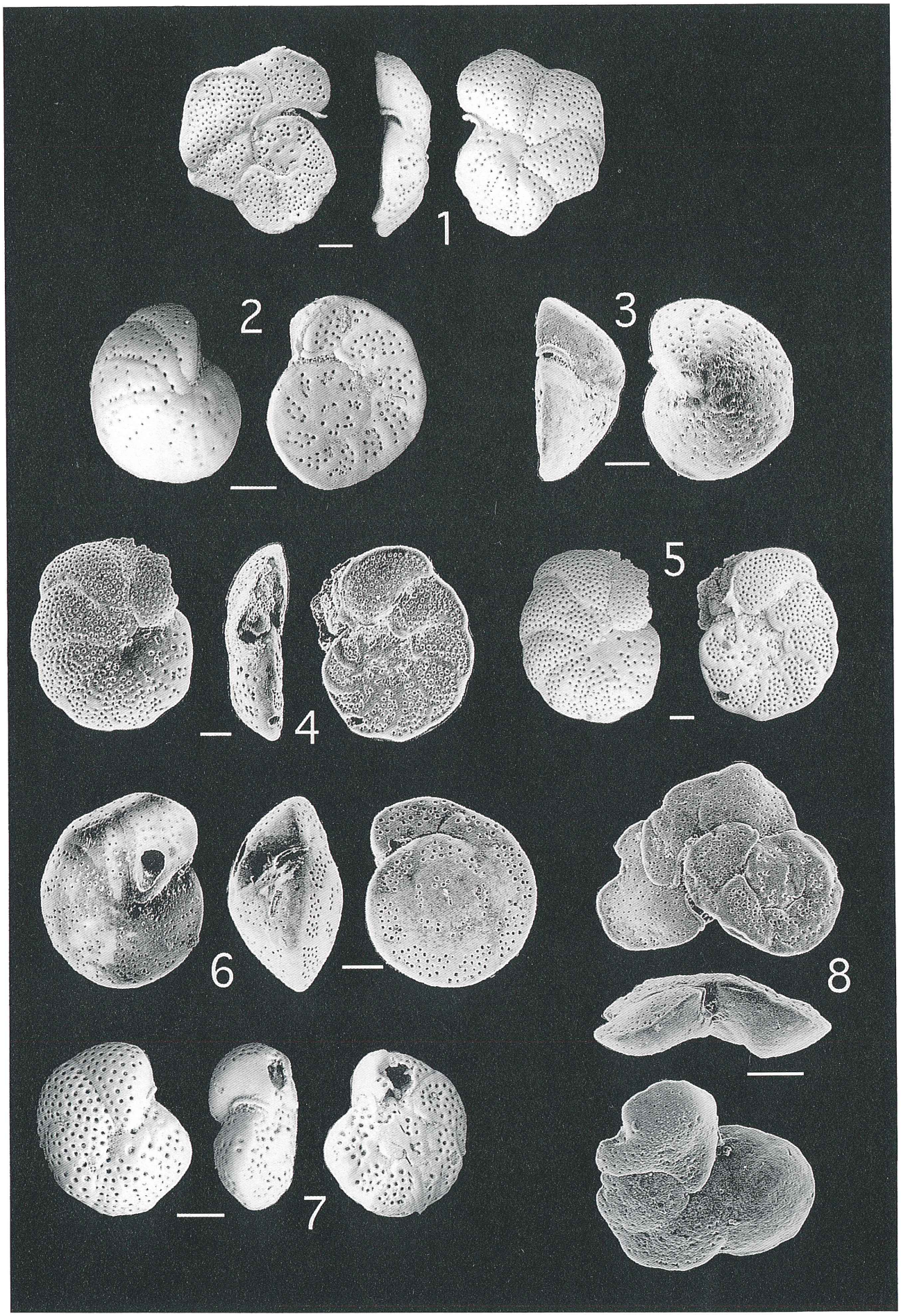

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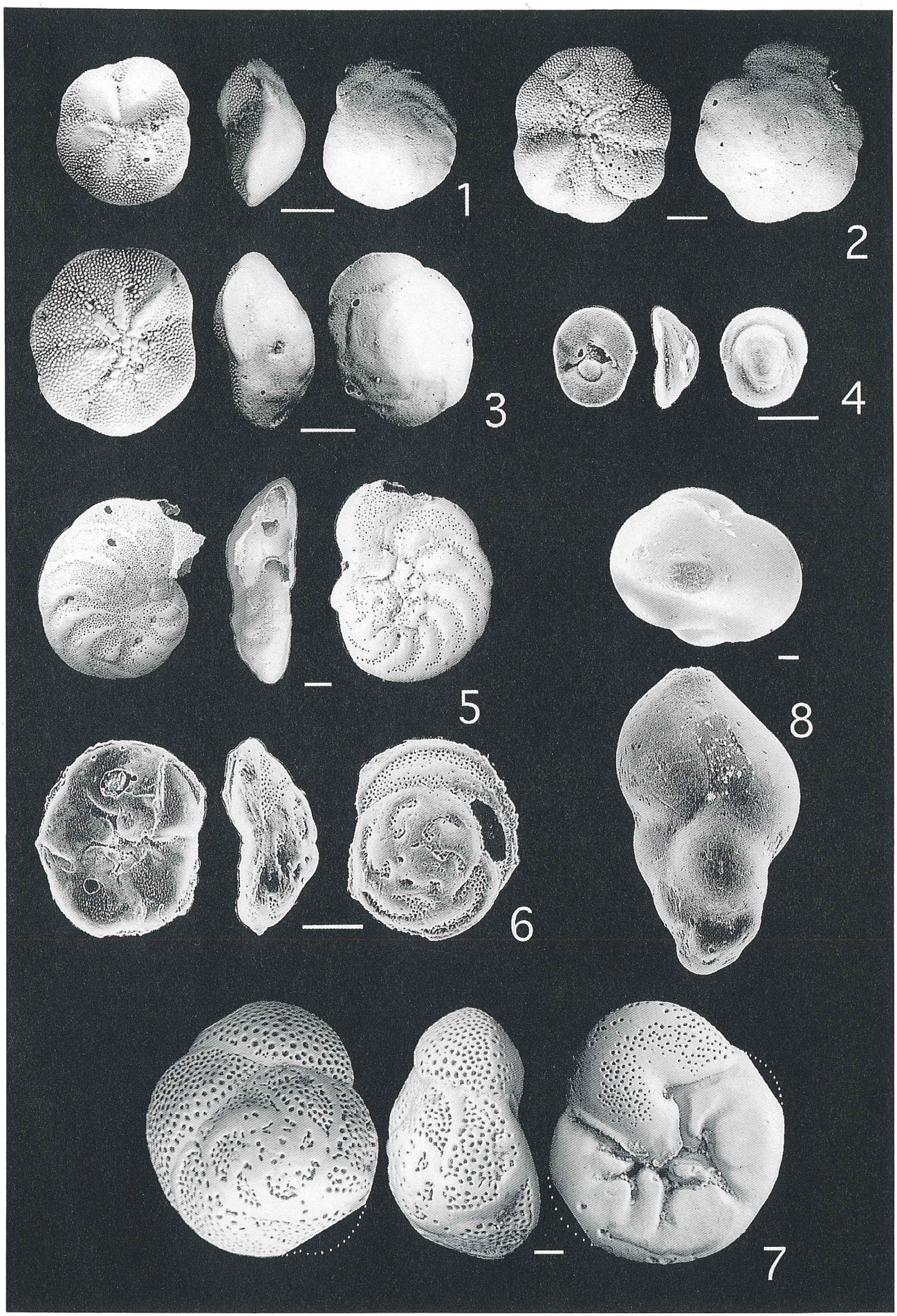

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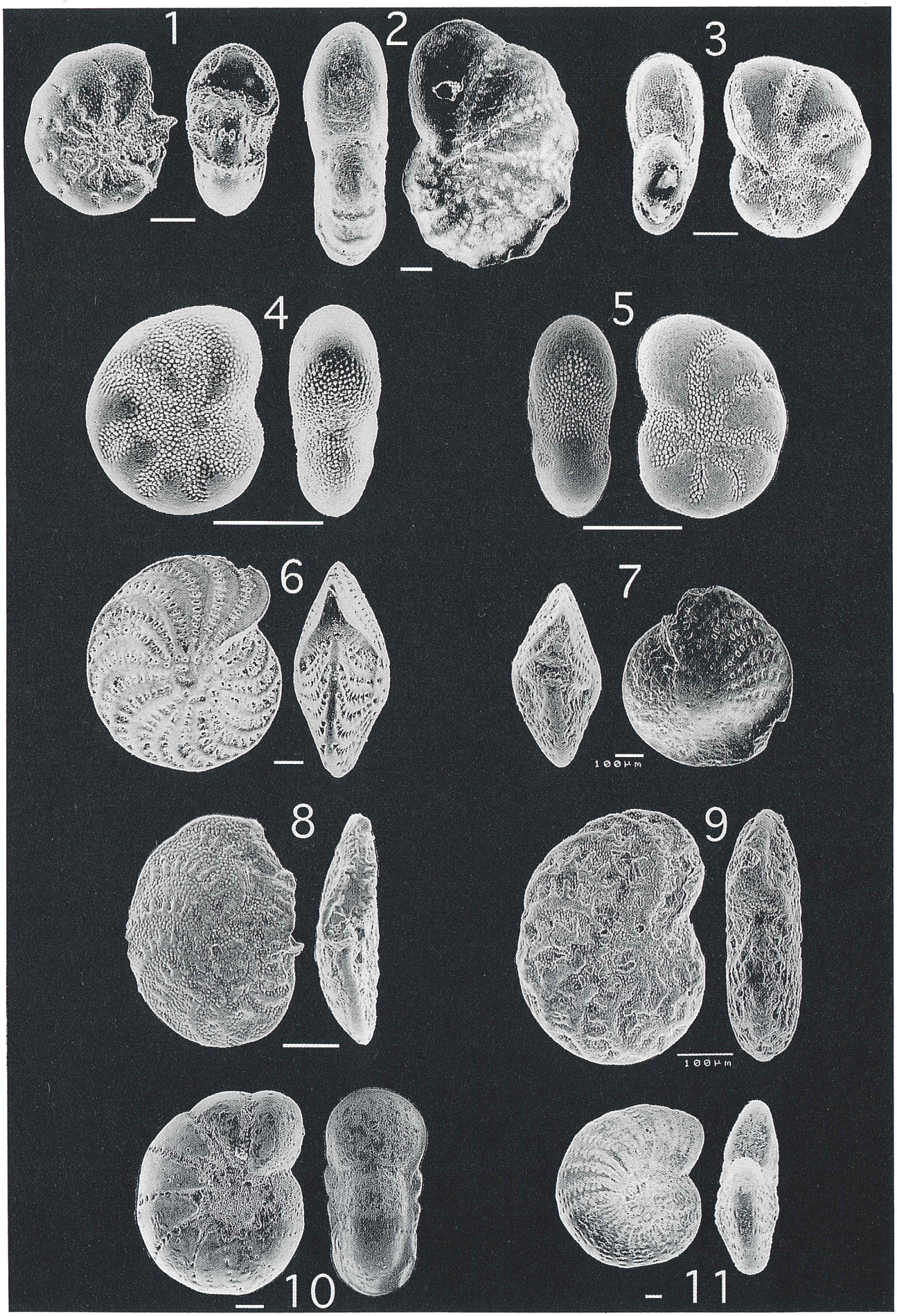

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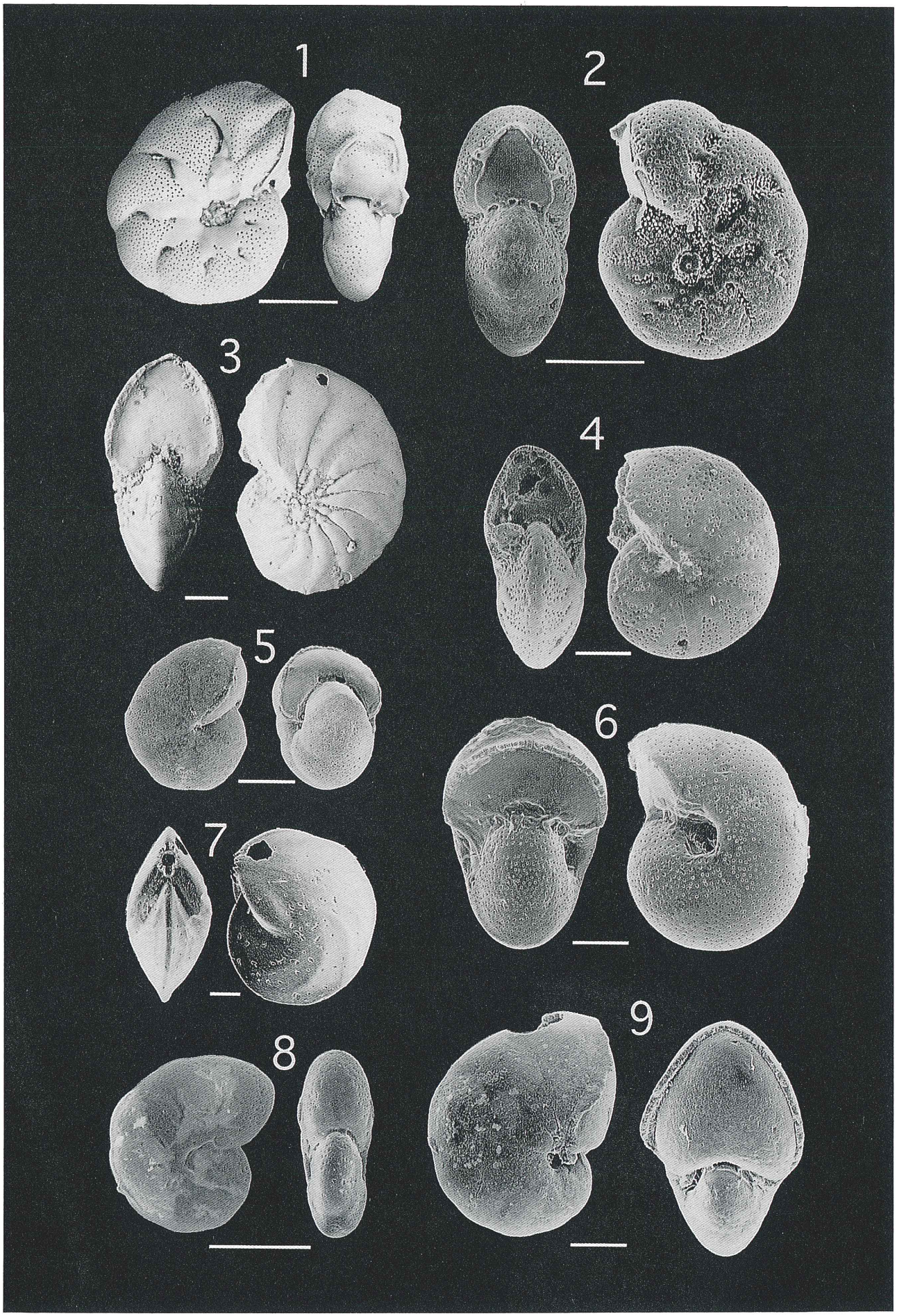

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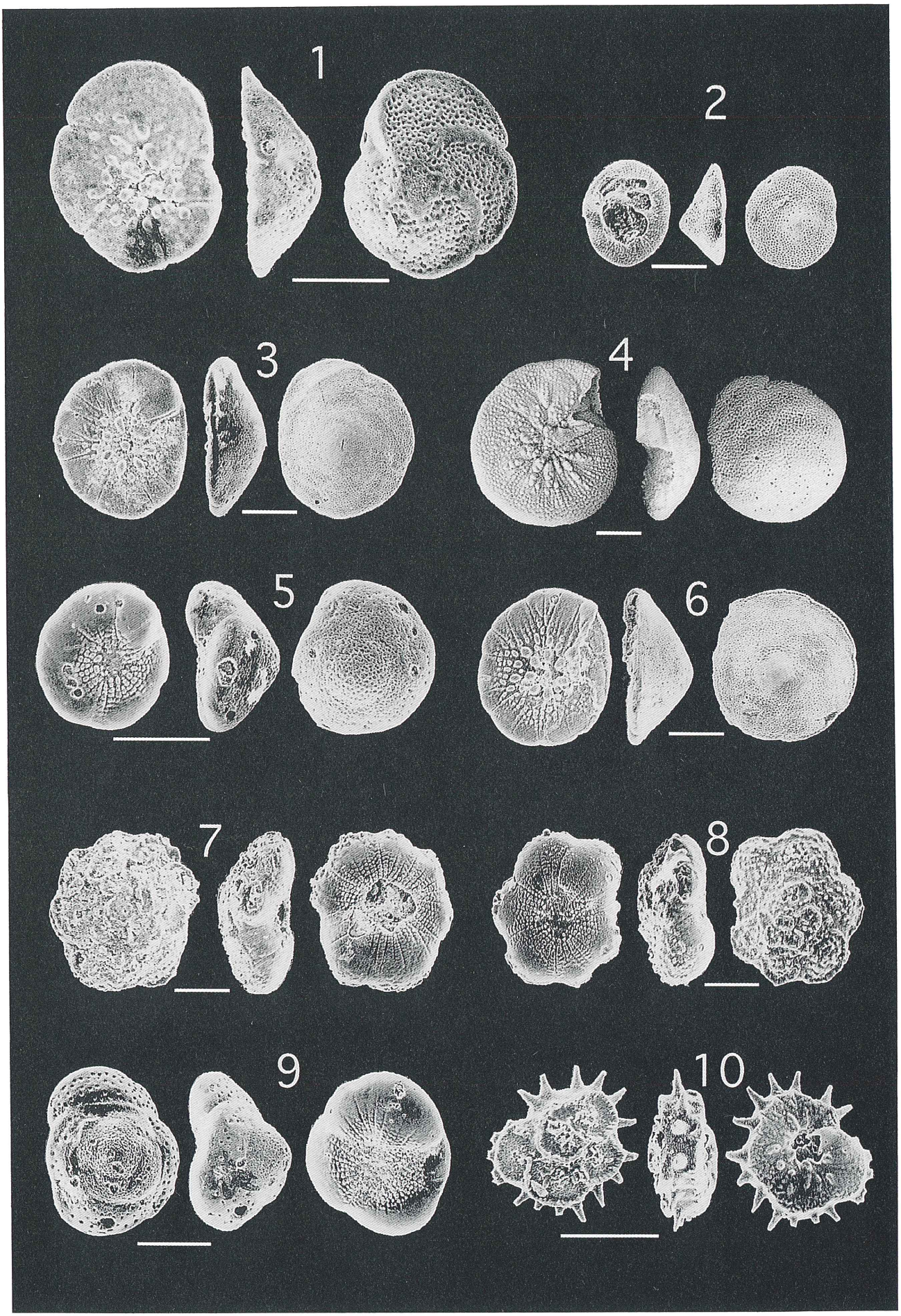

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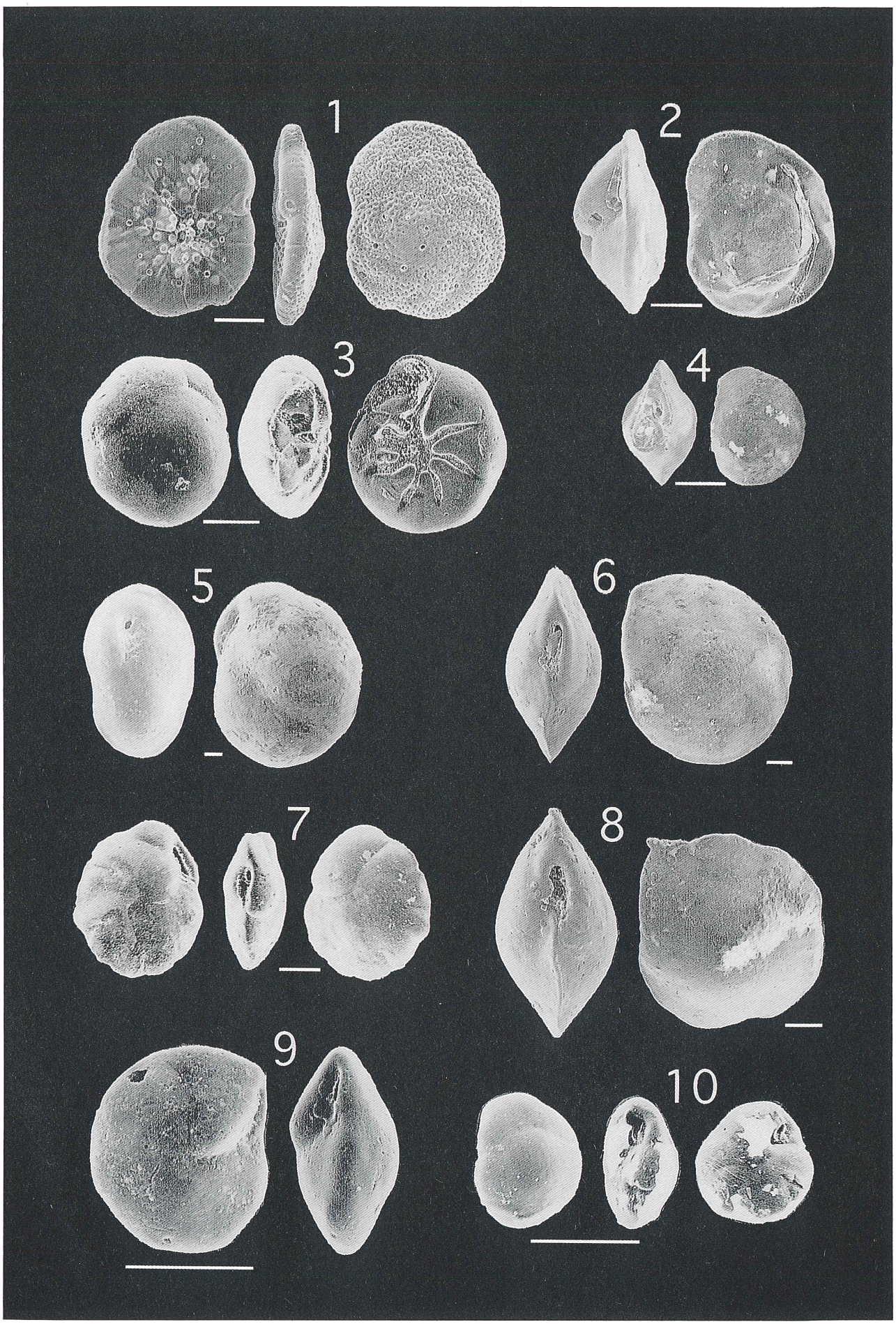

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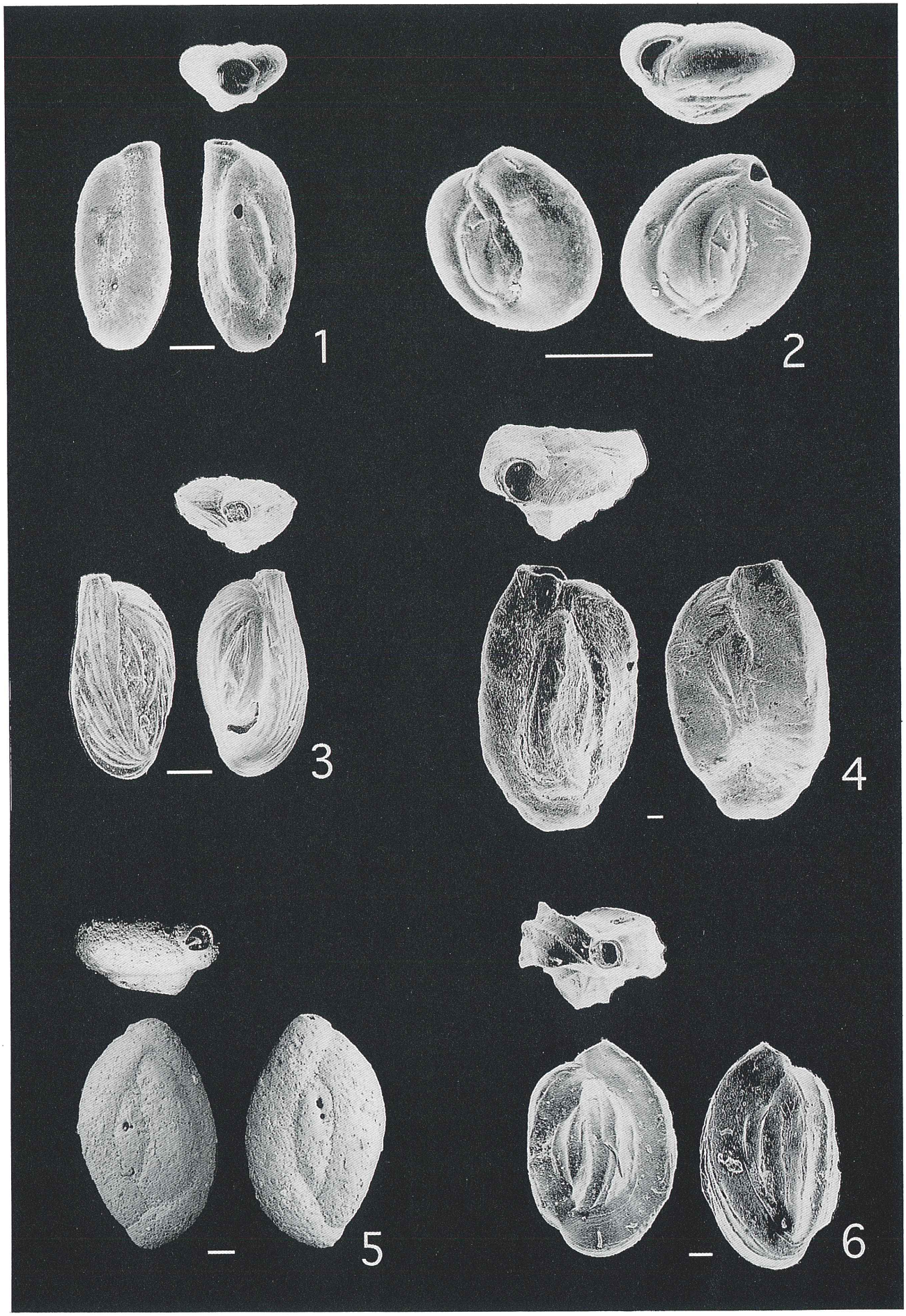

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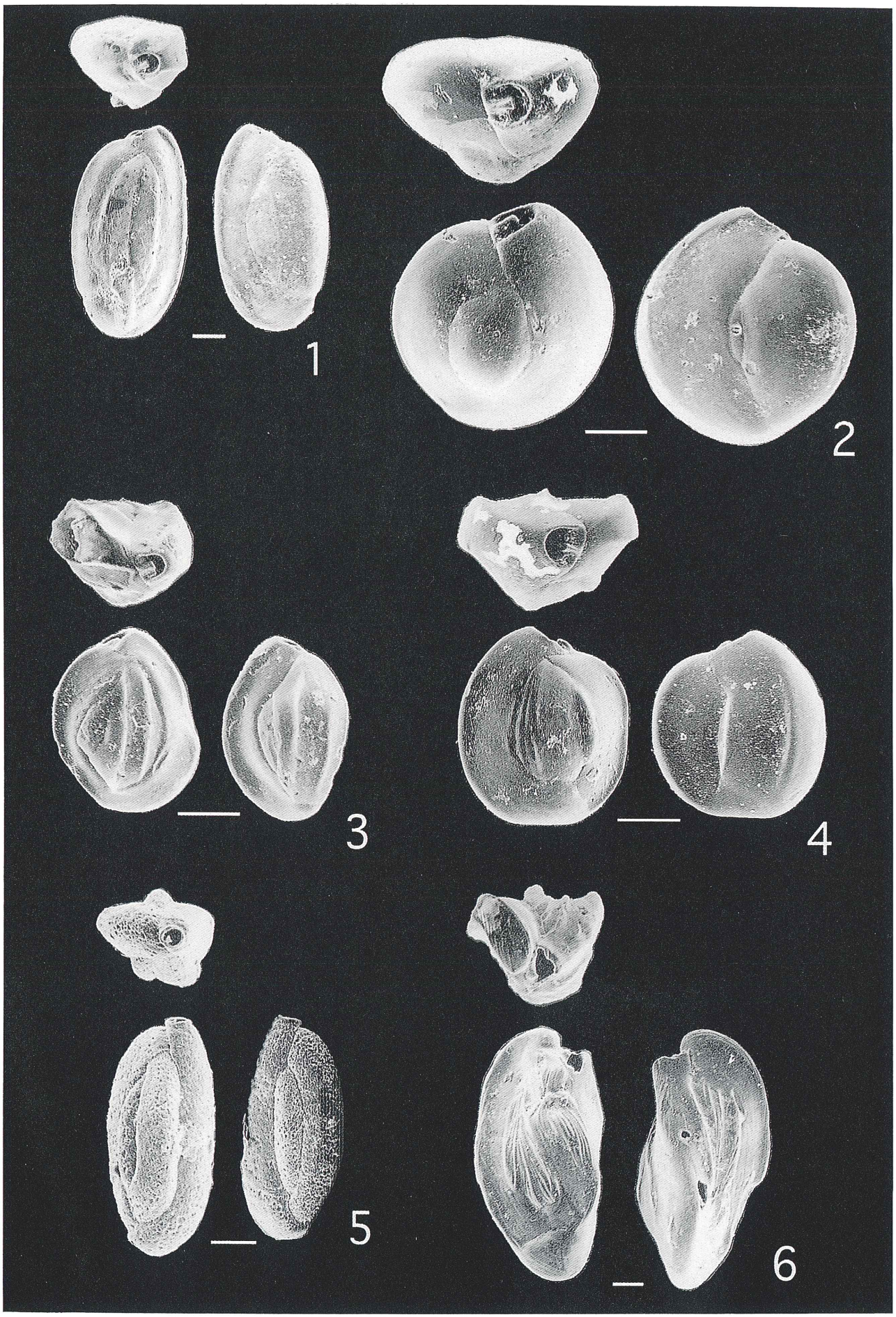

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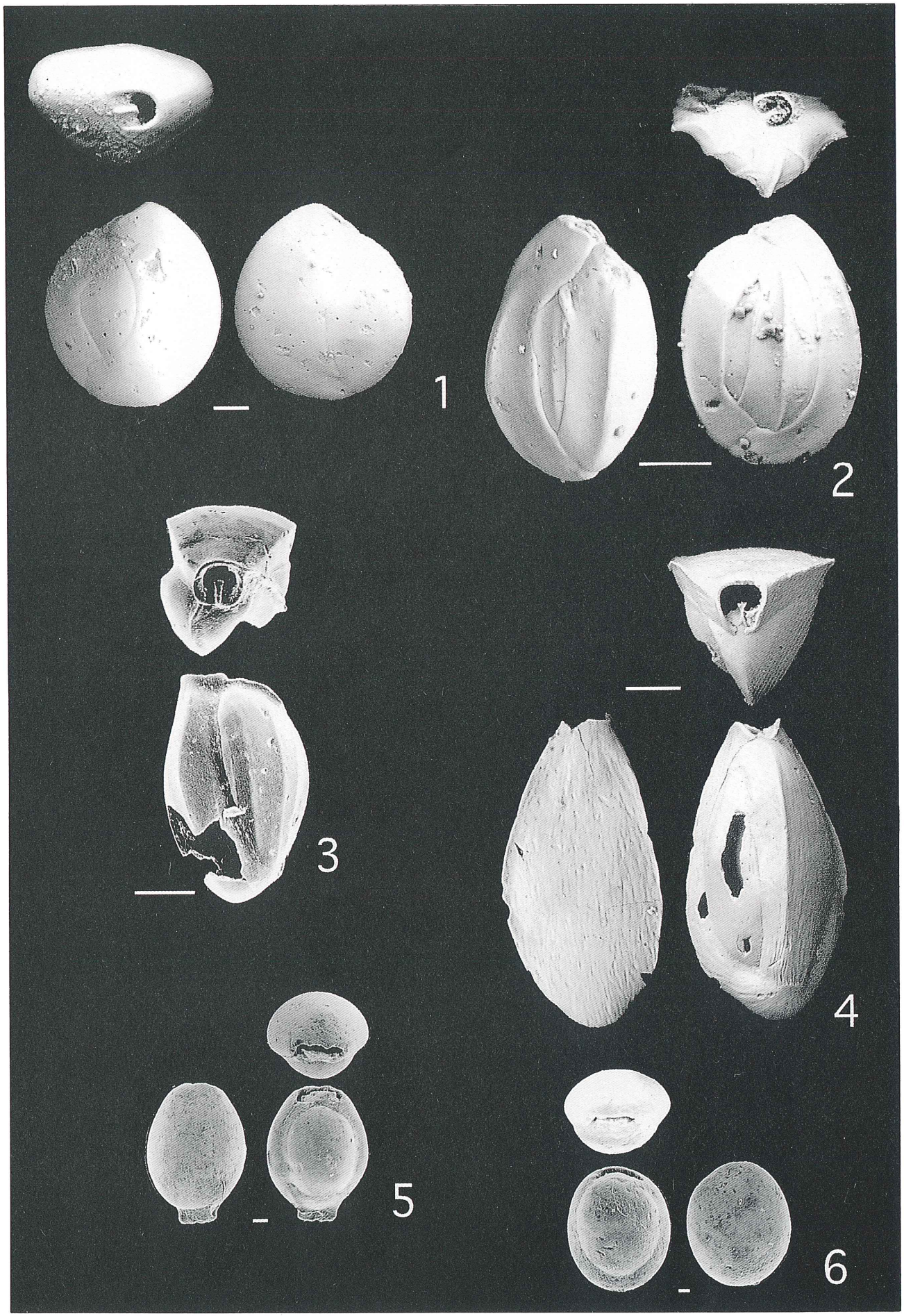

研究紀要「今金地域研究」第５号
Bulletin of the studies in Imakane district No.5
1999年３月23日　印刷
1999年３月31日　発行
編集発行者　今金町教育委員会
Imakane Board of Education
〒049-4308 北海道瀬棚郡今金町字今金303-1
303-1, aza Imakane, Imakane-cho, Setana-gun,
Hokkaido, 049-4308 Japan
PHONE : 01378-2-3488
F A X : 01378-2-3445
印　　刷　㈱長門出版社印刷部

Bulletin of the studies in Imakane District

No.5

Article

1999

Imakane Board of Education