

# 今金地域研究

第5号

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## 論説

ピリカカイギュウの復元

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Foraminifera from the Kuromatsunai and Setana Formations in  
southwestern Hokkaido, Japan-Preliminary report-

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## ピリカカイギュウの復元

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### Restoration 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, Restoration, 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

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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頸椎、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（桡骨、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）。

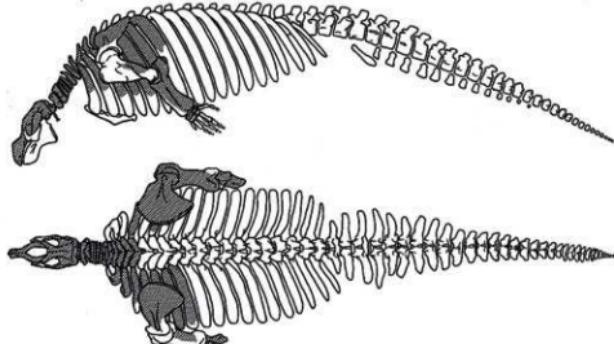
海牛類は始新世に地球上に登場して以降、水中生活に急速に適応し後肢を減退、消失していった海生哺乳類の一群である。したがって、本種は後肢を構成している13種、60個の骨格をすでに失っている。ゆえに、産出した29点は総数で140点あまりになる海牛類全身骨格のおよそ20%ということになる。死後水中に漂い、腐乱、沈降、分解あるいは海岸に漂着し、波などによって物理的に破壊されることが多い海生哺乳類の産出例としては本標本は完めて良い保存状態を示す。

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、太い梢円形～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、ジゴン科・ヒドロダマリス亞科・ヒドロダマリス属と判断した。その根拠は、ビ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軸の大型化（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 ビリカカイギュウの産出部位 斜線部が産出した部位

## ピリカカイギュウの復元

ピリカカイギュウは、タキカラカイギュウ、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る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頸蓋骨および脊椎の数とその大きさである。頸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

TMNHTakikawa Museum of Art and Natural History

C:頸椎, 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、頸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、歯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、むしろ前方に向かって細くなること、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雄と判断した。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ラカイギュウ (*H.spissa*: TMNH0001) や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（頸椎）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。



第3図 タキカラ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

### 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、最終的にはめらかな表面になるまで紙粘土の塗布、乾燥、磨きを繰り返す（第5図）。



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 ポリエチル樹脂による成形

## ピリカカイギュウの復元

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は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頸骨については、頭骨に残る下頸関節窓から吻端までの長さを基準にステラーカイギュウの下頸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ラカイギュウの値の115~130%の値を示すことから、タキカラ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、尾椎腹側の関節窓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ラカイギュウ(*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. jordanii*: 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肋骨をタキカラ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ラカイギュウの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ラ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ラ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）とポリエチレン樹脂による成形の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、今回はポリエチレン樹脂に直接同系顔料を混ぜ、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」、頸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。

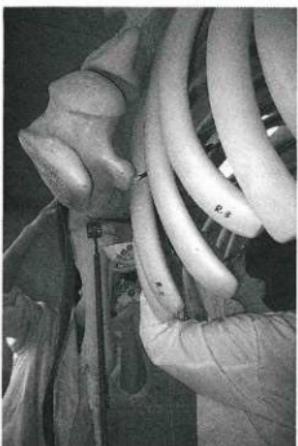
脊柱は椎体の中央に鉄管を貫通させ、椎間をポリエチレン樹脂で埋め、組み立てた際に外部から鉄管が見えないよう配慮した。頭部は脊柱の鉄管に当たる位置に鉄管の内径に一致する鉄筋を埋設、固定し、脊椎の鉄管に差し込んだ後、背腹方向に穴を貫通させ、ピンで止めた。胸部と尾部はそれぞれ2本の支柱で自立させ、展示スペースの多様性を考慮し、連結せず分離させて組み立てた。胸部と尾部の脊柱を支える2本の支柱はそれぞれ上下に高さが調節でき、頭部と尾部の高さを変えても展示ができるよう、支軸を矢状面に対し垂直方向になるようジョイントを加工した。また、狭い出入り口をもつ建物へも搬入ができるよう、胸郭を支える鉄筋は取り外しができ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

仮組み立てで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チレン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。

脊椎の中でも頸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

## ピリカカイギュウの復元



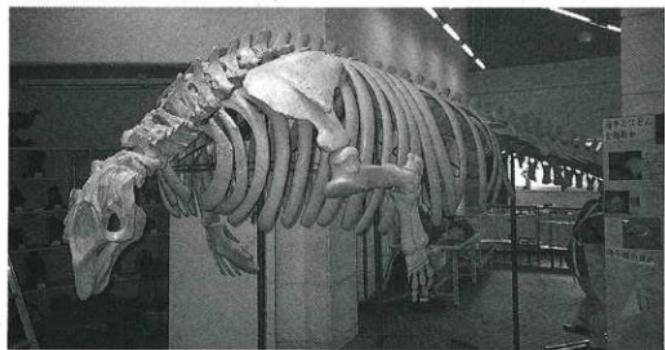
第9図 前肢の関節の固定



第10図 V字骨の固定

くポリエチ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、関節部をポリエチル樹脂で固定する（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、胸椎の横突起窩にリングを肋骨頭あるいは肋骨骨幹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、独断専行の説りを逸れないかもしれない。また、復元の前提となつた項目についても、異なる意見をもつ方もあるかと思う。しかし、敢えてここにビ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、ビ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。

「ビリカカイギュウ」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。残念ながらビ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ビ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「アバトサウルス」に名前を譲る羽目になった「プロントサウルス」である。ビリカカイギュウがプロントサウルスと同じ豪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”的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成らぬ。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。

ビ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 黙氏に記して厚くお礼申し上げる。

#### 文 献

- Domning, D. P., 1978, Sirenian evolution in the North Pacific Ocean, *Univ. Calif. Publ. Geol. Sci.*, 118.
- Furusawa, H., 1988, A new species of Hydrodamaline sirenia from Hokkaido, Japan, *Takikawa Mus. of Art and Nat. Hist.*, 1, 1-76.
- Kaiser, H. E., 1974, Morphology of the Sirenia. A macroscopic and X-ray atlas of the osteology of Recent species, Basel, S.Karger, 76pp.
- Marsh, H., 1980, Age determination of the Dugong (*Dugong dugon* (Müller)) in Northern Australia and its biological implications, *Rept. International Whaling Commission, Special Issue* 3, 181-201.
- 西村政雄, 1984, XVクリーニングと化石標本模型の作製、タキカワカイギュウ調査研究報告書, 187-202.

能條 歩・長谷川四郎・岡田尚武・都暉義寛・鈴木明彦・松田敏孝, 印刷中, 西南北海道瀬棚層の広域的岩相層序区分と生層序年代. 地質学雑誌, 109.

美利河海牛化石調査研究会, 1992, 美利河產海牛化石発掘調査報告書, 133p, 今金町教育委員会.

Steller, G. W., 1899, The beasts of the sea. The fur seals and fur-seal Islands of the North Pacific Ocean, Washington, Govt. Printing Off. Part 3, Art. 8, 178-218.



# Foraminifera from the Kuromatsunai and Setana Formations in southwestern Hokkaido, Japan

## -Preliminary report-

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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, Kunnu, 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 clinonconformably 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 Iwamare Board of Education. Some data of these works have been reported by Nojo et al. (1997; Tab. 1). This study is preliminary 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 foraminifera (Tab. 2) and shows their faunal 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 Iwamare area (after Nojo et al., 1997)

Sample number (Km: Sakurabetsu Pyro. Mem., Km: Okusawa Sand. Mem., Sc: Setana F.)	Km-1	Km-2	Km-3	Km-4	Km-5	Km-6	S-1	S-2	Sample number (Km: Sakurabetsu Pyro. Mem., Km: Okusawa Sand. Mem., Sc: Setana F.)	Km-1	Km-2	Km-3	Km-4	Km-5	Km-6	S-1	S-2
<b>Planktonic Foraminifera</b>																	
<i>Globigerina bellidifera</i> (Carter) <i>Globigerina obliquostriata</i> (Giggenbach) <i>Globigerina sp.</i> <i>Globigerinoides glomeratus</i> (Giggenbach) <i>Globigerinoides trilobatus</i> (Giggenbach)	+	+	+	+	+	+	+	+	<i>Flosteria regularis</i> (Suzuki) <i>Globigerina obliquostriata</i> (Giggenbach)	+	+	+	+	+	+	+	+
<i>Globigerinoides pseudodiscus</i> (Carter) <i>Globigerinoides pseudodiscus</i> (Carter) <i>Globigerinoides pseudodiscus</i> (Carter)	+	+	+	+	+	+	+	+	<i>Globigerinoides nubifer</i> (Nelson) <i>Globigerinoides nubifer</i> (Nelson) <i>Globigerinoides nubifer</i> (Nelson)	+	+	+	+	+	+	+	+
<i>Globigerinoides nubifer</i> (Nelson) <i>Globigerinoides nubifer</i> (Nelson)	+	+	+	+	+	+	+	+	<i>Globigerinoides nubifer</i> (McCulloch) <i>Globigerinoides nubifer</i> (McCulloch) <i>Globigerinoides nubifer</i> (McCulloch)	+	+	+	+	+	+	+	+
<i>Globigerinoides nubifer</i> (Nelson) <i>Globigerinoides nubifer</i> (Nelson)	+	+	+	+	+	+	+	+	<i>Guttulina yabei</i> Cushman & Ozawa <i>Guttulina sp.</i>	+	+	+	+	+	+	+	+
<b>Benthic Foraminifera</b>																	
<i>Aegaglobulus indistinctus</i> Asano <i>Aegaglobulus sp.</i> <i>Asterostomella hamata</i> Asano <i>Asterostomella hamata</i> Brady <i>Bolivina sp.</i> <i>Bolivina quadrivalvis</i> (Schwager) <i>Buccella fragilis</i> (Cushman) <i>Buccella fragilis</i> (Cushman) <i>Buccella sp.</i> <i>Buliminus sp.</i> <i>Cibicides blumense</i> (Weller & Jacob) <i>Cibicides edaphicus</i> de Montfort <i>Cibicides indistinctus</i> (Asano) <i>Cibicides sp.</i> <i>Cibicides spissulus</i> (Asano) <i>Cibicides spissulus</i> sp. <i>Discorbula sp.</i> <i>Discorbula perforata</i> Cushman & Valentine <i>Elphidium crispum</i> (Linné) <i>Elphidium crispum</i> (Linné) <i>Elphidium pectinatum</i> (Cushman) <i>Elphidium pectinatum</i> (Cushman) <i>Elphidium spissum</i> (Cushman) <i>Elphidium spissum</i> (Cushman) <i>Elongularia fusiformis</i> Maruyama <i>Eosphaerula sp.</i> <i>Epistoderia?</i> sp. <i>Fusorina macracma</i> (Benson & Holland) <i>Fusorina tenuis</i> (D'Orbigny & Berthelot) <i>Fusorina marginata</i> (Montagu) <i>Fusorina orbicularis</i> Seguenza	+	+	+	+	+	+	+	+	<i>Flabellina regularis</i> Asano <i>Heteropora praecincta</i> (Carter) <i>Heteropora subulifera</i> (Pur) <i>Indopelta rugosa</i> (Asano & Nakamura) <i>Indopelta rugosa</i> (Cushman) <i>Indopelta reticulata</i> (Asano & Nakamura) <i>Indopelta subulifera</i> (Asano & Nakamura) <i>Indopelta subulifera</i> (Asano & Nakamura) <i>Indopelta sp.</i> <i>Lagenaria aciculata</i> Rous <i>Lagenaria apiculata</i> Loddick & Tappan <i>Lagenaria apiculata</i> (Loddick & Tappan) <i>Lagenaria sp.</i> <i>Lenticulina sp.</i> <i>Miliolina punctulata</i> (Tisch & Moll) <i>Miliolina punctulata</i> (Tisch & Moll) <i>Miliolina punctulata</i> (Tisch & Moll) <i>Miliolina subulifera</i> (Cushman) <i>Miliolina subulifera</i> (Cushman & Jones) <i>Orbulina lenticulata</i> (Cushman) <i>Pleistocenea indistincta</i> (Asano) <i>Polyammina dorsalis</i> Yabe & Hosoya <i>Polyammina dorsalis</i> (Yabe & Hosoya) <i>Polyammina indistincta</i> (Asano) <i>Polyammina indistincta</i> (Asano & Nakamura) <i>Polyammina spissula</i> (Asano) <i>Retzia spissula</i> (Asano) <i>Retzia spissula</i> (Asano)	+	+	+	+	+	+	+	+
<i>Retzia spissula</i> (Asano)	+	+	+	+	+	+	+	+	<i>Polyammina dorsalis</i> Yabe & Hosoya <i>Polyammina spissula</i> (Asano)	+	+	+	+	+	+	+	+
<i>Reticularia</i> sp.	+	+	+	+	+	+	+	+	<i>Retzia spissula</i> (Asano)	+	+	+	+	+	+	+	+
<i>Reticularia</i> sp.	+	+	+	+	+	+	+	+	<i>Reticularia</i> sp.	+	+	+	+	+	+	+	+

Foraminifera from the Kuromatsunai and Setana Formations

Table 2 Foraminifera from the Kuromatsunai and Setana Formations

Sampling horizon	Upper Kuromatsunai F.	Lower Setana F.	Upper Setana F.	Sampling horizon	Upper Kuromatsunai F.	Lower Setana F.	Upper Setana F.
<b>Planktonic Foraminifera</b>							
Globigerina bulloides (Orbigny)	A	A	A	Discorbina bertheloti (d'Orbigny)	-	-	R
Globigerina quinqueloba Nodland	R	C	F	Discorbina spp.	R	-	VR
Globigerina glutinata (Egger)	F	F	F	Elophodina spp.	R	-	-
Globigerina uvula (Ehrenberg)	R	VR	F	Elphidium arctica (Parker & Jones)	C	-	-
Globigerinoides ruber (d'Orbigny)	-	-	R	Elphidium aculeatum (d'Orbigny)	-	-	VR
Globorotalia inflata (d'Orbigny)	C	C	VR	Elphidium advena (Cushman)	-	-	VR
Globigerina spp.	-	-	R	Elphidium bartletti Cushman	R	F	R
Neogloboquadrina cf. asanoi (Maiya, Saito, and Sato)	VR	-	-	Elphidium crispum (Lindström)	F	F	F
Neogloboquadrina dutertrei (d'Orbigny)	VR	-	-	Elphidium excavatum (Terquem) forma clavata Cushman	-	R	F
Neogloboquadrina incompta (Cifelli)	C	A	A	Elphidium frigidum Cushman	R	-	R
Neogloboquadrina pachyderma (Ehrenberg)	F	A	C	Elphidium hanzawai Asano	-	VR	-
Neogloboquadrina pachyderma (S) (Ehrenberg)	F	C	C	Elphidium incertum (Williamson)	-	-	VR
Neogloboquadrina sp.	-	VR	R	Elphidium janseni (Cushman)	VR	-	R
Gen. et sp. indet.	VR	R	VR	Elphidium macellum (Fichtel & Moll)	VR	-	-
<b>TOTAL COUNTED</b>	296	308	5035	Elphidium subarcticum Cushman	-	F	C
<b>Benthic Foraminifera</b>							
Alabamina japonica (Asano)	VR	-	-	Elphidium subgranulosum Asano	-	-	F
Ammonia beccarii (Lindström)	-	VR	-	Elphidium subincertum Asano	-	-	R
Ammonia ketefensis (Ishizaki)	-	VR	-	Elphidium transducens Nodland	-	-	R
Ammonia inflata (Seguenza)	-	R	-	Elphidium spp.	F	VR	R
Ammonia takanensis (Ishizaki)	-	VR	-	Epistominella pulchella Husezima & Maruhasi	R	VR	R
Ammonia spp.	-	VR	R	Epistominella spp.	VR	-	R
Angulogerina hughesi (Galloway and Wissler)	R	VR	R	Eponides? sp.	R	-	R
Angulogerina kokozurensis Asano	R	-	R	Fissurina annectens (Burrows & Holland)	-	-	R
Anomalina rotata (Brady)	-	VR	-	Fissurina cf. amoenica (Burrows & Holland)	VR	-	-
Anomalinella spp.	-	-	R	Fissurina lacunata (Burrows & Holland)	-	-	R
Anomalinae globulus (Chapman & Parry)	VR	-	R	Fissurina lucida (Williamson)	-	-	R
Atascoceras hyaloceras Loeblich and Tappan	VR	-	VR	Fissurina marginata (Walker & Boys)	R	R	F
Astromiosarcus aomoriensis Asano	-	VR	-	Fissurina obscurostriata Galloway & Wissler	VR	-	R
Astromiosarcus hamadaiensis Asano	-	F	R	Fissurina orbigniana Seguenza	R	-	VR
Astromiosarcus spp.	R	-	VR	Fissurina cf. rizza Seguenza	-	-	R
Bolivina decussata Brady	F	-	R	Fissurina semimarginata (Reuss)	VR	R	-
Bolivina sp. A	VR	R	R	Fissurina cf. subquadra Parr	-	-	R
Bolivina spp.	R	-	R	Fissurina spp.	R	VR	R
Brizalina alata (Seguenza)	-	-	VR	Gavelinopsis praegeri (Heron-Alen & Earland)	-	-	R
Brizalina spp.	-	-	R	Gavelinopsis spp.	R	-	R
Buccella frigida (Cushman)	VR	R	R	Glabellina cf. aurantista Seiglie & Bermúdez	-	-	R
Buccella makiyamai (Chiijii)	VR	R	C	Glabellina murabilis panamensis Seiglie & Bermúdez	-	-	R
Buccella nipponica (Husezima & Maruhasi)	-	VR	R	Glabellina pulvinata (Brady)	-	-	R
Buccella tanai (Uchio)	R	-	R	Glabellina sp. A	-	-	R
Buccella tenerima (Bandy)	R	-	C	Glabellina sp. B	-	-	R
Buccella spp.	VR	VR	R	Glabellina spp.	VR	-	R
Bulinina cf. imamurai Tai	R	-	-	Glandularia ovalis d'Orbigny	-	-	-
Bulinimella elegansissima (d'Orbigny)	-	-	F	Globocassidulina bisecta Nomura	F	R	R
Cancris auriculata (Fichtel & Moll)	VR	-	F	Globocassidulina canalifusistrata Eade	-	R	-
Chrysaldinella dimorpha (Brady)	VR	-	F	Globocassidulina noobrocha	-	-	R
Cibicides cf. kamadae Asano	-	VR	-	Globocassidulina spp.	F	R	F
Cibicides lobulatus (Walker & Jacob)	A	A	F	Guttulina spp.	VR	-	R
Cibicides refugens de Montfort	C	C	C	Gyroidina spp.	-	-	R
Cibicides subdepressus (Asano)	R	F	R	Hanzawaia nipponica Asano	R	VR	R
Cibicides tani Iwasa and Kiuchi	F	R	R	Haynesina sp.	-	-	VR
Cibicides spp.	R	R	R	Hercomallena sp.	-	-	R
Cibicidoides pachydermus (Rashak)	R	-	VR	Heterolepa subhaidergeri (Parr)	VR	-	-
Conospira involvens (Reuss)	R	-	R	Heterolepa sp.	-	-	R
Cribroelphidium oregonense (Cushman & Grant)	-	-	VR	Islandiella heleneae Feyling-Hansen & Buzas	-	-	R
Cribroelphidium yabei (Asano)	R	-	R	Islandiella islandica (Nishiwaki)	F	-	-
Cribrolinoidea curta (Cushman)	-	VR	R	Islandiella japonica (Asano & Nakamura)	F	C	R
Cycloforia contorta (d'Orbigny)	-	-	VR	Islandiella norcrossi (Cushman)	-	-	R
Cystammina paucilocula (Brady)	VR	-	-	Islandiella yabei (Asano & Nakamura)	F	F	-
Discorbina araucana (d'Orbigny)	R	VR	F	Islandiella spp.	-	R	R

Table 2 Foraminifera from the Kuromatsuai and Setana Formations (continued)

Sampling horizon	Upper Kuro- matsu- ai F.	Lower Setana F.	Upper Setana F.	Sampling horizon	Upper Kuro- matsu- ai F.	Lower Setana F.	Upper Setana F.
<b>Benthic Foraminifera</b>							
Karreriella baccata (Asano)	-	VR	-	Quinqueloculina alkeniana (d'Orbigny)	R	R	R
Karreriella spp.	R	-	R	Quinqueloculina costata (d'Orbigny)	-	-	R
Lagena aciculosa (Reuss)	-	-	VR	Quinqueloculina elongata (Nägeli)	-	-	R
Lagena apicula (Loeblich & Tappan)	VR	VR	R	Quinqueloculina kuronstansiensis Asano	-	-	R
Lagena sulcata spicata (Cushman & McCulloch)	-	-	R	Quinqueloculina sauvensis Asano	-	-	R
Lagena sp.	-	-	VR	Quinqueloculina seminulum (Linné)	-	VR	R
Lenticulina nikobarensis (Schwager)	-	-	VR	Quinquerocalina vulgaris (d'Orbigny)	-	R	R
Lenticulina sp.	-	-	VR	Quinquerocalina cf. vulgaris (d'Orbigny)	-	-	VR
Melonis pacificus (Cushman)	VR	-	VR	Quinqueloculina yezoensis Asano	-	-	R
Melonis uchii Hasegawa	-	-	VR	Quinqueloculina sp. B	-	-	R
Melonis spp.	VR	-	-	Quinqueloculina sp. C	-	-	R
Miliolina circularis (Bornemann)	-	-	R	Quinqueloculina sp. F	-	-	R
Miliolinella spp.	-	-	R	Quinqueloculina sp. G	-	-	R
Neocorbina stachii (Asano)	-	VR	-	Quinqueloculina sp. H	-	-	R
Neopponides procerus (Brady)	-	R	R	Quinqueloculina spp.	R	R	F
Neopponides spp.	VR	-	-	Rectobolivina rephanus (Parker & Jones)	-	-	VR
Noctularia? sp.	-	-	VR	Rosalina australis (Parf)	VR	VR	R
Nonion japonicus Asano	-	-	R	Rosalina bradyi (Cushman)	VR	VR	F
Nonion spp.	R	VR	R	Rosalina isabelleana d'Orbigny	-	-	R
Nonionella stellata Cushman & Moyer	-	-	R	Rosalina vilardobonae d'Orbigny	-	-	R
Nonionoides grataeoupi (d'Orbigny)	-	-	VR	Rosalina spp.	R	VR	R
Oolina carteri Albiani and Yasini	VR	-	-	Sigmochauerina sp.	-	-	VR
Oolina costata (Williamson)	-	-	VR	Sigmocidella pacifica Cushman & Ozawa	-	-	VR
Oolina melo d'Orbigny	-	VR	R	Sigmocidella spp.	VR	-	-
Oolina striatopunctata (Parker & Jones)	-	VR	-	Sigmolina siamoidea compressa Cushman	-	R	-
Oolina sp.	-	-	VR	Sigmolina sp.	-	-	VR
Oridosalis umbonatus (Reuss)	-	-	VR	Sigmomorphina spp.	-	-	VR
Oridosalis cf. umbonatus (Reuss)	VR	-	-	Sigmomorphina semitecta terquemiana (Fornasini)	-	-	R
Osangularinella umbonifera (Cushman)	VR	-	-	Sigmomorphina trilocularis (Bögg)	VR	-	-
Paracaudilina sulcata Belford	-	-	R	Sigmoilvirgulina sp.	-	-	VR
Pararotalia nipponica (Asano)	-	-	R	Sphaeroidina japonica Brady	VR	-	-
Patellina corrugata Williamson	-	VR	R	Sphaeroidina spp.	-	-	-
Patellina hanzawai Asano	-	-	R	Spirillina limbata Brady	-	-	VR
Patoris hauserioides (Rhmber)	-	-	F	Spirillina vivipara Ehrenberg	-	R	-
Planoglabellina austroensis (Heron-Alen & Earland)	-	-	R	Spirillina sp.	-	-	VR
Planoglabellina opercularis (d'Orbigny)	-	-	R	Spiricolina hadai Thalmane	-	-	R
Planoglabellina pateniformis (Brady)	-	-	R	Spiricolina sp.	-	-	VR
Planoglabellina subopercularis (Asano)	R	R	F	Spiroclematina sp. A	-	-	R
Planoglabellina? sp. C	-	-	VR	Spiroclematina sp.	-	-	VR
Polystomellina discorbinoides Yabe & Hanzawa	-	VR	R	Spirocinctella wrightii (Silvestri)	-	-	R
Porcoconides cribroconoides Asano & Uchio	-	-	R	Textularia conica d'Orbigny	-	-	VR
Pseudononion japonicum Asano	-	VR	R	Textularia spp.	-	-	R
Pseudononion spp.	-	VR	VR	Triloculina rotunda d'Orbigny	-	VR	-
Pseudoparella naraensis Kuwano	VR	-	F	Triloculina suttensis Asano	-	-	R
Pseudoparella takayangii (Iwasaki)	VR	R	F	Triloculina tricarinata d'Orbigny	-	-	VR
Pseudoparella spp.	-	-	R	Triloculina sp. A	-	-	VR
Pseudopolymorphina sp.	-	-	VR	Uvigerina juncea Cushman	-	VR	-
Pollena aperta Cushman	VR	-	-	Uvigerina spp.	VR	-	-
Pyrgo exo Asano	VR	-	-	Valvulinaria hamakaoensis (Ishiwada)	-	-	VR
Pyrgo fornicinii Chapman & Parr	-	R	-	Valvulinaria japonica Asano	-	VR	-
Quinqueloculina agglutinata Cushman	-	-	R	Gen. et sp. indet.	R	F	F
<b>Total counted</b>				869	780	4652	

A: 80.5-13.5%, C: 13.5-4.5%, F: 4.5-1.5%, R: &lt;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, Modèle 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.

#### *Globigerinella glutinata* (Egger)

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

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

#### *Globigerinella uvula* (Ehrenberg)

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

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

#### *Globigerinoides ruber* (d'Orbigny)

*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'Orbigny) (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 Saito, 1976, in Takayanagi and Saito eds. Progress in Micropaleontology, Micropal. Press, p. 408, pl. 2, figs. 5-7.

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

cf. *Globoquadrina asanoi* Maiya, Saito, 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.

*Neogloboquadrina 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)**

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

*Ammonia ketienziensis* (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. 1, nos. 50-53; 1950, Illust. Cat.Japan. Tert. Small. Foram., pt. 2, p. 19, figs- 94-96.

*Tifarina 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 hyalaculus* Loeblich and Tappan

*Astacolus hyalaculus* 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* (Seguenza), 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. 1, figs. 13-14.

*Buccella nipponica* (Husezima and Maruhasi)

*Discorbis nipponica* Husezima and Maruhasi, 1944, Jour. Shigenkagaku Kenkyusho (Res. Inst. Nat. Resour., Japan), v. 1, 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. imamurae* Tai

cf. *Bulimina imamurae* 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., Foraminifères, 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. I., 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. I, p. 122.
- Truncatulina refulgens* (Montfort), Brady, 1884, Voy. Challenger, Rep., Zool., v. 9, p. 659, pl. 92, figs. 7-9.
- Cibicides subdepressus* (Asano)  
*Planulina subdepresso* 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 Umgebung 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.
- Criboelphidium oregonensis* (Cushman and Grant)  
*Elphidium oregonense* Cushman and Grant (sic.), 1927, San Diego Soc. Nat. Hist., Trans., V, no. 6, 79, viii, 3.
- Criboelphidium yabei* (Asano)  
*Elphidium yabei* Asano, 1938, Geol. Soc. Japan, Jour., v. 45, no. 538, p. 589, pl. 14, figs. 9-10.
- Criboelphidium yabei* (Asano), Asano, 1950, Illust. Cat. Japan. Tert. Small. Foram., pt. I, 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), Cushman 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 contrita* d'Orbigny  
*Cycloforia contrita* d'Orbigny, 1846, Foram. Foss. Viene, p. 298, pl. 20, figs. 4-6.
- Cystammina pauciloculata* (Brady)

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

*Ampelochilostoma pauciloculata* (Brady), Eimer and Fickert, 1899, Zeitschrift Wissenschaftliche Zoologie 65, p. 692.

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

*Discorbina araucana* (d'Orbigny)

*Rosanila araucana* d'Orbigny, 1839,

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

*Discorbina 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

*Discorbina bertheloti* (d'Orbigny), Loeblich and Tappan, 1964, Treatise on Invertebrate 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. 1, no. 1, p. 31, pl. 10, 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, Foraminifères fossiles du Bassin Tertiaire 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. 10, figs. 1, 2.

*Elphidium articulatum* (d'Orbigny)

*Polystomella articulata* d'Orbigny, 1839, Amer. Merid., Foraminifères, v. 5, pt. 5, p. 30, pl. 3, figs. 9, 10.

*Elphidium articulatum* (d'Orbigny), Cushman, 1930, U.S. Nat. Mus., Bull. 104, pt. 7, p. 26, pl. 10, 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* (Williamson) 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. Sci., Rep., 4th, ser. v. 6, no. 3, p. 126, text-figs. 83a, b.

*Elphidium hughesi foraminosum* 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 Nautilus, 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. 1, no. 3, p. 398, pl. 34, figs. 10a-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 Paleontologists and Mineralogists, 9.

*Fissurina baccata* (Hellon-Allen and Earland)

*Lagena orbigniana* 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.

*Fissurina orbigniana 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. 1, 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. 1, p. 52, pl. 9, fig. 1.

*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 Schlicht, 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. I, p. 468.

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

*Fissurina cf. subquadrata* Parr

cf. *Fissurina subquadrata* Parr, 1954, Roy. Soc. Victoria, 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 Earland), 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 mirabilis panamensis* Seiglie and Bermúdez

*Glabratella mirabilis 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 with 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 observations 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. Geogr., v. 6, nos. 3-4, p. 68, pl. 13, fig. 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 subhaidergerii* (Parr)  
*Cibicides subhaidergerii* 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 subhaidergerii* (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. 1, 2.
- Islandiella japonica* (Asano and Nakamura), Troitskaja, 1970, Usloviya obitaniya i raspredelenie foraminifer v Yaponskom Morn (semeistva Elphidiidae, Cassidulinidae i Islandiellidae). In Fursenko A.V. ed., Obstchye voprosy izucheniya mikrofauny Sibiri, dalinego vostoka i drugikh raionov. Instituta Geologii i Geofiziki, Akademii 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. (Geol), 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. 10, figs. 14, 15.

*Lagena striata* (d'Orbigny)

*Oolina striata* d'Orbigny, 1839, Voy. Amer. Merid., Foralminifères, 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 uchchoi* Hasegawa

*Melonis uchchoi* 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, figs. 6a-c.

*Neoeponides procerus* (Brady)

*Pulvinulina procura* 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. I, 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., Foraminifères, 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 striatopunctata* (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* (Reuss), 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), Ujiiie, 1966, Palaeont. Soc. Japan, Trans. Proc., N.S. 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, Foraminifères, 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 Bermúdez, 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. 1, p. 54, pl. 5, figs. Sa-c.

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

*Planoglabratella ? sp.* C

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

*Polystomelina discorbinoidea* Yabe and Hanzawa

*Polystomelina discorbinoidea* Yabe and Hanzawa, 1923, Japan Jour. Geol. Geogr., v. 2, p. 99, text-figs. a-c.

*Poroepionides cibrorepandus* Asano and Uchio

*Poroepionides cibrorepandus* 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. 6a-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* Iwasa, 1955, Jour. Geol. Soc. Japan, v. 61, no. 712, p. 16, text-figs. 4a-c.

*Epistominella suetsuensis* 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. 10, 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.

*Quinqueloculina agglutinata* Cushman

*Quinqueloculina 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. 16-21.

*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. 10, p. 786.

*Quinqueloculina seminulum* (Linné), d'Orbigny, 1826, Ann. Sci. Nat., Paris, ser. I, v. 7, p. 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 chambers and coarsely perforated wall.

*Quinqueloculina* sp.C

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

*Quinqueloculina* sp.F

This form is similar to *Quinqueloculina 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. CS33, 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), Hornbrook and Vella, 1954, Micropal., v. 8, no. 1, p. 26.

*Rosalina globularis* d'Orbigny

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

*Rosalina isabelleana* d'Orbigny

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

*Rosalina vilardeboana* d'Orbigny

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

*Rosalina vilardeboana* d'Orbigny

*Rosalina vilardeboana* d'Orbigny, 1839, Voy. Amér. Mérid., Foraminifères, 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 amygdalooides* 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 candéiana* 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, Foraminifères, 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 akitaeensis* Asano

*Uvigerina akitaeensis* 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.

*Valvularineria hamanakoensis* (Ishiwada)

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

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

*Valvularineria japonica* Asano

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

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## References

- Asano K., 1936a, Foraminifera from Kuromatsunai-mura, Suttu-gun, Hokkaido. Studies on the fossil Foraminifera from the Neogene of Japan. (II). Jour. Grol. Soc. Japan, 43, 419-422. (in Japanese)
- Asano K., 1936b, Foraminifera from Kuromatsunai-mura, Suttu-gun, Hokkaido. Studies on the fossil Foraminifera from the Neogene of Japan. Part 2. Jour. Geol. Soc. Japan, 43, 615-624.
- Asano K., and Nakamura M., 1937, On the distribution of the Japanese species of *Cassidulinina*. Jour. Geol. Soc. Japan, 44, 42-49. (in Japanese)
- Asano K., 1937, Pliocene foraminifera from the Setana Beds, Hokkaido. Jour. Geol. Soc. Japan, 44, 509-512. (in Japanese)

- Asano K., 1939, Pliocene (Upper Mizuho) Foraminifera from Japan (preliminary Report). Jour. Geol. Soc. Japan, 46, 155-168. (in Japanese with English abstract)
- Hashimoto W., Kanno S., Shinada Y., and Oshima K., 1963, Geology of the Imagane, Kun'nui, and Yakumo districts, Oshima Peninsula, Hokkaido. Jour. Geol. Soc. Japan, 69, 228-238. (in Japanese with English abstract)
- Kato M., Katsui Y., Kitagawa Y., and Matsui M. (eds), 1990, Regional geology of Japan. Part 1. Hokkaido. Kyoritsu Shuppan, 337p.
- Masatani K., and Ohkura T., 1980MS, Neogene biostratigraphy in Oshima Peninsula, Hokkaido, Japan. In particular relation between "*Operculina-Miogypsina* Zone" and Planktonic foraminifera. Technol. Lab. JAPEX, 23, 32-52. (in Japanese with English abstract)
- Matsui M., Doi S., Takeda H., Uozumi S., Hujie T., Akiba C., Yoshimura N., Yamaguchi K., Obara T., and Odagiri T., 1955, Report on geology and ore depositions in the north-eastern Imakane area, Shiribeshi, Hokkaido, Japan. Imakane town, 56. (in Japanese)
- Nagao T., and Sasa Y., 1933, The Cenozoic systems of southwestern Hokkaido and its geological history, part 1-2. Jour. Geol. Soc. Japan, 40 555-577; 750-775. (in Japanese)
- Nojo A., Togo, Y., Suzuki, A. and Sagayama, T., 1994, Lithostratigraphy and chronology of the Neogene Kuromatsunai Formation in the Imakane area, southwestern Hokkaido, Japan. Jour. Geol. Soc. Japan, 100, 771-786. (in Japanese with English abstract)
- Nojo A., Uchida J., Soeda Y., Itagaki K., Nakagawa M., Nikaido A., Suzuki A. and Togo Y., 1997, Some Plio-Pleistocene foraminifera from the Imakane-Kamiyakumo area of southwestern Hokkaido, Japan (Preliminary report). Bulletin of the studies in Imakane district, no. 3, 29-37. (in Japanese)
- Nojo A., Hasegawa S., Okada H., Togo Y., Suzuki A., and Matsuda T., in press, Interregional lithostratigraphy and biostratigraphy of the Pleistocene Setana Formation, southwestern Hokkaido, Japan. Geol. Soc. Japan. (in Japanese with English abstract)
- Okada T., and Mitani K., 1981, Geology of the Imakane town. Imakane town, 77. (in Japanese)
- Shirai T., 1959, Geology in the Kuromatsunai district, with a special reference to the fossil foraminifera of the Pliocene Setana Formation-A study of the Neogene fossil foraminifera in northern Japan (1). Bull. Geol. Comm. Hokkaido, 38, 1-12. (in Japanese with English abstract)
- Shirai T., 1960, New genus and species of foraminifera from the Pliocene formation, southwestern Hokkaido. Jour. Fac. Sci. Hokkaido Univ., Ser. 4, 10, 537-543.

## 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'Orbigny), 6. *Globigerinoides ruber* (d'Orbigny),
- 7-9. *Neogloboquadrina incompta* (Chifelli), 10-11. *Neogloboquadrina pachyderma* (Ehrenberg)

### Benthic Foraminifera (Plate 2-12)

#### Plate 2

1. *Angulogerina kokozuraensis* (Asano), 2. *Uvigerina akitaensis* 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 orbigniana* 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),

Foraminifera from the Kuromatsunai and Setana Formations

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 discorbinooides* Yabe and Hanzawa, 9. *Elphidium jensenii* (Cushman),
10. *Criboelphidium yabei* (Asano), 11. *Criboelphidium oregonensis* (Cushman and Grant)

Plate 7

- 1, 8. *Astrononion hamadaense* Asano,
2. *Elphidium excavatum* (Terquem) forma *clavata* Cushman,
3. *Nonion japonicus* Asano, 4. *Melonis uchiori* Hasegawa, 5. *Pullenia apertura* Cushman,
6. *Melonis pomphiloides* (Fichtel and Moll), 7. *Lenticulina nicobarensis* (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. *Islandiella 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* (Rhumbler),
3. *Quinqueloculina costata* d'Orbigny, 4. *Quinqueloculina kuromatunaiensis* Asano,
5. *Quinqueloculina agglutinata* Cuslunan, 6. *Quinqueloculina* sp.F

Plate 11

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

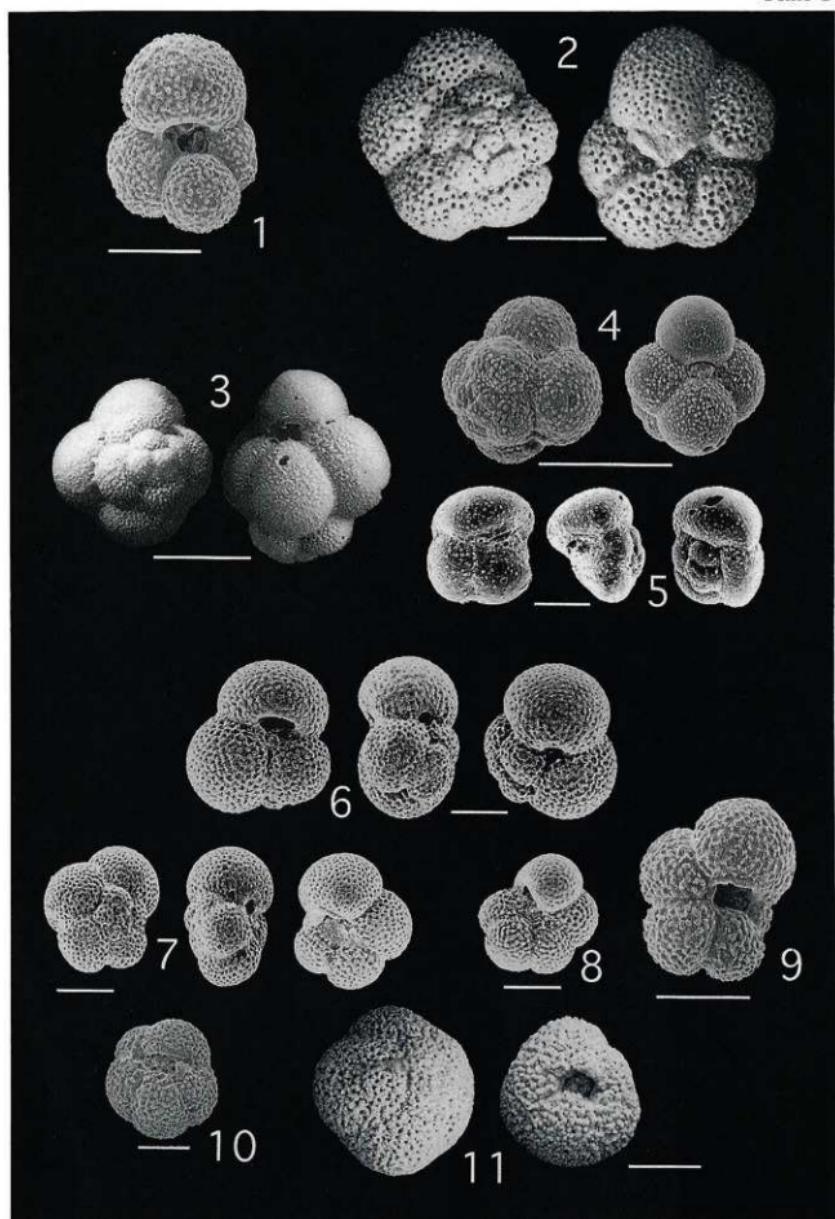
3. *Quinqueloculina* sp. C, 4. *Cribrolinoides curta* (Cushman), 5. *Quinqueloculina* sp. B,

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

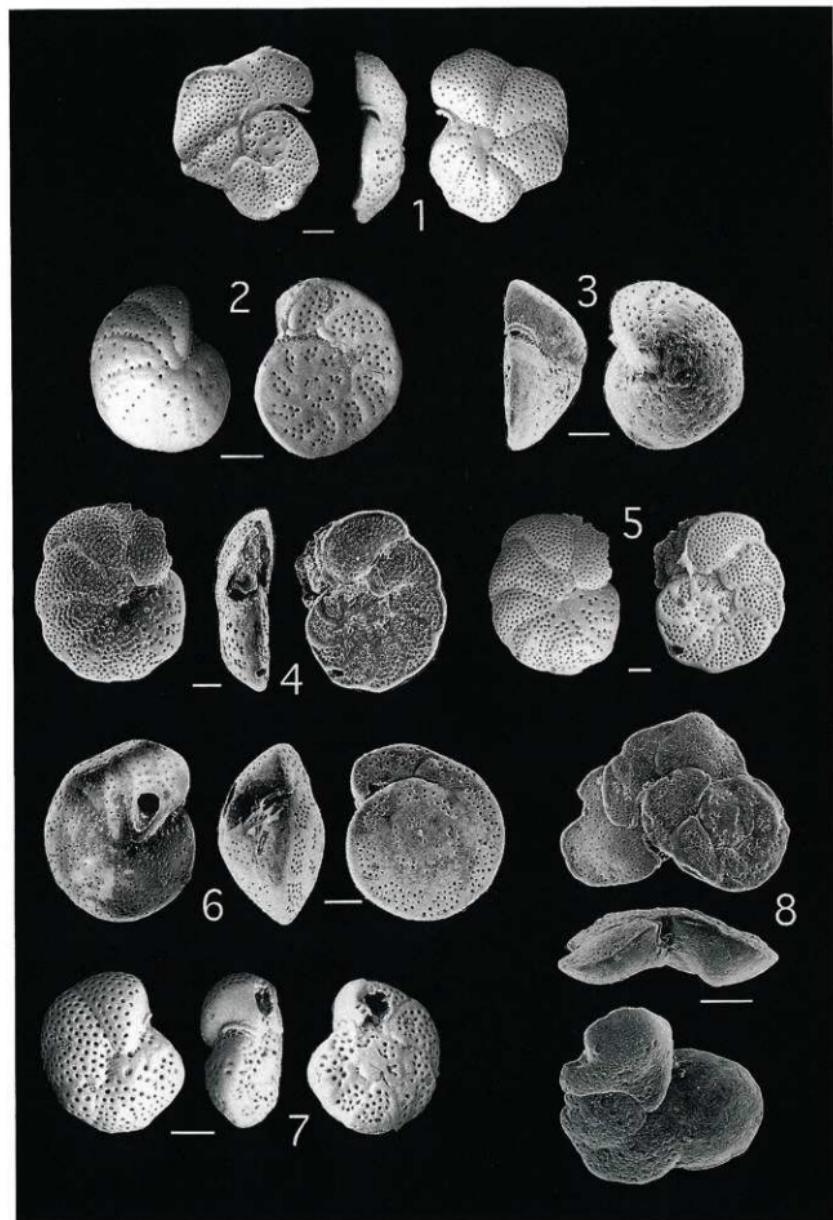


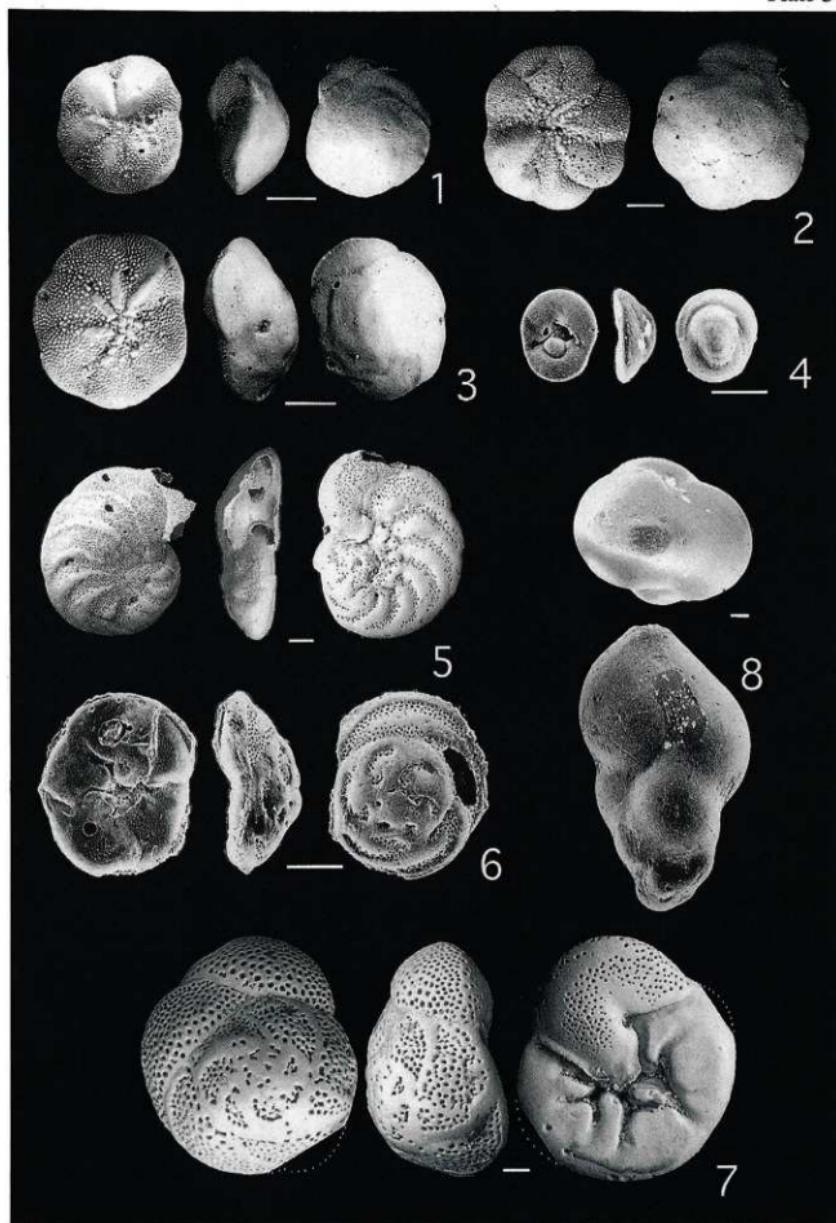


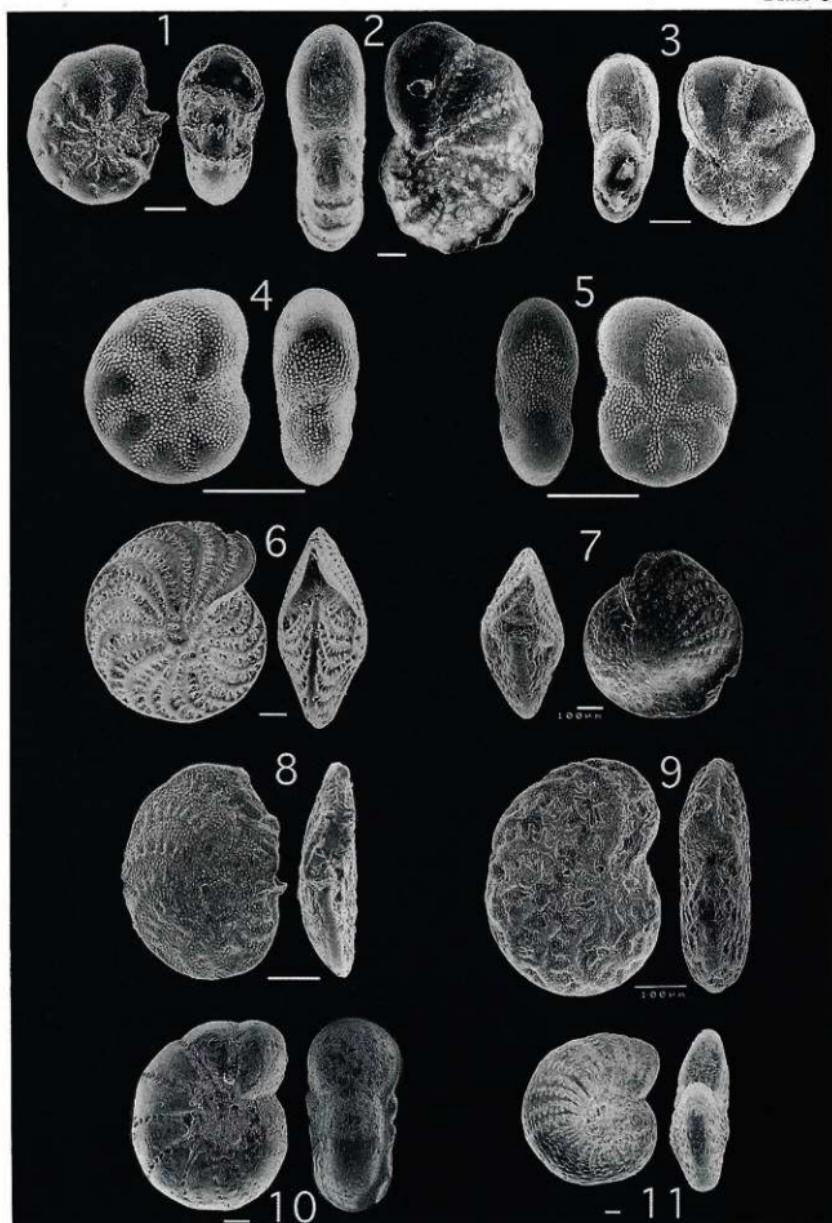
Foraminifera from the Kuromatsunai and Setana Formations

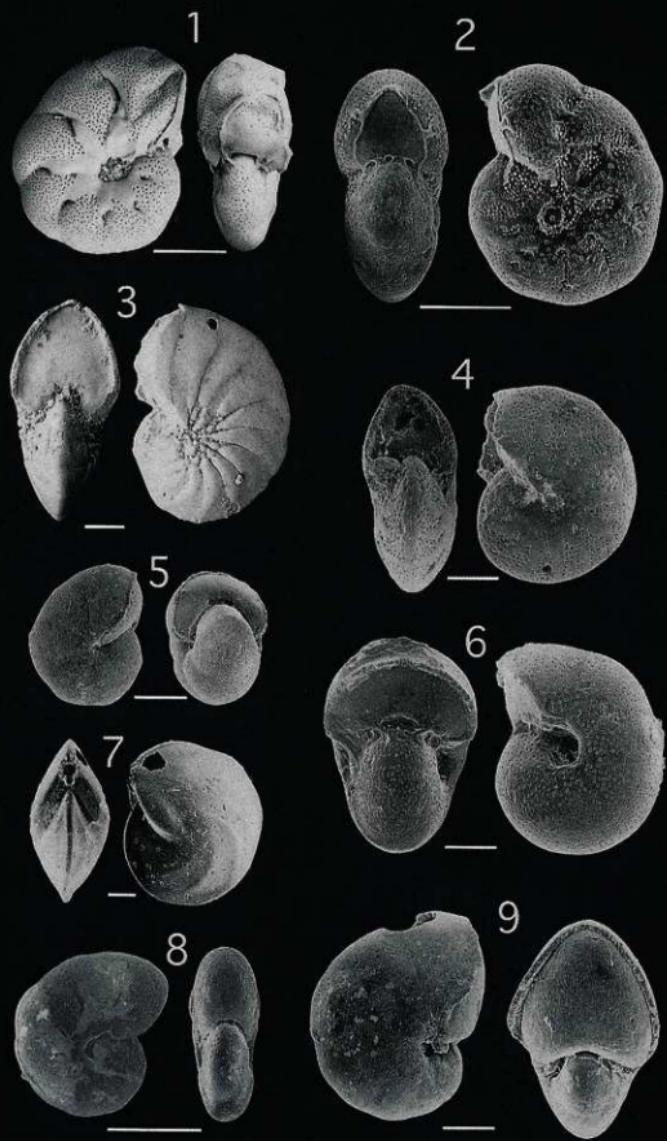
Plate 3

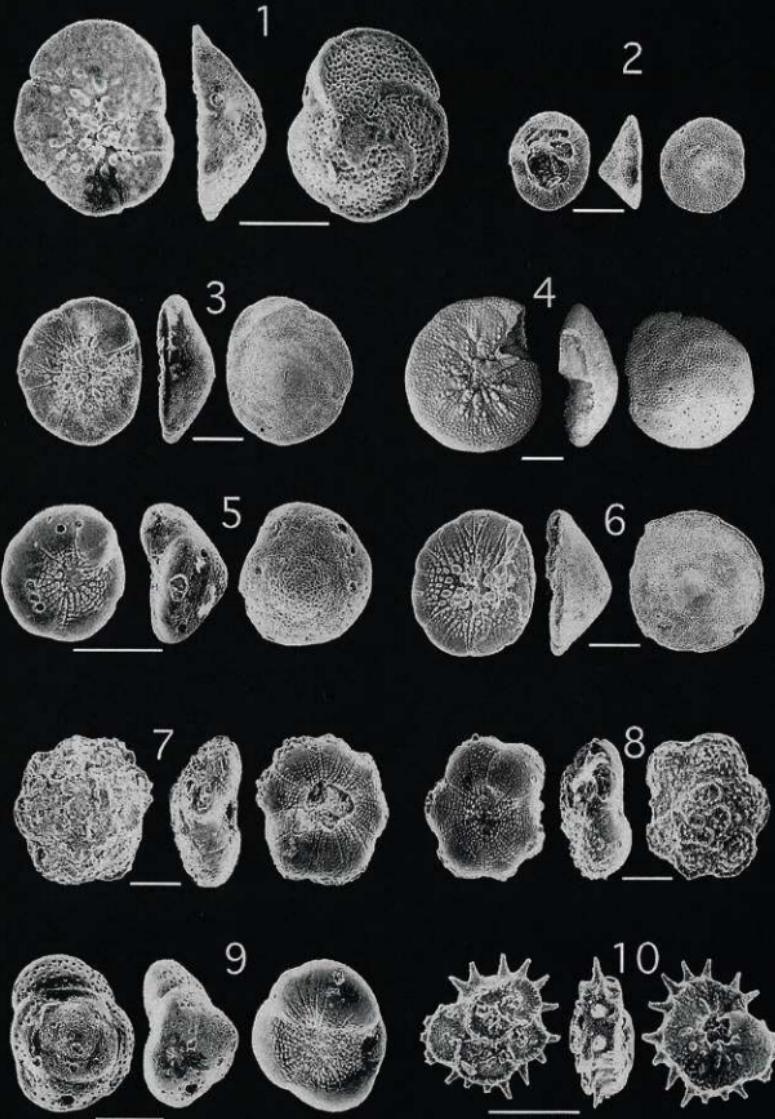


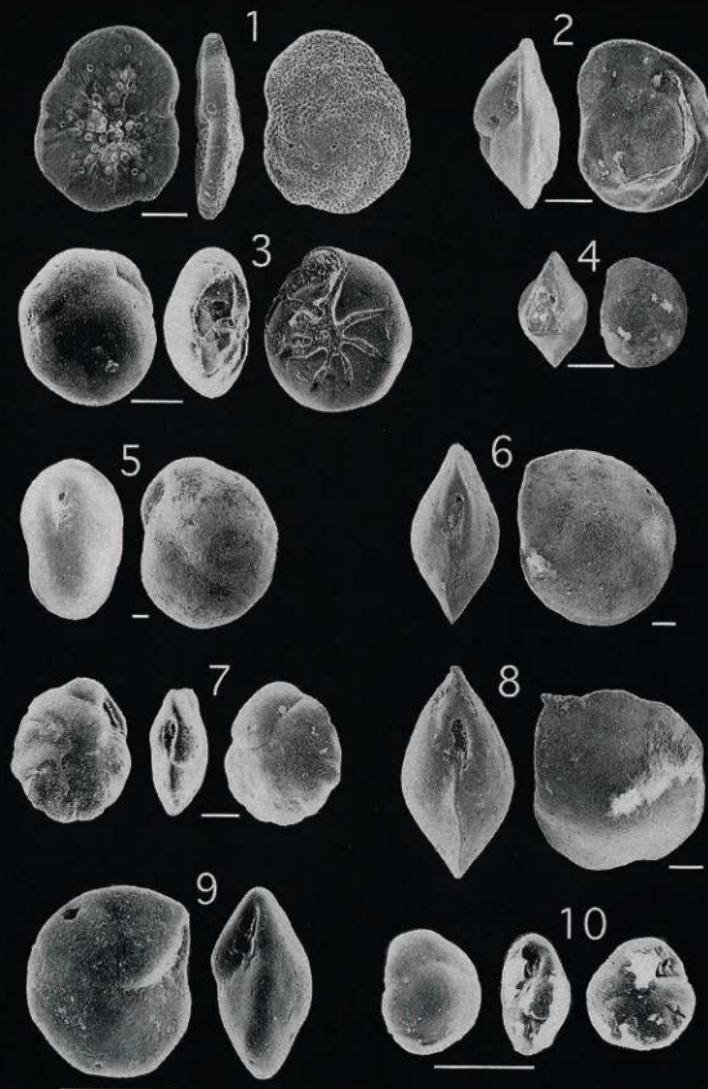




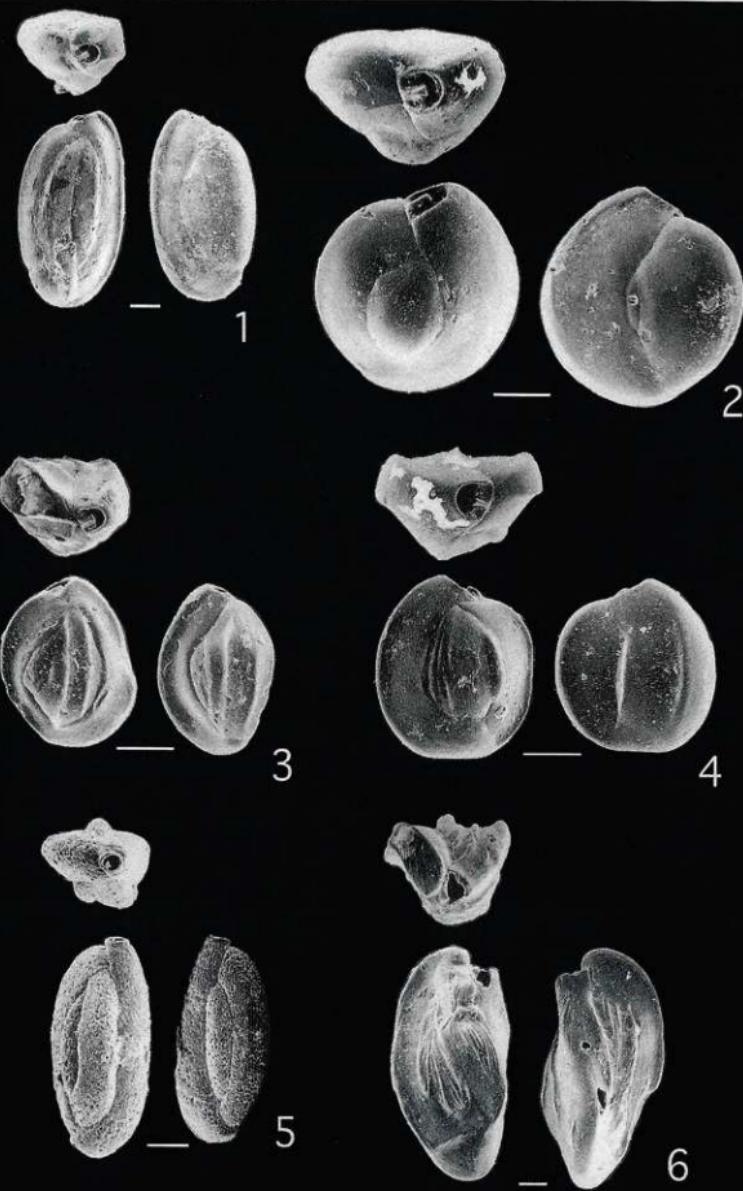


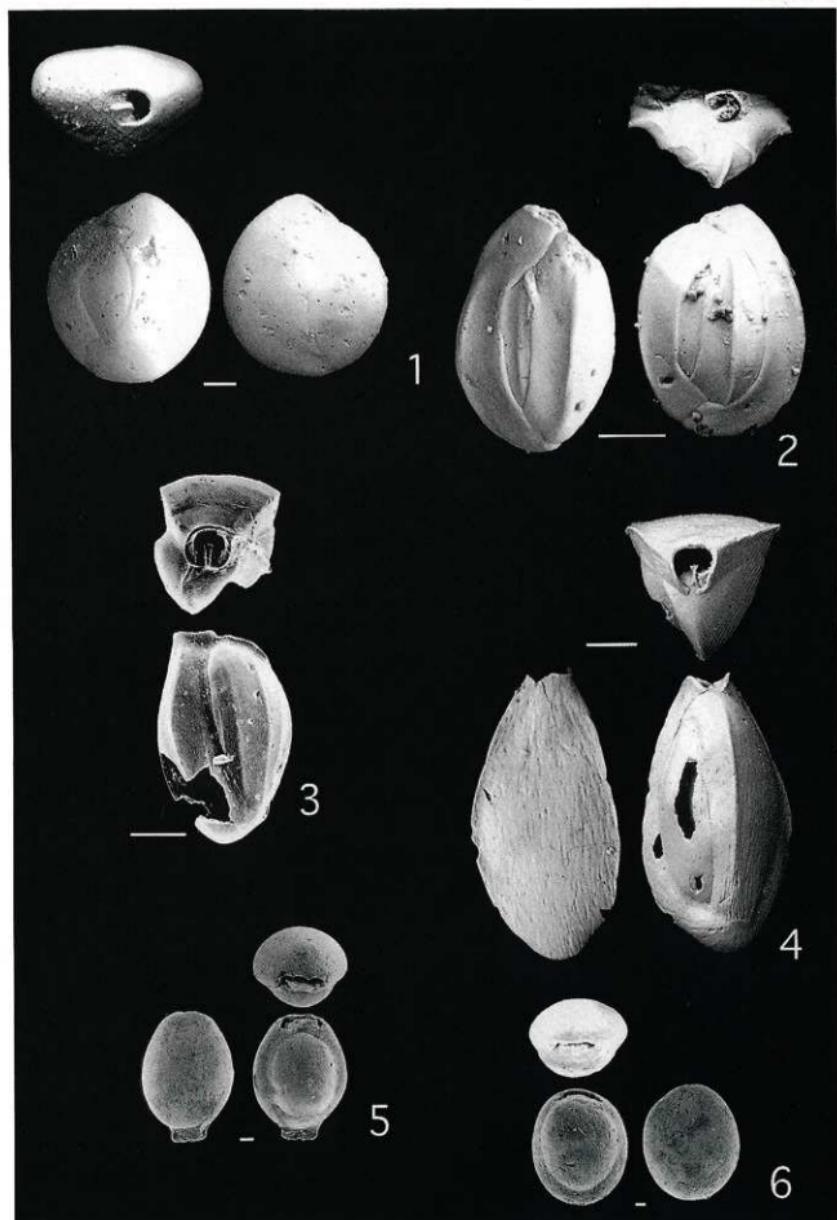












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## Article

Restration of the Pirika Sea-cow

Hitoshi Furusawa 1-9

Foraminifera from the Kuromatsunai and Setana Formations in  
southwestern Hokkaido, Japan-Preliminary report-

Ayumu NOJO 11-48

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