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348. ANNOTATED BIBLIOGRAPHY OF PALEozoIC NONFUSULINID FORAMINIFERA, ADDENDUM 5

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ABSTRACT
This addendum includes 150 annotated references pertaining to Paleozoic nonfusulinid Foraminifera, and can be considered reasonably complete through the year 1966. As in previous bibliographies (Toomey, 1959, 1961, 1963, 1965, 1966, and Toomey and Mamet, 1967a), the aims are: (1) to summarize briefly the pertinent data contained in each article, (2) to list all new genera and species described therein, and (2) to denote, by brackets, all taxonomic changes noted from current and subsequent publications, thus making the bibliography a more useful working tool. An attempt is also made to evaluate the literature to date and possibly to delineate trends.

INTRODUCTION
This annotated bibliography consists of 39 references containing original descriptions of genera and species and taxonomic nomenclature of Paleozoic nonfusulinid Foraminifera. An additional 111 references that utilized smaller foraminifers in stratigraphic subdivision and that mention incidental occurrences are also included for completeness.

The 150 references have been annotated by the compilers. These annotations include geologic age, geographic locality, type of illustrations, original language, new forms described, and comments in brackets on taxonomic changes from the annotated article or noted from subsequent publications. It should be noted that Professor Mamet is actively engaged in research on the Lower Carboniferous smaller foraminifers of the world, hence, many of the notations enclosed within the brackets, especially in reference to Lower Carboniferous articles, are comments made by him and based upon his considerable experience working with these forms.

This bibliography may be considered to be reasonably complete through the year 1966. This includes the Soviet references, which, through the able assistance of Dr. Mamet, have been up-dated.

Including this addendum, the total number of annotated Paleozoic nonfusulinid foraminiferal references has reached 965. The compilers would greatly appreciate the effort and cooperation of all Paleozoic foraminiferal workers in keeping them current on all new works that appear by sending pertinent reprints and separates when available.

LITERATURE EVALUATION AND APPARENT TRENDS
Text fig. 1 is an attempt to show chronologically the distribution of articles relating to Paleozoic nonfusulinid Foraminifera within designated geographic provinces. The inclusion of the present 150 references continues to point out the pronounced increase of foraminiferal literature from Europe, Africa, and the Middle East (Column C), and the continued additions made by the Soviet Union. Both these gains are due primarily to the ever increased usage of the endothyroid-type smaller foraminifers in stratigraphically subdividing the Lower Carboniferous on a worldwide basis.

In text fig. 2 the output of foraminiferal literature has been plotted according to geologic age. The basic overall trend shown in previous bibliographies remains the same, and again is a reflection of the intense work on Lower Carboniferous microfaunas, as noted above.

COMMENTS
At this time it seems pertinent to call attention to the fact that although some workers, principally our Soviet colleagues, still make use of such infrasubspecific entities as "variety" and "form" in systematic descriptions, the International Code of Zoological Nomenclature specifically considers them invalid if erected after 1960 (see Articles 1, 15, 17 (9), 45(e), etc.). The compilers have in the past, and will in the future, continue to report new taxa as they are originally erected by their author(s); however, the judgments and opinions of the I.C.Z.N., as mentioned above, should be borne in mind and strictly adhered to.

ANNOTATED BIBLIOGRAPHY
A. PRECARBONIFEROUS FORAMINIFERA


Primarily a paper describing a faunaule of holothurian sclerites from the upper Middle Devonian (Givetian) limestone of the Paffroth Syncline, a
TEXT FIGURE 1
Geographic Distribution of Paleozoic Foraminiferal Literature
TEXT FIGURE 2
Geological Distribution of Paleozoic Foraminiferal Literature
few miles east of Cologne, West Germany. It is noted that the sclerites are associated with benthonic Foraminifera (rare *Palachemonella torleyi* and very rare *Rhenothyrna refrathiensis*), ostracodes, sponge spicules, and various spheroidal bodies.


   Primarily a discussion of the paleoecology of Soviet stromatoporoid-bearing beds of the Late Devonian. Four types of stromatoporoid facies are considered. It is noted that the “sulfato-carbonate facies” is considered the most favorable to smaller foraminiferal occurrence. Turbulent stromatoporoid environments of growth appear to be characterized by an abundance of relatively thick-walled, bilayered forms such as *Eonodosaria* and *Eogeinitzina*.


   The most complete and best preserved specimens of a newly described genus of red alga, *Katavella*, came from deposits of the Ust-katav layers of the Upper Devonian (Frasnian) rocks on the left bank of the Katav River, near the village of Orlova (south Urals), U.S.S.R. Here, abundant foraminifers (*Nodosaria evlantas* Lipina, *N. solida* Kono lipina, *N. rauzerae* (N. Tchern.), *Geinitzina devonica* Lipina, and *Froendilina sorosis* Bykova) were found in association with the newly described alga *Katavella*.


   Mentions the occurrence of the foraminifers *Textilaria* [sic] *globulosa*?, *Guttulina* sp. and *Rotalia* sp. in the Lower Silurian shales near St. Petersburg [Leningrad], Russia. [The reported forms are probably inorganic concretions.]


   The writer notes the presence in some fossil protists (dinoflagellates, hystrichs, and foraminifers) of small globular structures which he interprets to be fossil symbions and which he believes are similar to and may even correspond to Recent zoochlorellae and/or zooxanthellae. It is shown that some Silurian (Gotland) foraminifers (*Archaeo-ochitosa clausa* and *Amphitremoidea robusta, nom. nud.*) from the Visby Marl contain these symbionts. Excellent photomicrographs are included.


   The present paper supplements former and recent reports by the writer on the Foraminifera of the Ordovician and Silurian from the Baltic region of Europe. Several lines of observational evidence concerning their biology are discussed in detail. Representative forms are illustrated by excellent photomicrographs.

   The writer presents an informative discussion on the remarkable plasticity in size, form, and test makeup of Paleozoic foraminifers—especially the forms *Blastamina polymorpha* and *B. polyedra*. He also notes that it would be a relatively easy matter to study these forms if we could realistically relate their peculiarities to substrate influence. In this way it would be possible to know something of their habitat and the conditions of deposition.

   Eisenack also emphasizes the point that many species can form relatively suddenly, that is, they are able to rapidly alter their test structure. This is a striking feature and appears to be directly concerned with the problem of the origin of new species.

   Many Lower and Middle Paleozoic foraminiferal specimens that the writer has collected during his long career contain various included bodies. These are problematical, but the writer suggests that the presence of included bodies within the foramin test may be related to as yet unknown nutritional phenomena and the hypothetical existence of a naked stage during the early phases of the life cycle—that is, before actual formation of the test.


   Reports the occurrence of the smaller foraminifers *Bathyosphin* sp., *Rhabdammina* sp., *Rainos­anna* sp., and *Lagenammina* sp., from the Lower Paleozoic (Cambro-Ordovician) black shales of Belgium.


   The writers report the discovery of Early Cambrian agglutinated Foraminifera, closely resembling
forms currently assigned to *Psammosphaera* sp. and
*Hyperamminoides* sp., from Ella Island, east Greenland
and Forteau Point, Labrador. [See Howell
and Dunn, 1942, for a formal description and dis-
cussion of this microfauna.]

9. Ireland, H. A., 1967, Microfossils from Silu-
_ium Geologists, Bull., v. 51, no. 3, p. 471, Abstracts of
A.A.P.G.-S.E.P.M.-N.A.G.T. Papers, Los Angeles,

The writer notes that acid residues of some Eng-
lish Silurian carbonates have yielded numerous ag-
glutinated foraminifers. These microfaunas corre-
late with contemporaneous beds in North America,
Norway, Sweden, Austria, Czechoslovakia, and
Australia. Preliminary examination of specimens
from Gotland and Scania indicates that most of the
species present from these islands are similar to
those from England. In addition, a few of the
species from England, Norway, and Gotland are iden-
tical to those from the Arbuckle Mountains of
southern Oklahoma, the Kansas subsurface, and the
central United States, but most of them are new.

Nearly all of the agglutinated Foraminifera be-
long to the family Saccamminidae; most are at-
tached forms, and these have not been previously
described. A few species of *Bathyphlophina*, *Hyper-
ammina*, and *Ammodiscus* are the only other gen-
era present. More than 11,000 agglutinated forami-
ifers from England and 3,000 from Gotland have
been isolated and studied.

10. Ireland, H. A., 1967, Zonation and correla-
tion of the subsurface Hunton Group (Silurian-
Devonian) in Kansas by Foraminifera and acid resi-
dues. IV: Essays in paleontology and stratigraphy,
R. C. Moore Commemorative Volume, Edited by C.
Teichert and E. L. Yochemson, p. 479-502, 4 text-
fig., 2 tables, Dept. Geol., Univ. Kansas Special

Silurian agglutinated Foraminifera, previously
described by Ireland (1966) and others, have been
found to be useful in identifying and correlating
certain subsurface stratigraphic horizons in Kansas
with outcrops in the Arbuckle Mountains of south-
ern Oklahoma and in areas east of Kansas. The Si-
lurian Zone 3, the only zone reported in this study
that contains agglutinated foraminifers, shows ex-
cellent correlation (similar microfaunas) with the
Clarita Member at the top of the Chimneyhill in
the Arbuckle Mountains. A series of cross-sections
show the subsurface distribution of the Silurian for-
aminiferal unit (Zone 3) in the Salina and Forest
City Basins of Kansas. [See Lee (1943, 1956) and
Ireland, 1966, for additional information on this
distinctive agglutinated microfauna.]

11. Juferev, O. V., 1961, Systematics of *Para-
thurammina*: Voprosy Mikropaleontologii, No. 5,
p. 121-127, 1 text-fig., 2 tables, [in Russian].

A revision of the systematics of the Upper Devo-
nian-Lower Carboniferous foraminiferal genus
*Parathurammina* Suleimanov, 1945.

It is noted that earlier workers based their sys-
tematic speciation primarily on wall structure and
thickness. The present writer rejects these views
and proposes a new classification that is solely based
on the gross morphology of the apertural spines.
Three main groups are distinguished: (1) papilli-
form, (2) tubular, and (3) conical. [It should be
noted that the shape of the apertural spines on Par-
thurammina partially depends on the orientation of
the thin section, since all workers utilize random
sections. In addition, no mention is made of the
fact that *Parathurammina* was originally described
as a calcisphere by Williamson (1880) as *Calcis-
phaera spinosa.*

12. Krestovnikov, V. N., and Terentieva, K. F.,
1933, On the lithology of the Devonian deposits
of the Moscow Basin: Bull. Soc. Nat. Moscou,
v. 41, n. s., sec. geo1. 11, no. 1, 3 pl., 1 text-fig.,
[in Russian].

The writers report the occurrence of the smaller foraminifer *Nodosaria [= Eonodosaria] in the Up-
per Devonian rocks of the Bobrik region near
Moscow, U.S.S.R. The photomicrographs are of
randomly cut thin sections (Pl. 2, fig. 9-10).

13. Lecompte, M., 1936, Contribution à la con-
naissance des “recifs” du Frasnien de l’Ardenne:
Inst. Géol. Univ. Louvain, Mém., v. 10, p. 30-112,
pl. 6-11, 7 text-fig., [in French].

According to the writer the Upper Devonian
(Frasnian) Chateau-Gaillard reef at Treloin, north-
ern France, has yielded the following foraminifers:
*Apertinella (sic), Bigenerina, Climacammina, En-
dothyra, Nodosinella, Gnomospira,* and representa-
tive Nonionidae. [Examination of the writer’s pho-
tomicrographs of supposed Devonian Foram-
inifera (pl. 7) indicates that they bear very little re-
semblance to foraminifers; some are definitely nepi-
onic gastropods.]

14. Lipina, O. A., 1961, Facies dependent Foram-
inifera from the Frasnian and lower Tournaisian of
the western slope of the Urals: Voprosy Mikro-
palaeontologii, No. 5, p. 147-161, [in Russian].

Based on a study of the Upper Devonian-Lower
Carboniferous smaller Foraminifera from the west-
ern slope of the Ural Mountains, Soviet Union, the
writer asserts that their distribution patterns are de-
pendent upon three factors: (1) evolution, (2) mi-
gation, and (3) the influence of physio-chemical
conditions. This article deals only with the last
factor, and most of the paleoecologic examples are taken from strata of the Famennian-Tournaisian boundary beds.

Depth of water is thought to be of little influence on the distribution of Paleozoic Foraminifera, since most occurrences appear to be restricted to shallow-water platform facies; there were probably no bathyal forms in the Paleozoic. It is believed that slight modifications in salinity induced obvious changes in foraminiferal assemblages (reduction of size and thickness of the test wall). As a result the Foraminifera are divided into what may be considered "normal marine" multilocular forms (Endothyridae and Tournayellidae) and euryhaline monolocular forms (Parathurammina, Bisphaera, Archeasphaera, and Tuberitina). Moderately agitated and well aerated seas appear to be favorable to both groups. Girvanella-bearing and ostracode-rich sediments of reduced salinity appear to be favorable to the monolocular forms. Crinoidal, crinoidal-algal, and algal limestones do not appear to be favorable to either group. Siliceous radioliters, spiculites, and siliceous mudstones are usually devoid of Foraminifera.


A large and diverse agglutinated foraminiferal microfauna consisting of 16 genera and 33 species is described from the Waldron Shale of Silurian (Niagaran) age in southeastern Indiana and northern Kentucky. The microfauna is described and illustrated by line drawings and thin-section and whole-specimen photomicrographs. One new genus, Sorostomasphaera, and 7 new species are recognized; these are, Stegnammilla casteri, Hemisphaerammina casteri, Metamorphina imbricata, Sorostomasphaera waldroneis, Webbinelooldea hatti, W. globulosa, and W. ventriquetra. Several species are recorded from rocks of Silurian age for the first time.

The Waldron Shale microfauna can be differentiated from certain other Silurian formations on the basis of the foraminiferal assemblages and relative abundance of certain groups. The Waldron microfauna is dominated by members of the Saccamminidae, whereas Lower Silurian foraminiferal assemblages appear to be characterized by the abundance of members of the Ammodiscidae.


Of special interest is a discussion of the validity of the genus Bijurcammina (p. 497-499), in which it is concluded that the bifurcation of the test in the last coil, the primary basis for the establishment of this genus, is accidental; such forms should probably be regarded as sports referable to the genus Ammodiscus.


Pebbles present in the Kolturban Limestones from the southern Urals, U.S.S.R., contain various previously described foraminiferal elements, among which are recognized such genera as: Caligella, Parathurammina, Umbella [= Umbellina], Eoeginitzina, Eonodosaria, Tikhinella, Uralinella, Nanicella, Paratikhinella, Ammodiscus, and Moravammina. According to the microfauna the pebbles vary in age from Middle to Upper Devonian (Givetian-Famennian).


A volcano-sedimentary series of rocks from the middle and southern Urals, ranging in age from Upper Devonian to Middle Carboniferous, has been examined and is compared to the standard section on the Russian Platform. The age of the Kolturban and Zilair Formations, of the Famennian Series near Vernieurasl, and of the coal-bearing strata in the Great Balandon district is discussed in detail. All of the foraminiferal taxa mentioned have been previously described.
The writer describes and discusses a number of Silurian and Lower and Middle Devonian foraminiferal assemblages occurring in the volcano-sedimentary rocks of the Zelenokam Formation of the Ural Mountains, U.S.S.R. All taxa have been previously described. Megafauna, especially brachiopod assemblages, are also evaluated.


This article deals with the stratigraphic distribution of 23 genera and 56 species of smaller Foraminifera from the Upper Devonian (Famennian) and Lower Carboniferous (Tournaisian) carbonates of the Tian-Shan Mountains, U.S.S.R. Five foraminiferal assemblages are recognized; these range in age from uppermost Devonian to lower Viséan. Comparison with the European microfaunal zonation is also outlined. [The writer reports the following foraminifers as new: Quasitubertinita magna n. gen., Q. magna var. minor, Bispheera elongata, Cribrosphaera ovalis, Eotubertinita reitlingeri M. Maclay var. tenuissima, E. crassa var. minima, E. salassica, Tubertinita magna, T. malakhovae nom. n., Thurammina bykovae nom. n., Hyperammina parariminia var. crassa, H. pseudovulgaris, Exseroannodiscus neovrebitius n. gen., Glomospirella wauramica, Septatournayella magna, S. lebedvae, Endothyra donguztauenensis, E. asiatica, Septagiomospiranella grozilovae, and Plectogyra paraturcestunicia. However, none of the above are formally described or illustrated, hence all must be regarded as nomina nuda. Some of these species were formally described in a later paper; see Purkin, Poyarkov, and Rozanec, 1961.]


Comparative analysis of the morphology of the shells of the Devonian fossil microorganism Umbella, foraminiferal texts of representative Lagenidae, and the utricles and gyrogonites of Chara confirms the suggestion that Umbella is a plant microfossil. The writer accepts this view and places Umbella in the family Umbellaceae Fursenko, 1959. Under the organ genus Umbella Maslov, 1950, the following forms are included: Umbella bella Maslov, U. bashkirica Bykova, U. patella Bykova, U. pagatochevnes Bykova, U. bykoyae Reitlinger, and U. bykoyae var. grandis Reitlinger. Under the new organ genus Elenia the following forms have been included: Elenia [Umbella] famen (Bykova), E. [U.] ornata (Bykova), and E. [U.] ollaria (Bykova); and the following forms are now included under the new organ genus Quasiumbella: Quasiumbella [Umbella] rotunda (Bykova), Q. [U.] saccaminitformis (Bykova), and Q. [U.] nana (Reitlinger). All of the above forms are reported from the Middle and Upper Devonian of European U.S.S.R. and central Asia. Representative sketches of Umbella and Quasiumbella are included. [See Toomey, 1965, and Teichert, 1965, for pertinent discussions relevant to the genus Umbellina.]


From the Devonian rocks of Tian-Shan, asiatic U.S.S.R., 5 new species and 1 new variety of the problematical form Umbella are described and illustrated by thin-section photomicrographs. The new forms are: Umbella bashkirica Bykova var. magna, U. sumoriensis, U. hemisphaerica, U. mica, U. minima, and U. borcoldoica. A brief review of all previously described species of Umbella is given, and it is again reaffirmed that Umbella should be considered as a charophyte. Taxonomic changes include the following: U. rotunda Bykova, 1955, and U. radiata Konolipina, 1959 = Quasiumbella rotunda (Bykova); U. nana Reitlinger, 1954 = Quasiumbella nana (Reitlinger); and U. globula Reitlinger, 1966 = Quasiumbella globula (Reitlinger). [See Reitlinger, 1966, and Toomey, 1965, for pertinent comments on this problematical form.]


From the Middle Devonian (lower Givetian) limestones of the central and southern Urals, U.S.S.R., a microfauna comprising 1 new genus and 10 new species is described and illustrated by thin-section photomicrographs. The new forms are: Paratubammina graciosa, P. apertura, P. cordata, P. arguta, P. irregulair, P. marginata, Cribrosphaera crassa, C. novita, Tubiporina gloriosa n. gen., and Archaelagena borealiva.

A discussion of all the described forms of Umbella from the Devonian of the Soviet Union and Poland. It is noted that most workers regard Umbella as a foraminifer, although Poyarkov assigns Umbella to the Charophyta (a practice followed in this paper). The writer states: that "actually, the uniqueness of Umbella morphological structure, the presence of basal and apical apertures, despite the similarity of the wall microstructure to the lagenid Foraminifera, gives us reason to believe that they are of algal nature." Loeblich and Tappan (1961) called attention to the fact that the name Umbella is preoccupied for the mollusc Umbella d'Orbigny, 1841, and suggested the name Umbellina. However, according to Reitlinger the genus Umbella is regarded as a charophyte and, hence, it is still possible to retain the old generic name Umbella.

The writer describes and presents thin-section photomicrographs of 3 new species of Umbella from the Upper Devonian of Armenia, U.S.S.R. The new forms are: Umbella globula, U.? lageniformis, and U.? elliptica. At present 18 species and 2 varieties of Umbella have been described. By the nature of their gross morphology and shell microstructure the writer subdivided all of the described forms into 5 major groups. An evolutionary sequence demonstrating morphological change from Middle Devonian (Givetian) to Upper Devonian (Famennian) is briefly discussed. [See Toomey, 1965, for a foraminiferid opinion; the new species described by Reitlinger, i.e., U.? lageniformis and U.? elliptica, definitely appear to be more closely related to lagenid or archaelagenid-type foraminifers.]


Primarily a brachiopod paper; however, does contain numerous references to Upper Devonian Foraminifera. The writer notes that the lower upper Famennian is characterized by the first appearance of Endothyra communis in association with Vencesphaera squilida, and Parathurammina cushion. The uppermost Famennian is characterized by the Septatournayella rauserae assemblage. It is further noted that the base of the Likhvinsk is drawn at the acme of the Endothyra communis-Quasiendothyra kobelitsiana assemblage, whereas the lower Tournaisian (Lower Carboniferous) is subdivided into three zones based on the genera Quasiendothyra, Septatournayella, and Bisphaera.


Monochloroacetic acid residues of lower Middle Devonian carbonates from the Eifel Stufe, near Meggen, in the Rhenish Schiefegebirge, West Germany, have yielded numerous pyritized steinkerns of the foraminifer Semitextularia thomasi Miller and Carmer. Four distinctive morphological forms are recognized within the assemblage and described, although all are placed under the genotype. Previous reported occurrences of Semitextularia from Russia, eastern Europe, and North America are also discussed and comparisons offered. The foraminifers are illustrated by whole-specimen photomicrographs.


The purpose of this study was to determine the method by which agglutinated Foraminifera could be extracted with the greatest efficiency and least damage by acid solution of the limestone. The limestone chosen was the Silurian Chimney Hill Limestone Formation [Clarita Member] found in the Arbuckle Mountains of southern Oklahoma.

Results indicate that if time is an important factor, a high acid concentration, either hydrochloric or acetic, with a crushed sample is the most effective method. For more detailed work and a maximum recovery of the largest number of undamaged specimens, a solid sample is best, the acid concentration depending on the shape, size, and fragility of the microfossils sought.

Seven morphotype categories were found in the Chimney Hill Limestone, these are: (1) planispiral (Ammodiscus), (2) tube (Bathydiscus), (3) and (4) small or large spheres (Lagenammina, Psammosphaera, Thrurammina), (5) hemisphere (Colonnammina), (6) clustered spheres (Sorosphaera), and (7) other Turritellella [coiled tube].

B. LATE PALEOZOIC FORAMINIFERA


A brief listing of the foraminiferid microfauna present in the Lower Carboniferous Oka Series of the Ukraine, U.S.S.R. Archaediscus ex. gr. bashkiricus is described from the uppermost Viséan beds.
in association with Tetrataxis conica var. gibba \( [= \text{Howchinia bradyana Howchin} \), Endothyra similis and Cribrostomum bradyi. [First appearance of Archaeacous bashkiricus is uppermost P2 in England, and uppermost Viséan V3c sup. in North Africa.]


A brief description of the D zone microfauna of the Lower Carboniferous of the Lwow Trough, Ukraine, U.S.S.R. The occurrence of Forschia subangulata, Haplophysmagrella irregularis, H. tetraloculi, and Litoutubella glomospiroides var. magna suggests a DI zone assemblage. It is noted that the upper part of the Oka Series belongs to the D2-PI-P2 assemblage, and contains Endothyra omphalota var. minima, E. crassa, E. globulus \( [= \text{Globendothyra} \), Monotaxis gibba, Bradyina rotula, Archaeidiscus karreri, A. moelleri and species of Parastaffella \( [= \text{Pseudoendothyra} \).


A foraminiferal hiatus is shown to exist in the Lower Carboniferous rocks of the Lwow Trough, Ukraine, U.S.S.R., of the zones CIV\( a \) and CIV\( e \). The lower foraminiferal assemblage, which is comparable to zone IV of the Donetz Basin, is characterized by species of Calciphia, Parathurammilla, Brunsia, Endothyra globulus var. parva, E. ishimiaca, and Archaeidiscus krestovnikovii, on which rests a VII foraminiferal assemblage rich in Endothyra similis, E. omphalota var. minima, E. ishimiaca, Palaeotextularia brevisepata, P. dobroljubovae, and species of Cribrostomum, Tetrataxis, and Eostaffella.


A discussion of the biostratigraphic correlations of the Lower Carboniferous (upper Tournaisian to middle Viséan) rocks of the Donetz Basin, Moscow Basin, and the Urals.

In the Donetz Basin the CIV\( a \) is characterized by Quasienothyra solida \( [= \text{Urbanella} \), Q. magna, Endothyra spinosa \( [= \text{Spinoendothyra} \), E. chomatica \( [= \text{Dainella} \), E. prisca, E. similis, E. crassa var. compressa \( [= \text{Endothyranops} \), and E. similis. The CIV\( b \) contains Litoutubella tenuissima, L. glarea, Endothyra staffeliformis, E. chomatica, E. prisca, E. crassa var. compressa, E. omphalota var. minima, Tetrataxis eominima, and species of Eostaffella. The CIV\( c \) yields Forschia subangulata, Litoutubella glomospiroides, Endothyra staffeliformis, E. chomatica, E. crassa var. compressa, E. ishimiaca, E. omphalota var. minima, E. similis, Permodiscus zuryanicus, P. rotundus, and Eostaffella mediocris \( [= \text{Mediocris} \).

The CIV\( e \) is correlated with the Tula Horizon and carries numerous species of Archaeidiscidae. [The lower Viséan microfauna of the Donetz Basin is of particular importance, since this substage is usually absent in the Moscow Basin or poorly represented in the Urals. The existence of Spinoendothyra in Viséan time, associated with Dainella, has also been noted in western Europe. Conversely, true Endothyranops does not occur stratigraphically as low as Brazhnikova asserts, which suggests that this form is probably misidentified.]


A biostratigraphic discussion of the Lower Carboniferous rocks of the Ukrainian Donbass Basin, U.S.S.R. The lower part of the Buzinovaya interval is characterized by Bispheara spp., Glomospirella spp., Tournayella discoida, Endothyra communis, E. karacubensis, and Parathurammmina spp., and is correlated with the CIV\( a \) - CIV\( b \). The upper Buzinovaya (CIV\( c \) - CIV\( d \)) carries Brusia spp., Tournayella segmentata \( [= \text{Septatournayella} \), Carbonella spp., Endothyra glomiformis \( [= \text{Chernyshinella} \), E. ex. gr. costifera \( [= \text{Spinoendothyra} \), and Spirolectammina sp. \( [= \text{Palaeospirolectammina} \).

The Elenovskaya interval (lower and middle Viséan) contains Endothyra chomatica \( [= \text{Dainella} \), Endothyra convexa, E. similis, E. crassa var. compressa \( [= \text{Endothyranops} \), Eoparastaffella sp., Ammodiscus sp. \( [= \text{Cyclozyga} \), Forschia sp., Valvulinella sp., Permodiscus sp., and Tetrataxis sp.

The Efremova interval (which straddles the Viséan-Namurian boundary) is characterized by Sacconamminopsis sp., Nanicella sp. \( [= \text{Loeblichia} \), Endothyra omphalota, Bradyina rotula, Cribrostomum sp., Monotaxis gibba \( [= \text{Howchinia} \), Archaeidiscus moelleri var. gigas \( [= \text{A. karerrli} \), and species of Eostaffella.


A thick Lower Carboniferous (Tournaisian) carbonate section is described from Saitovo, northern Tataria, U.S.S.R. Abundant foraminiferal assem-

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blages enable zonation and recognition of the Trans-Volga beds (Quasiendothyra communis, Q. kobetusana, Q. mirabilis), the Chernyshin beds (Spiroplectammina nana, S. tchernyshinensis [= Palaeospiroplectammina], Chernyshinella tumulosa, C. glomiformis), lower Kizel beds (Plectogyra inflata [= Endothyra], P. latispiralis, P. parakosveilis), and upper Kizel beds (Tourayella discoidea, Plectogyra tuberculata, and P. parakosveskis).


A rich microfauna of endothyroid smaller foraminifers is reported from the Mississippian (Meramecian) Arroyo Peñasco Formation in the Sangre de Cristo Mountains of north central New Mexico. [This microfauna was later formally described; see Armstrong, 1958.]


Lower Carboniferous (uppermost Osagean and lower Meramecian) rocks crop out in the San Pedro, Nacimiento, Jemez, Sandia, Manzano, and Sangre de Cristo Mountains of northcentral New Mexico. They range in thickness from 10 to 130 feet. The lower unit, carrying an uppermost Osagean microfauna, consists of a basal quartz sandstone and shale overlain by pelletaloidal, ostracodal, calcispherite-bearing lime mudstones capped by stromatolitic limestones. The microfauna from this unit consists of Endothyra spinosa Chernysheva, E. inflata Zeller, and Septabrusini.ina n. sp.

The overlying unit of marine limestones varies from oolitic packstones, to lime mudstones, to dolomite, all with differing amounts of fine quartz sand. The oolitic facies contains a rich microfauna of early Meramecian age and carries: Endothyra spireides Zeller, E. macra Zeller, E. prodigiosa Armstrong, and E. inflata Zeller.


Brief interim report on the stratigraphy, carbonate petrography, and micropaleontology of the Mississippian (Osagean-Meramecian) Arroyo Peñasco Formation of northcentral New Mexico.

The oldest foraminiferal microfauna recognized in the Arroyo Peñasco Formation is composed of Endothyra spinosa Chernysheva, Endothyra inflata Zeller, and Septabrusini.ina n. sp. It is believed that this microfauna indicates a late Osagean age. Overlying this microfauna is an assemblage characterized by Endothyra spireides Zeller with a more advanced form of E. aff. E. spinosa Chernysheva. Generally, above this zone, there is a rich foraminiferal assemblage of early Meramecian age composed of Endothyra macra Zeller, E. prodigiosa Armstrong, E. irregularis Zeller, and Septatournella n. sp.


The writer notes (p. 2101) that on the basis of smaller foraminifera (identified by B. A. L. Skip) that the upper part of the Ouray Formation, in Utah and Colorado, and the lower member of the Leadville Formation indicate an early to middle Osagian (Lower Carboniferous) age for that interval.

Endothyroids of the lower member of the Leadville are poorly preserved because of dolomitization. The foraminifers found in this interval in the eastern Paradox Basin closely resemble Chernysheva, and probably are related closely to C. tumida (E. J. Zeller) and C. granulosa (E. J. Zeller).

The upper member of the Leadville Formation contains a well preserved and abundant endothyroid microfauna, especially in the oolitic strata near the base. The assemblage is typified by Endothyra tuberculata Lipina. Endothyra aff. E. tumula (E. J. Zeller), Septaglomospirandella anteflexa (E. J. Zeller), and S. dainae Lipina commonly are present in the lower beds. Endothyra spinosa Chernysheva is more prevalent in pelletaloidal sandstone beds in post-crinoid bank strata where the other species are of diminished importance.


The writers present a thorough discussion of the sparse occurrence of endothyroid foraminifers found to date in the so-called pre-Pennsylvanian sediments of northcentral and northeastern New Mexico. In this paper, a new Lower Mississippian unit, the Tererro Formation, is named and formally described from the Sangre de Cristo Mountains region of New Mexico. Within the Manuelitas Member of this formation the present writers report finding only a few specimens and fragments of Endothyra, and they call attention to the inaccuracies and discrepancies of the reported distribution of these foraminifers by Armstrong (1955, 1958), [see
Armstrong and Holcomb, 1967, for additional foraminiferal data).


A preliminary investigation of the marine and brackish foraminiferal horizons in the cyclic upper Namurian and Westphalian sediments of the Ruhr region of Germany. It is noted that only agglutinated foraminifers appear in most of the marine horizons [these are delineated on Text-fig. 1], as well as in some Lingula horizons, which are partly marine and may also be brackish. The finding of foraminifers in sediments which until now have been regarded as representing fresh water environments indicates a stronger marine or brackish water environment in the productive Upper Carboniferous section than had been previously suspected.

39. Barwick, W., 1966, Microfauna in the Lower Zechstein of the Pre-Sudetic Monocline: Rudy i Metale Niezelazne (Sci. and Tech. Jour. of the Non-Ferrous Metals Industry), v. 11, no. 8, p. 422-425, 6 text-fig., 1 table, [in Polish with abstracts in Russian, English, French, and German].

Description is given of the characteristics of the basal Zechstein (Permian-Wolfcampian) sediments of the Pre-Sudetic Monocline in Poland. A rich complex of smaller foraminifers consisting of 16 previously described species has been identified from this interval. In an area between Lubin and Sieroszowice a zone has been encountered in the Zechstein limestones which contains the above mentioned foraminiferal assemblage and another in which this assemblage is conspicuously absent.

A few representative smaller foraminifers are illustrated by thin-section photomicrographs.


The non-marine, coal-bearing Stalinogorsk Horizon of Lower Carboniferous (Viséan) age lies with pronounced disconformity on the Likhivsk Limestone, in southern Udmuritia, U.S.S.R. The Lower Carboniferous (Tournaisian) age of the Likhivsk Limestone is ascertained by the presence of Endothyra parakosvensis, E. tuberculata, E. latisspiralis, Chernysheiina ex. gr. glomiformis, and Spongoplectammina tchernyshinensis [= Palaeosprioplectamina].


From the Pennsylvanian Minturn Formation of a portion of Eagle County, Colorado, the writer reports the following smaller foraminifers:

A. Robinson Limestone Member - smaller foraminifers (mainly agglutinated) associated with a varied biota including Ivanovia?, Archaeolithophyllum?, Komia, and Des Moines fusulinids.

B. White Quail Limestone Member - agglutinated foraminifers dominate the assemblage, but phylloid algae, Komia?, and other marine biotic elements also occur. Plate 2, fig. F shows a thin-section photomicrograph of this member which contains hydratid-type tubular foraminifers and a large Bradyina.

C. Jacque Mountain Limestone Member - contains tubular foraminifers (Calcitornella sp.) [probably Hedraites; see Henbest, 1963], associated with phylloid algae and other biotic elements.


The Bashkirian-Moscovian-Kasimovian-Sakmarian Stages of the Middle and Upper Carboniferous of the oriental portion of the Alai Range, U.S.S.R., are subdivided into nine faunal zones based mainly on fusulinids. Stratigraphic use of smaller foraminifers is restricted to the lower portion of the Middle Carboniferous sequence. From this lower interval 18 species of smaller Foraminifera are described, of which 3 species and 1 variety are new. The new forms are: Bradyina planissima, B. tarassovi, Climacambina bosbiensis, and Tubertilina collosa Reitlinger var. tschekabadica. All forms are illustrated by thin-section photomicrographs.


The present writers subdivided the strata (uppermost Devonian to Middle Carboniferous age) in the Kara-Tau Range, U.S.S.R. (Kazakh, S.S.R.), into 11 foraminiferal assemblages based on previously described species of smaller foraminifers.

44. Bogush, O. I., Gerasmov, E. K., Cherniak, G. E., and Juferev, O. V., 1963, Kleistak Con-

The age of two Lower Carboniferous formations present in the Soviet Arctic is established on the basis of their contained microfauna. Emphasis is placed on the similarity of these northernmost Siberian microfaunas with that of identical microfacies present in rocks of similar age on the Russian Platform and in the Urals.


The Visian Krestiakh Conglomerates contain: Earlalldia elegans, Archaesphaera crassa, Plectygra prisca, P. similis, P. lenticiniosa, P. explicita, P. bradyi, Tetra taxis media, and Fusuliniidae. [The presence of Quasiendothyra communis communis as high as the upper Tournaisian is in contradiction with the observed Eurasiatic distribution of this characteristic upper Famennian-lower Tournaisian index fossil; Quasiendothyra rotali and Q. compata are now classified as species of Planendothyra, and Q. urbana is now classified as a species of Urbanella.]


Primarily a fusulind paper; however, mention is made of the occurrence of certain smaller foraminiferal genera (Tuberitina, Ammodiscus, Glomospira, Endothyra, Tetra taxis, Bradyina, and Textulariidae [= Paleotextulariidae]) from the Middle and Upper Carboniferous of the Central Donbas Basin (Ukraine) of the Soviet Union.


The genus Eosigmatolina Ganelina, 1956, is discussed in detail, and forms that are referred to this genus from the Lower Carboniferous rocks of the Donets Basin of the Soviet Union are described and illustrated by rather poor whole-specimen sketches (?) and representative sketches(?) of thin-section photomicrographs. Two species are regarded as new: Eosigmatolina rugosa, and E. (?) minuta.


A biostratigraphic survey of the characteristic Lower Carboniferous foraminiferan assemblages found in the Ukraine, U.S.S.R. All foraminiferal references are made to previously described forms.

C1qa is characterized by species of Archeaesphaera, Vicinexphaera, Parathurammina, Bispheara, Glomospiranella, Brunsina, Tournayella discoidea, Quasiendothyra communis, Q. kobeitsuana, and Umbella.

C1qb is characterized by the appearance of Endothyra ex. gr. glomiformis [now Chernysihinella].

C1q contains abundant Brunsia, Spiroplectammina [now Palaedespiroplectammina], Endothyra inflata, E. ukrainica [now Septatournayella], E. spinosa [now Spinoendothyra], and Tournayella segmentata [now Septatournayella].

C1q contains Endothyra glomiformis, Bispheara, Glomospiranella, Palaedespiroplectammina, Tournayella, and Carbonella.

C1va shows a mixture of characteristic Tournaisian forms along with such Visian forms as Eostaffella, Eoporastaffella, and Endothyra chomatica [now Dainella].

C1vb - C1vd contains Haplophragmella, Tetra taxis, Endothyra onmphalota minima, E. ishimica, E. paula, and E. bradyi.

C1vd contains Anmodiscus [ = Cyclogyra], Forschia, Permodiscus, and Valvulinella.

C1ve contains Palaedesuexia and abundant Archaea discidae.

C1vc contains Saccamminopsis, Palaedesuexia, Cribrostomum, Climacaminna, Nanicella [now Loeblichia], Samarina [now Janishevkinia], Bradyina, Monotaxis [now Howchinia], Parastaffella [now Pseudoendothyra], Millereilla [now Millereilla Thompson], Endothyra globulus, and E. crassa [now Endothyranopsis].

C1va contains a microfauna very similar to the preceding assemblage.

C1na contains Endothyra ex. gr. crassa [now Endothyranopsis], Janishevkinia, Bradyina, Climacaminna, Howchinia, Archaea discus ex. gr. moelleri, Monotaxinoides, Globivalvulina, Eosigmatolina.
Ammovertella, Glomospira, Ammobaculites, Loculichia, Endothyra, Howchinia, Archaeidiscus braznikovae, and A. angulatus.


An illustrated catalog of 41 species, subspecies, varieties, and forms of smaller foraminifers present in the Lower Carboniferous (lowest part of the Tournaisian-zone C1(red)) of the Donetz Basin region of the Soviet Union. Most of the microfauna has been previously described, although two new subspecies are included. These are: Cribrospheeroides simplex Reitlinger subsp. donica, and Paratunikella cannula (Bykova) subsp. kajalica. All of the Foraminifera are described and illustrated by excellent thin-section photomicrographs. [Plates 19-21 contain thin-section photomicrographs of Umbella, a questionable foraminifer, although there is no discussion of these forms anywhere in the text.]


First description (p. 17) and illustration (pl. 4, fig. 2) of the Lower Carboniferous foraminifer Endothyra bowmanni Phillips, from Great Britain. [Considerable controversy has arisen due to various interpretations of Brown, 1843, and the figures given by Phillips, 1846. Recently, the I.C.Z.N. has ruled that Endothyra bowmanni Phillips in Brown emend. Brady, 1876, is the valid type species of Endothyra; see China, 1965, for this important decision.]


The Lower Carboniferous (Viséan) and Middle Carboniferous (Moscovian) microfaunas from six basins in North Africa have been studied in detail; special emphasis has been placed on the smaller foraminifers, and their distribution within the six basins is fully discussed. It is noted that there are a great many microfaunal similarities with strata of the same age in Spain and on the Russian Platform. The microfauna, including fusulinids, is listed on table 1, and thin-section photomicrographs of representative foraminifers are also included.

52. Chermnykh, V. A., 1960, Detailed stratigraphy of the Viséan deposits in the Bolshaya Shait-

The Lower Carboniferous (Viséan) in the Petchora region of the northern Urals, U.S.S.R., attains a thickness of somewhat over 2,000 feet and has been subdivided into eight foraminiferal zones. A microfauna of one hundred previously described species of smaller foraminifers is reported. The foraminiferal assemblages are very similar to those found on the Russian Platform, although species of the genera Permodiscus, Mikhailovella, Samarina, and Bradyina are conspicuously scarce in the Urals.


Principally a paper describing the Persian fusulinids from the Gircha Formation exposed in the Shaksgam Valley, Karakorum, Pakistan, and the Bulola (Hindu Kush), Afghanistan. From the Shaksgam Valley locality the millolid Hemigordioopsis renzi Reichel is reported as occurring in a cream-colored sublithographic limestone in association with fusulinids. This smaller foraminifer is illustrated by a single very poor thin-section photomicrograph.


A monographic revision of some Nodosariidae based on a detailed study of the Upper Permian microfaunas of Turkey (Taurus Mountains in the province of Antalya, the old Pamphylia), in addition to some Mesozoic material from Austria and France.

From the Upper Permian, 29 species are described and illustrated by whole-specimen drawings and thin-section photomicrographs. Of this Upper Permian microfauna, 8 genera, 20 species, and 1 subspecies are new. The new forms are: Geinitzia taurica, G. ichnousa, Pachyphloia cukirkoyi, P. schwageri, Tristix geinitziana, Langella cukirkoyi, L. ocarina, L. conica, Cryptosepta anatoliensis n. gen., Cryptomorphina limolithic n. gen., Calvezina ottomana n. gen., Pseudolangeilla fragilis n. gen., Frondula permica n. gen., Frondonodosaria pyrula n. gen., F.? orthoecrina, Protonodosaria globifrondina, Taurida pampyliensis n. gen., Ichyolaria permodiscata, I. primitiva, I. latilimbata, and
Langella perforata n. subsp. A new genus, Sosnininella, probably a polymorphinid, is provisionally proposed, based on thin-sections previously illustrated and described by Sosnina, 1960.

In this revision of the Nodosariidae, the Paleozoic genera are tentatively subdivided into four main groups: (1) the geinitzinids, (2) the cryptoseptids, (3) the frondinids, and (4) the colaniellids.

In agreement with the International Rules of Nomenclature, the type species originally designated for Pachyphloia and Colaniella are substituted by new type species. Also, the original type of Geinitzina postcarbonica Spanدل is herein considered as the genotypetype of Geinitzina.

A new generic name, Langella (pro Padangia Lange, 1925) is also proposed and a new diagnosis of the genus given. New diagnoses are proposed for the following genera: Geinitzina, Pachyphloia, Ichtyoloria, Protonodosaria, Colaniella, Lingulina, and Frondicularia. Discussion is also given to the genera Spandelina and Tristix and the genera Monogenerina and Nodosinella, based on unidentifiable types, which are now considered invalid. The genera Spandelina, Lingulina, Protonodaria, Lingulina, Luncacamina, Spandelinoidea, and the so-called Nanicellinae are here considered insufficiently documented, and doubt is cast upon their validity.

In addition, a practical nomenclature of oriented thin-sectioned foram specimens is proposed. Finally, the writer discusses some general problems concerning the Nodosariidae such as: (1) the wall structure of certain Paleozoic forms that have been referred to the Nodosinellidae by some authors, (2) the inadequate definition of Nodosinella and the Nodosinellidae, (3) the inadequate descriptions and diagnoses of genera based exclusively on random thin-sections, (4) the non-validity of genera and species based on corroded specimens or internal molds, (5) the lack of proof concerning the Paleozoic spiroserial Nodosariidae, (6) the evolutionary trends in aperture form and in test size, and (7) interfamiliar and interspecific boundaries.


Five outcrops of Paleozoic strata (Lower to Upper Carboniferous) were examined along a tributary of the Merse River in Tuscany, Italy. Most of the rock exposures in this area have been metamorphosed; however, some fossiliferous detrital limestones contain smaller foraminifers identified as Bradyina gr. G. nautiliformis Moeller, Endothyra bradyi Mikhailov, Tetrataxis sp., and Climacamina cf. C. fragilis Reitlinger. The above smaller foraminifers are illustrated by rather poor thin-section photomicrographs.


The writer briefly discusses the micropaleontology of the Lower Carboniferous (Viséan) rocks in the vicinity of Dender (Namur Syncline), Belgium. Chart 1 lists the distribution of 38 smaller foraminifers, all previously described, retrieved from well cuttings. Relatively barren rock facies at the base of the Viséan make the "first appearance" criterion uncertain, and, as a result, comparison with the zonation in use for the Dinant Synclinorium proved to be difficult.


Ten species of Lower Carboniferous (Tournaïsian-Viséan) smaller foraminifers are described from the Dinant region of Belgium. Of this microfauna one species, Archaeasphaera barbata, is described as new. All forms are illustrated by thin-section photomicrographs. On the basis of this microfaunal study the Lower Carboniferous rocks of the Dinant synclinorium have been subdivided into five biostratigraphic zones. Two species of calcareous algae are also described and illustrated.


The known stratigraphic distribution of 35 important species of agglutinated Foraminifera in the Upper Devonian and the Mississippian (Kinderhookian and lower Osagean) in the type Mississippian area of the United States is as follows: 4 species are restricted to the Upper Devonian; 4 species occur in the Upper Devonian and Kinderhookian; 4 species range from the Upper Devonian through the lower Osagean; 15 species are restricted to the Kinderhookian; 7 species occur in the Kinderhookian and lower Osagean; and 1 species, Hyperammina kentuckiensis, is restricted to and definitive of the Osagean. Thus there are distinct differences in species content between the Upper Devonian and the Kinderhookian microfaunas, as well as between those microfaunas of the Kinderhookian and lower Osagean. It is believed that agglutinated Foraminifera are of considerable value in age determina-
tion and correlation not only within the Upper Devonian and Lower Mississippian of the type Mississippian area, but also interregionally in the United States. Figures 5 and 6 give representative whole-specimen photomicrographs of this Upper Devonian-Lower Mississippian microfauna.


The writer lists Cretaceous and Permian species of smaller Foraminifera recovered from a well drilled in the Surat Basin of Queensland, Australia. Foraminifera are not abundant in the Permain rocks, but a tentative foraminiferal correlation with the Springsure assemblage is suggested.


Formal designation of the type species of the following Upper Paleozoic Foraminifera: Nodosinella (N. digitata Brady, 1876), Agathammina (A. pusilla Geinitz, 1846), Stacheia (S. marginuloides Brady, 1876) and Bradyina (B. nautiliformis von Möller, 1878).


Two microfaunal zones are recognized in the Lower Carboniferous Viséan limestones of Armenia: (1) a lower assemblage characterized by Endothyra sp. cf. E. omphalota, and E. bowmani, and (2) an upper assemblage rich in Endothyra omphalota, E. bradyi, Tetrataxis minima, Permodiscus transcaucasicus, and Hyperammina vulgaris [= Earlandia]. Both assemblages appear to be of lower to middle Viséan age.


The writer lists previously described species of Lower Carboniferous (Viséan-Namurian) smaller foraminifers from the rocks of the Belety Basin in central Kazakhstan, U.S.S.R.


A thin series of organic-detrital limestones, discovered at the base of a thrust sheet, in the Taurus Occidentaux, Turkey, is regarded as Lower Carboniferous (Viséan) age due to the presence of the following smaller foraminifers: Eotubertitina, Endothyranella, Forschia, Permodiscus sp. aff. P. vetustus, Moravammina, Ammodiscus, Endothyra sp. aff. E. bowmani, E. sp. aff. E. convexa, and Earlandia. This microfauna has many similarities with the smaller foraminifers described from the Donetz and Moscow Basins.

64. HARLTON, B. H., 1929, Some Pennsylvanian Ostracoda and Foraminifera from southern Oklahoma—a correction: Jour. Paleontology, v. 3, no. 3, p. 308.

A brief note giving corrected changes in location for certain Pennsylvanian foraminifer- and ostracode-bearing units outcropping in the Ardmore Basin of southern Oklahoma. These corrections apply to two earlier Harlton papers (1927).


A simple method is described for obtaining oriented sections of smaller Foraminifera from slices of indurated limestone using a surgical scalpel and small diamond drill bits. One plate of foramin photomicrographs illustrating the technique is included. The illustrated specimens are from the Upper Paleozoic (Namurian) Upper Limestone Group of Lanarkshire, Scotland.


The writer briefly outlines the technique that he has found most satisfactory in extracting Paleozoic microfossils (agglutinated foraminifers, scolocodonts, and conodonts) from acid residues of carbonate rock.


Mainly a listing and a description of a few new species of Recent foraminifers found off Australia, and, in addition, foraminifers found in some Tertiary limestones of Australia. Mention is also made (p. 830) of a thin-section examination of the Permo-Carboniferous Pokolbin Limestone which
proved to be rich in Late Paleozoic foraminifers [this Permian microfauna had been previously reported by Howchin (1893)].


Numerous listings are given of smaller foraminifers occurring in Lower and Upper Carboniferous limestones that crop out within the boundaries of Moor House National Nature Reserve, northeast Westmorland, northern England.

Lower Carboniferous limestone beds that contain smaller foraminifers within this region are: Melmerby Scar, Robinson, Lower Smiddy, Lower Little, Jew, Tyne Bottom, Single Post, Scar, Five Yard, Three Yard, and Four Fathom.

From the Upper Carboniferous only the Great Limestone has yielded smaller foraminifera in this region.

All of the foraminifers are either only referred to genus or listed under previously described species; none are illustrated.

69. **JURKIEWICZ, H., 1966, Foraminifers of the Lower Zechstein in the vicinity of Galezice and Kajetanow in the Swietokrzyskie Mountains: Poland Instytut Geol., v. 6, Biul. 195, p. 159-200, 5 pl., 2 text-fig., 1 table, [in Polish with Russian and English summaries].**

A study of the microfauna from bore holes, mine shafts, and outcrops of the Permian (Wolfcampian) Lower Zechstein Formation in the vicinity of Galezice and Kajetanow in the Swietokrzyskie Mountains, Poland, has yielded 28 species of Foraminifera. Stratigraphically, this interval has been subdivided into 3 foraminiferal zones. These four species and 1 subspecies are regarded as new: *Reophax permianus*, *Ammodiscus rosieter disoides*, *Geinitzina elongata*, *Fronticulat richula*, and *F. corpulenta*. All forms are described and illustrated by drawings of whole-specimens and interior sections; plates 4 and 5 give photographs of representative sown-slide microfaunal assemblages from each of the designated foraminiferal zones.

The present study demonstrates that this microfauna can also be correlated with the Lower Zechstein in Sudetes, in central Poland, and Germany.


Reef structures of Lower Permian (Artinskian) age were discovered on the eastern border of the Russian Platform and at the western edge of the Ural piedmont trough. Both reef structures contain three similar zones: (1) large robust brachiopods, (2) algal-bryozoan, and (3) bryozoan-small brachiopods. The principal difference in the reefs associated on the platform from those on the trough appears to be in their small foraminiferal assemblages. The platform reefs contain: *Glomospira*, *Tolympaminina*, *Globivalvulina*, *Nodosaria*, *Geinitzina*, and *Dentalina*. The reefs located on the trough contain the following smaller foraminifers: *Hemidiscus*, *Hemigordius*, *Tetrateaxis*, *Lasidiscus*, *Ammovertebra*, *Ammodiscus*, *Dentalina*, and *Frondicularia*. The platform reefs are identified with the Sylvinsk Reefs of the Ufa Plateau, and those associated with the piedmont trough with the Sarginsk Reefs of the same plateau. The foraminiferal difference is attributed to facies changes rather than to a difference in age.


In the lower part of the Middle Carboniferous of the pre-Ural Molotov District, U.S.S.R., four microfaunal assemblages are recognized from the lower Namurian to the top of the Bashkirian: (1) the Protvaian Horizon is characterized by *Endothyra crassa sphaeric*, *Bradyina ex. gr. cribrostomatata*, *Archaeodiscus moelleri*, *A. karneri*, *A. rugosus*, *A. baschkiricus*, and *Globivalvulina sp.*; (2) the upper Namurian is characterized by *Bradyina cribrostomatata*, *Endothyra bradyi*, *A. archaeodiscus ex. gr. rugosus*, *A. baschkiricus*, *A. karneri*, *A. moelleri*, and *A. ovoides*; (3) the lower Bashkirian is distinguished by conspicuous fusulinid assemblages; and (4) the foraminifer *Bradyina nautiliformis* makes its appearance in upper Bashkirian time.


A comparison is made of the biostratigraphic zonations of the Late Paleozoic Bashkirian Stage as proposed by various Soviet workers. This zonation is primarily based upon fusulinids, but representative species of the smaller foraminiferal genera *Archaeodiscus*, *Globivalvulina*, and *Bradyina* also appear to be useful to the biostratigrapher. In particular, the lower Bashkirian Stage is characterized by an assemblage of *A. subbaschkiricus*, *A. subbaschkiricus var. grandis*, *A. postrugosus*, *A. pseudomoelleri*, and abundant *Bradyina cribrostomatata*.

73. **KOCHANSKY-DEVIDE, V., and RAMOV, A., 1966, Oberkarbonische Mikroforaminifera und Stratigraphische**
Entwicklung in den Westkarawanen: Slovenia Acad. Sci. & Art, 35 p., 11 pl., 1 text-fig., 5 strat. sections, [in Yugoslavian with German summary].

The writers describe the algae, smaller Foraminifera, and fusulinids from the Upper Carboniferous rocks (Gshel and Orenburg Stufe) of northwestern part of Yugoslavia. All forms are illustrated by thin-section photomicrographs; none are new.


The Upper Permian deposits of Kwaja Gar, north of Bamian in Afghanistan, is rich in fusulinids and brachiopods. This fauna was first reported by Hayden in 1907, and was later regarded by Reed (1931) as Upper Carboniferous age.

Horizon 2 contains, along with the algae Mizia and Permocalculus and abundant fusulinids, the following smaller foraminifers: Glomospira regularis, G. sp. Hemigordius n. sp., Cribrostomum sp., Spiroplectammina sp. (= Palaeospirectammina), Glibivalvulina sp., Langella perforata (Lange), and Geinitzina sp. Horizon 4 contains approximately the same smaller foraminifers, although no algae are reported from this unit.


The writer reports the occurrence of Upper Permian fusulinids and smaller foraminifers from central Afghanistin. The foraminifers occur in dolomitic limestones and have been identified as: Cilmacammmina sphaerica, C. gigas, Glibivalvulina buloides, Tubertitina bulbecae, Cribrostomum, Glomospirella, Pachyphloia, Langella, Geinitzina, Hemigordius, and Pseudobradyina.


From the Lower Carboniferous (Viséan) rocks of the Altai Mountain Region, of the Urals, U.S.S.R., 31 species of smaller foraminifers are described and illustrated by representative thin-section photomicrographs. Of this microfauna, 4 species and one variety are new. The new forms are: Endothyra? evoluta Lobeveda var. maxima, Plectogyra maximovae, P. chumyshensis, Globoendothyra muccessis, and G. mikutzyi. Some fusulinids are also described and illustrated.


The writers present a revision of the lithostratigraphy and biostratigraphy (megafauna and some Foraminifera) of the Lower Carboniferous (Tournaissian) at its type locality in Belgium. Foraminifer assemblages 5, 6, 7, 8?, and 10 have been recognized. Assemblage 5 (Upper Devonian-Famen nian) contains Septaglomospiranea sp., a primitive Quasiendothyra sp., and Umbellina sp. Assemblage 6 (lower Tournaissian) has abundant Quasiendothyra communis, Endothyra (?) ex. gr. prim aeva, Caligella sp., Irregularina sp., Bisphaera sp., Lugtonia sp., and others. Assemblage 7 (middle Tournaissian) is characterized by abundant Chernyshe nilla sp., Septatournayella sp., Endothyra ex. gr. rjausakensis, and others. Assemblages 8 and 9 (upper Tournaissian) which were originally recognized in the Dinant Synclinorium are poorly displayed in Tournai due to pronounced rock dolomitization. A discussion is also included on the definition of the base of the lower Tournaissian and of the Lower Carboniferous utilizing a phylogenetic sequence of forms of Quasiendothyra.


Discusses and lists the stratigraphic distribution of Permian Foraminifera from sediments of the Olenek Highland, Arctic region, U.S.S.R. All forms have been previously described.


A complete discussion of the stratigraphy of the Lower, Middle and Upper Carboniferous sequence in the Ural Mountains, U.S.S.R. The occurrences of numerous previously described species of smaller foraminifers are given for each of the diagnostic stratigraphic horizons. This is supplemented by excellent well documented stratigraphic sections shown on Figs. 1-3.

80. LISITSINA, N. A., and BOGUSH, O. I., 1954, Stratigraphy of the Upper Paleozoic of the oriental part of the Alaik Range: Moskovskoe obschestva ispytalelei prirody, Biull. Otdel. Geol., v. 29, no. 3, p. 3-17, 3 text-fig., [in Russian].
Middle Carboniferous (Moscovian) limestones of the Alaik Range, U.S.S.R., are reported to contain the following smaller foraminifers: *Archaeodiscus* sp., *Bradyina* sp., *Tuberculina* sp., *Globivalvulina* sp., *Ammodiscus multivolutus*, *Bradyina nuttilliiformis*, *B*. sp. cf. *B. lepida*, *Deckerella* sp. aff. *D. mjachkovensis*, and *Hemigordius discoideus*. Numerous fusulinids are associated with the above microfauna.


The writers report the occurrence of agglutinated foraminifers (tolypaminids = minammodontids, and *Saccammina*) from the Early Pennsylvanian Smithwick Shale claystones of Burnet County, central Texas.


It is noted that the base of the Tournaisian, or Etrooeungt Beds, along the western slopes of the middle Urals is characterized by the foraminifers *Archeasphaera minima*, *A. magna*, *Pararuthruminina sulaimanovi*, *Bisphaera* spp., *Endothyra communis* [now *Quasiendothyra communis*], and *Septatournayella* sp.


In the Polevskii region of the middle Urals, the Zyuelskaya Formation, whose age was formerly regarded as ranging from Upper Silurian to Lower Devonian, has been found to contain smaller foraminifers representing the following genera: *Brusnia*, *Ammodiscus*, *Endothyra?*, *Eostaffella*, *Tetrataxis*, *Archaeodiscus?*, and *Pachysphaera*. It is now thought that this formation is of Lower Carboniferous age.

In addition, the Polevskii Formation, consisting principally of marbleized limestones, has yielded fusulinids, and smaller foraminifers representing the genera: *Glomospira*, *Brusnia*, *Ammodiscus*, and *Archaeodiscus*. This unit is now thought to be no older than Middle Carboniferous.

84. Manukalova, M. F., 1956, Stratigraphy of the Middle Carboniferous of the Donetz Basin according to the Foraminifera: Moskovskoe obschestvo ispytatelei prirody, Biull. Otdel geol., v. 31, no. 6, p. 79-102, 3 pl., [in Russian].

Primarily a fusulinid paper in which nine foraminiferal assemblages are recognized in rocks from upper Namurian to Moscovian time in the Donetz Basin, U.S.S.R. The three oldest zones are characterized by representatives of the family Archaeodiscidae, whereas the overlying zones are based on fusulinids. One new smaller foraminifer, *Bradyina elongata*, is described and illustrated by thin-section photomicrographs. A number of new fusulinid species are also described and illustrated.


A biostratigraphic subdivision of the rocks of the Lower and Middle Carboniferous of the Donetz Basin, U.S.S.R., into 32 foraminiferal assemblages. These foraminiferal assemblages are based upon previously described species of smaller foraminifers and range in age from Tournaisian to upper Namurian. Of special interest is that the Tournaisian-Viséan boundary is placed at the first major "outburst" of the genus *Quasiendothyra* [now *Dainella*].


A microfauna of *Tetrataxis* ex. gr. *conica*, *Bradyina* sp. aff. *B. donetziana*, *Climacammina* sp. cf. *C. elegans*, *Glomospira* sp., *Cribrostomum* sp., *Endothyra* sp., *Hamidiscus* sp., *Tuberculina* sp., and *Nodosaria* sp. is reported from the Upper Carboniferous carbonate series of the eastern Altai in southwestern Asia.


A complete résumé of Carboniferous biostratigraphy of Middle Asia, U.S.S.R. Some of the more pertinent features are: (1) the Tournaisian may be subdivided into three recognizable units, (a) the Etrooeungt layers with common *Quasiendothyra*, (b) stratigraphic intervals dominated by single-chambered foraminifers (*Pararuthruminina*, *Tubertina*), and (c) those intervals characterized by more advanced multicameral forms such as *Plectogyra rjauakensis*, *P. tuberculata*, and *P. inflata*; (2) the Viséan is divided into two distinctive foraminiferal complexes, (a) those units with *Planarchaeodiscus* ex. gr. *spirillinoides*, *Archaeodiscus* ex. gr. *karreri*, *Propermodiscus* sp., *Tetrataxis* sp., and *Plectogyra* ex. gr. *omphalota*, (b) those layers that carry *Asteroarchaeodiscus* ex. gr. *baschkiricus*, *Neo-

Same article as given in the 1960, IV Congrès pour l'avancement de la stratigraphie du Carbonifère.


Primarily a stratigraphic paper dealing with a fusulinid zonation of the Upper Paleozoic deposits of the eastern Soviet Union. Mention is made that some smaller foraminifers are used as stratigraphic markers, i.e., Asteroarchaediscus for the Bashkirian Stage, and Geinitzina ovata, Pachyphloia sp., and Colaniella parva for the Palmarian Stage.


Primarily a Permian stratigraphy paper of the Caucasus region of the U.S.S.R. based upon fusulinid zonation. However, numerous previously described smaller foraminifers are shown to be useful in subdividing the Upper Permian of central Asia. The lower Murgabian contains such forms as Pachyphloia gefoensis and Geinitzina tcherdynczevi, and the Pamirian contains numerous nodosariids, the first Robuloides, and the last Globivalvulina and Climacaminna.


The lower part of the Middle Carboniferous rocks in the vicinity of the Alau Range and Karachatisk, southern Fergana, U.S.S.R., is biostratigraphically zoned on the basis of previously described species of Asteroarchaediscus, Neoarchaediscus, Globivalvulina, Bradyina, and Fusulinidae.


Briefly discusses the occurrence of certain types of previously described Permian uniserial foraminifers occurring within the Kazan Basin of the Soviet Union. The following genera are represented: Nodosaria, Pseudonodosaria, Lingulodonodosaria, and Spandelina. All of the foraminifers discussed are illustrated by what appear to be drawings of thin-section photomicrographs.


A new occurrence of the smaller foraminifer Succaminopsis carteri (= S. fusuliformis) is reported from the Lower Carboniferous upper Viséan rocks (Yuanophyllum Zone) of Japan.


The Carboniferous sequence of Dolgiy Island in the Pechora Sea, northern Soviet Union, is typical of the western side of the Urals and contains similar facies and microfossil assemblages. Previously described species of smaller foraminifers are particularly abundant and their study has demonstrated that part of the lower Viséan and lower Tournaisian substages are missing. Smaller foraminifers are listed from the upper Tournaisian and the Tula and Aleska Horizons of the upper Viséan sediments.


A few genera of smaller Foraminifera (Bradyina, Climacamina) are noted on a series of measured sections of the Pennsylvanian (Desmoinesian-Virgilian) Madera Limestone exposed in the Tajiue Quadrangle, in Torrance and Bernalillo counties, northcentral New Mexico.


The Middle Carboniferous rocks of the Ufa region, U.S.S.R., consists of approximately 375 feet of carbonates which have been subdivided into seven foraminiferal assemblage zones. The rocks range in age from Namurian to upper Bashkirian, and are subdivided primarily on the basis of previously described species of Fusulimadae, Archaeididae, and Asteroarchaediscidae. [It is noted that Asteroarchaediscus bashkiricus, which is presented as a characteristic index of the Bashkirian Stage, is
now generally accepted as widely present in the Namurian].


A revision of the stratigraphy presented in Okimura’s 1958 article. It is to be noted that the Plectogyra communis [now Quasiendothyra] and P. primaeva [now Septaglos spiranella] Zones, formerly thought to be Osagian in age, are now considered as Meramecian. The endothyroid spiroides- “symmetrica” Zones are attributed to the Chesteran-Springeran.


The Lower and Middle Carboniferous rocks of the Chugoku region, southwestern Japan, especially in the Atetsu, Taishaku, and Akiyoshi Limestone areas, are microbiotactigraphically subdivided into lower and upper parts on the basis of the contained microfaunal elements. The lower portion of well bedded limestones with “schalstein” and chert, of Lower Carboniferous age, is subdivided into 3 zones which contain abundant smaller foraminifers (endothyroids, palaeotextulariids, archaeodiscids, turbetinids, and tetrataxids). The upper portion of unstratified limestones, disconformably overlying the lower portion, and Middle Carboniferous in age, is characterized by relatively primitive fusulinids. The microfaunal characteristics of the lower interval suggests a Viséan age, whereas the upper interval apparently ranges from Bashkirian to Moscovian in age.

One plate of thin-section photomicrographs of some representative Lower Carboniferous smaller foraminifers is given. Of special interest are the excellent photomicrographs of the foraminifer Saccaminopsis fusulinaformis (M’Coy).


The Lower Carboniferous limestones and shales exposed on the coast of northwestern Ireland were mapped and various vertical sections measured. The lithology and foraminiferal content of these coastal limestones are similar to those of the upper part of the inland succession previously described. They are correlated with the upper formations (Benbulben-Glenvar Formation and the Darty Limestone), and not with the lowest formation (Ballyshannon Limestone), as has been previously done. The contained smaller foraminifers are thought to be indicative of a Lower Carboniferous (Viséan-D.) age. All of the foraminifers are referred to previously described species and listed under their respective formational units.


From Upper Carboniferous shales intercalated in Nubian-type sandstones at Abu Darag, eastern desert, Egypt, an agglutinated foraminiferal assemblage of 19 species is described and illustrated by whole-specimen photomicrographs. This microfauna is represented by previously described foraminiferal species of the families Astrorhizidae, Ammodiscidae, Textulariidae, Palaeotextulariidae, and Trochaminidae. One new subspecies, Trochammina arenosa Cushman and Waters abudaragensis, is described and illustrated. The microfauna is thought to be Westphalian in age and to have been deposited in a shallow sea adjacent to a coastline. [See Omara and Vangerow, 1965, for a previously described foraminiferal assemblage from this area.]


In a brief discussion of the relationship of the fusulinid Depratella to Endothyra the writer notes that after detailed examination of the shell structure of some Lower Carboniferous Endothyra from the Avon Gorge, England, he found some forms with an agglutinated texture. However, in some species the wall becomes very thin, more or less loses its agglutinated texture, and approaches the shell structure of primitive Fusulina. Some forms of Endothyra may also have a perforate test, but others are undoubtedly imperforate like Fusulina. There is no doubt but that Staffella, characterized by a lenticular or nautiloidal test, is derived from Endothyra by the loss of the agglutinating character of the test in Lower Carboniferous time (Viséan). Depratella is derived from Endothyra during the Lower Permian.


The writer lists a number of previously described Middle Carboniferous (Bashkirian and Moscovian Stages) smaller foraminifers and fusulinids from western Serbia, Yugoslavia. The foraminifers occur in limestone lenses enclosed in schists. Most of the microfauna is illustrated by rather poor thin-section photomicrographs of random foram sections.


From limestone pebbles of Permo-Triassic conglomerates at Montenegro, Yugoslavia, a diverse microfauna of 11 species of Upper Permian smaller foraminifers is recorded. Of this microfauna one species, Lasiotrochus hajnegajensis, is described as new. All of the microfauna is described and illustrated by thin-section photomicrographs. Associated with the smaller foraminifers are fusulinids and calcareous algae.


The writer reports the occurrence of smaller foraminifers from the Pennsylvanian (Missourian) Swope Formation of Missouri and Iowa. Identified forms are: Bradyina, Polytyaxis, Textularia? [=Palacotextularia], and Calciotornella [=Hedraites].


Principally a discussion of the stratigraphy of the Carboniferous sediments of the southwestern part of the southern Urals, U.S.S.R. Mention is made of the lower Viséan age of a thin limestone unit in the Mugodzhar. The microfauna reported from this carbonate unit includes: Endothyra crassa Brady, E. similis Rauser. and Reitlinger, Hyperammina vulgaris Rauser. and Reitlinger [=Earlandia] and Archaeaidiscus krestovnikovi Rauser.


The Coal Measures of the Carboniferous of the eastern slope of the Urals, and Kazakhstan, U.S.S.R., are dated on the basis of their contained smaller foraminifers. The Ber-Chogur Series are dated as Lower Carboniferous (upper Tournaisian) due to the presence of Endothyra sp. cf. E. tschikmanica and Glomospira elliptica. The presence of Endothyra crassa [now Endothyranopsis], Archaediscus karreri, A. krestovnikovi var. pusillius indicate a Lower Carboniferous (upper Viséan) age for the Karagandysai Series, whereas the foraminifers Bradyina cribrostomata and Archaediscus baschkiricus [now Asteroarchaeodiscus] are representative species for the Lower Carboniferous (Namurian).


In the center of the Rotliegendes Basin of northwestern Germany the Lower Permian Rotliegendes Formation passes conformably into the Zechezstein Formation (Upper Permian). The uppermost portion of the Rotliegendes Formation is characterized by a rich marine microfauna in which smaller foraminifers are a dominant constituent. Previously described species representing the following genera occur quite commonly: Hyperammina, Ammodiscus, Reophax, Lingulina, Pseudoglandulina, Earlandia?, Glomospira, Ammobaculites, Geinitzina, Spandelia, Monogenerina, Calciotornella [=Hedraites], Cornuspira, Nodosaria, Dentalina, Spandelinoidea, and Spirillina. Associated with this rich and diverse foraminifer assembly are ostracodes, molluscs, and fish remains.

From a paleogeographic point of view the marine microfauna from the uppermost Rotliegendes indicates a marine ingresssion of the Scandic prior to Zechezstein time. The Banderschierfe Bed is a characteristic marker horizon used in stratigraphic correlations (see text-fig. 2). The writer believes that the uppermost Rotliegendes and the Zechezstein belong to the same biostratigraphic unit.

The microfauna is illustrated by whole-specimen photomicrographs of characteristic forms from diagnostico stratigraphic horizons.


A number of foraminifer assemblages are described from the Mt. Magnitskaja section in the Urals, U.S.S.R.; all are composed of previously described foraminiferous species. The Quasiendothrya Zone is recognized and found to contain abundant Q. communis and Q. kobetiusana. The Tournaisian microfauna appears to be well developed, but the lower Viséan boundary is difficult to place, since Haplophragmella, Tetraaxis, and Palacotextularia
gradually appear as components within the Tournaissian assemblage.

The lowermost Viséan assemblage is characterized by *Quasiendothyra chomatica* [now *Dainella*], primitive *Globoendothyra* and the first *Endothyra* ex. gr. *staffeliformis*.

The Grumby complex carries the earliest *Endothyranopsis*, *Eostaffella mediocris* [now *Mediocristis*], and *Pseudoendothyra*. This assemblage is similar to that of the Bobrikovskii.

The first *Archeadiscus* appears within the Tula Horizon.


Primarily a paper describing the fusulinid microfauna of the Bashkir sediments (lower Middle Carboniferous) of the greater Donets Basin of the Soviet Union; however, 5 smaller foraminifers are also described and illustrated by excellent thin-section photomicrographs. Three of the smaller foraminifers are new: *Plectogyra baschkirica*, *Tetrateactis extensa*, and *Eolasiodiscus dilatus*.


Primarily a fusulinid paper, although one smaller foraminifer, *Textularia elinae [= Palaeotextularia]* is described from the Middle Carboniferous rocks of Mordovsk, U.S.S.R., and illustrated by one thin-section photomicrograph. On the basis of fusulinids the Moscovian Stage of the Middle Carboniferous is subdivided into four substages: (1) the Vereian Substage containing *Endothyra aljutovica* and *Climacoxammina aljutovica*, (2) the Kachiran Substage carrying *Haplophragmina kashirica* and *Bradyina minima*, (3) the Podolian Substage characterized by abundant *Climacoxammina grandiis*, and *Bradyina pseudonautiformis*, and (4) the Miatchkogio Horizon which yields *Bradyina lepida*.


In a large, well exposed mining district within which the predominantly flat-lying beds simplify recognition of individual strata in the sequence, the Bochumer beds (i.e., from the Katharina Coal to the Karolinen Coal) have been thoroughly investigated with especial reference to their contained microfauna.

The sudden pinching-out of foraminiferal horizons from coal-rich sequences demonstrates that one must be very cautious in correlating coal units between widely separated sections of the Carboniferous rocks of the Ruhr region of western Germany. Moreover, the fact that there are Foraminifera (all agglutinated: *Hyperammina*, *Glomospira*, *Glomospirella*, and *Ammodiscus*) within many intervals of the Bochumer beds was quite surprising. In regard to facies development, it demonstrates that as early as upper Westphalian A time the lower Rhine region had acquired a unique character (many intercalations of units thought to be of brackish-water origin) as compared with the Aachen region to the west and the central part of the Ruhr district to the east.

Foraminiferal horizons are shown on table 2; the microfauna is not illustrated.


A comparative study of the biostratigraphy of the Middle Carboniferous strata of the Russian Platform with that of the Donbass standard section. It is noted that the Krasnaya Polyana Formation is the microfaunal equivalent of the C1f (E) of the Donetz, by comparison of the various species of *Globivalvulina*, *Climacoxammina*, *Palaeotextularia*, the endothyroids, archaediscids, and fusulinids.


The lower boundary of the Etroeuengt Beds in the Ural Mountains, U.S.S.R., is drawn on the basis of an evolutionary sequence of Tournayellidae and Quasiendothyridae smaller foraminifers. On the Russian Platform this boundary is impossible to recognize, since tournayellids and quasiendothyrids are absent; however, these forms are replaced by calcispheres and monolocular primitive smaller Foraminifera. Most Soviet workers attribute this change in microfaunal assemblages to changes in water salinity.

The Ozerko dolomites and limestones are correlated with the top of the *Septatournayella rauserae* Zone, while the Khovansk Formation is thought...
to be equivalent to the *Endothyra communis-Quasiendothyra kobeliusana* Zone.

This paper mainly describes the calcispheres, but two new species of questionable Foraminifera are described and illustrated by whole-specimen photomicrographs. The new forms are: *Rauzerina compressa* and *Tscherdynecevella globulosa*.


A complete systematic revision of the Upper Devonian-Lower Carboniferous smaller foraminifers of the Family *Quasiendothyridae* and some crinbrate primitive *Endothyridae*, is here considered and is ranked as a distinct morphologic subgenus.

One discusses foraminifers by whole-specimen photomicrographs. In addition, the new *Endothyra*, genus *Klubovella* is regarded as an isomorphic form and is ranked as a distinct morphologic subgenus. All discussed foraminifers are illustrated by excellent thin-section photomicrographs.

Six new species, one new subspecies, and four new varieties are described. The new forms are: *Septaglomospiranella* (S.) *nana*, *S. (S.)* *lingirica*, *S. (S.)* *crassa*, *Rectoseptaglomospiranella* *elegantula*, *S. (R.)* *asiatica*, *S. (R.)* *crassiformis*, *Septaglomospiranella* (S.) *primaeva* (Rauer) subsp. *graciosa*, *Quasiendothyra communis* (Rauer) var. *radiata*, *Q. konensis* (Lebedeva) var. *mutabilis*, *Q. konensis* (Lebedeva) var. *glomiformis*, *Septaglomospiranella* (S.) *primaeva* (Rauer) var. *kazakhstanica*.


115. Reitlinger, E. A., 1964, Present status of the studies of the order *Endothyrida*: Voprosy Mikropaleontologii, No. 8, Morphology, taxonomy, and present status of studies on foraminifers and ostracodes, p. 30-52, 1 pl., 2 text-fig., 3 tables, [in Russian].

The writer presents a lucid analysis of the world-wide usage of endothyroid Foraminifera in Lower Carboniferous micropaleontological studies up to 1963. Text-figure 1 illustrates the dramatic increase of the endothyroid literature since 1925. It is noted that most of the current work is being done in the Soviet Union. Tables 2 and 3 show the stratigraphic subdivision of the Soviet Lower Carboniferous sequence on the basis of faunal representatives of the order *Endothyrida*: the characteristic "index fossils" for each stratigraphic subdivision are noted.


The writer notes that smaller foraminifers and diverse skeletal grains are relatively abundant in the limestones of the Pennsylvanian Gaptank Formation of west Texas. The microfauna includes such forms as: *Glomospira, Tetrataxis, Bradyina, Endothyra, Bigeneria* [sic], and *Orthovertella* [probably *Hedraites*].


Primarily a paper describing the Late Paleozoic fusulinids from the Northern Yukon Territory, Canada. One new species of smaller foraminifers, *Endothyra arctica*, is described from rocks of Pennsylvanian age (probably Moscovian) and illustrated by thin-section photomicrographs. In addition, the forms *Endothyra* sp. and *Bransia* sp. are illustrated and described from rocks of this region believed to be of Pennsylvanian (late Morrowan) age. The foraminifers *Bradyina* sp. and *Climacammina* sp. are noted as occurring in Pennsylvanian rocks of early Moscovian age in this area.


A short synopsis of a number of proposals presented to the Commission of Zoological Nomenclature relative to the Family *Endothyridae*. The more important points are: (1) *Endothyra bowmani* is a nomen dubium since Brown and Philips descriptions are unsatisfactory, (2) the first revision of the genus is that of Brady, 1876, which has been accepted for more than 50 years, (3) in order to stabilize nomenclature, *Endothyra bradyi* Mikhailov, 1939 (= *E. bowmani* Brady, 1876) is suggested as the type of *Endothyra*, (4) the genus *Plectogyra* is synonymous with *Endothyra* as emended, (5) *Plectogyrinae* Reitlinger, 1959, is emended as *Endothyrinae* Brady, 1884, and (6) the subfamily
Quasiendothyriae is proposed on Quasiendothyra Rauser-Chernousovs, 1948. [See China, 1965, for the final decision of the Commission of International Zoological Nomenclature].


Two foraminiferal assemblages present in well cores from Moldavia, U.S.S.R., indicate the existence of lower and upper Viséan (Lower Carboniferous) rocks in this area. The lowermost Viséan is characterized by the presence of early Globoendothyra and Dainella, mixed with a residual Tournaisian microfaunal assemblage.


Primarily a paper discussing the Middle Carboniferous stratigraphy of the Zeravshano-Gissorslosoi Mt. Province, U.S.S.R., based principally on fusulinid age determinations and correlations. A number of previously described smaller foraminiferal species are also listed.


From the Lower Carboniferous (Namurian) limestones of Tan-Lam, province of Quang-Tri, central Viet Nam, southeast Asia, a microfauna of 54 species is briefly described and illustrated by medioquire thin-section photomicrographs. Three species are described as new: Plectogyrina fontainei, Globoendothyra annamitica, and G. tanlamensis. A few fusulinids are also described. One taxonomic change is included: cf. Haplophragmella dussaulti Saurin, 1960 = Ammobaculites cf. A. dussaulti Saurin.


The writer lists a number of smaller foraminifers, in association with fusulinids and calcareous algae, from the Upper Carboniferous of Dalmatia (Yugoslavia). [This microfauna is now regarded as Lower Permian in age. It should be noted that the designation of Valvulinella is an invalid nomen nudum. The correct designation is that of Schubert, March 1908, with V. youngi as the type species. True Valvulinella died out at the end of the Lower Carboniferous; Permian "Valvulinella" probably should be re-named].


Primarily a discussion of the fusulinid biostratigraphy of the Carboniferous sediments of the Don-Medveditza dislocations, U.S.S.R. It is noted that the Middle Carboniferous Sukhov Series contains Endothyra sp. and Bradyina sp. The microfauna of the Lower Panika Series (Upper Carboniferous) contains Glomospira sp., Globivalvulina sp., Palaotextularia sp., Cribrostomum sp., and Bradyina sp.


The writer briefly describes the stratigraphic dispersion and geographic distribution of 20 Middle Carboniferous smaller foraminifers and fusulinids from several regions of the Russian Platform (Donetz, Prae-Timan, Molotov, Saratov, western Urals, Don, Ouliuvanovsk, and Dniepropolovsk). Of especial note is the large microfauna referred to the Archaeodiscidae.


The writer presents a historical and paleontological review of the so-called "passage beds" of the Devonian-Carboniferous and Tournaisian-Viséan boundaries of the Volga-Ural districts of the Soviet Union. The problems most apparent in correlating the Khovansk Beds of the Russian Platform with the Endothyra communis layers of the Volga region are briefly outlined.

126. SERGUNKOVA, O., 1957, Stratigraphic scheme of the Lower Carboniferous of the southern part of the Tian-Chian Range: Resolution Committee for the unified stratigraphic scheme of the pre-Paleozoic and Paleozoic of the Oriental part of Kazakhstan, p. 114-118, 2 tables, [in Russian].

The Lower Carboniferous rocks (Tournaisian and Viséan Stages) of the Tian Chian Range, southern Kazakhstan, U.S.S.R., is subdivided into eight foraminiferal assemblages based upon previously described species of smaller Foraminifera. The
foraminiferal ranges are compared to a previously used megafaunal zonation.


From the Lower Carboniferous (Viséan) rocks of the Corrig Lodge Beds, exposed in the northeastern part of Limerick County, Ireland, a microfauna of 16 species (all previously described) is listed and commented upon. R. H. Cummings identified the foraminiferal assemblage and noted that the microfauna is probably of upper D-zone age.


The Lower Carboniferous (Viséan) sediments in Volynia and Padolia, U.S.S.R., are divided into five biostratigraphic zones: (1) the basal Olesko, which contains endothyrids of the group Endothyra globulus, primitive Eostaaffella, and abundant Parathuramina and Calciaphera, (2) the Busk Horizon, which is characterized by Forschia suangulata, Littootabula glomospiroides, Haplophragmina irregularis, and Endothyra omphalota minima, (3) The Ustilug, which yields Saccaminopsis carteri ukrainica, Endothyra crassa [now Endothyranopsis], Monotaxis gibba [= Howchinia], Stacheia fusiformis [now Fourstonella], and Archaeodiscus moelleri gigas [= Archaeodiscus karreri], (4) the Potitsk, which carries Nanicella ammonoides [now Loeblichia], Quasiendothyra ukrainica [now Loeblichia] and Archaeodiscus bashkiricus [now Asteroarchaeodiscus], and (5) the Ivanichi Horizon, which is characterized by Endothyra crassa sphaerica.


The writers present a preliminary outline of the biostratigraphic subdivision of the Upper Paleozoic rocks of the Soviet Arctic, Taimyr Peninsula. Marine Middle Carboniferous Makarov sediments contain Neorchaedis flusilis, Asteroarchaeid us ex. gr. subbaschkiricus, and Archaeodiscus aff. relicuus. The lowermost part of the Lower Permian sediments rest unconformably on the Carboniferous and contain Neorchaedis gregori. Somewhat higher in the section such characteristic forms as Protodorsaria praeecessor, P. proceriformis, and Hyperammina cf. H. borealis, make their appearance. The lower part of the Upper Permian carries Pseudonodosaria ventrosa, Dentalina kalinkii, Frondicularia planilata, and numerous nodosariids. The upper part of the Upper Permian is non-marine and has been zoned by pollen.


The writer discusses the microfacies of the Upper Devonian and Lower Carboniferous Khovansk, Malevka, Upinsk, and Tula Limestones of the Moscow district, U.S.S.R. Microfaunal lists are given for the Lower Carboniferous (upper Viséan) sediments, which contain the following forms: Archaeodiscus karreri, Hyperammina vulgaris, Endothyra crassa, E. crassa var. complexa, E. similis, E. globulus, E. sp. cf. E. omphalota, and Haplophragmella sp. cf. H. fallax. [This is one of the earliest Soviet references in which Lower Carboniferous limestones have been recognized and identified by their microfaunas.]


A petrographic study of the Lower Carboniferous (Tournaisian) Chernyshin Limestone of the Moscow Basin discloses the presence of abundant foraminifers (Endothyra and Textularia) associated with blue-green algae. [The Chernyshin Textularia are now referred to Palaeoepsiroplectammina.]


A suite of Permian Foraminifera (fusulinids and smaller foraminifers), illustrated both by sketches and rather poor thin-section photomicrographs, is described from the Gircha Formation of the upper Hunza Valley in the western Karakorum (Pakistan). Of 16 species of smaller foraminifers, one, Hemigordius? pakistanus, is regarded as new. Most of the foraminifers occur in thin, dark-grey dolomite limestone intercalations within the predominantly clastic (dark arenaceous slates) Gircha Formation.

133. SKIPP, B., HOLCOMB, L. D., and GUTSCHICK, R. C., 1966, Tournayellinae, calcareous Foraminif-

Recent work in North America has shown the presence of tournayellid foraminifers in rocks of Kinderhookian, Osagean, and Meramecian age, and that these have restricted ranges useful for stratigraphic zonation in the North American Lower Carboniferous. To date, none have been recovered from the Devonian. A striking similarity between the tournayellid and endothyroid microfaunas of the Early Carboniferous of the North American Cordillera and several areas of the U.S.S.R. suggests concomitant development, similar environments, and possibly connecting seaways during that period. A correlation chart, based on ranges of identical species discussed in this paper is appended.

The genus Septoglosmospiranella Lipina, 1955, for which one new subspecies is described, is found in: the Redwall Limestone, Arizona; the Leadville Limestone, Colorado; the Madison Limestone, Wyoming; the Tin Mountain Limestone, California; the Shunda and Pekisko Formations, Alberta, Canada; and the Gilmore City Limestone, Iowa. Septabrussitina Lipina, 1955, for which two new species are described, is recognized in: the Redwall, Leadville, and Madison Limestones, and in the Livingstone and Mount Head Formations, Alberta. Tournayella Dain, 1953, and Septatournayella Lipina, 1955, for which two new species are described, are found in: the Redwall Limestone, the Madison Limestone, Montana; beds formerly assigned to the Bramer Limestone in southeastern Idaho and northern Utah; parts of the White Knob Limestone of Idaho; the Arroyo Penasco Formation, New Mexico; the Mount Head Formation, Alberta; and the Salem Limestone, Indiana. A section containing translations into English of the original descriptions of major Russian genera and species discussed in this paper is appended.

A very significant section on the tournayellid wall structure gives evidence that the test wall was originally composed of finely perforate porcellaneous (?) material that was later totally recrystallized.

The new taxa are: Septabrussitina mckeei, S. parakrainica, Septoglosmospiranella primaeva (Chernysheva) noda, n. subsp., Septatournayella henbesti, and S. kennedyi. All forms are described and illustrated by excellent thin-section photomicrographs.

Important taxonomic changes include the following: Endothyra kynensis Malakhova, 1956, and Endothyra? spp. McKay & Green, 1963, = Septaglosmospiranella dainae Lipina, 1955; and Endothyra primaeva Chernysheva, 1940, = Septaglosmospiranella primaeva (Chernysheva).


Primarily a study of the "internal stratigraphy" of the Lower Carboniferous (Meramecian) Salem Limestone of Indiana, particularly to the determination of Salem depositional conditions, in order that this unit may be properly utilized as a future source of dimension stone.

It is noted that the smaller foraminifer Endothyra is a conspicuous biotic element within the Salem Limestone. Fig. 2 and 3 show percentage abundance of Endothyra in a number of outcrop sections and cores from various localities in Indiana.


In the Soviet Arctic the Tiksin Horizon contains Archaediscus cf. A. krestovnikovi, Planochaediscus sp., Brullassiella ammodiscidea, and Plectogyra ex. gr. bradyi; its age is Carboniferous (Viséan to Namurian).

The Makarov rests on the Namurian and its lower part is characterized by Neoarchaeodiscus incertus, N. stillus, N. timanicus, and Asteroarchaeodiscus ex. gr. baschkiricus and is probably Bashkirian in age. The upper part of the Makarov is thought to be Moscovian in age and carries Archaeodiscus pauxillus, A. krestovnikovi, Planochaediscus stitus, Neoarchaeodiscus rugosus, and Planospirodiscus minimus.

The Colodmin Series is thought to be of Upper Carboniferous age and contains Asteroarchaeodiscus subbaschkiricus, Neoarchaeodiscus accuratus, N. collatatus, and Archaeodiscus commutabilis.


Primarily a discussion of the stratigraphy and fusulinid zonation of the Middle Carboniferous sediments (Namurian-Bashkirian-Moscovian) of central Asia, U.S.S.R. Reference is made to a number of previously described species of smaller foraminifers and it is noted that species of the families Archaeidae, Bradyinidae, and Palseotextulariidae provide reliable local stratigraphic markers.
CONTRIBUTIONS FROM THE CUSMAN FOUNDATION FOR FORAMINIFERAL RESEARCH


Primarily a fusulind paper describing the Permian microfauna from the Sikhote-Alin' Range, of the eastern part of the U.S.S.R. In addition, 3 new species of smaller foraminifers are described and illustrated by whole-specimen drawings and thin-section photomicrographs: Nodosaria vasiljevi, N. grandecamerata, and Dentalina orienta.


The writer describes three Middle Carboniferous and Lower Permian foraminiferal assemblages from the Taimyr Peninsula, U.S.S.R. The microfauna consists of 36 species, of which 1 genus and 18 species are new. All forms are illustrated by thin-section photomicrographs. The new Permian species are: Reophax socioinensis, Ammobaculites permicus, Nodosaria dentaliformis, N. gigantea, N. lata, N. astritkii, N. taimyrica, Frondicularia bajurica and F. spectata. The new Middle Carboniferous forms are: Archaeodiscus dubius, A. commutabilis, A. enodatus, Planoarchaeodiscus sebeus, P. absimilis, Neoarchaeodiscus accuratus, N. collatatus, Planospiridiscus taimyricus n. gen., and P. effectus. Pertinent taxonomic changes include the following: Pseudoglandulina pygmeiformis (Maclay); Archaeodiscus stitus Grozdilova and Lebedeva, 1954 = Planoarchaeodiscus stitus (Grozdilova and Lebedeva); Archaeodiscus rugosus Rauser, 1953 = Neoarchaeodiscus rugosus (Rauser); Archaeodiscus tunicatus Rettinger, 1953 = Neoarchaeodiscus tunicatus (Rettinger); and Archaeodiscus minimus Grozdilova and Lebedeva, 1953 = Planospiridiscus minimus (Grozdilova and Lebedeva).


The writer presents a summary report of the Commission on the stratigraphy of the Carboniferous by the National Committee of Soviet Geologists. The purpose of this commission is to see that a generalized standard classificatory scheme of the Carboniferous subdivisions can be prepared and presented for discussion and acceptance. Such points as the entity of the Carboniferous System, the division of the Carboniferous into two systems or sub-systems, the boundaries of the Carboniferous, and the biotic subdivision of the Carboniferous are all discussed in detail. Mention is made of a number of fusulinid and small-foraminifer genera that appear to have excellent stratigraphic potential.


Stratigraphic and paleontologic studies in eastern Nevada and western Utah show that at least eight major marine and paralic fossil communities occur in rocks of Early Permian age. The eight communities are: (1) palaotextulariid, (2) fusulimid, (3) coral, (4) dictyoclostoid-Composita, (5) chonetoid, (6) Heteralosia, (7) nuculanid, and (8) ephemidit. The first five communities probably required a salinity close to 35 ppm. The palaotextulariid community (consisting of Palaotextularia, Cribrigerina, Palaeobigerina, and Climacamina) probably lived at a depth of 50-70 m; fusulinids at 20-50 m; and corals at 10-30 m. The dictyoclostoid-Composita and chonetoid communities may have lived at a depth of a 4-10 m, the latter in an environment of lower energy level than the former. The Heteralosia, nuculanid, and ephemidit communities apparently were euryhaline and occupied very shallow bottoms. The writer notes that the smaller foraminifer Globovalvulina [sic] is also present in some samples of the palaotextulariid community. [See Stevens, 1965, for a similar study on Middle Pennsylvanian rocks exposed near McCoy, Colorado.]


In the Lower Carboniferous rocks of southwestern Wales, United Kingdom, four principal carbonate facies can be recognized in the Dinantian rocks: (1) "zaphrentid-phase" facies, (2) "standard" facies, (3) "lagoon-phase" facies, and (4) reef facies. The "zaphrentid-phase" facies was deposited in deeper and quieter water on the southern edge of the shelf. The "standard facies" extended over the greater part of the shelf and represents clear, shallow, agitated waters. The "lagoon-phase" facies represents the local development of restricted coastal flats on the margins of the landmass as a result of mid-Dinantian tectonic movements. In the southern part of the shelf, reefs grew in response to this widespread shallowing of the sea. The writer reports that all of the above facies yield smaller foraminifers, i.e., plectogyrids, earlandiids, endothyrids, and tournayellids.

142. TEOĐOROVITCH, G. I., BAGDASAROVA, M. V., GROZDILOVA, L. P., LEBEDEVA, N. S., and FOTIEVEVA, N. N., 1963, Stratigraphy of the upper Tournaissian

From the Lower Carboniferous rocks of the west side of the southern Ural Mountains a continuous sequence of carbonate rocks (upper Tournaisian-lower Viséan) contain an excellent foraminiferal microfauna. The writers recognize the following four horizons: (1) the Cherepet, containing Chertyshinella glomiformis, C. tumula, Tournayella sp., and Spiroplectammina tschernyschienensis [= Palseo­spiroplectammina]; (2) the Chikman Horizon with Plectogyra latispiralis [= Latendothyra], P. costifera [= Spinoendothyra], P. septima, Haplogh­mella sp., Lituotubella? sp., Tournayella sp., and Palaeotextularia ex. gr. diversa; (3) the strata above the Chikman or “upper Kizel” of Tournaisian age, containing Plectogyra costifera [= Spinoendothyra], Tournayella moelleri, Haplogh­mella sp., Tetra­taxis obtusus, and T. expansus; and (4) the Usuyala Horizon of Viséan age which carries the first Eo­staffella, Tetra­taxis spp., and Plectogyra costifera [= Spinoendothyra]. The writers claim that due to a conspicuous sedimentation break, this microfauna is not present in the Donbass region.


Primarily, a paper on the occurrence and distribution of Late Paleozoic fusulinid zones in Japan, but mention is made of a number of previously described smaller foraminiferal species that are associated with the fusulinid assemblages.


From the Upper Paleozoic of the Soviet Arctic, the Tiksin Horizon contains Archaeaspidas aff. A. kilymaensis, A. aff. A. pauxillus, A. krestovnikovi, Planooarchaeaspidas cf. P. stilus, and P. aff. A. spirilio­noides, all of which suggest a Namurian to Bash­kirian age.

The Makarov Horizon is subdivided into two zones, both Bashkirian in age. The contained smaller foraminifers are: Archaeaspidas commutabilis, A. dubius, A. endodatus, A. krestovnikovi, A. pauxillus, A. donetzianus, A. volgurensis, Planooarchae­aspidas stilus, P. absimilis, Asteroarchaeaspidas sub­baschkiricus, Neoarchaeaspidas ruginosus, N. tinarmicus, N. incertus, N. collallatus, Planospiro­discus minimus, and P. taymiricus.

The Tourousov Zone is Sakmorian in age and contains abundant nodosarids. [See Solomina 1962, and Sossipatova 1962, for a microfaunal comparison.]


The lateral distribution of Pennsylvanian foraminifers is demonstrated for the marine horizons of the Wasserfallzone from the Ruhr district of West Germany. The possibility of using Foraminifera (totally agglutinated microfauna) as palaeo­geographical indicators for this region is considered and discussed in detail. One figure shows the lateral distribution pattern as presently documented.


The writer lists previously described species of Lower Carboniferous (Tournaisian-Namurian) smaller foraminifers that occur in the Late Paleozoic rocks of central Kazakhstan, U.S.S.R. A brief discussion of the stratigraphic value of smaller foraminifers is also included.


The writers briefly discuss the microfaunal characteristics of the Namurian beds of the northwestern part of the Dnieper-Donets Lowlands, U.S.S.R. (Ukraine). A number of previously described species of smaller foraminifers and fusulinids are mentioned.


Primarily a paper on the Lower and Middle Carboniferous stratigraphy and facies of the Bashkir region of the Soviet Union.

A dozen districts of the Bashkir have displayed a stratigraphically consistent pattern of foraminiferal assemblages; these are summarized as follows: (1) the lower boundary of the Carboniferous is drawn at the base of the Endothyra communis Zone; (2) the Malevka-Upinsk intervals are characterized by abundant monolocular forams (Bi­sphaera, Parathurammina) interspersed with Tour­nayella aff. T. minuta and relict Endothyra com­
munis; (3) the Cherepet Horizon key microfossils are Tournayella minuta, Cherinyshinella glomiformis, Spiropectammina [= PalaeoSpiropectammina] tschernyshinensis; (4) Endothyra aff. E. spinosa [= Spinoendothyra], Endothyra naliivkini, and Tournayella molleri are common in the Kizel Horizon; (5) the Viséan begins with a widespread unconformity of non-marine strata over lain by Tula microfossils—Endothyra prisca, E. similis, Archaeodiscus krestovnikovi, A. spirillinoides, Eostaffella [now Dainella] tujmasensis, and Endothyra [now Endothyranopsis] crassa; (6) the Aleksin Horizon carries Endothyra [now Endothyranopsis] crassa var. sphaerica, Endothyra prisca, E. similis, and E. [now Globoenothyra] globulus; (7) from the Mikhailov and Venev Horizons the following forms are noted: Endothyra similis, E. [now Globoenothyra] globulus var. numerabilis, E. [now Globoenothyra] paula, Endothyra omphalota, Monotaxis [now Howchinia] gibba, Bradyina rotula, Tetrataxis dentata, and T. paraminima; and (8) the forms Archaeodiscus rugosus, A. timanicus, and A. bashkiricus, along with species of Globivalvulina, are abundant in the Protva Horizon.


From the Upper Permian rocks of China (Hunan? Province) two new genera and seven new species of smaller foraminifera are described and illustrated by thin-section photomicrographs. The new forms are Colaniella minima, C. pulchra, C. xikouensis, C. lepida, Pseudocolaniella xufulingensis n. gen., Paracolaniella leei n. gen., and P. inflata. In the present paper, previous works pertaining to the genus Colaniella are briefly reviewed and some misinterpretations regarding the internal structure are pointed out. These genera and others, including Wanganella Sosrina, are tentatively referred to Colaneillinae Fursenko, but the writer feels that their complicated internal structure and their restricted stratigraphic occurrence (Upper Permian) may justify a new family, which he suggests be called Colaniellidae.

DISTRIBUTION OF ARTICLES
ACCORDING TO GEOLOGIC AGE AND CATEGORY

CAMBRIAN
7, 8
ORDOVICIAN
4, 6, 7
SILURIAN
5, 6, 9, 10, 15, 26
DEVONIAN
1, 2, 3, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 43, 58, 114, 125, 130
MISSISSIPPIAN
PENNSYLVANIAN
38, 41, 42, 43, 46, 51, 52, 55, 64, 68, 71, 72, 73, 79, 80, 81, 84, 86, 89, 91, 95, 96, 98, 100, 102, 104, 109, 110, 111, 112, 116, 117, 120, 121, 123, 124, 129, 135, 136, 138, 139, 143, 144, 145, 147, 148, 149
PERMIAN
39, 53, 54, 59, 67, 69, 70, 74, 75, 78, 89, 90, 92, 103, 107, 122, 129, 132, 137, 138, 140, 144, 150
GENERAL
5, 6, 11, 20, 26, 60, 64, 65, 66, 101, 114, 115, 118, 139
CONTRIBUTIONS FROM THE CUSHMAN FOUNDATION
FOR FORAMINIFERAL RESEARCH
VOLUME XIX, PART 2, APRIL, 1968

349. DISCOCYCLINA FROM PONDICHERRY, SOUTH INDIA
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ABSTRACT
The foraminiferan genus Discocyclina is represented by two species, D. ramaraoi Samanta and D. furoni n. sp., in the Palaeocene-Early Eocene sediments of Pondicherry, South India. A detailed account of the new species is given and the variation in the shape of the test of D. ramaraoi is discussed and illustrated.

INTRODUCTION
In South India the Early Tertiary marine sediments are best exposed in the Pondicherry area. Here, the marine Tertiary sequence is made up of the Pondicherry Formation (Palaeocene), the Discocyclina-bearing Limestone (Upper Palaeocene-Early Lower Eocene) and the Nummulitic Limestone (Late Cusian). Of these three units, the Pondicherry Formation occurs as an outcropping unit while the other two are known from subsurface only.

These Pondicherry units are highly fossiliferous and contain abundant smaller and larger foraminifera. Among the larger foraminifera, Discocyclina is the most abundantly represented genus. A detailed study of the discocyclines occurring in the Pondicherry Formation and the Discocyclina-bearing Limestone has been carried out by the author and the genus is found to be represented by two species, namely D. ramaraoi Samanta and D. furoni n. sp. D. ramaraoi occurs only in the Pondicherry Formation, while D. furoni is present in both the units. An account of D. furoni is given in a previous paper (Samanta, 1967). In the present paper the new species is described and illustrated and remarks on the morphological variation of D. ramaraoi are included.

ACKNOWLEDGEMENTS
The author is indebted to Professor R. Furon and R. Laffitte, Paris, for the samples of Discocyclina-bearing Limestone; to Dr. Madeleine Neumann, Paris, for topotypes of Discocyclina pratti (Michelin); to Mr. M. V. A. Sastry, Calcutta, for permission to examine materials from the Pondicherry Formation deposited in the collections of the Geological Survey of India; to Professor N. Rajagopalan, Madras, for valuable discussion of the stratigraphy and micropalaeontology of the Early Tertiary sediments of Pondicherry; and to Dr. J. R. Haynes for reading the manuscript.

SYSTEMATIC DESCRIPTIONS
Family DISCOCYCLINIDAE Galloway, 1928
Genus Discocyclina Gumbel, 1868
Discocyclina furoni Samanta, n. sp.
Plate 5, figures 1-6; plate 6, figures 1-2; text fig. 2, figures A-G
Discocyclina pratti (Michelin) - Furon, 1941, (not Michelin, 1846), France Bur. Etudes Géol. et Minières Coloniales, Publ. no. 17, p. 18, pl. 2, figs. 2-4.

Material. Discocyclina-bearing Limestone: About 100 specimens were separated from two small pieces of Discocyclina-bearing Limestone provided by Professor R. Laffitte of Museum National d'Histoire Naturelle, Paris, from the Wathelet Collection [Coll. no. 1491; recovered from a boring in Pondicherry near the "Grand Etang" at depths between 150 and 180 metres (Furon, 1941, p. 18)]. Both microspheric and megalospheric generations are represented; of the former, twenty-five specimens were studied in equatorial and fifteen in vertical section; of the latter, one specimen was examined in equatorial section. In addition, the three thin sections of Discocyclina-bearing Limestone figured by Furon (1941, pt. 2, figs. 2-4) were also available for examination.

Pondicherry Formation: Abundant material was collected by the author from the stream-channel section east of Sedarappattu village (text. fig. 1), the type locality for the Pondicherry Formation (Rajagopalan, 1965, p. 115). Only megalospheric specimens were examined. Ten specimens were studied in equatorial and five in vertical section. Numerous vertical sections were also examined in rock sections.

Diagnosis. Test small, thin, discoidal, with uniformly papillate surface. Megalospheric embryonic apparatus small and neprolepideine. Equatorial chambers rectangular and increase appreciably in radial diameter and in height with ontogenesis. Low, slit-like to quadrate lateral chambers are arranged between thick roofs and floors.

Description of megalospheric generations. The test is small, discoidal, flat or rarely curved, with or without a small umbonal elevation not distinctly demarcated from the rest of the test. Very often one side of the test is more convex than the other. Surface of the test covered with small, subrounded, fine papillae, almost uniform in size throughout the
test. Diameter of test varies from 1.4 to 5.7 mm., thickness from 0.3 to 0.65 mm.

In tangential section the small, subcircular pillars are surrounded by 4-6 small, polygonal lateral chambers that are very variable in shape and size. The walls between the chambers are straight. The pillars are separated by one row of lateral chambers. The diameter of pillars varies from 15 to 37μ and the distance between the pillars from 20 - 50μ.

In equatorial section the small, bilocular megalospheric embryonic apparatus consists of a subcircular to elliptical protoconch usually embraced up to 3/4 by the large, crescentic to reniform deuteroconch (text fig. 2). Often the outer wall of the embryonic apparatus is triangular to quadrate in outline. In vertical section the protoconch is circular to elliptical and the deuteroconch is semicircular to triangular in outline. The embryonic apparatus is, therefore, of the nephrolepine type. A eulepidine arrangement of the embryonic chambers is rarely observed. The maximum diameter of the protoconch varies from 88 to 187 and the deuteroconch from 150 to 337μ; the distance across both chambers varies from 162 to 312μ and the height of the embryonic apparatus from 125 to 150μ.

The periembyronic equatorial chambers are rectangular to pentagonal in outline and are either tangentially or radially elongate. Their arrangement is of the type γ. The two principal auxiliary chambers are very often tangentially much elongated and are larger than the other chambers in the periembyronic ring. There are about 16 to 30 chambers in the periembyronic annulus, which is frequently irregular in its width. The radial diameter of the periembyronic equatorial chambers varies from 20 to 62μ and the tangential diameter from 20 to 92μ.

The equatorial chambers are rectangular in outline and are arranged in concentric annuli that are very irregular in their courses and in width. The chambers are normally radially elongate but may be square or tangentially elongate near the centre in some specimens. The radial diameter of the equatorial chambers always increases towards the periphery, while the tangential diameter remains almost unchanged during ontogenesis. The height of the equatorial chambers increases considerably from near the centre to the periphery. The annular walls are thicker than the radial walls, which usually alternate in adjacent annuli. Near the centre the annular walls are gently convex, but they are prominently convex outwards near the periphery. The roof and floor of the equatorial chambers become thicker with ontogenesis. The annular stolons are situated on the proximal side of the radial chamber walls. The radial diameter of the equatorial chambers varies from 12 to 62μ, the tangential diameter from 16 to 37μ, and the height from 12 to 62μ. The annular walls are about 5 to 10μ thick, the radial walls 4 to 7μ thick and the roofs and floors of the equatorial chambers 10 to 25μ thick.

The lateral chambers, when observed in vertical section, vary considerably in shape, size and arrangement in different specimens as well as in different parts of the same specimen. The chamber cavities are low, slit-like, oval to quadrate in shape.
The slit-like cavities are irregularly arranged, while the more open chamber cavities are comparatively regular in arrangement. Usually, the chamber cavities near the periphery are more open than those over the embryonic apparatus. There are about 5 to 9 lateral chambers on each side of the embryonic apparatus. The length of the lateral chambers varies from 20 to 62\(\mu\) and the height from 5 to 15\(\mu\). The thickness of the roofs and floors varies from 6 to 15\(\mu\).

**Measurements.** See tables 1 and 2 for measurements of the equatorial and vertical sections of megaspheric specimens.

**Occurrence and age.** Discocyclina furoni occurs in both the Pondicherry Formation and the Discocyclina-bearing Limestone. In the Pondicherry Formation it is quite rare and occurs in association with D. ramaraoi, the most abundant larger foraminiferal element present in the unit. On the basis of the contained planktonic foraminifera and nanofossils, the Pondicherry Formation is considered to be of Palaeocene age (Rajagopalan, 1966).

*D. furoni* is the only larger foraminifera present in the Discocyclina-bearing Limestone, which is made up essentially of the tests of this species. Here, it occurs associated with abundant smaller foraminifera, including some index planktonic species, some bryozoa and few ostracodes. On the basis of the presence of Globigerina horribrookii Bronnimann, *G. linaperta* Finlay, Globorotalia acuta Toulin, *G. aequa* Cushman and Renz, *G. convexa* Subbotina and *G. imitata* Subbotina, the Discocyclina-bearing Limestone is considered to be Upper Palaeocene - Early Lower Eocene in age (Samanta, 1966). *D. furoni* n. sp. is, therefore, Palaeocene to Early Lower Eocene in age.

**Holotype.** The specimen figured in Plate 5, fig. 1, is from the Discocyclina-bearing Limestone recovered from a boring in Pondicherry near the "Grand Etang" (which probably refers to the Usteri tank (see text fig. 1)) at depths between 150 and 180 metres.

**Repository.** Holotype and other figured specimens are deposited in the collections of the Geology Department of the University of Calcutta.

**Etymology.** This species is named for Professor R. Furon, Paris, in recognition of his contribution to the geology of the Pondicherry area.

**Remarks.** In its small, thin, discoidal test, nephrolepidine megaspheric embryonic apparatus and low lateral chambers between thick roofs and floors, *D. furoni* n. sp. is quite distinctive and cannot be closely compared with any described species of the genus. It shows some relationship to *D. ramaraoi* Samanta, with which it occurs associated in the Pondicherry Formation, only in possessing small nephrolepidine embryonic apparatus. In all other diagnostic features they are different. It can also be very easily distinguished from other Indian species of Discocyclina with nephrolepidine embryonic apparatus [*e.g., D. augustae* Weijden, *D. pygmaea* Henriot and *D. sp.* (Nagappa, 1959)] by the shape of the test and the structure of the lateral chamber layers. *D. furoni* possesses the largest megaspheric embryonic apparatus among the Indian representatives of the genus having a nephrolepidine megasphere.

The previous assignment of these Pondicherry specimens to *D. pratti* (Michelin) (Furon and Lemoine, 1938; Furon, 1941, and Gowda, 1964) was obviously due to the lack of a detailed examination of the sample and to insufficient knowledge of the European form. *D. pratti*, as it is known at present through the systematic studies of Van der Weijden (1940) and Neumann (1958) is characterized by having a test of moderate size, large, eulepidine to multilocular megasphere, and long moderately open, rectangular lateral chambers between thin roofs and floors. *D. pratti* (Michelin) and *D. furoni* n. sp. actually belong to two distinctly different groups of species and are not comparable with each other. Sections of topotypes of *D. pratti* (Michelin), kindly donated by Madeleine Neumann of Paris University, are illustrated here (text fig. 2h; Plate 6, fig. 3) to show the difference from *D. furoni*. It should be mentioned here that there is no authentic report of the occurrence of *D. pratti* (Michelin) outside the European region (Neumann, 1958).

**Discocyclina ramaraoi** Samanta

Plate 6, figures 4-17


Samanta: *Discocyclina* from South India
Samanta: *Discocyclina* from South India
Remarks. After the paper on Discocyclina rama-raoi was sent for publication, Setty (1966) reported the rare occurrence in the Pondicherry Formation of discocyclines having tests of strikingly unusual shape. An examination of Setty’s sections at Bangalore has revealed that they are identical with D. rama-raoi in such diagnostic internal features as the megalospheric embryonic apparatus and the equa-

### TABLE 1

Measurements of Equatorial Sections of *Discocyclina furoni* Samanta, n. sp., (Form A)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of test (mm.)</td>
<td>2.0+</td>
<td>1.7+</td>
<td>2.2+</td>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Embryonic chambers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameters of protoconch (μ)</td>
<td>150 x 150</td>
<td>75 x 100</td>
<td>150 x 187</td>
<td>125 x 137</td>
<td>88 x 88</td>
</tr>
<tr>
<td>Diameters of deuterococh (μ)</td>
<td>200 x 240</td>
<td>137 x 150</td>
<td>250 x 312</td>
<td>175 x 225</td>
<td>125 x 150</td>
</tr>
<tr>
<td>Distance across both chambers (μ)</td>
<td>250</td>
<td>175</td>
<td>312</td>
<td>225</td>
<td>162</td>
</tr>
<tr>
<td>Thickness of outer wall (μ)</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Periembryonic chambers Number</td>
<td>22</td>
<td>16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial diameter (μ)</td>
<td>20 - 50</td>
<td>30 - 40</td>
<td>25 - 62</td>
<td>20 - 37</td>
<td></td>
</tr>
<tr>
<td>Tangential diameter (μ)</td>
<td>37 - 92</td>
<td>25 - 62</td>
<td>28 - 43</td>
<td>20 - 25</td>
<td></td>
</tr>
<tr>
<td>Equatorial chambers (Near centre)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radial diameter (μ)</td>
<td>16 - 37</td>
<td>22 - 25</td>
<td>25 - 45</td>
<td>20 - 37</td>
<td>12 - 25</td>
</tr>
<tr>
<td>Tangential diameter (μ)</td>
<td>20 - 37</td>
<td>20 - 28</td>
<td>16 - 25</td>
<td>20 - 35</td>
<td>16 - 22</td>
</tr>
<tr>
<td>(Near periphery) Radial diameter (μ)</td>
<td>Peripheral part not preserved</td>
<td>37 - 50</td>
<td>31 - 62</td>
<td>max. 62</td>
<td>25 - 37</td>
</tr>
<tr>
<td>Tangential diameter (μ)</td>
<td>22 - 28</td>
<td>25 - 30</td>
<td>20 - 31</td>
<td>22 - 25</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 2

Measurements of vertical sections of *Discocyclina furoni* Samanta, n. sp., (Form A)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of test (mm.)</td>
<td>5.2+</td>
<td>3.7</td>
<td>3.5+</td>
<td>3.5</td>
<td>3.2+</td>
</tr>
<tr>
<td>Thickness at centre (mm.)</td>
<td>0.5</td>
<td>0.4</td>
<td>0.45</td>
<td>0.31</td>
<td>0.3</td>
</tr>
<tr>
<td>Embryonic chambers Length (μ)</td>
<td>225</td>
<td>220</td>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (μ)</td>
<td>125</td>
<td>125</td>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Embryonic apparatus not preserved</td>
<td></td>
<td></td>
<td></td>
<td>225</td>
<td></td>
</tr>
<tr>
<td>Equatorial chambers Height near centre (μ)</td>
<td>20</td>
<td>15</td>
<td>20</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Height near periphery (μ)</td>
<td>50</td>
<td>62</td>
<td>37</td>
<td>31</td>
<td>37</td>
</tr>
<tr>
<td>Lateral chambers Number (on one side of the embryonic apparatus)</td>
<td>9</td>
<td>8</td>
<td>8</td>
<td>X</td>
<td>5</td>
</tr>
<tr>
<td>Length (μ)</td>
<td>31 - 62</td>
<td>20 - 50</td>
<td>37 - 62</td>
<td>31 - 50</td>
<td>20 - 30</td>
</tr>
<tr>
<td>Height (μ)</td>
<td>5 - 12</td>
<td>5 - 12</td>
<td>6 - 12</td>
<td>10 - 15</td>
<td>10 - 12</td>
</tr>
<tr>
<td>Thickness of roofs and floors (μ)</td>
<td>10 - 15</td>
<td>10 - 15</td>
<td>6 - 10</td>
<td>6 - 10</td>
<td>8 - 10</td>
</tr>
</tbody>
</table>

### EXPLANATION OF PLATE 6

**Figs.**


3. *Discocyclina pratii* (Michelin). (Form A.) Central part of the vertical section of topotype, × 45.

4-17. *Discocyclina rama-raoi* Samanta. (Form A.) External views showing the variation in the shape of the test, × 10. All from the Pondicherry Formation exposed in the stream-channel section east of Sedarappattu village.
torial chambers. Moreover, from an examination of a large number of samples from the Pondicherry Formation collected from the stream channel section east of Sedarappattu village, it is observed that there is a gradation in shape of test from the normal lenticular variety to the unusual type (see Plate 6, figs. 4-17). Accordingly, the specimens of unusual shape are identified here as *D. ramaraoi*. This species is, thus, found to be unique among the Indian Palaeocene representatives of the genus in exhibiting a remarkable variation in the shape of the test.

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CONTRIBUTIONS FROM THE CUSHMAN FOUNDATION FOR FORAMINIFERAL RESEARCH

VOLUME XIX, PART 2, APRIL, 1968

RECENT LITERATURE ON THE FORAMINIFERA

Below are given some of the more recent works on the Foraminifera that have come to hand.

ADAMS, C. G. Tertiary Foraminifera in the Tethyan, American, and Indo-Pacific provinces. —Systematics Assoc. Publ. No. 7, 1967, p. 195-217, tables 1-5. —Circulation of surface oceanic waters may account for two different provinces in the circumtropical zone (Central American and Indo-Pacific) besides the old Tethys province. Genera of larger Foraminifera present in the 3 provinces are tabulated for ages between upper Paleocene and Recent.


BUZAS, MARTIN A. An application of canonical analysis as a method for comparing faunal areas. —Jour. Animal Ecol., v. 36, Oct. 1967, p. 563-577, text figs. 1-5 (map, graphs), tables 1-6. —Method is applied to Phleger's 1956 study of living and total populations of Foraminifera off the central Texas coast. Results may be useful in defining biofacies.

Foraminifera from the Hadley Harbor complex, Massachusetts. —Smithsonian Misc. Colln., v. 152, No. 8, Feb. 16, 1968, p. 1-26, text figs. 1-4 (maps), tables 1, 2. —Twenty-two species found over 2 years.


CLOSS, DARCY, and DE MEDEIROS, VERA M. F. Thecamoebina and Foraminifera from the Mirim Lagoon, southern Brazil. —Iheringia, Zoologia, No. 35, Sept. 9, 1967, p. 75-88, text figs. 1, 2 (map, check list). —Six species of brackish Foraminifera.


CORDEY, W. G. The development of Globigerinoides ruber (D'Orbigny 1839) from the Miocene to Recent. —Palaeontology, v. 10, pt. 4,
Dec. 1967, p. 647-659, pl. 103, text figs. 1-5 (drawings, phylogenetic diagrams, columnar sections).—Restudy of specimens of *G. riber* reveals 2 unrelated lineages. The ancestor of the earlier one, in lower to middle Miocene, was *G. quadrilibatus altaiperturthus* and *G. quadrilibatus* s.s. Specimens of this earlier lineage are referred to *G. subquadriatus* and the species is redefined. The ancestor of the later lineage, in uppermost Miocene or basal Pliocene to Recent, was a form similar to *G. obliquus*.


**Gibson, Thomas G., and Schlee, John.** Sediments and fossiliferous rocks from the eastern side of the Tongue of the Ocean, Bahamas.—Deep-Sea Research, v. 14, No. 6, Dec. 1967, p. 691-702, text figs. 1-4 (map, bottom photographs), tables 1, 2.—Late Tertiary to Recent age of rocks is based on planktonic Foraminifera and depth is interpreted from benthonic species and planktonic/benthonic ratios.


**Gudina, V. I., and Sadova, Kh. M.** Novyyj Rod *Alabaminoides* (Foraminifera) i ego Vidy, in Foraminifery Mezozoja i Kainozoja Zapadnoj Sibiri, Taimyra i Dal'nego Vostoka.—Akad. Nauk SSSR, Sibirskoe Otdel., Instit. geol. geo-


**Hedley, R. H., Hurdle, C. M., and Burdett, I. D. J.** The marine fauna of New Zealand: Intertidal Foraminifera of the *Corallina officinalis* zone.—New Zealand Oceanographic Instit., Mem. No. 38, 1967, p. 1-86, pls. 1-12, text figs. 1-60 (map, drawings), tables 1-3.—Beautifully illustrated systematic catalog includes 63 species (3 new). Study based on 10 widely scattered samples around the islands.


**Foraminiferos Planctonicos del Oligoceno Superior en la Provincia de Pinar del Rio, Cuba.**—Instit. Nac. Recursos Hidraulicos, Estratigrafia y Carsologia, Publ. Especial No. 4, 1967, p. 5-8, pl. 1.—Six species illustrated.

**Iva, Mariana, Gheorghian, Mihaela, and Gheorghian, M.** Sur la présence du groupe de *Cibicides* (*Cibicides*) *dampelae* Bycova et Chramaja dans l’Eocène Supérieur et l’Oligocène Inférieur du NW de la Transylvanie (French résumé of Rumanian text).—Dari de Seama ale Sedintelor, v. 53, pl. 2a, 1965-66 (1967), p. 17-24, 1 pl., text figs. 1-3 (map, graph, phylogenetic diagram).—Biometric study reveals an upper Eocene subspecies and a lower Oligocene subspecies, both new.
Ivanova, E. F. Novye Vidы Foraminifer iz Otlozen-
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skoj Vpadyin i Severnogo Tajmyra, in Fora-
minifery Mezozoja i Kainozoja Zapadnoj Sibiri, 
Tajmyra i Dal’nego Vostoka.—Akad. Nauk 
SSSR, Sibirskoe Otdel., Instit. geol. geofiz., 
1967, p. 5-14, pls. 1-3, text figs. 1, 2 (map, 
range chart).—Four new Jurassic (lower Vol-
gian) species from the Taymyr Peninsula.

Foraminifery iz Otlozenjeni Verkhnogo Volzhsko-
go Jarusa Khatangskoj Vpadyiny, in Foramin-
ifery Mezozoja i Kainozoja Zapadnoj Sibiri, 
Tajmyra i Dal’nego Vostoka.—Akad. Nauk 
SSSR, Sibirskoe Otdel., Instit. geol. geofiz., 
1967, p. 15-25, pls. 4, 5, text figs. 1, 2 (map, range 
chart).—Five new Jurassic (upper Vol-
gian) species from the Khatanga depression.

Jenkins, D. Graham. Planktonic foraminifer-
ous zones and new taxa from the lower Miocene 
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chart, drawings).—A new species and 3 new 
subspecies of Globorotalia. Ranges of 80 
planktonic species indicated between lower Mi-
ocene and Recent.

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per Miocene and Lower Pliocene of New Zea-
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v. 10, No. 4, Oct. 1967, p. 989-1008, 3 pls.— 
Fourteen new species, one genus new: Ruaki-
turia (type species R. pseudorobusta n. sp.) in 
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(upper Miocene, New Zealand).—New Zea-
1967, p. 1051-1063, text fig. 1 (map), table 1 
(correl. chart).—Depth interpretations and 
correlation based on forams. Intense cooling 
in uppermost Miocene is indicated by left-
coiling Globigerina pachyderma. Shallow-water 
and deep-water facies of Kapitean correlated 
by the Globorotalia crassaformis bioseries.

Kent, Harry C. Microfossils from the Niobrara 
Formation (Cretaceous) and equivalent strata 
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1433-1456, pls. 183, 184, text figs. 1-8 (map, 
stratigraphic sections, range charts, graphs).

—About 30 species, 3 species and 1 subspe-
cies new.

Kisel’man, Eh. N. Heterostomella foveolata 
(Marsson)—Kharakternyj vid iz Verkhne-
go Maastrichti Zapadno-Sibirskoj Nizmennosti, 
in Foraminifery Mezozoja i Kainozoja Zapad-
noj Sibiri, Tajmyra i Dal’nego Vostoka.— 
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erostomella foveolata in the upper Maastrich-
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Japan.—Bull. Osaka Mus. Nat. Hist., No. 20, 
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monia and Elphidium, the other by miloliids.

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—Geologie, Berlin, Jahrgang 16, Heft 6, 1967, 
p. 718-726, text figs. 1-5 (graphs, diagram, 
drawing).

Lindenberg, H. G. Die Bolivinen (Foram.) der 
Häringer Schichten. Mikropaläontologische Un-
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bietes.—Boll. Soc. Paleont. Ital., v. 4, No. 1, 
1965, p. 64-160, Anlage 1-4 (columnar sections, 
graphs, drawings), text figs. 1-32 (maps, dia-
gram, range chart, drawings, graphs).—Eight-
teen species (3 new and 1 given a new name) 
and 6 subspecies (1 new) from lower to mid-
tle Oligocene. Species studied biometrically.

Lynts, George W., and Pfister, Robert M. Surf-
ace ultrastructure of some tests of Recent Fo-
raminiferida from the Dry Tortugas, Florida. 
387-399, text figs. 1-16 (electron micrographs, 
diagram, graph), tables 1-12.—Illustrations of 
two layers in miloliids and Archaeas (an outer 
pavement-like layer and an underlying random-
ly oriented layer). Illustrations of crystal ag-
gregates on surfaces of Discorbis, Asterigerina, 
Cribroelpllidium, Amphistegina, Cymbalopore-
ta, and Fursenkoina.

Malapris-Bizouard, M. Les Lingulogavelinelles 
de l’Albien inférieur et moyen de l’Aube.—


MATSUMARU, KUNITERU. Geology of the Tomioka area, Gunma Prefecture, with a note on "Lepidocyclina" from the Abuta Limestone Member.—Sci. Repts. Tohoku Univ., 2nd Ser. (Geol.), v. 39, No. 2, Nov. 10, 1967, p. 113-147, pls. 7, 8, text figs. 1-31 (maps, geol. sections, columnar sections, graphs, diagrams), tables 1-7.—Nephrolepidina japonica.

MATTHEWS, BARRY. Late Quaternary marine fossils from Froebisher Bay (Baffin Island, N. W. T., Canada).—Palaeogeography, Palaeoclimatology, Palaeoecology, v. 3, No. 2, Aug. 1967, p. 243-263, pls. 1, 2, text figs. 1, 2 (map, diagram), tables 1-4.—Nineteen species of Foraminifera listed.


MICHAEL, ERHARD. Die Mikrofauna des NW-Deutschen Barrême. Teil I. Die Foraminiferen des NW-Deutschen Barrême.—Palaeontographica, Suppl.-Band 12, July 1967, p. 1-176, pls. 1-26, text figs. 1-9 (diagrams, graphs), tables 1-22 (range charts, graphs, columnar sections, occur. tables).—An illustrated systematic catalog, including 141 species and subspecies (9 species and 3 subspecies new), and paleoecologic interpretations.


NORVANG, AKSEL. The internal tooth of Bulimina striata d'Orbigny (Foraminifera), a preliminary notice.—Vidensk. Medd. fra Dansk Naturh. Foren., bd. 129, 1966, p. 285, 286, pl. 24.—Reconstruction from serial sections showing internal tooth passing through final and penultimate chambers.

OHM, UWE. Zur Kenntnis der Gattungen Reinholdella, Garantella und Epistomina (Foramin.).—Palaeontographica, Abt. A, Band 127, Lief. 3-6, Sept. 1967, p. 103-188, pls. 16-21, text figs. 1-55 (drawings, graphs), tables 1-12.—Description and illustrations of 37 species (6 new and 5 indeterminate) and 7 subspecies (5 new) mostly in Epistomina.


RICHTER, GOTTHARD. Faziesbereiche rezenter und subrezenter Wattensedimente nach ihren Foraminiferen-Gemeinschaften.—Senckenbergiana lehthea, Band 48, No. 3/4, Aug. 17, 1967, p. 291-335, text figs. 1-15 (maps, graphs, diagram), tables 1, 2.—Foraminifera populations (living and dead) from 6 different facies. Ecological conditions in the sub-Recent beneath the surface of the marsh are interpreted.


Seiglie, George A. Distribution of foraminifers in the sediments of the Araya-Los Testigos shelf and upper slope.—Caribbean Jour. Sci., v. 6, No. 3-4, Sept.-Dec. 1966, p. 93-117, text figs. 1-12 (maps), table 1.—Eleven assemblages defined, mapped, and discussed as to depth and bottom conditions.