TULANE STUDIES IN GEOLOGY

Volume 2, Number 3 June 30, 1964

THE SPECIES AND STRATIGRAPHIC DISTRIBUTION OF *CAUCASINA* AND *AEOLOMORPHELLA,* NEW GENUS (FORAMINIFERIDA)

ALFRED R. LOEBLICH, JR. and HELEN TAPPAN

CALIFORNIA RESEARCH CORP., LA HABRA, CALIFORNIA AND UNIVERSITY OF CALIFORNIA, LOS ANGELES

CONTENTS

Page

I. ABSTRACT 69
II. INTRODUCTION 70
III. KNOWN GEOLOGIC AND GEOGRAPHIC DISTRIBUTION 70
IV. ECOLOGIC RELATIONSHIPS 72
V. FAMILIAL AND PHYLOGENETIC RELATIONSHIPS 73
VI. ACKNOWLEDGMENTS 74
VII. SYSTEMATIC DESCRIPTIONS 74
A. *Caucasina* 74
1. Upper Cretaceous Species 75
2. Paleocene Species 75
3. Eocene Species 75
4. Oligocene Species 78
5. Oligo-Miocene Species 78
6. Miocene Species 82
7. *Nomina Nuda* 83
8. *Nomenclatura Aperta* 84
B. *Aeolomorphella* 84
VIII. REFERENCES 85
PLATE 1 77
PLATE 2 81

I. ABSTRACT

Species of *Caucasina* are described and figured. Two Austrian Miocene species, *Bulimina elongata* and *B. subulata,* are transferred to *Caucasina* and new Californian species erected: *C. minuta* (Paleocene, Dos Palos Shale) and *C. khalilovi* (Oligocene, Rincon Formation). *Aeolomorphella,* new genus, is based on the new species, *A. plectilis* (north Alaskan Upper Cretaceous). *Caucasina* ranges from Upper Cretaceous (Campanian) to Miocene, occurring in both Old and New Worlds. Paleoecologic implications, as well as familial and phylogenetic relationships of the Caucasininae also are discussed.

II. Introduction

The genus *Caucasina* was defined by Khalilov in 1951, and since has been widely reported in the Soviet Union from strata of Oligocene and Miocene age. The monotypic Cretaceous genus *Aeolostreptis* Loeblich and Tappan (1957) was described from the American Upper Cretaceous, but later regarded by us as a junior synonym of *Caucasina,* thus extending the geographic and geologic range to include the Upper Cretaceous of the American Gulf Coast (Loeblich and Tappan, 1961, p. 314). Eocene and Oligocene species of *Caucasina* were described by Khalilov (1958), and a new species was referred to the genus from the Eocene of France in 1961. The genus also has been reported from Yugoslavia by Sikić (1962).

Because of the distinctive morphological characters of the genus, the very limited records of its occurrence are somewhat surprising. The present compilation of previously described species is accompanied by the description of two new Californian species (of Paleocene and Oligocene age, respectively) and transfer to the genus *Caucasina* of two previously described species from the Austrian Miocene.

Because the species recorded to date have proved to be of considerable stratigraphic value, the present summary of the generic occurrence may aid in the recognition of these and additional species, in strata of other areas, and thus further increase their usefulness.

III. Known Geologic and Geographic Distribution

The earliest reported occurrence of *Caucasina* is in the Campanian, by which time the genus was present in both North America and Eurasia (fig. 1). *Caucasina tuzkoensis* was described from the Campanian of the region of the Amu Darya River and Bukhara, in Uzbek SSR, and the Kyzyl Kum of Uzbek and Kazakh SSR, central Asia (Suleymanov, 1962), and *Caucasina vitrea* (Cushman and Parker) occurs in the Selma Chalk of nearly equivalent age in Mississippi. Of nearly the same age, and perhaps derived from *Caucasina,* is the north Alaskan form *Aeolomorphella plectilis,* new species.

No Maastrichtian records are known as yet (fig. 2), but a new Danian (Paleocene) species is here described from the Dos Palos Shale of California. Another gap in the known record represents the Landenian (upper Paleocene) and lower and middle Eocene (Ypresian, Lutetian), although the *nomen nudum C. "suzakensis"* is reported from the Paleocene (Pg_1) of Fergana, central Asia (Bykova, 1960). Two species have been recorded from the upper Eocene of Azerbaijan SSR: *C. eocaenica* from the Lesser Caucasus, east Azerbaijan and the Azov Kuban basin (Khalilov, 1958; Nikitina, 1962), and *C. aziderensis* from the upper Eocene-Oligocene of

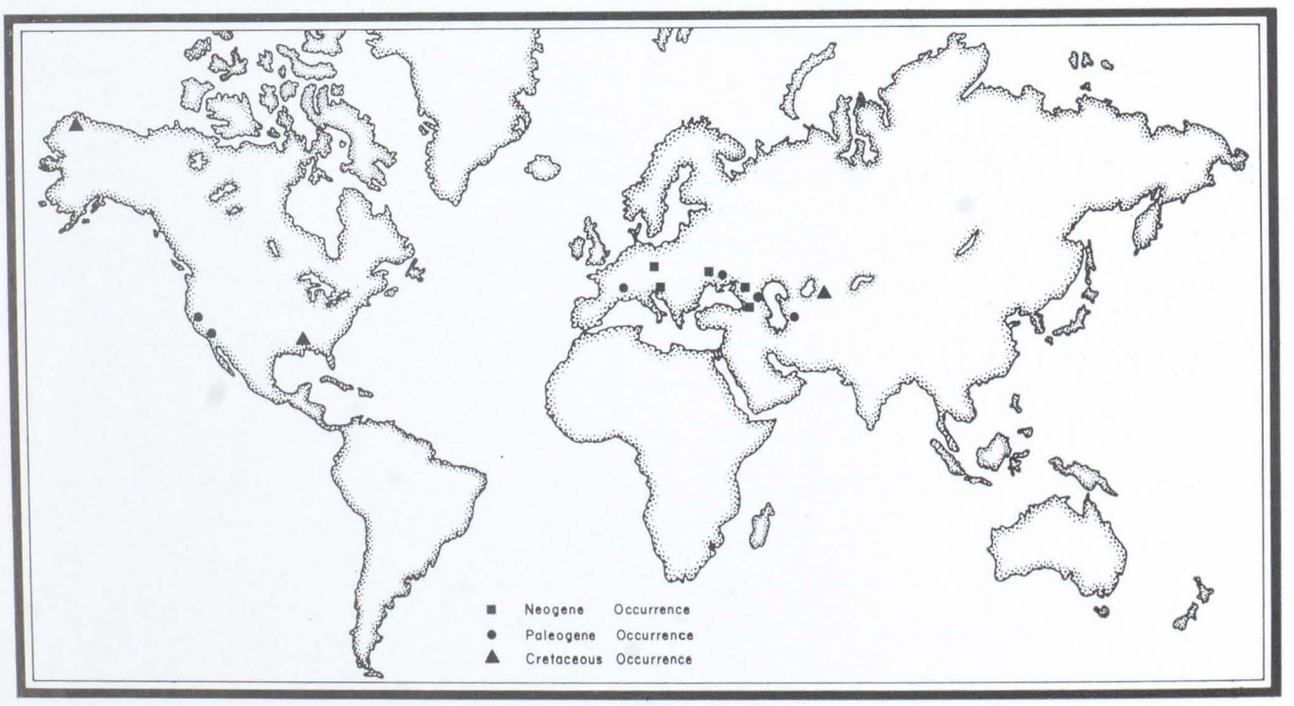

Figure 1. Occurrence of Caucasininae.

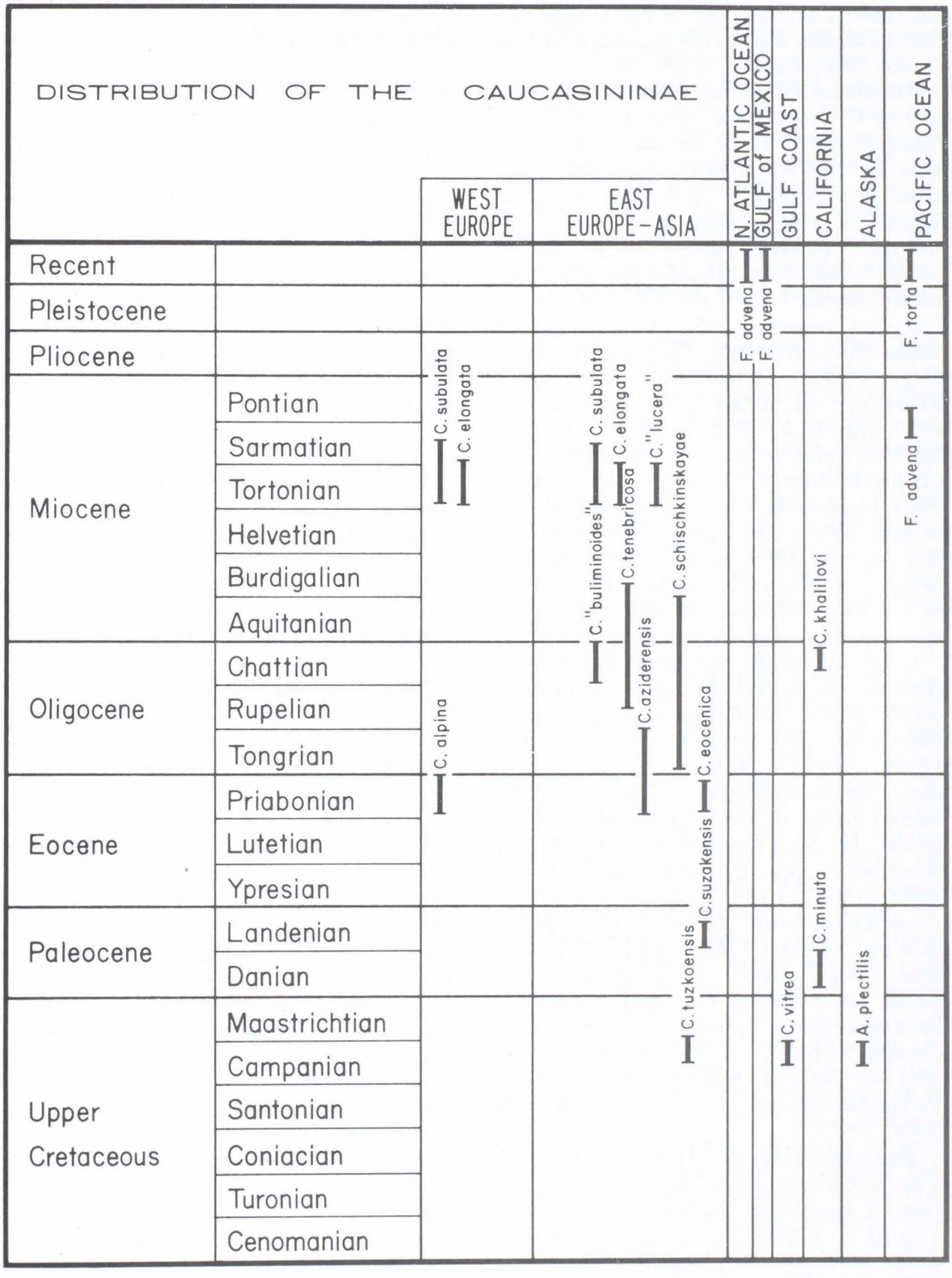
DISTRIBUTION OF THE CAUCASININAE
WEST EUROPE
EAST EUROPE-ASIA
N. ATLANTIC OCEAN
GULF of MEXICO
GULF COAST
CALIFORNIA
ALASKA
PACIFIC OCEAN
Recent
Pleistocene
Pliocene
Miocene
Pontian
Sarmatian
Tortonian
Helvetian
Burdigalian
Aquitanian
Oligocene
Chattian
Rupelian
Tongrian
Eocene
Priabonian
Lutetian
Ypresian
Paleocene
Landenian
Danian
Upper Cretaceous
Maastrichtian
Campanian
Santonian
Coniacian
Turonian
Cenomanian
F. advena
F. advena
F. advena
F. torta
C. subulata
C. elongata
C. subulata
C. elongata
C. "buliminoides"
C. tenebricosa
C. "lucera"
C. schischkinskayae
C. aziderensis
C. alpina
C. eocenica
C. suzakensis
C. tuzkoensis
C. khalilovi
C. minuta
C. vitrea
A. plectilis

FIGURE 2

the Lesser Caucasus. An upper Eocene species, *C. alpina,* also has been described from France (Espitalié and Sigal, 1961).

Additional Oligocene species are the type species *C. oligocenica* (here regarded as a synonym of *C. schischkinskayae,* as it has been by various workers, although recognized as a subspecies or distinct species by others), *C. schischkinskayae, C. tenebricosa,* and the apparently undescribed *C. "buliminoides." Caucasina schischkinskayae* has been widely reported from the Oligocene of the Crimea (Ukrainian SSR), Caucasus (Azerbaijan SSR), Armenian SSR, and the Kopet Dag (Turkmen SSR) (Samoylova, 1947; Khalilov, 1951, 1962; N. K. Bykova, 1953, 1959; Myatlyuk, 1960; Bogdanovich, 1960; Merklin, Morozova and Stolyarov, 1960; Chernyak, Bogaets, Voloshina and Khadikin, 1961; Kaptarenko-Chernousova, Golyak, Zernetskiy, Kraeva and Lipnik, 1963; Nosovskiy and Savenko, 1963; and Dmitriev and Kozhevnikova, 1963). It also has been reported in the lower Miocene of Abkhazii (northern Georgian SSR) by Dzhanelidze (1956).

Caucasina tenebricosa occurs in the Oligocene and in the mid-Miocene (Stebnikskoy beds) of the pre-Carpathians (Subbotina, Pishvanova and Ivanova, 1960, and Didkovs'kiy, 1963). References to two apparently undescribed species also occur frequently in the literature: *Caucasina "buliminoides"* has been reported from the Maykopskian beds (upper Oligocene) of the Crimea and Caucasus of the Ukrainian SSR and the Azov Kuban basin (Nikitina, 1962; Nosovskiy and Savenko, 1963) and from the Miocene (Burdigalian) of the northern Caucasus. Another form, *Caucasina "lucera,"* has been reported in the upper Tortonian (Tyachevskaya beds) of the trans-Carpathian area and Ukrainian SSR (Vyalov, Pishvanova, Petrashkevich and Grishkevich, 1962; Ivanova, 1962).

Bulimina elongata d'Orbigny from the Vienna Basin is widely reported in the Miocene of Europe and is here regarded as belonging to *Caucasina.* It has been referred to as *Neobulimina elongata* and as *"Caucasinella,"* in various publications, but the latter generic name has not been validated by a description, and the basis for its separation is not clear (N. K. Bykova, 1959; Myatlyuk, 1960; Nikitina, 1962).

An additional Austrian Miocene species, originally described as the "variety" *subulata of Bulimina elongata* is now regarded as a separate species and is here transferred to *Caucasina.* This basally spinose form also occurs in the trans-Carpathian region of the Ukrainian SSR, although there referred to *C. schischkinskayae* (Venglins'kiy, 1958).

Caucasina also has been reported from the Tortonian of Croatia, Yugoslavia (Sĭkić, 1962).

Because of the recognition of eleven valid species and three as yet undescribed, within the dozen years since the genus was described, it seems probable that additional species also will be found in other regions and strata, when their distinctive characters are noted.

IV. Ecologic Relationships

In some regions the abundance of specimens of *Caucasina* has led to recognition of a characteristic *Caucasina* complex. Other foraminifers commonly occurring with *Caucasina* include representatives of various agglutinated genera *(Bathysiphon, Spiroplectammina, Textularia, Haplophragmoides)* and *Rotalia, Valvulineria, Gyroidina, Heterolepa, Bulimina, Bolivina, Uvigerina* and *Nonion.* Ostracodes also may be present, as are such molluscan genera as *Leda, Tornatella, Ostrea, Natica, Planorbella* and *Dentalium.*

According to N. K. Bykova (1953, p. 270) the *Caucasina* complex in the Paleocene of Fergana occurs in a fine red clay deposit of very slight $CaCO_3$ content, formed under calm conditions in relatively shallow quiet waters, which may have been somewhat brackish. The sea bottom appears to have had an oxidizing environment. In some regions the *Caucasina* facies is associated with greenish-brown glauconitic clays (Kaptarenko-Chernousova, Golyak, Zernetskiy, Kraeva, and Lipnik, 1963). In nearly all regions radiolarians are found in association with the *Caucasina* complex or in nearby strata, and pelagic foraminifers may also be present.

The dominance of short low spired tests in some species, for example *Causasina minuta,* new species, is in contrast to the much more elongated test and higher spire of *C. elongata.* Such differences in proportion may in fact be related to the temperature conditions, as suggested by N. K. Bykova (1960), the short compact Paleocene forms thus being characteristic of relatively lower

temperatures, and the more elongate forms having appeared with the warmer conditions of the Oligocene-lower Miocene.

There is apparently a general correlation of occurrence of the *Caucasina* complex with moderate to warm temperature, as the genus has not been reported in cold water deposits. Although widespread and abundant in the Paleogene and Miocene, none has yet been recorded from the Pliocene, Pleistocene, or Recent.

V. Familial and Phylogenetic Relationships

The Subfamily Caucasininae was proposed within the Family Buliminidae by N. K. Bykova (in Rauzer-Chernousova and Fursenko, 1959, p. 328). Genera included were *Neobulimina, Caucasina, Uvigerinella, Hopkinsina,* and *Bitubulogenerina.* These were regarded as having in common a rotaloid base, later and dominantly triserial development which might become irregular or even biserial, and a loop-shaped subterminal aperture which nevertheless connects to the base of the apertural face. No neck is present, but an apertural flange was said to occur.

The subfamily was elevated to family rank (Loeblich and Tappan, 1961, p. 314), and removed from the Buliminidae because of the granular wall microstructure of *Caucasina* as contrasted with the radially crystalline wall of the Buliminidae. Of the genera originally placed in the subfamily, *Neobulimina* is now referred to the Family Turrilinidae, Subfamily Turrilininae, and *Uvigerinella, Hopkinsina,* and *Bitubulogenerina* (a junior synonym of *Sagrina*) to the Uvigerinidae, all with similar radially crystalline walls (Loeblich and Tappan, 1964). *Caucasina* was the single remaining genus in the subfamily until the Recent genus *Francesita* Loeblich and Tappan, 1963, was placed therein. In addition to the type species, *Virgulina? advena* Cushman, which occurs in the North Atlantic Ocean and Gulf of Mexico, the Recent *Bulimina torta* Cushman from the Pacific Ocean also appears referable to *Francesita,* and the genus may occur in Miocene deposits.

N. K. Bykova (1959, 1960) observed small rotaliform tests, described as similar to *Pseudoparrella,* associated with *Caucasina* in the Russian Paleocene. These *"Pseudoparrella"* were believed to have migrated from boreal regions into the Fergana Basin during the Paleocene (Pg_1). With progressive rise in temperature, the population became high-spired, and a reduction in number of chambers per whorl gave rise to *Caucasina.* A contemporary branch from *"Pseudoparrella"* was said to have led to species of *Turrilina* and then *Bulimina.* By mid-Eocene time *Caucasina* developed some nearly biserial forms. The lineage proposed by Bykova led from *"Pseudoparrella"* to *Caucasina* to *"Caucasinella"* (a *nomen nudum*), then to *Uvigerinella, Hopkinsina,* and finally *Uvigerina.*

Caucasina attained maximum development in Oligocene time according to Bykova, with three main groups appearing: an elongate form with well developed rotaloid early coil; another group of shortened and swollen tests, with obsolescent triserial stage; and a third group in which the number of chambers and number of whorls is greater than three, and with deeply incised sutures. These groups may be separate lineages, but may equally well represent different generations of the species.

Although originally agreeing with the facts known, the hypothesis of a Paleocene derivation of *Caucasina* from *Pseudoparrella* is no longer credible, as *Caucasina* is now known to have a longer geologic history, occurring in the Campanian (Upper Cretaceous). *Pseudoparrella* has a radially crystalline wall, similar to that of the Buliminidae and Uvigerinidae but unlike the granular-walled *Caucasina,* hence a relationship appears quite unlikely.

Normal variation within a local population may include numerous juvenile individuals, which may be erroneously regarded as distinct species or genera, and thus suggest different generic interrelationships. Although much remains to be learned before many lineages and interrelationships can be determined, it seems to us most probable that the origin of a given genus is most likely to be among those of similar biochemical constitution, as shown by the type of test secreted, and its chemical composition and microstructure. Thus the Caucasininae and Fursenkoininae are regarded as closely related, both groups of genera being characterized by calcite tests of perforate granular microstructure and monolamellar septa. Perhaps their origin may be found in such rotaliform genera of similar composition and microstructure as *Alabamina.*

VI. Acknowledgments

We are indebted to D. M. Khalilov, Institute of Geology, Academy of Sciences, Azerbaijan SSR, Baku, for topotypes of *Caucasina oligocenica* and to N. K. Bykova, VNIGRI, Leningrad, USSR, for specimens of *Caucasina schischkinskayae.* Specimens of *Aeolomorphella plectilis* are from a sample collected by C. A. Hall, Department of Geology, University of California, Los Angeles. Richard Cifelli, of the U. S. National Museum, loaned type specimens of *Bulimina elongata* and *Bulimina elongata* var. *lappa.* The Miocene specimens figured from Baden, Austria, were obtained from samples collected for the California Research Corporation by W. W. Hay. The Rincon material from Los Sauces Creek was collected by A. R. Loeblich, Jr., and the Dos Palos (Paleocene) material was from core holes drilled for us by the California Research Corp. in order to obtain unweathered material for foraminiferal studies.

All figured specimens are deposited in the paleontological collections at the University of California, Los Angeles. A duplicate set of hypotypes and paratypes is in the paleontological collections of Tulane University, New Orleans. The illustrations consist of shaded camera lucida drawings by Helen Tappan Loeblich.

VII. Systematic Descriptions

Family Caucasinidae N. K. Bykova, 1959

Subfamily Caucasininae N. K. Bykova, 1959

A. Genus Caucasina Khalilov, 1951

Caucasina Khalilov, 1951, Akad. Nauk Azerbaydzhanskoy SSR, Izvestiya, no. 3, p. 58; N. K. Bykova, 1959, Voprosy Paleobiologii i biostratigrafii, Trudy II sessii Vses. Paleontol. obshchestva, p. 73, text-fig. 3; N. K. Bykova and Voloshinova in Rauzer-Chernousova and Fursenko, 1959, Osnovy Paleontologii, pt. 1, p. 328; N. K. Bykova, 1960, Geol. Sbornik 5, Trudy VNIGRI, vyp. 163, p. 315; Loeblich and Tappan, 1961, Jour. Paleontology, v. 35, no. 2, p. 314; Espitalié and Sigal, 1961, Rev. Micropaléontologie, v. 3, no. 4, p. 203; Suleymanov, 1962, Paleontologicheskiy Zhurnal, no. 2, p. 163; Loeblich and Tappan, 1964, Treatise on Invertebrate Paleontology, Pt. C, Protista 2, v. 2, p. 734.

Aeolostreptis Loeblich and Tappan, 1957, U. S. Natl. Museum, Bull. 215, p. 227.

Type Species: *Caucasina oligocenica* Khalilov, 1951 = *Bulimina schischkinskye* Samoylova, 1947 *(recte B. schischkinskayae).* Fixed by original designation.

Test free, elongate, base bluntly rounded, early portion in low discorbine coil with up to 8 chambers per whorl, later portion high-spired with fewer chambers per whorl, becoming triserial in the later stage; early chambers low, later of approximately equal breadth and height and may be inflated; sutures distinct, commonly depressed in the later stages, may be flush in the early spiral portion; wall calcareous, finely perforate, microgranular in structure, surface smooth or may be coarsely spinose in the early stages; aperture an elongate loop at the inner margin of the final chamber, with narrow bordering lip, posterior apertural margin strongly infolded and flaring internally to form a distinct toothplate.

Remarks: Most later publications have erroneously cited the type species as *C. schischkinskayae.* The type was originally designated as *C. oligocenica,* hence cannot be changed. *Caucasina oligocenica* has been regarded by some later workers as a synonym of *C. schischkinskayae,* but by others is regarded as a variety [= subspecies] or as a distinct species, hence the type should be cited as *C. oligocenica.* If regarded as a synonym, the prior name *(C. schischkinskayae)* may be added as an equivalent, as given above, in type citations.

Occurrence: Upper Cretaceous (Campanian), USA, Asia; Paleocene, USA, USSR; Eocene, USSR, France; Oligocene, USSR, USA; Miocene, USSR, Austria, Croatia.

Described from the Oligocene, the geologic range of the type species was soon extended to include Miocene strata, and another species of this age was recently described (*C. tenebricosa* Pishvanova, 1960). In 1958, Khalilov extended the range to include the new Eocene-Oligocene species *C. aziderensis* and *C. eocenica,* and an additional Eocene species, *C. alpina,* was described from France in 1961. In 1957, Loeblich and Tappan described the genus *Aeolostreptis,* with *Buliminella vitrea,* from the Upper Cretaceous of the American Gulf Coast, as type species. The genus was later regarded (Loeblich & Tappan, 1961, p. 314) as synonymous with *Caucasina,* extending the generic range into the Upper Cretaceous. The following year *Caucasina tuzkoensis* was described from the Upper Cretaceous of Soviet Asia.

In the present study two additional Miocene species are transferred to *Caucasina (C. elongata* and *C. subulata),* a new Oligocene species is described from California *(C. khalilovi),* and the first lower Paleocene (Danian) occurrence noted with the description of *C. minuta.*

1. Upper Cretaceous Species

CAUCASINA TUZKOENSIS Suleymanov, 1962

Pl. 1, fig. 7

Caucasina tuzkoensis SULEYMANOV, 1962, Paleontologicheskiy Zhurnal, no. 2, p. 163, text-fig. 1a, b.

Test small, elongate, cylindrical, early trochospiral stage of two whorls, 6 small subquadrangular chambers in the first whorl, and 5 in second, later development in a high trochospiral coil of which the first whorl contains 4 chambers and the final whorl three, test tending to uncoil in the later stage; sutures simple, straight and oblique, nearly flush with the surface; wall calcareous, vitreous, perforate, microgranular, surface smooth; aperture a broad loop in the face of the final chamber, somewhat narrowed at the base.

Length 0.22-0.24 mm; breadth 0.1-0.15 mm.

Types and Occurrence: Holotype (VNI GRI, Leningrad, No. 517-3), Upper Cretaceous (upper Campanian), Tashkudukskaya beds, Kyzyl Kum, central Asia.

CAUCASINA VITREA (Cushman and Parker)

Pl. 1, figs. 5, 6

Buliminella vitrea CUSHMAN and PARKER, 1936, Cushman Lab. Foram. Research, Contr., v. 12, p. 7, pl. 2, fig. 4; CUSHMAN, 1946, U. S. Geol. Survey, Prof. Paper 206, p. 119, pl. 50, fig. 14; CUSHMAN and PARKER, 1947, U. S. Geol. Survey, Prof. Paper 210-D, p. 59, pl. 15, fig. 12; FRIZZELL, 1954, Univ. Texas, Bur. Econ. Geol., Rept. Invest. 22, p. 114, pl. 16, fig. 42.

Aeolostreptis vitrea (Cushman and Parker). LOEBLICH and TAPPAN, 1957, U. S. Natl. Museum, Bull. 215, p. 227, pl. 72, fig. 20.

non *Aeolostreptis vitrea* (Cushman and Parker). TAPPAN, 1960, Amer. Assoc. Petr. Geol., v. 44, no. 3, p. 285, 289.

non *Caucasina vitrea* (Cushman and Parker). TAPPAN, 1962, U. S. Geol. Survey, Prof. Paper 236-C, p. 188, pl. 49, figs. 23-25.

Test free, elongate, base bluntly rounded, early portion in low trochospiral coil of about 6 broad and low chambers per whorl, later decreasing to three chambers per whorl with chambers relatively high; sutures distinct, depressed in the later portion; wall calcareous, perforate, surface smooth; aperture a high arch extending up the final chamber face from the contact with the previous whorl.

Length of holotype 0.25 mm; other specimens from 0.16 to 0.25 mm in length, 0.08 to 0.15 mm in breadth.

Types and Occurrence: Holotype (Cushman Coll. 22575, U. S. Natl. Museum) from the Selma Chalk (Upper Cretaceous), 2 miles west of Guntown, Mississippi. Figured hypotype (Cushman Coll. 32549, U. S. Natl. Museum) from the Selma Group, 11.5 miles east of Blue Springs, Mississippi. It also has been reported from the Upper Cretaceous (upper Austin) of Texas.

2. Paleocene Species

CAUCASINA MINUTA Loeblich and Tappan, n. sp.

Pl. 1, figs. 8-11

Test free, tiny, elongate, base broadly rounded, early portion consisting of a low trochospiral coil of about 3 volutions and 5 to 6 chambers per whorl, later portion subcylindrical and high spired; sutures distinct, slightly depressed; wall calcareous, finely perforate, surface smooth; aperture a loop shaped arch with posterior margin forming an infolded toothplate.

Length of holotype 0.18 mm, breadth 0.10 mm. Other specimens range between 0.11 and 0.15 mm in length.

Remarks: This species is the smallest yet described, somewhat resembling the Oligo-Miocene *C. schischkinskayae* in general form and proportions, but with less inflated chambers and less depressed sutures, and is less than one-half as large. It also has a more gradual change from trochospiral to triserial development.

Types and Occurrence: Holotype (UCLA 34220) from depth of 255 feet, figured paratypes (UCLA 34221-34223) from depth of 260 feet, Dos Palos Shale Member of Moreno Formation, in core hole in Panoche Hills, Sec. 8, T. 15S., R. 12E., M.D.M., Fresno Co., Calif.; collected by A. R. Loeblich, Jr.

3. Eocene Species

CAUCASINA ALPINA Espitalié and Sigal, 1961

Pl. 1, figs. 14-15

Caucasina alpina ESPITALIÉ and SIGAL, 1961, Rev. Micropaléontologie, v. 3, no. 4, p. 204, pl. 1, figs. 9a-d.

Test very small, base obtuse, rapidly increasing in breadth, final whorl occupying at least ¾ test length; earliest 1½ whorls low spired with 5 to 5½ chambers per whorl,

then high spired with 3 strongly inflated chambers per whorl; sutures deeply incised, curved; wall calcareous, vitreous, finely perforate; aperture in a large buliminoid depression.

Length 0.30 to 0.39 mm; breadth 0.18 to 0.24 mm.

Remarks: This species was separated on the basis of the rapid enlargement of the test, relative importance of the final whorl, and in having 5 to 5½ chambers in the early whorl.

Types and Occurrence: Upper Eocene (Upper Priabonian), Blue Marls, Clouet, near Clumanc (Basses-Alpes), France.

CAUCASINA AZIDERENSIS Khalilov, 1958

Pl. 1, fig. 12

Caucasina aziderensis KHALILOV, 1958, Akad. Nauk Azerbaydzhanskoy SSR, Izvestiya, Ser. Geol. Geogr. Nauk, no. 2, p. 4, 12, pl. 1, figs. 3a, b.

Test elongate, flaring, high trochospiral; following the globular proloculus the first whorl consists of 4 to 4½ semicircular chambers, later whorls reduced to 3½ to 4 chambers each, final 2 or 3 whorls each with 2 to 3 subglobular chambers; sutures narrow, curved, incised; wall calcareous, surface distinctly perforate; aperture elongate-ovate, a high loop with bordering lip, extending up the final chamber face.

Length 0.4 mm; greatest thickness 0.24 mm.

Types and Occurrence: Holotype (No. 339, Microfaunal collection, Institute of Geology, Akad. I. P. Gubkin, Academy of Science, Azerbaijan SSR) from upper Eocene-lower Oligocene deposits, in the northeast foothills of the Lesser Caucasus, Azerbaijan.

CAUCASINA EOCAENICA Khalilov, 1958

Pl. 1, fig. 13

Caucasina eocaenica KHALILOV, 1958, Akad. Nauk Azerbaydzhanskoy SSR, Izvestiya, Ser. Geol.-Geogr. Nauk, no. 2, p. 4, 12, pl. 1, figs. 2a, b; KHALILOV, 1962, Akad. Nauk Azerbaydzhanskoy SSR, Inst. Geol. im Akad. I. M. Gubkina, p. 30; NIKITINA, 1962, Byull. Moskov. obshch. Ispyt. Pri-

---

PLATE 1

Figures		Page
1–4	*Aeolomorphella plectilis* Loeblich and Tappan, n. gen., n. sp. Sentinel Hill Member, Schrader Bluff Formation, Upper Cretaceous, northern Alaska. 1a-c, side, top and basal views of paratype (USNM P6681) originally referred to *Caucasina vitrea.* 2a-d, side edge, top and basal views of holotype (UCLA 34237) showing early trochospiral coil and final biserial development, 3, side view of smaller paratype (UCLA 34238). 4, a, b, side and basal view of juvenile specimen (UCLA 34239). All x 120	84
5–6	*Caucasina vitrea* (Cushman and Parker). Selma Chalk, Upper Cretaceous, Mississippi. 5a-c, opposite sides and apertural view of holotype (Cushman Coll. 22575), redrawn from Cushman and Parker, x 130. 6a-c, side, apertural and basal views of hypotype (Cushman Coll. 32549), redrawn from Loeblich and Tappan. x 140	75
7	*Caucasina tuzkoensis* Suleymanov. Tashkudukskaya beds, upper Campanian, Upper Cretaceous, Kyzyl Kum, central Asia, USSR. 7a, b, side and basal views of holotype, redrawn from Suleymanov. x 120	75
8–11	*Caucasina minuta* Loeblich and Tappan, n. sp. Dos Palos Shale member of Moreno Formation, lower Paleocene (Danian), California. 8, 9, 11a, side views of small paratypes. 11b, basal view (UCLA 34221-34223). 10a-c, side, top and basal views of holotype (UCLA 34220). All x 180	75
12	*Caucasina aziderensis* Khalilov. Upper Eocene, Lesser Caucasus, Azerbaijan SSR. 12a, b, side and basal views of holotype, redrawn from Khalilov. x 70	76
13	*Causasina eocaenica* Khalilov. Upper Eocene, Lesser Caucasus, Azerbaijan SSR. 13a, b, side and basal views of holotype. Redrawn from Khalilov. x 70	76
14–15	*Caucasina alpina* Espitalié and Sigal. Priabonian blue marls, upper Eocene, Basses-Alpes, France. 14a-d, opposite sides, top and basal views of holotype. x 110. 15, side view of paratype. x 120. Redrawn from Espitalié and Sigal	75

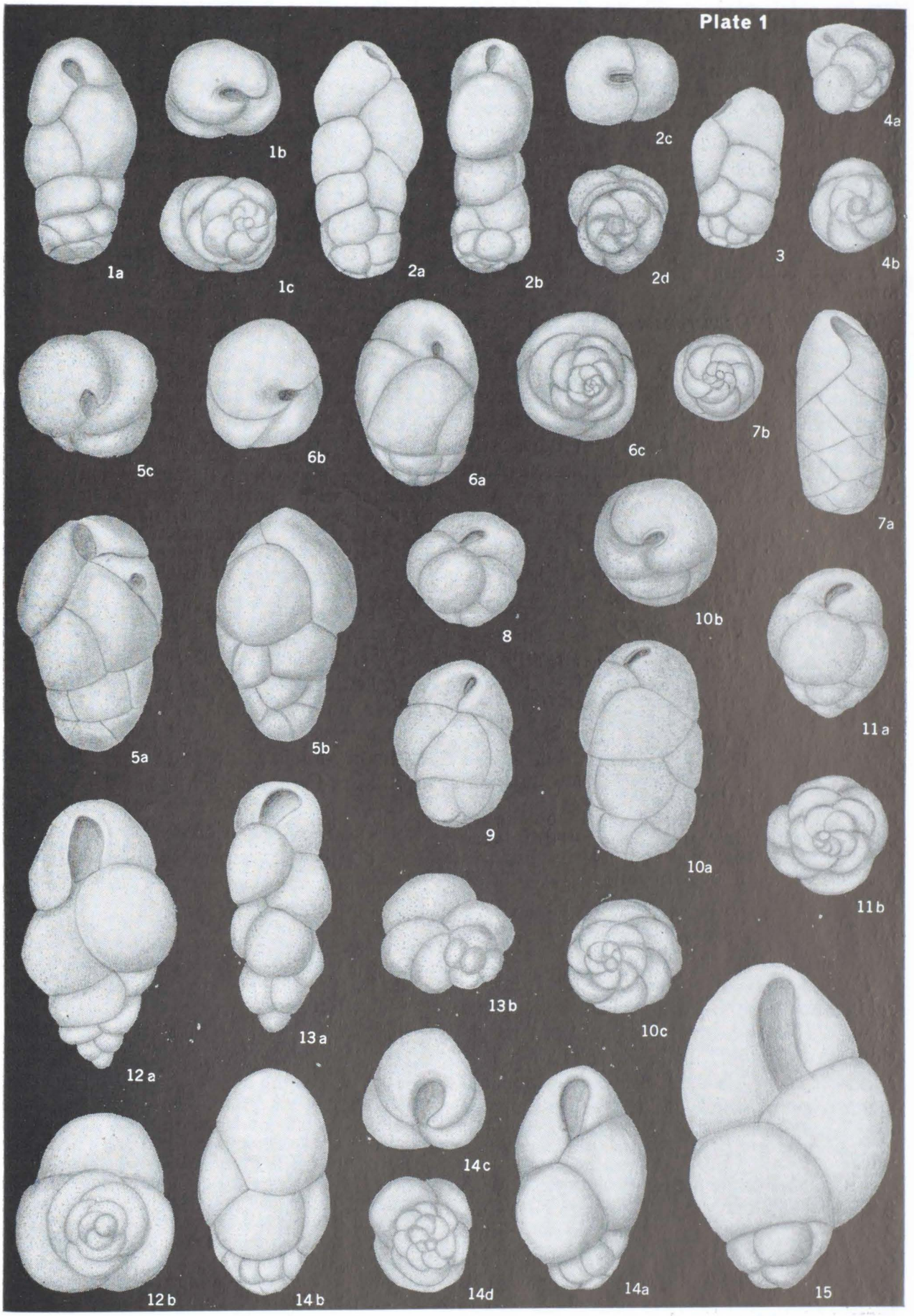
Plate 1
1a
1b
1c
2a
2b
2c
2d
3
4a
4b
5a
5b
5c
6a
6b
6c
7a
7b
8
9
10a
10b
10c
11a
11b
12a
12b
13a
13b
14a
14b
14c
14d
15

PLATE 1

rody, otdel. geol., v. 37, no. 2, p. 50, 52, 57; NIKITINA, 1963, ibid., v. 38, no. 1, p. 97, 104.

Test elongate, narrow, high spired, tapered at the base, early one or two whorls consist of 4 to 5 rounded chambers per whorl, later 2 to 4 whorls more highly spired and loosely triserial, inflated chambers tend to become uniserial; sutures strongly incised; wall calcareous, vitreous, distinctly perforate; aperture a high, broad loop in the apertural face, irregularly ovate in outline, narrowing at the base.

Length 0.48 mm; greatest thickness 0.17 mm.

Types and Occurrence: Holotype (No. 338, Microfaunal collection of the Institute of Geology, Akad. I. P. Gubkin, Academy of Science, Azerbaijan SSR), Upper Eocene (occurring with *Globigerina turkmenica* and *Globigerinoides conglobatus*) in the northeast foothills of the Lesser Caucasus, eastern Azerbaijan, USSR.

4. Oligocene Species

CAUCASINA KHALILOVI Loeblich and Tappan, n. sp.

Pl. 2, figs. 7-9

Test small, elongate, only slightly increasing in diameter from the bluntly rounded base, early stage in a low trochospiral coil of 1½ to 2 volutions and about 5 chambers per whorl, then rapidly reducing to triserial and becoming high spired with subglobular chambers; sutures depressed; wall calcareous, finely perforate, surface smooth; aperture a high loop-shaped opening extending up the apertural face from its base, bordered by a narrow lip with forward margin overlapping that opposite at its base.

Length of holotype 0.24 mm; breadth 0.13 mm. Paratypes range from 0.13 to 0.29 mm in length.

Remarks: This species differs from *C. schischkinskayae* in the smaller size, fewer chambers per whorl and more rapid reduction to triseriality. It is separated from *C. tenebricosa* by its smaller size, proportionately narrower test, and more numerous chambers per whorl in the early trochospiral stage.

Types and Occurrence: Holotype (UCLA 34224) and figured paratypes (UCLA 34225-34226) all from the lower portion of the Oligocene Rincon formation, regarded by some as Lower or Middle Miocene (Wilmarth, 1938, p. 1815), in bed of Los Sauces Creek, Ventura Co., California; collected by A. R. Loeblich, Jr.

CAUCASINA TENEBRICOSA Pishvanova *in* Subbotina, Pishvanova and Ivanova, 1960

Pl. 2, figs. 5-6

Caucasina tenebricosa PISHVANOVA *in* SUBBOTINA, PISHVANOVA and IVANOVA, 1960, Mikrofauna SSSR, Sbornik 11, Trudy VNIGRI, vyp. 153, p. 90, pl. 6. figs. 2a-c; SUBBOTINA, 1960, Mikrofauna SSSR, Sbornik 11, Trudy VNIGRI, vyp. 153, p. 212, pl. 4, figs. 2a-4c; LESHCHINSKIY, A. A. 1960, Opornye Skvazhiny SSSR, 1, Trudy VNIGRI, vyp. 24, p. 215, 226; DIDKOVS'KIY, 1963, Geol. Zhurnal, Akad. Nauk Ukraïns'koï RSR, Khimich. i Geologich. Nauk, v. 23, no. 2, p. 98.

Test free, small, elongate, bluntly rounded at base and enlarging slightly toward the aperture, peripheral margin slightly lobulate; chambers in high trochospiral coil of 4 to 6 whorls, early rotaloid portion of 2 to 2½ whorls contains 4 to 5 rounded chambers per whorl, later portion of test triserial with chambers increasing rapidly in size; sutures distinct, oblique, slightly excavated; wall calcareous, finely perforate, surface smooth; aperture a high loop in a trough-like excavation in the final chamber face.

Length 0.96 to 1.06 mm; breadth 0.53-0.59 mm.

Types and Occurrence: Holotype (VNI GRI, Leningrad, No. 5197), from Oligocene (lower Vorotyshchensky beds), in the Pre-Carpathians, Dzvinyach village, USSR. Also occurs in middle Miocene (Slebniksky beds) of the Pre-Carpathians.

5. Oligo-Miocene Species

CAUCASINA SCHISCHKINSKAYAE (Samoylova), 1947

Pl. 2, figs. 1-4

Bulimina schichkinskii SAMOYLOVA, 1947, Byull. Moskov. Obshch. Ispyt. Prirody, otdel. geol., v. 21, no. 2, p. 52 (table 4) *(nom. nud.)*.

Bulimina schischkinskii SAMOYLOVA, 1946, ibid., v. 21, no. 2, p. 54 *(nom. nud.)*.

Bulimina schischkinskye SAMOYLOVA, 1947, ibid., v. 22, no. 4, p. 82, text-fig. 10; GABRIELYAN, 1954, Geol. Sbornik, L'vovskogo Geol. Obshch. no. 1, p. 140; N. K. BYKOVA and VOLOSHINOVA *in* RAUZER-CHERNOUSOVA and FURSENKO, 1959, Osnovy Paleontologii, Obshchaya Chast', Prosteyshie, p. 328 *(nom. imperf.)*.

Caucasina oligocenica KHALILOV, 1951, Akad. Nauk Azerbaydzhanskoy SSR, Izvestiya, no. 3, p. 58, pl. 4, fig. 4.

Caucasina schischkinskae (Samoylova). N. K. BYKOVA, 1953, Trudy VNIGRI, n. ser., vyp. 73, p. 223, 267, table 8; N. K. BYKOVA, 1960, Geol. Sbornik, no. 5, Trudy VNIGRI, vyp. 163, p. 316, pl. 2, B 1-8; N. K. BY-

KOVA and AZBEL', 1962, Geol. Sbornik, no. 7, Trudy VNIGRI, vyp. 190, p. 377, 381 (table), 385 (fig. 2), 387, 388, 390, 391, 393 (table) *(nom. imperf.)*.

Caucasina aff. *schischkinskae* (Samoylova). GEKKER, OSIPOVA and BEL'SKAYA, 1962, Ferganskiy zaliv paleogenovogo morya sredney azii, ego istoriya, osadki, fauna, flora, usloviya ikh obitaniya i razvitie: Knigi 1, Akad. Nauk SSSR, Paleontol.-Inst., p. 73, 271; *ibid.*, Knigi 2, p. 6 (table 1), 9, 16, text-fig. 2a, p. 18, 264 *(nom. imperf.)*.

Caucasina schischkinskyae (Samoylova). DZHANELIDZE, 1956, Akad. Nauk Gruzinskoy SSR, Trudy Sektora Paleobiol., v. 3, p. 93, 122; IVANOVA, 1956, Geol. Sbornik, L'vovskogo Geol. Obshch., no. 2-3, p. 327; NOSOVSKIY and YARTSEVA, 1960, Paleogenovye otlozheniya yuga Evropeyskoy chasti SSSR, Akad. Nauk SSSR, p. 183, 184; BOGDANOVICH, 1960, ibid., table opposite p. 246, p. 249, 250, 251, 252, 253, 254, 255, 256, 258, 269, pl. 4, figs. 3-5; MYATLYUK, 1960, Trudy Pervogo Seminara po Mikrofaune, VNIGRI, p. 208; GABRIELYAN, SAAKYAN and MARTIROSYAN, 1960, ibid., p. 305; OVECHKIN, 1962, Vses. Nauchno-Issledov. Geol. Inst. (VSEGEI), Trudy, n. ser. v. 77, p. 194, 234; KAPTARENKO-CHERNOUSOVA, GOLYAK, ZERNETSKIY, KRAEVA and LIPKNIK, 1963, Akad. Nauk Ukraïnskoï SSR, Inst. Geol. Nauk, ser. stratig. i paleontol., vyp. 45, p. 165, pl. 47, figs. 5-7; DMITRIEV and KOZHEVNIKOVA, 1963, Akad. Nauk Turkmenskoy SSR, Izvestiya, ser. Fiz.-Technich., Kimich. i Geol. Nauk, no. 2, p. 103, 106; VESELOV and KRAEVA, 1963, Akad. Nauk Ukraïns'koï RSR, Geol. Zhurnal, v. 23, vip. 4, p. 42 *(nom. imperf)*.

Caucasina aff. *schischkinskyae* (Samoylova). DZHANELIDZE, 1956, Akad. Nauk Gruzinskoy SSR, Trudy Sektora Paleobiol., v. 3, p. 92, 93, 121, pl. 3, figs. 7a, b *(nom. imperf.)*.

Caucasina aff. *schischknskyae* (Samoylova). DZHANELIDZE, 1956, ibid., p. 113 *(nom. imperf.)*.

Caucasina schisckinskyae DZHANELIDZE, 1956, ibid., p. 113 *(nom. imperf.)*.

Caucasina schischkinskayae (Samoylova). KHALILOV, 1958, Akad. Nauk Azerbaydzhanskoy SSR, Izvestiya, Ser. Geol.-Geogr. Nauk, no. 2, p. 4 (*nom. correct.* pro *Bulimina schischkinskye* Samoylova, 1947); MERKLIN, MOROZOVA and STOLYAROV, 1960, Doklady Akad. Nauk, v. 133, no. 3, p. 654, 655.

Caucasina oligocaenica Khalilov. KHALILOV, 1958, Akad. Nauk Azerbaydzhanskoy SSR, ser. Geol.-Geogr. Nauk, no. 2, p. 3, 12, pl. 1, fig. 1; KHALILOV, 1962, Mikrofauna i stratigrafiya paleogenovykh otlozhenii Azerbaydzhana, Akad. Nauk Azerbaydzhanskoy SSR, Inst. Geol. im Akad. I. M. Gubkina, p. 40; ESPITALIÉ and SIGAL, 1961, Rev. Micropaléontologie, v. 3, no. 4, p. 204, pl. 1, figs 1-8 (*err. cit.* pro *C. oligocenica* Khalilov, 1951).

Caucasina schischkinkiae (Samoylova). NIKITINA, 1958, Izvest. Vysshikh Uchebnykh Zavedeniy Geol. i Razvedka, no. 7, p. 52 *(nom. imperf.)*.

Caucasina schischkinskiae (Samoylova). NIKITINA, 1958, ibid., p. 45, 46, 48, 49, 52; BOGDANOVICH, 1960, Trudy Vses. Neftegaz. Nauchno-Issledov. Inst. Krasnodarskiy Filial, vyp. 4, Geol. Sbornik, p. 241; TER-GRIGOR'YANTS, 1961, Trudy VNIGRI, vyp. 30, p. 271 *(nom. imperf.)*.

Caucasina aff. *schischkinskiae* (Samoylova). NIKITINA, 1958, Izvest. Vysshikh Uchebnykh Zavedeniy Geol. i Razvedka, no. 7, p. 46, 52.

Caucasina schischkincskajae (Samoylova). N. K. BYKOVA and VOLOSHINOVA *in* RAUZER-CHERNOUSOVA and FURSENKO, 1959, Osnovy Paleontologii, Obshchaya Chast', Prosteyshie, text-fig. 799a, b *(nom. imperf.)*.

Caucasina schischkinskye (Samoylova). YARTSEVA, 1959, Geol. Zhurnal, Akad. Nauk Ukraïns'koï RSR, v. 19, vyp. 3, p. 29, 30, 31, 32, 33, 35; SELIN, 1960, *ibid.*, v. 20, vyp. 4, p. 105; ESPITALIÉ and SIGAL, 1961, Rev. Micropaléontologie, v. 3, no. 4, p. 203, 206 *(nom. imperf.)*; DABAGYAN, 1961, Paleont. Sbornik, L'vov. Geol. Obshch., No. 1, p. 98, 99.

Caucasina schischkinshkye (Samoylova). YARTSEVA, 1959, Geol. Zhurnal, Akad. Nauk Ukraïns'koï RSR, v. 19, vyp. 3, p. 31 *(nom. imperf.)*.

Caucasina schichkinskyae (Samoylova). KRAEVA, 1960, Paleogenovye otlozheniya yuga Evropeyskoy chasti SSSR, Akad. Nauk SSSR, p. 236 *(nom. imperf.)*.

Caucasina shishkinskiae (Samoylova). YANSHIN, VYALOV, DOLGOPOLOV and MENNER, 1960, ibid., table 2 (opposite p. 9) *(nom. imperf.)*.

Caucasina schisckhinshkyae (Samoylova). BOGDANOVICH, 1960, Paleogenovye otlozheniya yuga Evropeyskoy chasti SSSR, Akad. Nauk SSSR, p. 254 *(nom. imperf.)*.

Caucasina schischkiskiae (Samoylova). TER-GRIGOR'YANTS, 1961, Trudy VNIGRI, vyp. 30, p. 268, 270 *(nom. imperf.)*.

Caucasina schischkinskajae (Samoylova). CHERNYAK, BOGAETS', VOLOSHINA, and KHADIKIN, 1961, Geol. Zhurn., Akad. Nauk Ukraïn. RSR, v. 21, vyp. 2, p. 84; NOSOVSKIY, 1963, Byull. Moskov. Obshch. Ispyt. Prirody, otdel. geol., v. 38, no. 5, p. 8, 10 *(nom. imperf.)*.

Caucasica [sic] *schischkienskajae* (Samoylova). KRAEVA, 1961, Foram. Verkhn'oeotsenovikh ta Oligotsenovikh vidkladiv . . . p. 29 *(nom. imperf.)*.

Caucasina schishkinskae (Samoylova). SULEYMANOV, 1962, Paleontologicheskiy Zhurnal, no. 2, p. 163 *(nom. imperf.)*.

Caucasina schischkinskayae (Samoylova) var. *oligocaenica* Khalilov. KHALILOV, 1962, Mikrofauna i stratigrafiya paleogenovykh otlozhenii Azerbaydzhana, Akad. Nauk Azerbaydzhanskoy SSR, Inst. Geol. im Akad. I. M. Gubkina, p. 168, 184, 195, 196, 202, 203, 210, 211, 298, 302, 303, 304

(var. = infrasubspecific rank after Jan. 1961, hence excluded from zoological nomenclature. ICZN Art. 45 (c) (e) & Art. 1; *nom. imperf.*).

Caucasina schischkynskayae (Samoylova) var. *oligocaenica* Khalilov. KHALILOV, 1962, ibid., p. 251, 302 (see remarks in synonomy above; *nom. imperf.*).

Caucasina cf. *schischkinskajae* (Samoylova). NIKITINA, 1962, Byull. Moskov. Obshch. lspyt. Prirody, otdel. geol., v. 37, no. 2, p. 58 *(nom. imperf.)*.

Caucasina schischkienskyae (Samoylova). NOSOVSKIY and SAVENKO, 1963, Doklady Akad. Nauk SSSR, v. 148, no. 5, p. 1179, 1180 *(nom. imperf.)*.

Caucasina schischinskajea (Samoylova). NOSOVSKIY, 1963, Byull. Moskov. Obshch. Ispyt. Prirody, otdel. geol., v. 38, no. 5, p. 14 *(nom. imperf.)*.

non *Caucasica* aff. *schischkinskae* (Samoylova). N. K. BYKOVA, 1953, Trudy VNIG RI, n. ser., vyp. 73, p. 266 *(nom. imperf.)*.

non *Caucasina* aff. *schischkinskae* (Samoylova). N. K. BYKOVA, 1953, Trudy VNI GRI, n. ser., vyp. 73, p. 223, 225, 263, 267, 273, pl. 5, figs. 11-13, pl. 6, fig. 2.

non *Caucasina schischkinskye* (Samoylova). VENGLINS'KIY, 1958, Foraminiferi Miotsenu Zakarpattya, Akad. Nauk Ukraïns'koï RSR, Inst. Geol. Korisnikh Kopalin, p. 33, 135, table 3, pl. 29, figs. 4-9. [= *C. subulata*]

Test free, robust, subcylindrical, base broadly rounded; early stage in low trochospiral coil of about 3 whorls, with 5 to 7 chambers per whorl, later portion of test of somewhat lesser diameter and higher spired in microspheric form, slightly flaring in megalospheric generation, later portion triserial; chambers of early portion broad and low, in adult stage much inflated and of about equal breadth and height; sutures distinct, depressed, spiral suture nearly horizontal with septal sutures gently curved; wall calcareous, finely perforate, granular, surface smooth; aperture a high loop-shaped opening extending up final chamber face, forward apertural margin somewhat overlapping posterior margin near the chamber base, inner posterior margin infolded to form an apertural toothplate.

Length of juvenile specimen, showing only the trochospiral coiled stage, 0.11 mm; breadth 0.14 mm. Length of larger specimen 0.37 mm; breadth 0.18 mm. Length of specimen of fig. 4, 0.50 mm.

Remarks: This species has been widely recorded (see above synonymy) in the Oligocene-Miocene of the USSR, where it

---

PLATE 2

Figures — Page

1–4 *Caucasina schischkinskayae* (Samoylova). 1-3, hypotypes of *C. oligocenica* (UCLA 34227-34229), Oligocene Azerbaijan SSR. 4, hypotype of *C. schischkinskayae* (UCLA 34230), Oligocene, Mangyshlak well, USSR. 1a-c, side, top and basal views of large hypotype. 2a, b, side and top views of juvenile specimens. 3, side view. All x 115. 4, side view of large specimen, x 80 — 78

5–6 *Caucasina tenebricosa* Pishvanova. Lower Vorotyshchensky beds, Oligocene, pre-Carpathians, USSR. 5a-c, opposite sides and base of microspheric holotype, redrawn from Subbotina, Pishvanova and Ivanova, x 85. 6a-c, opposite sides and base of megalospheric specimen, redrawn from Subbotina, x 120 — 78

7–9 *Caucasina khalilovi* Loeblich and Tappan, n. sp. Rincon Formation, Oligocene, California. 7a-c, side, top and basal views of holotype (UCLA 34224). 8, 9, side and basal views of paratypes (UCLA 34225-34226). All x 120 — 78

10–13 *Caucasina subulata* (Cushman and Parker). Badener Tegel, Tortonian, Miocene, Austria. 10a-c, side, top and basal views of large topotype with slightly spinose base (UCLA 34233). 11a, c, side and base of topotype with few spines (UCLA 34234). 12a, b, side and base of strongly spinose topotype (UCLA 34235). All x 60. 11b, enlarged view of apertural region to show overlapping basal margin and narrow lip. 13a, side view of apertural region of topotype (UCLA 34236) with outer apertural rim broken to show infolded toothplate which broadens internally (compare to fig. 11b). 13b, top view of same viewed in partially transmitted light, showing the infolded toothplate within the final chamber, just above the apertural margin as oriented in the figure. Figs. 11b, 13a, b, x 180 — 83

14–15 *Caucasina elongata* (d'Orbigny). Badener Tegel, Tortonian, Miocene, Austria. 14a, b, side and basal views of hypotype (UCLA 34231). 15a-c, side, top and basal views of hypotype (UCLA 34232). Both x 60 — 82

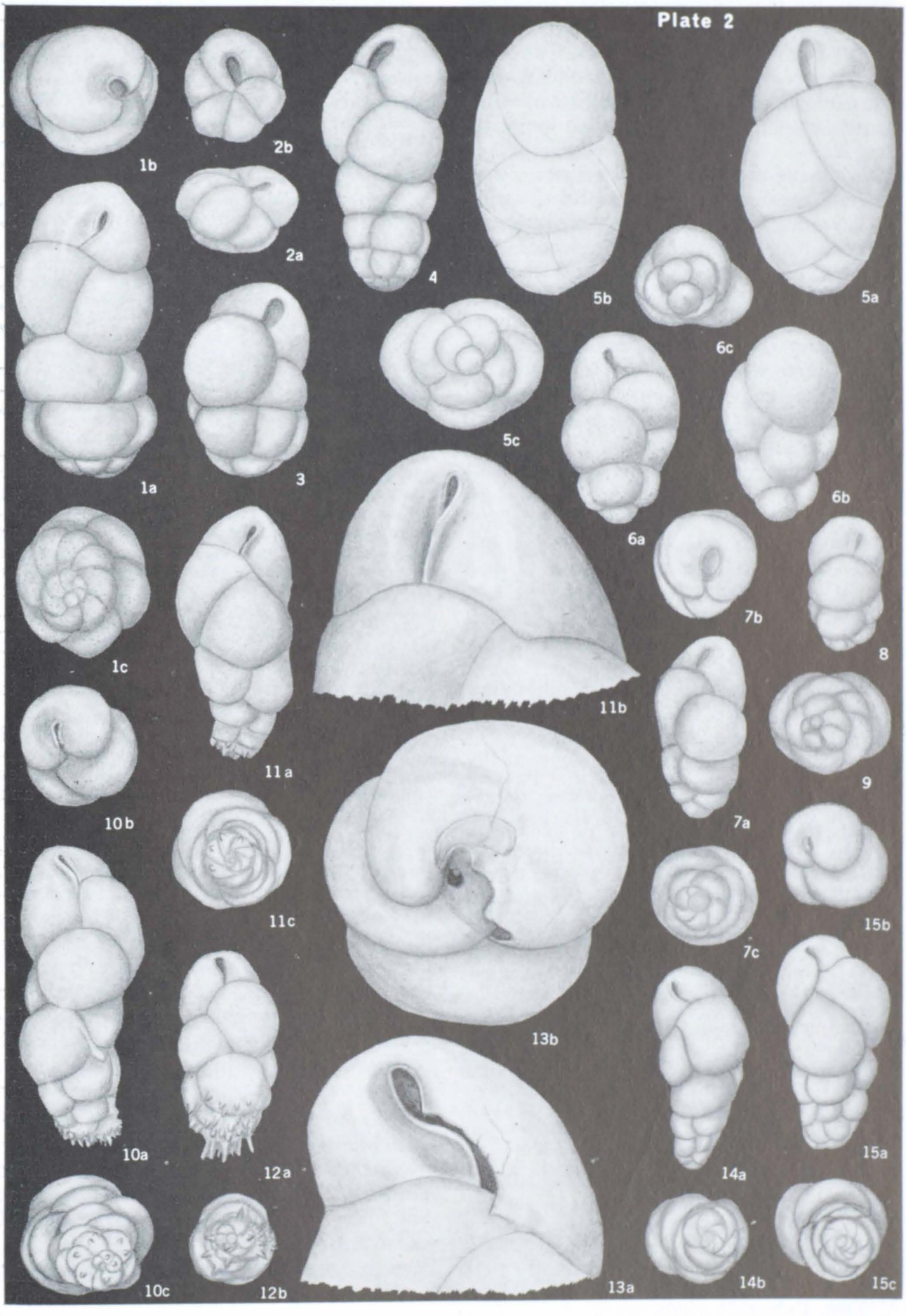
Plate 2
1b
2b
4
5b
5a
2a
6c
1a
3
5c
6b
6a
1c
7b
8
11b
11a
10b
9
7a
11c
15b
7c
13b
10a
12a
15a
14a
10c
12b
13a
14b
15c

PLATE 2

is regarded as a zonal index fossil. The above cited record of *C.* aff. *schischkinskae* by N. K. Bykova (1953) from the Paleocene Suzaksky beds of Fergana is not this species, but may be the same as *C. "suzakensis,"* cited in recent publications but apparently not yet described.

Originally described as *Bulimina schischkinskye,* the species had been listed earlier as *B. schischkinskii (nomen nudum),* but as a feminine patronymic required correction to *schischkinskayae,* as was done by Khalilov, 1958. The type species of the genus, *Caucasina oligocenica,* is regarded by many as a synonym of *B. schischkinskayae,* as it is here. Some 30 different combinations and variant spellings (including misprints and erroneous emendations) have been used for this species during the past 17 years.

Types and Occurrence: Hypotypes (figs. 1-3) of *C. oligocenica* (UCLA 34227-34229) from the Oligocene of Zeiva, Village, Azerbaijan SSR; from D. M. Khalilov. Hypotype (fig. 4) of *C. schischkinskayae* (UCLA 34230) from Mangyshlak well, USSR; from N. K. Bykova.

6. Miocene Species

CAUCASINA ELONGATA (d'Orbigny)

Pl. 2, figs. 14-15

Bulimina elongata D'ORBIGNY, 1846, Foram. fossiles bassin tertiaire de Vienne, p. 187, p. 11, figs. 19-20; CUSHMAN and PARKER, 1937, Cushman Lab. Foram. Res., Contr., v. 13, p. 49, pl. 7, figs. 1-3 (in part, not including all synonymy); DZHANELIDZE, 1956, Akad. Nauk Gruzinskoy SSR, Trudy Sektora Paleobiol., v. 3, p. 95, 122; VENGLINS'KIY, 1958, Foraminiferi Miotsenu Zakarpattya, Akad. Nauk, Ukraïns'koï RSR, Inst. Geol. Korisnikh Kopalin, p. 132, pl. 28, fig. 3, pl. 29, figs. 1, 2; KUZNETSOVA, 1959, Voprosy Paleobiologii i Biostratigrafii, Trudy II Sessii Vses. Paleontol. obshchestva, p. 107; MYATLYUK, 1960, Trudy Pervogo Seminara po Mikrofaune, VNIGRI, p. 211; SUBBOTINA, PISHVANOVA and IVANOVA, 1960, Mikrofauna SSSR, Sbornik 11, Trudy VNIGRI, vyp. 153, p. 83, pl. 5, figs. 12, 13 (not 14, 15); VYALOV, PISHVANOVA, PETRASHKEVICH and GRISHKEVICH, 1962, Byull. Moskov. obshch. Ispyt. Prirody, otdel. geol., v. 37, no. 5, p. 71, 72, 73, 75.

Neobulimina elongata (d'Orbigny). SUBBOTINA, 1953, Mikrofauna SSSR, Sbornik 6, Trudy VNIGRI, vyp. 69, p. 217, pl. 9, figs. 12-14; N. K. BYKOVA, 1959, Voprosy Paleobiologii i Biostratigrafii, Trudy II sessii Vses. Paleontol. obshchestva, p. 73; KHALILOV, 1962, Mikrofauna i Stratigrafiya paleogenovykh otlozhenii Azerbaydzhana, Akad. Nauk Azerbaydzhanskoy SSR, p. 40, 211, 212; DMITRIEV and KOZHEVNIKOVA, 1963, Akad. Nauk Turkmenskoy SSR, Izvestiya, Ser. Fiz.-Technich., Kimich. i Geol. Nauk, no. 2, p. 104.

Caucasinella elongata (d'Orbigny). N. K. BYKOVA, 1959, Voprosy Paleobiologii i Biostratigrafii, Trudy II sessii Vses. Paleontol. Obshchestva, p. 73; MYATLYUK, 1960, Trudy Pervogo Seminara po Mikrofaune, VNIGRI, p. 208; NIKITINA, 1962, Byull. Moskov. obshch. Ispyt. Prirody, otdel. geol., v. 37, no. 2, p. 52.

Bulimina elongata var. *elongata* d'Orbigny. SUBBOTINA, PISHVANOVA and IVANOVA, 1960, Mikrofauna SSSR, Sbornik 11, Trudy VNIGRI, vyp. 153, p. 84, pl. 5, figs. 12, 13.

Bulimina (= Caucasinella) elongata d'Orbigny. NIKITINA, 1962, Byull. Moskov. obshch. Isypt. Prirody, otdel. geol., v. 37, no 2, p. 60.

Test elongate, varying from slightly tapering throughout to tapered only in early trochospiral portion and nearly cylindrical in later portion; chambers at first trochospiral, later reducing in number of chambers per whorl to become triserial, chambers slightly inflated, of nearly equal breadth and height; sutures slightly depressed; wall calcareous, finely perforate, polished, smooth; aperture an elongate loop with narrow bordering lip, forward apertural margin somewhat overlapping base of opposite margin which is infolded and flaring to form the apertural toothplate.

Length of figured specimens, 0.50 and 0.52 mm; breadth 0.24 and 0.28 mm. Cushman and Parker state that the species ranges from 0.28 to 0.67 mm in length and from 0.14 to 0.22 mm in diameter.

Remarks: Cushman and Parker, (1937, p. 49) regard *Bulimina inconstans* Egger, from the Miocene of Bavaria, and *B. scabriuscula* Reuss, from the Belgian Pliocene, as synonymous with the present species. We have not compared the primary types of these latter species, but *B. inconstans* is a short flaring foraminifer with few, but inflated and subglobular chambers, and *B. scabriuscula* is a narrow elongate form with narrow elevated chambers. Apparently, neither has an early trochospiral coil, hence we do not regard them as synonymous.

This species also has been reported from the Miocene of the Carpathians (Ukrainian SSR) and the Caucasus of Georgian SSR and Azerbaijan SSR.

Types and Occurrence: Hypotypes (UCLA 34231-34232) from the Miocene (Tortonian) Badener Tegel, Baden, Austria; collected by W. W. Hay.

CAUCASINA SUBULATA (Cushman and Parker)

Pl. 2, figs. 10-13

Bulimina elongata d'Orbigny var. *subulata* CUSHMAN and PARKER, 1937, Cushman Lab. Foram. Res., Contr., v. 13, p. 51, pl. 7, figs. 6-7; VENGLINS'KIY, 1958, Foraminiferi Miotsenu Zakarpattya, Akad. Nauk Ukraïns'koï RSR, Inst. Geol. Korisnikh Kopalin, p. 133, pl. 28, fig. 2.

Bulimina elongata d'Orbigny var. *lappa* CUSHMAN and PARKER, 1937, Cushman Lab. Foram. Res., Contr., v. 13, p. 51, pl. 7, fig. 8; CUSHMAN and PARKER, 1947, U. S. Geol. Survey, Prof. Paper 210-D, p. 109, pl. 25, fig. 19.

Caucasina schischkinskye (Samoylova). VENGLINS'KIY, 1958 (*non* Samoylova), Foraminiferi Miotsenu Zakarpattya, Akad. Nauk Ukraïns'koï RSR, Inst. Geol. Korisnikh Kopalin, p. 33, 135, table 3, pl. 29, figs. 4-9.

Bulimina subulata Cushman and Parker. SUBBOTINA, PISHVANOVA and IVANOVA, 1960, Mikrofauna SSSR, Sbornik 11, Trudy VNIGRI, vyp. 153, p. 86, pl. 5, fig. 16, 17; VYALOV, PISHVANOVA, PETRASHKEVICH and GRISHKEVICH, 1962 Byull. Moskov. obshch. Ispyt. Prirody, otdel. geol., v. 37, no. 5, p. 71, 74, 75.

Test free, elongate, slightly flaring, base bluntly rounded, early portion in low trochospiral coil of about 3 whorls, with 6 to 7 chambers per whorl, then becoming higher spired and reduced to 3 chambers per whorl; sutures distinct, strongly depressed; wall calcareous, finely perforate, granular, surface smooth, but early chambers with one to 5 or 6 solid blunt spines, varying from relatively long spines to a mere roughened basal surface of the test, and with all gradations present between these extremes of spine development; aperture an arch at base of final chamber, extending up the face, the posterior apertural margin infolded as a flaring apertural toothplate.

Figured specimens range from 0.47 to 0.68 mm in length and 0.23 to 0.29 mm in breadth.

Remarks: Figured topotypic specimens are from the Miocene of Baden, Austria, and were compared with the holotype of *Bulimina elongata* var. *lappa* (USNM Cushman Coll. 23725) from the Miocene at Nussdorf, Vienna Basin, Austria. The two varieties were also reported to occur in the Miocene of Hungary and Egypt and the Pliocene of Italy. The Pliocene specimens of *Bulimina elongata* var. *lappa* from Attavilla, Italy (USNM Cushman Coll. 59128) were examined by us. They represent a short, broad, hirsute *Bulimina* and are not referrable to the present species or genus. Venglins'kiy (1958) referred to *C. schischkinskye* [sic] specimens from the Sarmatian of the Zakarpats'ky district (Borzhavs'ka series) which show the characteristic roughened and spiny base of the present species.

The varieties *subulata* and *lappa* were stated to occur together, the latter being shorter and heavier with shorter spines or merely roughened base, the typical *subulata* being distinctly spinose. In a large number of topotypic specimens a gradation occurs between specimens of these extremes, partly because of breakage of the spines and partly a dimorphism between the more elongate and tapering microspheric and blunter megalospheric specimens. They are regarded as identical, being merely variants within a single population.

The species figured by Brady (1884, pl. 51, fig. 1) from the North Atlantic, northwest of Ireland, as *Bulimina elongata,* and that (pl. 51, fig. 2) considered to be intermediate between *B. elongata* and *B. ovata* d'Orbigny, were regarded by Cushman (1942, p. 11) as *B. elongata* var. *subulata.* Although of similar outline and size, the Recent specimens need restudy, and refiguring in basal view in order to determine whether or not they are referrable to *Caucasina subulata* or *C. elongata*—or even to the present genus.

Caucasina subulata also has been reported from the Miocene of Rumania, Albania and the pre-Carpathians of the Ukrainian SSR.

Types and Occurrence: Topotypes (UCLA 34233-34236) of *C. subulata* (Cushman and Parker) from the Miocene (Tortonian) Badener tegel, Baden, Austria; collected by W. W. Hay. The species appears to be widespread in Sarmatian-Tortonian deposits of central Europe, but we have not seen younger specimens that we regard as conspecific.

7. *Nomina Nuda*

The following specific names have appeared in Soviet publications, but we have been unable to locate published descriptions. They are therefore regarded as *nomina nuda.*

CAUCASINA BULIMINOIDES Bogdanovich

Caucasina buliminoides NIKITINA, 1962, Byull. Mosk. Obshch. Ispyt. Prirody, otdel. geol., v. 37, no. 2, p. 52 (table), 60 (list).

Caucasina buliminoides Bogdanovich. NOSOVSKIY and SAVENKO, 1963, Doklady Akad. Nauk SSSR, v. 148, no. 5, p. 1179 (in list); DIDKOVS'KIY, 1963, Geol. Zhurnal, Akad. Nauk Ukraïns'koï RSR, v. 23,

no. 2, p. 98 (in list) Burdigalian (Miocene) of northern Caucasus.

CAUCASINA LUCERA Pishvanova

Caucasina lucera Pishvanova. VYALOV, PISHVANOVA, PETRASHKEVICH and GRISHKEVICH, 1962, Byull. Moskov. Obshch. Ispyt. Prirody, otdel. geol., v. 37, no. 5, p. 74; IVANOVA, 1962, Dopovidi Akad. Nauk Ukraïns'koï RSR, no. 4, p. 521 (in list).

This species may have been described in an unpublished dissertation from L'vov University (1960): Pishvanova, L. S., Foraminifery miotsena predkarpat'ya i ikh stratigraficheskoe znachenie: Avtoreferat. Rand. dis. L'vov, 1960.

CAUCASINA SCHISCHKINSKAYAE (Samoylova) var. DOLIELLA Ivanova, 1956

Caucasina schisckinskyae (Samoylova) var. *doliella* IVANOVA, 1956, Geol. Sbornik, L'vovskogo Geol. Obshch., no. 2-3, p. 327 *(err. cit.;* recte *C. schischkinskayae* var. *doliella).*

CAUCASINA SUZAKENSIS N. K. Bykova, 1960

Caucasina suzakensis N. K. BYKOVA, 1960, Geol. Sbornik no. 5, Trudy VNIGRI, vyp. 163, p. 315, pl. 2, A5 (*nom. nud.*, figured, not described).

8. *Nomenclatura aperta*

CAUCASINA sp. Bignot, 1962

Caucasina sp. BIGNOT, 1962, Rev. Micropaléontologie, v. 5, no. 3, p. 169, pl. 2, figs. 34-35.

Eocene (Cuisian), Cap d'Ailly, Seine Maritime, France.

CAUCASINA sp. nov. (?) Bogdanovich, 1960

Caucasina sp. nov. (?) BOGDANOVICH, 1960, Trudy VNNII, Krasnodarskiy filial, Trudy, vyp. 4, Geol. Sbornik, p. 240, pl. 3, figs. 4, 5.

Assinsky beds, middle Maykopian (upper Oligocene), Urukhskiy region, N. Osetiya, USSR.

B. Genus AEOLOMORPHELLA Loeblich and Tappan, n. gen.

Type species: *Aeolomorphella plectilis,* n. sp.

Test free, elongate, early stage in close discorbine coil, up to 6 chambers per whorl, later becoming high spired with rapid reduction in number of chambers per whorl, finally biserial; chambers broad and low in early stage, later of nearly equal breadth and height and somewhat inflated; sutures distinct, depressed; wall calcareous, finely perforate, granular; surface smooth; aperture a high loop shaped opening extending up the apertural face from its base, with posterior margin infolded to form a toothplate.

Remarks: Aeolomorphella differs from *Caucasina* in being biserial rather than triserial in the later stage.

Occurrence: Upper Cretaceous (Campanian) of northern Alaska.

AEOLOMORPHELLA PLECTILIS Loeblich and Tappan, n. sp.

Pl. 1, figs. 1-4

Aeolostreptis vitrea (Cushman and Parker). TAPPAN, 1960, Amer. Assoc. Petr. Geol., Bull., v. 44, no. 3, p. 285, 289.

Caucasina vitrea (Cushman and Parker). TAPPAN, 1962, U. S. Geol. Survey, Prof. Paper 236-C, p. 188, pl. 49, figs. 23-25.

non *Buliminella vitrea* CUSHMAN and PARKER, 1936, Cushman Lab. Foram. Research, Contr., v. 12, pt. 1, p. 7, pl. 2, figs. 4a-c.

non *Aeolostreptis vitrea* (Cushman and Parker). LOEBLICH and TAPPAN, 1957, U. S. Natl. Museum, Bull. 215, p. 227, pl. 72, fig. 20.

Test free, elongate, base bluntly rounded, early portion close coiled with 6 low chambers per whorl, later reducing to triserial and finally biserial, with chambers of nearly equal breadth and height; sutures distinct, depressed, becoming more constricted in later stages; wall calcareous, finely perforate, surface smooth; aperture an arched slit extending up the face from inner margin of final chamber, with narrow lip at the forward margin.

Length of holotype 0.26 mm; breadth 0.13 mm. Other specimens range from 0.10 to 0.28 mm in length.

Remarks: The present species was formerly regarded by us as conspecific with *Caucasina vitrea,* from the Upper Cretaceous of Mississippi, but it differs in the more elongate test, less rapid flaring, final biserial chamber arrangement, more incised sutures and chambers of nearly equal breadth and height. It differs from *Caucasina tuzkoensis,* from the Upper Cretaceous (Campanian) of central Asia (Kyzylkumy), in having a slightly flaring test instead of parallel sides, in the more incised sutures and in the more equidimensional, biserially arranged chambers.

Types and Occurrence: Holotype (UCLA 34237) and figured paratypes (UCLA 34238-34239) from the Sentinel Hill member of the Schrader Bluff formation, in bank of river at Ocean Point on the Colville River, northern Alaska; collected by C. A. Hall.

The species was previously reported (as

Caucasina vitrea) from cores in the Sentinel Hill Member of the Schrader Bluff Formation, in Sentinel Hill Core Test 1 on the west bank of the Colville River, lat. 69° 35′48″N., long. 151°28′09″W., northwest of Umiat, northern Alaska.

VIII. References

Bignot, G., 1962, Étude micropaléontologique de la formation de Varengeville du gisement Éocène du Cap d'Ailly (Seine Maritime): Rev. Micropaléontologie, v. 5, no. 3, p. 161-184, pls. 1-4.

Bogdanovich, A. K., 1960, Novye dannye o stratigraficheskom i prostranstvennom raspredelenii maykopskoy mikrofauny severnogo kavkaza: Paleogenovye otlozheniya yuga Evropeyskoy chasti SSSR, Akad. Nauk SSSR, p. 245-276, pls. 1-5, 1 table (Moskva). [New data on the stratigraphy and areal distribution of the Maykopskian microfauna of the northern Caucasus].

Bogdanovich, A. K., 1960, Mikrofauna i flora iz spongolitovykh otlozheniy srednego maykopa kubani i severnoy osetii: Vses. Neftegazovogo Nauchno-Issledov. Inst., Krasnodarskiy Filial, Trudy, vyp. 4, Geol. Sbornik, p. 233-246, pls. 1-3 (Moskva). [Mikrofauna and flora from the sponge-bearing deposits of the middle Maykopian of Kuban and northern Osset].

Brady, H. B., 1884, Report on the foraminifera dredged by *H. M. S. Challenger*, during the years 1873-1876: Repts. Scientific Results Voyage *H. M. S. Challenger*, v. 9 (Zool.), p. 1-814, pls. 1-115.

Bykova, N. K., 1953, Materialy k paleoekologii foraminifer suzakskogo yarusa Paleogena Ferganskoy doliny: Trudy VNIG RI, n. ser., vyp. 73, p. 207-275, pls. 1-10, 8 tables, 4 text-figs. [Materials on paleoecology of the foraminifera of the Paleogene Suzakskian stage of the Fergana Valley].

Bykova, N. K., 1959, K voprosu o zakonomernostyakh filogeneticheskogo razvitiya foraminifer v usloviyakh periodicheski izmenyayushcheysya sredy: Voprosy Paleobiologii i Biostratigrafii, Trudy II sessii Vses. Paleontol. obshchestva, p. 63-75, figs. 1-3, tables 1, 2 (Moskva). [On the question of phylogenetic regularity in development of foraminifera under conditions of a periodically changing environment].

Bykova, N. K., 1960, K voprosu o tsiklichnosti filogeneticheskogo razvitiya u foraminifer: Geol. Sbornik, No. 5, Trudy VNIGRI vyp. 163, p. 309-327, pls. 1-7. [On the question of cyclic recurrence in phylogenetic development of foraminifera].

Bykova, N. K., and A. Ya. Azbel', 1962, Stratigraficheskoe raschlenenie maykopskikh otlozheniy poluostrova buzachi po foraminiferam: Geol. Sbornik, no. 7, Trudy VNIGRI, vyp. 190, p. 375-397. [Stratigraphic subdivision of the Maykopian deposits of the Buzachi Peninsula, by means of foraminifera].

Chernyak, N. Yu., O. T. Bogaets', G. M. Voloshina and F. T. Khadikin, 1961, Do stratigrafii kreydovikh i paleogenovikh vidkladiv pivnichnogo skhilu Prichonomors'koï zapadini: Geol. Zhurnal, Akad. Nauk Ukraïns'koï RSR, v. 21, vyp. 2, p. 80-85 (Kiev) (in Ukrainian). [Stratigraphy of the Cretaceous and Paleogene sediments of northern slope of the Black Sea depression].

Cushman, J. A., 1942, The foraminifera of the tropical Pacific collections of the "Albatross" 1899-1900. Part 3—Heterohelicidae and Buliminidae: U. S. Natl. Museum, Bull. 161, p. 1-67, pls. 1-15.

Cushman, J. A. and Frances L. Parker, 1936, Notes on some Cretaceous species of *Buliminella* and *Neobulimina:* Cushman Lab. Foram. Research, Contr., v. 12, pt. 1, p. 5-10, pl. 2.

Cushman, J. A. and Frances L. Parker, 1937, Notes on some European Eocene [Miocene] species of *Bulimina: ibid.*, v. 13, pt. 2, p. 46-54, pls. 6, 7.

Cushman, J. A., and Frances L. Parker, 1947, *Bulimina* and related foraminiferal genera: U. S. Geol. Survey, Prof. Paper 210-D, p. 55-176, pls. 15-30.

Dabagyan, N. V., 1961, Foraminifery iz oligotsenovykh otlozheniy okrestnosti s. Uzhka (r. Uzh) v vostochnykh Karpatakh: Paleont. Sbornik, L'vov. Geol. Obshch., no. 1, p. 97-104, pls. 1-4. [Foraminifera from Oligocene deposits in the vicinity of northern Uzhka (Uzh region) in the eastern Carpathians].

Didkovs'kiy, V. Ya., 1963, Pershiy kolokvium z problem mikrofauni neogenu SR SR: Geol. Zhurnal, Akad. Nauk Ukraïns'koï RSR, Khimichnikh i Geologichnikh Nauk, v. 23, no. 2, p. 97-100 (Kiev) (in Ukrainian). [First colloquium on microfaunal problems of the Neogene of the USSR].

Dmitriev, A. V. and G. E. Kozhevnikova, 1963, O Paleogene tsentral'nogo Kopet-Daga: Akad. Nauk Turkmenskoy SSR, Izvestiya, ser. Fiziko-Tekhnicheskikh, Khimicheskikh i Geologicheskikh Nauk, no. 2, p. 99-107 (Ashgabat). [On the Paleogene of the central Kopet-Dag].

Dzhanelidze, O. I., 1956, Foraminifery nizhnego Miotsena Abkhazii: Akad. Nauk Gruzinskoy SSR, Trudy Sektora Paleobiologii, p. 89-120 (Georgian), 120-136 (Russian), pls. 1-4, 2 tables (Tbilisi). [Foraminifera of the lower Miocene of Abkhazian ASSR].

Espitalié, J. and J. Sigal, 1961, Microstratigraphie des "marnes bleues" des bassins tertiaires des Alpes Méridionales, le genre *Caucasina* (Foraminifère): Rev. Micropaléontologie, v. 3, no. 4, p. 201-206, pl. 1, text-fig. 1.

Gabrielyan, A. A., 1954, Armeniya v tretichnyi period: Geol. Sbornik, L'vovskogo

Geol. Obshch., no. 1, p. 136-147. [Armenia in the Tertiary period.]

GABRIELYAN, A. A., N. A. SAAKYAN, and YU. A. MARTIROSYAN, 1960, Paleogene Erevanskogo Basseyna: Paleogenovye otlozheniya yuga Evropeyskoy chasti SSSR, Akad. Nauk SSSR, p. 298-307, 1 table (Moskva). [Paleogene of the Erevansky Basin, in Paleogene deposits of the southern European part of the USSR].

GEKKER, R. F., A. I. OSIPOVA, and T. N. BEL'SKAYA, 1962, Ferganskiy zaliv paleogenovogo morya sredney azii, ego istoriya, osakdi, fauna, flora, usloviya ikh obitaniya i razvitie: Kniga 1, p. 1-335, Akad. Nauk SSSR, Paleontol. Inst. (Moskva). [Fergana Gulf of the Paleogene sea of central Asia, its history, sediments, fauna, flora, and their living condition and development].

GEKKER, R. F., A. I. OSIPOVA, and T. N. BEL'SKAYA, 1962, *ibid.:* Knigi 2, p. 1-332.

IVANOVA, L. V., 1956, K kharakteristike foraminifer polyanitskoy serii i nizhnevorotyshchenskoy svity predkarpat'ya: Geol. Sbornik L'vovskogo Geol. Obshch., no. 2-3, p. 325-328. [On the characteristic foraminifera of the Polyanitsky series and lower Vorotyshchensky beds of the pre-Carpathians].

IVANOVA, L. V., 1962, Mikrofaunistichni kompleksi v galits'kiy seriy rayonu dashava-zhidachev v peredkarpatti: Dopovidi Akad. Nauk Ukraïns'koï RSR, no. 4, p. 520-523 (in Ukrainian). [Microfaunal complex in the Galitsky series in the Dashava-Zhidachev region of the pre-Carpathians].

KAPTARENKO-CHERNOUSOVA, O. K., L. M. GOYLAK, B. E. ZERNETSKIY, E. YA. KRAEVA, and E. S. LIPNIK, 1963, Atlas kharakternykh foraminifer Yury, Mela i Paleogena platformennoy chasti Ukrainy: Akad. Nauk Ukraïns'koï SSR, Inst. Geol. Nauk, ser. Stratig. i Paleontol., vyp. 45, p. 1-200, pls. 1-47 (Kiev) (in Ukrainian). [Atlas of characteristic foraminifera of the Jurassic, Cretaceous and Paleogene of the platform part of the Ukraine].

KHALILOV, D. M., 1951, O faune foraminifer i raschlenenii oligotsenovykh otlozheniy severo-vostochnogo predgor'ya malogo kavkaza: Akad. Nauk Azerbaydzhanskoy, Izvestiya, no. 3, p. 43-61, pls. 1-4 (Baku), [On a foraminiferal fauna and subdivision of the Oligocene deposits of the northeast foothills of the lesser Caucasus].

KHALILOV, D. M., 1958, Novye predstaviteli foraminifer paleogenovykh otlozheniy Azerbaydzhana: Akad. Nauk Azerbaydzhanskoy SSR, Izvestiya, ser. Geol.-Geogr. Nauk, no 2, p. 3-11, pls. 1, 2 (Azerbaijan summary, p. 12-14) (Baku). [New representatives of foraminifera of Paleogene deposits of Azerbaijan].

KHALILOV, D. M., 1962, Mikrofauna i stratigrafiya paleogenovykh otlozhenii Azerbaydzhana: Akad. Nauk Azerbaydzhanskoy SSR, Inst. Geol. im. Akad. I. M. Gubkina, p. 1-326, 45 text-figs. (Baku). [Mikrofauna and stratigraphy of Paleogene deposits of Azerbaijan].

KRAEVA, E. YA., 1960, Foraminiferovye kompleksky verkhneeotsenovykh i oligotsenovykh otlozheniy prichernomorskoy vpadiny (zapadnaya chast') : Paleogenovye otlozheniya yuga Evropeyskoy chasti SSSR, Akad. Nauk SSSR, p. 230-243, 1 pl., table (Moskva). [Foraminiferal complex of the upper Eocene and Oligocene deposits of the Black Sea basin (western part), in Paleogene deposits of the southern European part of the USSR].

KRAEVA, E. YA., 1961, Foraminiferi verkhn'oeotsenovikh ta oligotsenovikh vidkladiv pivnichnogo krila Prichornomors'koy zapadini: Akad. Nauk Ukraïns'koï RSR, Inst. Geol. Nauk, p. 1-95, pls. 1-11 (Kiev) (in Ukrainian). [Foraminifera of upper Eocene and Oligocene sediments of the northern branch of the Black Sea depression.].

KUZNETSOVA, Z. V., 1959, Geograficheskoe rasprostranenie mikroiskopaemykh v verkhnem maykope Azerbaydzhana i ikh stratigraficheskoe znachenie: Voprosy Paleobiol. Biostrat., Trudy II sessii Vses. Paleontol. obshch., p. 105-109. [Geographic distribution of microfossils in upper Maykopian of Azerbaijan and their stratigraphic significance].

LESHCHINSKIY, A. A., 1960, Stryyskay opornaya skvazhina: in Opornye skvazhiny SSSR, 1, Vostochnye i zapadnye oblasti USSR [Ukrain]: Vses. Nauchno-Issledov. Geologorazved. Neftyan. Inst., VNIGNI, Trudy, vyp. 24, p. 200-242, 7 tables, 2 figs. [Stryyskay datum wells: in, Datum wells USSR, 1, eastern and western districts of the Ukrainian SSR].

LOEBLICH, A. R., JR. and HELEN TAPPAN, 1957, Eleven new genera of foraminifera: U. S. Natl. Museum, Bull. 215, p. 223-232, pls. 72, 73.

LOEBLICH, A. R., JR. and HELEN TAPPAN, 1961, Suprageneric classification of the Rhizopodea: Jour. Paleontology, v. 35, no. 2, p. 245-330.

LOEBLICH, A. R., JR. and HELEN TAPPAN, 1964, Treatise on Invertebrate Paleontology. Pt. C, Protista 2, v. 1, p. 1-510a; v. 2, p. 511-900.

MERKLIN, R. L., V. G. MOROZOVA, and A. S. STOLYAROV, 1960, O biostratigrafii maykopskikh otlozheniy yuzhnogo mangyshlaka: Doklady Akad. Nauk SSSR, v. 133, no. 3, p. 653-656. [On the biostratigraphy of the Maykopian deposits of southern Mangyshlak].

MYATLYUK, E. V., 1960, Novye dannye po issledovaniyu foraminifer verkhneoligotsenovykh i nizhnemiotsenovykh otlozheniy: Trudy Pervogo Seminara po Mikrofaune, VNIGRI, p. 207-227. [New data on foraminiferal research in upper Oligocene and lower Miocene deposits].

NIKITINA, YU. P., 1958, Skhema stratigraficheskoga raschleneniya maykopskikh otlozheniy Ergeney, Salo-Manychskogo mezh-

durech'ya i nizhnego Dona: Izvestiya Vysshikh Uchebnykh Zavedeniy, Geologiya i Razvedka, no. 7, p. 44-45 (Moskva). [Scheme of stratigraphic subdivision of the Maykopian deposits of Ergeney, Salo-Manychskogo, middle and lower Don].

NIKITINA, YU. P., 1962, Stratigrafiya i fatsii Paleogenovykh otlozheniy severnoy chasti Azovo-Kubanskoy Vpadiny: Byull. Moskov. obshch. Ispyt. Prirody, otdel. geol., v. 37, no. 2, p. 48-61. [Stratigraphy and facies of the Paleogene deposits of the northern part of the Azov-Kuban basin].

NIKITINA, YU. P., 1963, O Kievskom i Khar'kovskom "yarusakh" Skifskoy platformy: *ibid.*, v. 38, no. 1, p. 94-108. [On the Kiev and Kharkov stages of the Scythian platform].

NOSOVSKIY, M. F., 1963, Oligotsen Nikopol'skogo margantsevorudnogo basseyna: Byull. Moskov. obshch. Ispyt. Prirody, otdel. geol., v. 38, no. 5, p. 3-19. [Oligocene of the Nikopol manganese ore basin].

NOSOVSKIY, M. F. and N. G. SAVENKO, 1963, O stratigraficheskom polozhenii sferoidinovoy zony v maykopskikh otlozheniyakh prichernomorskoy vpadiny: Doklady Akad. Nauk SSSR, v. 148, no. 5, p. 1179-1181. [On the stratigraphic position of the spheroidal zone of the Maykopian deposits of the Black Sea Basin].

NOSOVSKIY, M. F. and M. V. YARTSEVA, 1960, Paleogenovye otlozheniya sklona Ukrainskogo kristallicheskogo massiva: Paleogenovye otlozheniya yuga Evropeyskoy chasti SSSR, Akad. Nauk SSSR, p. 173-186, table (Moskva). [Paleogene deposits of the slopes of the Ukraine crystalline massive, in Paleogene deposits of southern European part of USSR].

D'ORBIGNY, A., 1846, Foraminifères fossiles du bassin tertiaire de Vienne (Autriche): 312 p., 21 pls. (Paris).

OVECHKIN, N. K., 1962, Materialy po stratigrafii mezo-kaynozoya turgayskogo progiba, severnogo priaral'ya i zapadno-sibirskoy nizmennosti: Vses. Nauchno-Issledov. Geol. Inst. (VSEGEI), Trudy, n. ser., v. 77, p. 1-269, text-figs. 1-11, tables. [Material on the stratigraphy of the Meso-Cenozoic of the Turkaysky flexure, northern Aral and western Siberian lowlands].

RAUZER-CHERNOUSOVA, D. M. and A. V. FURSENKO, 1959, Osnovy Paleontologii. Obshchaya chast' Prosteyshie: Akad. Nauk SSSR, p. 1-368, pls. 1-13, text-figs. 1-894. [Principles of paleontology. Part 1, Protozoa].

SAMOYLOVA, R., 1946, Stratigraficheskoe raspredelenie foraminifer v verkhnepaleogenovykh otlozhenyakh r. Al'my (Krym): Byull. Moskov. obshch. Ispyt. Prirody, otdel. geol., v. 21, no. 2, p. 40-57 (French summary, p. 56-57). [Stratigraphic distribution of foraminifera in the upper Paleogene deposits of the Almy region (Crimea)].

SAMOYLOVA, R., 1947, O nekotorykh novykh i kharakternykh vidakh foraminifer iz verkhnego paleogena Kryma: *ibid.*, v. 22, no. 4, p. 77-99 (English summary, p. 100-101), text-figs. 1-42. [On certain new and characteristic species of foraminifera from the upper Paleogene of Crimea].

SELIN, YU. I., 1960, Deyaki zauvazhennya z privodu statti M. V. Yartsevoi "Do stratigrafiï oligotsenovikh vidkladiv pivdnennoskhidnogo shkilu Ukraïnsk'kogo kristalichnogo shchita": Geol. Zhurnal, Akad. Nauk Ukraïns'koï RSR, v. 20, vyp. 4, p. 105-107 (Kiev). [Some observations on the subject of the article of M. V. Yartseva, "On the stratigraphy of Oligocene sediments of the southeastern slope of the Ukraine crystalline shield"]. (in Ukrainian)

SIKIĆ, L., 1962, Erster Fund der Gattung *Caucasina* Chalilov, 1951 im Torton der Banija (Kroatien): Bull. Scientifique, Conseil Acad. RPF Yougoslavie, v. 7, no. 4-5, p. 98.

SUBBOTINA, N. N., 1953, Verkhneeotsenovye lyagenidy i buliminidy yuga SSSR: Mikrofauna SSSR, Sbornik 6, Trudy VNI GRI, n. ser., vyp. 69, p. 115-255, pls. 1-13. [Upper Eocene Lagenidae and Buliminidae of southern USSR].

SUBBOTINA, N. N., 1960, Mikrofauna oligotsenovykh i miotsenovykh otlozheniy r. vorotyshche (Predkarpat'e): Mikrofauna SSSR, Sbornik 11, Trudy VNIGRI, vyp. 153, p. 157-243, pls. 1-10. [Mikrofauna of the Oligocene and Miocene deposits of the Vorotyshchi region (Carpathians)].

SUBBOTINA, N. N., L. S. PISHVANOVA, and L. V. IVANOVA, 1960, Stratigrafiya oligotsenovykh i miotsenovykh otlozheniy predkarpat'ya po foraminiferam: *ibid.*, p. 5-127, pls. 1-14. [Stratigraphy of the Oligocene and Miocene deposits of the Carpathians based on the foraminifera].

SULEYMANOV, I. S., 1962, O novom pozdnemelovom vide roda *Caucasina:* Paleontologicheskiy Zhurnal, no. 2, p. 163-164, text-figs. 1a, b. [On a new Late Cretaceous species of the genus *Caucasina*].

TAPPAN, HELEN, 1960, Cretaceous biostratigraphy of northern Alaska: Amer. Assoc. Petr. Geol., Bull., v. 44, no. 3, pt. 1, p. 237-297, pls. 1, 2, text-figs. 1-7.

TAPPAN, HELEN, 1962, Foraminifera from the Arctic slope of Alaska, Pt. 3, Cretaceous foraminifera; U. S. Geol. Survey, Prof. Paper 236-C, p. 91-209, pls. 29-58, text-figs. 10-18.

TER-GRIGOR'YANTS, L. S., 1961, Stratigraficheskoe raschlenenie maykopskikh otlozheniy severnogo stavropol'ya; in Geologiya i neftegazonosnost' sredney azii, Volgo-Ural'skoy oblasti, Predkavkaz'ya i prikaspiya: Trudy VNIGRI, vyp. 30, p. 263-273. [Stratigraphic subdivision of the Maykopian deposits of northern Stavropol: in Geology and Natural Gas of central Asia, Volga-Ural district, the Caucasus and Caspian].

VENGLINS'KIY, I. V., 1958, Foraminiferi miotsenu zakarpattia: Akad. Nauk Ukraïns'koï RSR, Inst. Geol. Korisnikh Kopalin,

p. 1-168, pls. 1-36, text-figs. 1-12, 3 tables (Kiev) (in Ukrainian). [Foraminifera of the Carpathian Miocene].

VESELOV, A. O. and KRAEVA, E. YA., 1963, Stratigrafiya oligotsenovikh vidkladiv pivichno-skhidnogo Prichornomorya: Geol. Zhurnal, Akad. Nauk Ukraïns'koï RSR, v. 23, vyp. 4, p. 39-50 (in Ukrainian; Russian summary). [Stratigraphy of the Oligocene deposits of the northeastern Black Sea].

VYALOV, O. S., L. S. PISHVANOVA, M. I. PETRASHKEVICH, and G. N. GRISHKEVICH, 1962, Skhema stratigrafii miotsena zakarpat'ya: Byull. Moskov. obshch. Ispyt. Prirody, otdel. geol., v. 37, no. 5, p. 69-79. [Stratigraphic scheme of the Carpathian Miocene].

WILMARTH, M. G., 1938, Lexicon of the geologic names of the United States (including Alaska): U. S. Geol. Survey, Bull. 896, pt. 2, M-Z, p. 1245-2396.

YANSHIN, A. L., O. S. VYALOV, N. N. DOLGOPOLON, and V. V. MENNER, 1960, Vvedenie, in: Paleogenovye otlozheniya yuga Evropeyskoy chasti SSSR, Akad. Nauk SSSR, p. 3-12 (Moskva). [Introduction, in: Paleogene deposits of the southern European part of the USSR].

YARTSEVA, M. V., 1959, Do stratigrafiï oligotsenovikh vidkladiv pivdennoskhidnogo skhilu Ukraïs'kogo kristalichnogo shchita (za faunoyu foraminifer): Geol. Zhurnal, Akad. Nauk Ukraïns'koï RSR, v. 19, vyp. 3, p. 25-36 (in Ukrainian, Russian summary p. 35-36). [On the stratigraphy of the Oligocene sediments of the southeastern slope of the Ukraine crystalline shield].