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BRONISLAV P. NAZAREVICH & KRYSTYNA ZAWIDZKA

Lower Triassic conodonts from the Eastern Caucasian Foreland

ABSTRACT: The occurrence of conodont assemblages with *Neospathodus homeri* and *N. triangularis* in the Lower Triassic of the Eastern Caucasian Foreland in the Soviet Union is indicative of the uppermost Smithian to lowermost Spathian age (the Olenek Stage) of the conodont-bearing carbonate sequences, as well as of the usefulness and importance of conodonts as biostratigraphic keys.

INTRODUCTION AND GEOLOGIC SETTING

The Triassic of the Eastern Caucasian Foreland in the Soviet Union makes part of the epi-Variscan Scythian platform delimited by the Alpine folds of the Caucasus in the south, and the Precambrian basement of the East-European platform in the north (Text-fig. 1). It occurs at a considerable depth of a few thousands of meters, and its total thickness ranges up to 2,000 m in synsedimentary grabens plunging eastwards (*cf.* Judin & *al.* 1974).

All the Triassic series are recognizable in the Eastern Caucasian Foreland. The Lower Triassic overlies in sedimentary continuity the Permian; it includes red-colored clastics and limestones, often of the biohermal type (*cf.* Text-fig. 2). The Middle Triassic comprises dolomitic--calcareous deposits interbedded with the clastics. The Upper Triassic is represented by sandstones and claystones, with minor amounts of limestones, and thick (up to some hundreds of meters) volcanogenic members.

The investigated area is situated at the middle Kuma river, mostly within the East-Manych graben (*cf.* Text-fig. 1; *and* Letavin & Saveljeva 1975, Text-fig. 2). The analysed samples that yielded the investigated conodonts have been taken from the following boreholes: Sovkhoznaya *5* (sample *50906*), Sovkhoznaya *8* (samples *54257*, *54263*, and *54268*), Vostochnaya *16* (sample *60535*), Pravoberezhnaya

20 (samples *51130*, *51132*, and *51143*), Centralnaya *1* (sample *53183*), Zaterechnaya *1* (samples *47953*, *47954*, *47855*, *47957*, *43176*, and *43180*), and Zimnaya Stavka *75* (sample *47417*).

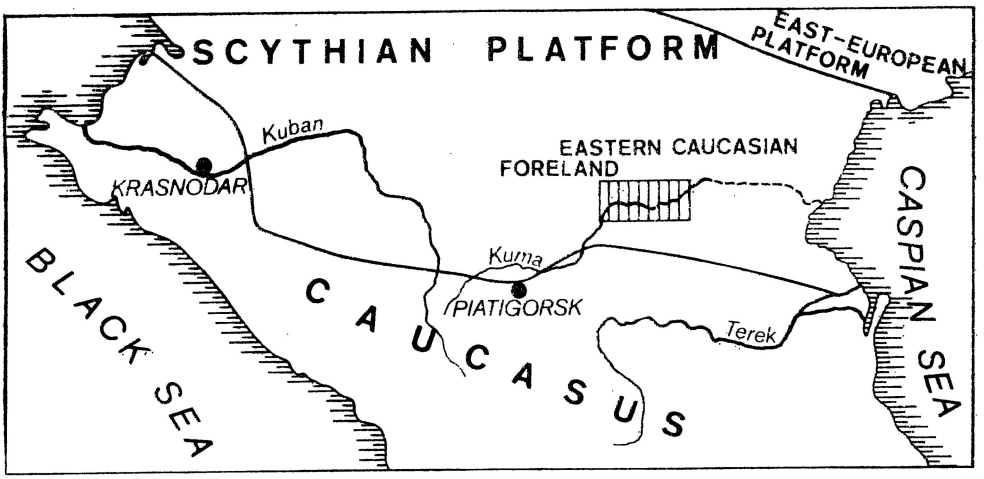


Fig. 1. Location map of the investigated area in the Eastern Caucasian Foreland, Soviet Union

Age-indicative conodont assemblages have been found in samples taken from three boreholes only, namely Zaterechnaya *1*, Vostochnaya *16*, and Sovkhoznaya *5* (Text-fig. 2).

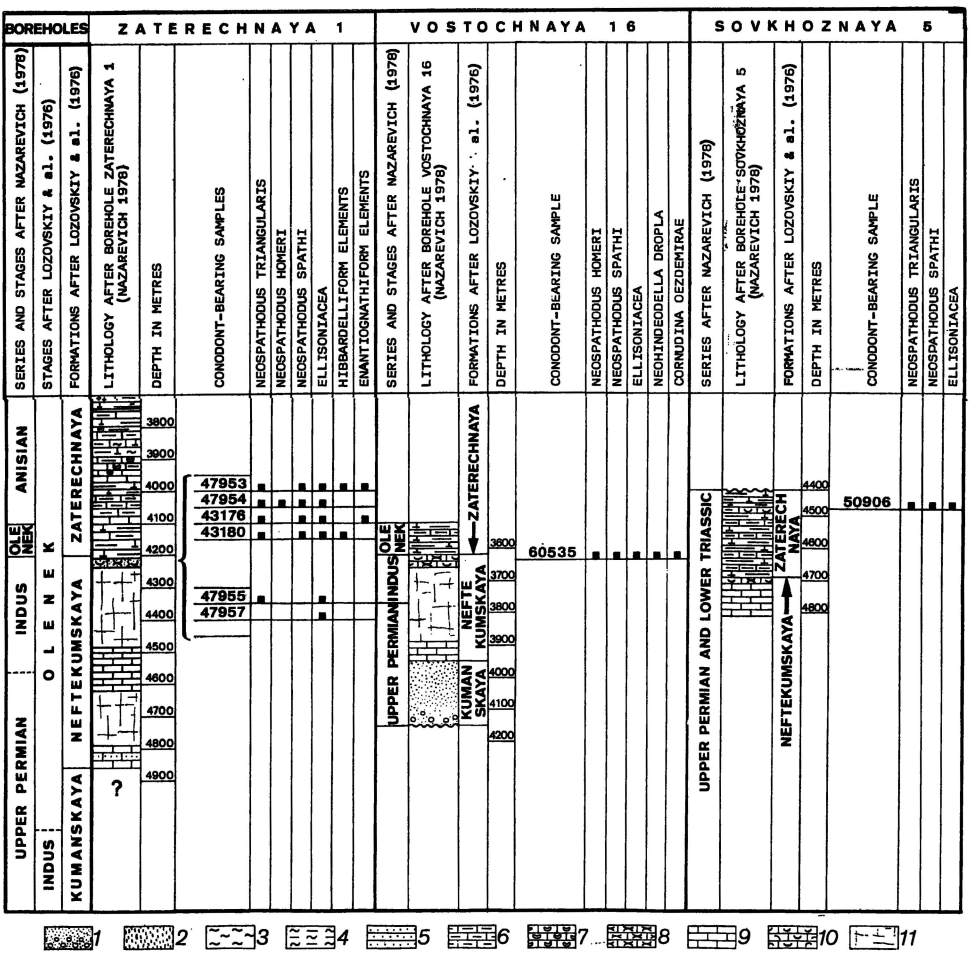
STRATIGRAPHY

A number of lithostratigraphic formations have been established in the Permian and Triassic of the Eastern Caucasian Foreland (*cf.* Lozovskyi & *al.* 1976). Out of these, the Kumanskaya, Neftekumskaya, and Zaterechnaya formations are representative of the uppermost Permian to Middle Triassic. However, the chronostratigraphic position of the formations has thus far remained disputable.

According to Nazarevich (1978), the Permian/Triassic boundary lies within the Neftekumskaya Formation, while the Indus/Olenek boundary lies at the base of the Zaterechnaya Formation the upper part of which is to be attributed to the Anisian. Lozovskyi & *al.* (1976), however, assigned the Kumanskaya Formation to the Lower Triassic (Indus and Olenek Stages), and the Neftekumskaya and Zaterechnaya Formations to the Olenek Stage (*cf.* Text-fig. 2).

All thus far known biostratigraphic data, derived mostly from the ammonite, pelecypod, and foraminifer assemblages, are indicative of the Olenek age of the Neftekumskaya Formation (Judin & *al.* 1974, Alijev &*al.* 1975, Hofman & Glazunova 1975, Letavin & Saveljeva 1975). The uppermost part of that formation (*cf.* Text-fig. 2), reached by the boreholes Zaterechnaya *1* (depth interval 4,200—4,220 m) and

Stratigraphic ranges of the conodonts obtained in boreholes pierced in the Eastern Caucasian Foreland, Soviet Union



LITHOLOGY: *1* conglomerates and gravelstones, *2* sandstones, *3* siltstones, *4* clayey siltstones, *5* claystones, *6* clayey limestones, *7* lumpy limestones, *8* brecciated limestones, *9* micritic limestones, *10* organogenic limestones and calcarenites, *11* biohermal limestones

Vostochnaya *16* (depth interval 3,630—3,637 m), represented by brecciated limestones, mostly biomicrites, often red-colored, with foraminifers, ostracodes, filaments, fragmented trochites, and small-sized ammonites, has yielded a conodont assemblage. A similar assemblage has been also found in the Zaterechnaya Formation (borehole Sovkhoznaja *5*, depth interval 4,380—4,385 m).

The most characteristic elements of the recorded conodont assemblages are the species *Neospathodus triangularis* Bender, *N. homeri* Bender, and *N. spathi* Sweet (*see* Pls 1—2). The latter species was first described by Sweet (1970) from Pakistan where it occurs in the lower part of the conodont zone *10* (Platyvillosus). In addition, it was reported (Burij 1975) from the fourth conodont set of the South Primorie in the Soviet Union, equivalent to the conodont zone *9* (Neogondolella milleri).

The species *Neospathodus homeri* is indicative of the Lower homeri Zone established in the Campilian of Greece (Bender 1967), a part of which is characterized by occurrence of both *N. homeri* and *N. triangularis* (see Text-fig. 3).

The latter species was also recognized by Ganev & Stefanov (1967) as indicative of the Campilian in the East Balcans. Two conodont zones were established by Budurov & Trifonova (1974) in the Campilian of that area, namely the *N. triangularis* Zone in the lower part of the stage, and the *N. homeri* Zone in the upper part. The species *N. triangularis* and *N. homeri* are characteristic of the Spathian of Dobruja, Rumania (Mirauta 1974). They range from the Upper Smithian to Lower Spathian in Turkey (Gedik 1975), as well as in the Pacific part of the Soviet Union (Burij 1979). In the Nepalian Tibet, *N. triangularis* occurs with conodonts indicative of the Lower Olenek (Kozur & Mostler 1973). That species is confined to the Subcolumbites Zone in Nevada (Mosher 1968) but according to Sweet & *al.* (1971), it is indicative of the conodont zones *10—13* equivalent to the Spathian. In fact, it first appears in the lower part of the conodont zone *10* in the Thaynes Formation in Utah (Solien 1979), being there the earliest representative of the Spathian conodont assemblage. McTavish (1978) recognized *N. triangularis* and *N. homeri* as characteristic of the Spathian of various sections situated in the Gondwana shelf, and Spasov & *al.* (1977, 1978) found them also in the Lower Triassic, supposedly Spathian, of Crimea in the Soviet Union.

With all these data taken into account (*see* Text-fig. 3), the investigated borehole sections representative of the Lower Triassic of the Eastern Caucasian Foreland are to be correlated with the uppermost Smithian (Anasibirites nevolini Zone) to lowermost Spathian (Tirolites cassianus Zone).

There are two hypotheses that may be invoked to explain the absence of the index conodonts, such as *Platyvillosus* or *Neogondolella jubata*, from the investigated strata. Firstly, the investigated strata may represent a time interval earlier than the appearance of those taxa. Secondly, the Eastern Caucasian Foreland may have made part

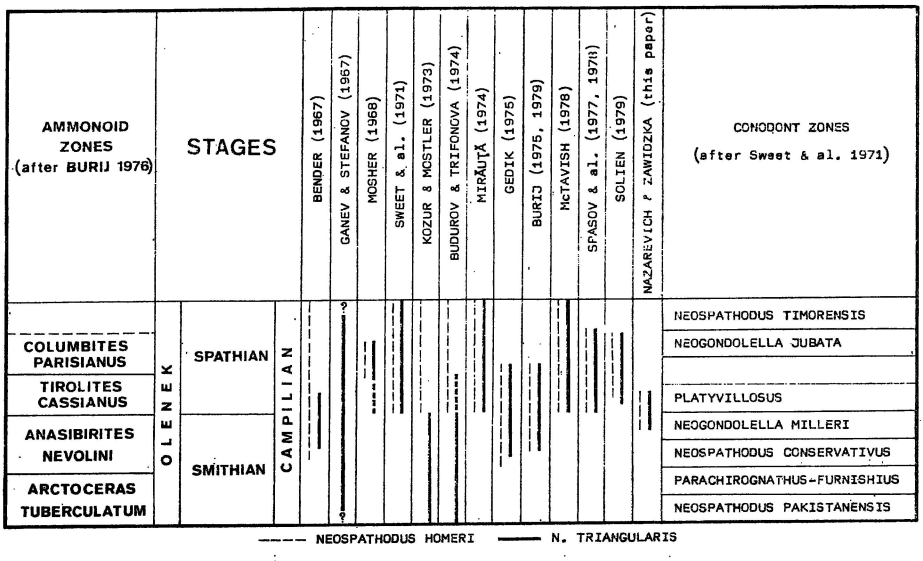


Fig. 3. Stratigraphic range of the conodont species *Neospathodus homeri* Bender and *N. triangularis* Bender in the Lower Triassic deposits of diverse regions of the world as recognized by successive authors (see the text)

of the East Mediterranean-Aegean bioprovince, like the East Balcans, Dobruja, Greece, and supposedly Turkey did (*cf.* Budurov 1976), where *Platyvillosus* and *Neogondolella jubata* are absent from, being just replaced by *Neospathodus homeri* and *N. triangularis*.

Institute of Historical Geology
of the Moscow University,
Leninskie Gory,
Moscow, B-234, USSR
(B. P. Nazarevich)

Institute of Geology
of the Warsaw University,
Al. Żwirki i Wigury 93,
02-089 Warszawa, Poland
(K. Zawidzka)

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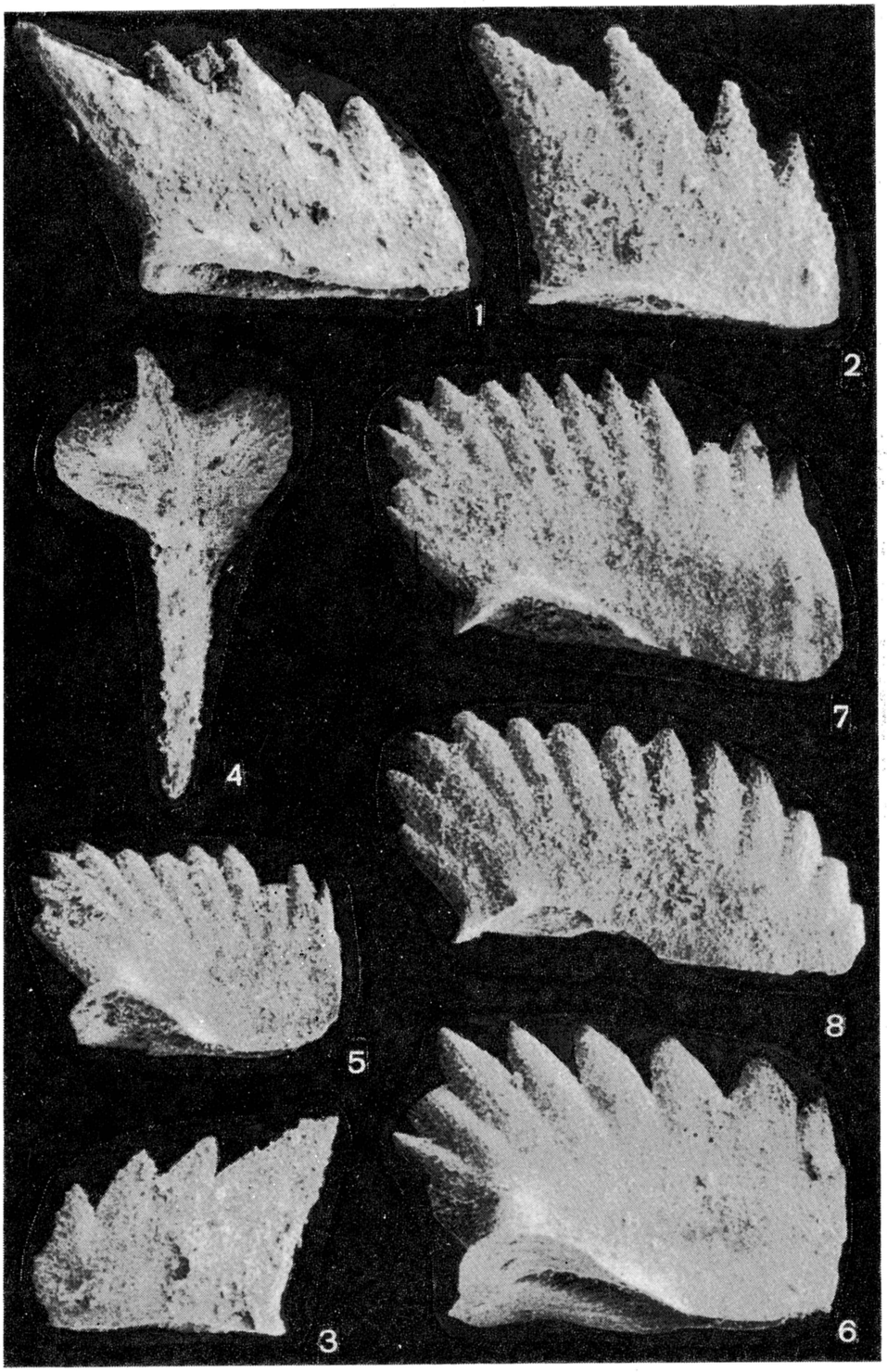
B. P. NAZAREVICH i K. ZAWIDZKA

KONODONTY Z DOLNEGO TRIASU WSCHODNIEGO PRZEDKAUKAZIA

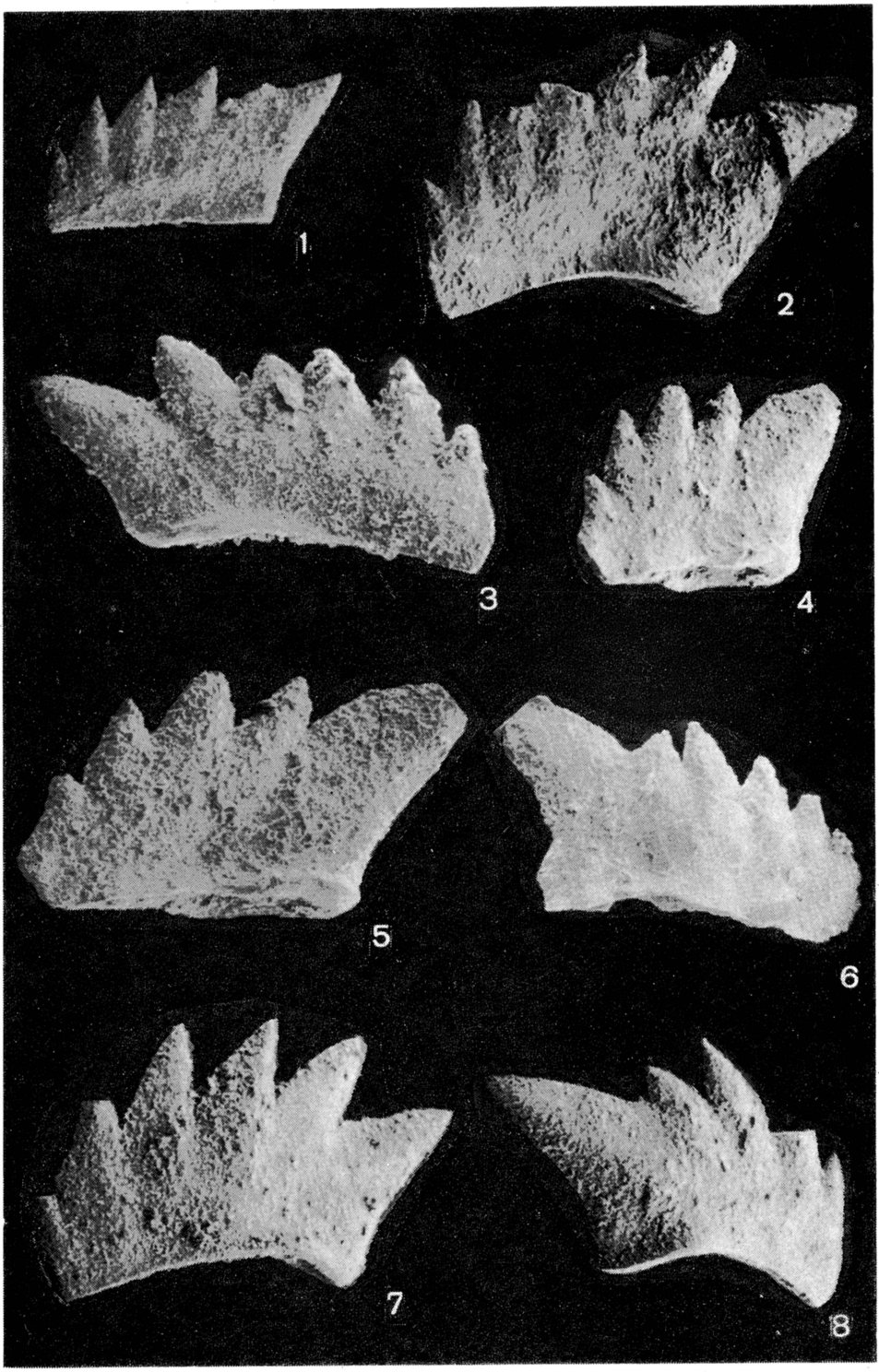
(Streszczenie)

W utworach dolnego triasu Wschodniego Przedkaukazia (*por.* fig. 1) stwierdzono występowanie zespołów konodontowych, których charakterystycznymi elementami są *Neospathodus homeri* Bender, *N. triangularis* Bender oraz *N. spathi* Sweet. Zespoły te występują w profilach trzech wierceń: Zaterechnaya, Vostochnaya i Sovkhoznaya (*patrz* fig. 2 oraz pl. 1—2).

Rozważywszy znane dotychczas w dolnym triasie zasięgi tych trzech taksonów (*por.* fig. 3) można przyjąć, iż wiek zawierających je osadów odpowiada najwyższemu smithowi (poziom Anasibirites nevolini) i najniższemu spathowi (poziom Tirolites cassianus). Brak taksonów indeksowych dla standardowych zon konodontowych *9* i *10* (*patrz* Sweet & *al.* 1971) wynikał zapewne (*por.* Budurov 1976) z ówczesnej przynależności Wschodniego Przedkaukazia do egejskiej prowincji faunistycznej.



1—3 — *Neospathodus spathi* Sweet; 1 and 3 are from borehole Vostochnaya, 2 from Zaterechnaya; 1 is taken × 150, 2 and 3 × 200; 4—6 — *Neospathodus trangularis* Bender; Zaterechnaya; 4 and 6 are taken × 200, 5 × 150; 7—8 *Neospathodus homeri* Bender; Zaterechnaya, × 150



1—8 — *Neospathodus spathi* Sweet; 1 and 6 are from borehole Vostochnaya, others from Zaterechnaya; 6 is taken ×200, others ×150