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Қ. И. Сәтпаев атындағы Қазақ ұлттық техникалық зерттеу университеті

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FEATURES OF DEVONIAN AND CARBONIFEROUS BOUNDARY DEPOSITS IN THE KARAMURUN SECTION OF THE BOLSHOI KARATAU MOUNTAINS

Abstract. Subcommission on Carboniferous Stratigraphy of the International Commission on Stratigraphy conducts and completes studies of the boundary depositsof the Carboniferous and Devonian systems in order to carry out global correlations and prepare an unified International Stratigraphic Scale of the Carboniferous system. The Global Boundary Stratotype Section and Point (GSSP) of the Tournaisiantier base, Mississippi subsystem and the Carboniferous system was established in the La Sierra section in Southern France. The boundary was defined by conodonts and other fauna and flora (ammonoids, foraminifera, ostracodes, myospores, corals and brachiopods). However, the existing GSSP currently being revised.In the Karamurun reference section of the Bolshoi Karatau Mountains Devonian and Carboniferous boundary deposits are observed in the reefogenic facies with biogermes. Such conditions of sedimentation and stratigraphic levels are promising in search for oil and gas deposits in Kazakhstan and the world. Foraminifer complexes allow tracing zones, identified in other regions and acceptable for correlation and substantiation of location of the Devonian-Carboniferous boundary at a modern level. The near-boundary level is marked by big biotic re-buildings caused by abiotic changes.

Key words: boundary, Devonian, Carboniferous, Karamurun, section, reef, foraminifer, zone, the International Stratigraphic Scale, correlation.

The Subcommission on Carboniferous Stratigraphy of the International Commission on Stratigraphy sets tasks of studying and completion of knowledge on the boundary between the Carboniferous and Devonian systems in order to carry out global correlations and create a single International Stratigraphic Scale of the Carboniferous system [1; 2]. Special work teams are dedicated to the study of boundaries. The International Work Group (IWG) on Devon and Carboniferous Boundary Problems recommended setting the boundaryin accordance with the decision of the II Geerlen Congress near the level of goniatite zones of *Wocklumeria-Gattendorfia*, on the first appearance of *Siphonodella sulcata* conodonts, which precedes the appearance of *Gattendorfia* in Henetal and corresponds to the base of layers with *Acutimitoceras* [1].

The Global Boundary Stratotype Section and Point (GSSP) fixing the base of the Tournaisian stage, the Mississippian Subsystem and the Carboniferous system were established in the La Sierra section in Southern France. The boundary was determined by the first appearance of the conodontic species *Siphonodella sulcata* in the phylogenetic sequence of *Siphonodella praesulcata – S. sulcata*.The decision was approved by the International Stratigraphic Committee and published in 1991. However, the existing GSSP of the Carboniferous is currently being revised due to the discovery of *Siphonodella sulcata* below the established boundary [3].The New Joint Devonian–Carboniferous Boundary GSSPReappraisal Task Groupincluding Devonian and Carbon specialists, is currently working on developing new criteria for determining position of the D-C boundary and choosing a new tipesection [4, 5].

In 1986, the Interdepartmental Stratigraphic Committee in Minsk accepted the boundary of Devonian and Carboniferous at the bottom of the *Acutimitoceras prorsum* subzone of the *Gattendorfia* [6-8], this level corresponds to the base of the conodont zone of *Siphonodella sulcata* Zone, the ostracod *Richterinalatior – Pseudoleperditia tuberculifera-Gryptophyllussocialis* Zone and the beds with forami-

nifera *Tournayellina pseudobeata* and remnant *Quasiendothyra*. Similar foraminiferal assemblage shave been studied in recent decades in sections of the Bolshoi Karatau, including the Karamurun section, where boundary deposits are observed in the reefogenic facies with biogerms. Such conditions of sedimentation and stratigraphic levels are promising in search of oil and gas deposits in various regions of Kazakhstan and the world. In this case, they are disposed on surface and are available for research [9-12].

There was a decision of the Kazakhstan Stratigraphic Committee todelimitate the Devonian-Carboniferous boundary within the regional Carboniferous setup, conditionally at the base of the Kassian Horizon and foraminiferal beds with *Bisphaera malevkensis – Earlandia minima* [7]. In the new version, the boundary is placed in the zone below.

In South Kazakhstan, R.E. Alekseeva and A.I. Sidyachenko [13] were engaged in stratigraphy of the Famennian-Tournaisian deposits of the BolshoiKaratau. They described stratigraphy and brachiopods of Famennian deposits in the central and south-east parts of the Karatau range. Here, B.V.Poyarkov [14] studied Devonian foraminifera, including those of the Famennian. He identified six foraminifer aassemblages in the Upper Devonian. In 1960, O. I. Bogush and O.V. Yuferev studied biostratigraphy and fauna of the Upper Devonian and Carbonifrous of the Bolshoi Karatau[15]. During many years, the Fame-nnian-Carboniferous foraminifera of the Bolshoi Karatau, Talas-Ugam and other regions in Carboniferous, Carboniferous-terrigenous section types were studied by M.M. Marfenkova [16]. She proposed the Aksuran (Baizhansai) section as a reference section for the boundary deposits of the Devonian-Carboniferous of the Karatau-Talas Structural-Facial Zone (SFZ), where an Upper Famennian *Septaglomospiranella rauserae – Quasiendothyra communis* Zone was identified. She proposed to compare the base of the Carboniferous system with the base of *Quasiendothyra kobeitusana – Q. konensis*, over which the *Bisphaera malevkensis – Earlandia minima* zone was individuated (1988). The same successive change of zones was also identified by M. M. Marfenkova for the Takhtamysh-Sai section located at the southeast end of the Akuyuk syncline of the Bolshoi Karatau.

During 1993-1998 and 2000-2018, the boundary deposits D_3/C_1 of the Bolshoi Karatau have been studied by the author [10, 11, 17, 18]. During the 2017 International Field Trip to the upper part of the Karamurun reef, the Upper Famennian ammonoids were discovered and collected for the first time [12].

As a result of this work, we managed to find the foraminiferal assemblages which allow us tracing the zones identified in other regions and acceptable for correlation and justification of the location of the Devonian-Carboniferous boundary at the present level [19].

The section is compiled by A.E. Zorin, basing on the central part of the Karamurun cover-syncline [10] (figure 1). The reef deposits are rest on limestone of the Khatynkamal series (layers 1-5, figure 2). The upper part of the Karamurun reef complex consists of the following units (from up downwards).

6. Limestones:white, light grey, dark grey in spots, large-plate massive algal boundstones (figures 3-6). Numerous stromatactoid textures are present. Algae (renalcises) – are the reef builders. Large accumulations of gastropods and brachiopods, are observed everywhere, crinoids and single rugoses also present. Foraminifera: *Archaesphaera* sp., *Neoarchaesphaera* cf. *polypora* Antropov, *Vicinesphaera* cf. *angulata* Antropov, *V.* cf. *squalida* Antropov, Bisphaera *sp.*, *Parathuramminites* cf. *cushmani (S*uleimanov), *P.* cf. *vasiljevae (*Pojarkov), *Parathurammina* cf. *dagmarae* Suleimanov, *P.* cf. *brewiradiosa* Pojarkov*, Suleimanovella* cf. *suleimanovi(*Lipina), *Cribrosphaeroides* cf. *ovalis (*Pojarkov), *C.* cf. *simplex (*Reitlinger), *Bykovaella* cf. *crassitheca* Antropov, *Rauserina notata* Antropov, *Corbiella ?* sp., *Parastegnammina pseudocamerata* Pojarkov, Paracaligelloides? florennensis *Conil et Lys,* Tournayella *aff.* Praeseg-mentata *(Bogush et Yuferev)*. Algae Issinella *cf.* devonica Reitlinger and *Renalcis* sp. Thickness: 55 m.

7. Limestones:white, light grey, coarse-plate recrystallized boundstone, similar to those des-cribed in the layer 6. Foraminifera: *Archaesphaera* cf. *magna* Suleimanov, *A.* cf. *minima* Suleima-nov, *Vicinesphaera* cf. *squalida* Antropov, *V.* cf. *angulata* Antropov, *Suleimanovella* cf. *.suleimanovi (Lipina), Parathurammina* sp., *Cribrosphaeroides* sp., *Bisphaera* ? sp., *Irregularina ?* sp., Eotour-nayellina*? sp.; problematic sphaeras Radiosphaera* cf.*basilica* Reitlinger. Thickness: 60 m.

8. Limestones: white, light grey, large-plate, massive algae boundstones. There are cracks 2-5 cm wide, secant to the layer in its upper part, made by needle calcite. The cracksare 4-10 m long. Foraminifera: *Parathurammina* sp., *Bisphaera* sp., Auroria *cf.* ferganensi s*Pojarkov***,** Paracaligelloides ? *sp.* Algae Renalcis*sp.* Thickness: 105 m.

Figure 1 – General view of the section: the Karamurun reef massif (foreground), outcrop rocks of the Lower Shalkia subsuite (centre), and outcrop rocks of the Upper Shalkia subsuite (above)

Figure 2 – The top part of the Karamurun reef. The Famennian stage with Clymeniida

Figure 3 – Ammonoid-rich bed of the Karamurun reef massif, the upper part (detail).
The Famennian stage with Clymeniida. 1 – Clymeniida

Figure 4 – The Karamurun reef massif, the upper part.
The Famennian stage with Clymeniida and nautiloids (detail). 1 – Nautiloids, 2 – Clymeniida.

Figure 5 – The Karamurun reef massif, the upper part (detail).
The Famennian stage:abundant accumulations of gastropods

Figure 6 – The Karamurun reef massif, the upper part (detail).
The Famennian stage: stromatactoid textures

9. Breccias:grey, boulder-massive, coarsely clastic, unsorted, carbonate of composition. Fragments of angular shape, 0.5 cm-10 m, are represented exclusively by algae limestone (boundstone), underlying the buildings. The cementing matrix is composed of fine crystalline calcite. Numerous remnants of crinoids are found in the debris. In general, breccias are the accumulation of fragments of different size. Thickness: 132 m.

10. Breccias: gray, boulder-massive, coarsely clastic, carbonate. Rubbles are not rolled, ranging in size from 1 cm to 3-4 m, represented by algae limestones (boundstone). The cementing matrix is represented by medium-coarse-grained bioclast-lithoclastic limestones (grainstones). Thickness: 65 м.

The Karamurun reef thickness along the section is 417 m. Above, are regular beddings of the Shalkiya suite deposits (figure 7).

Figure 7 – Outcrops of the Lower Shalkiya subsuite

The Shalkiya Suite (D_3 - C_1*slk*).

The first attempts to identify carbonaceous-siliceous-carbon deposits under this title were made by geologists of the Karamurun geological exploration team at the Shalkiya polymetallic deposit field.

The Shalkiya Suite integrates carbonates and carbonaceous-siliceous-clayey-carbonate sediments of the carbonate platform slope and its base, which lie on the Karamurun reef massif.

The section of the Lower Shalkiya subsuite is compiled within the Karamurun syncline, which contains the following deposits located on the Karamurun reef massif (from down to up, figures 7-10):

11. Breccias: massive grey with unrolled debrisand boulders (from 0.1 to 3-4 m) of algae limestones (boundstone) and anisometric gradation-layered limestones (turbidites) in different proportions. The cementing matrix is composed of bioclast-lithoclastic limestone (grainstone) from debris flow depositions. Foraminifera are determined from fragments of turbidites: *Archaesphaera* cf. *suleimanovi* Boguch et Yuferev, *A.* cf. *crassa* Lipina, *A.* cf. *grandis* Lipina, *A.* cf. *minima* Suleimanov, *Neoarchaesphaera* cf. *polypore* Antropov, *Vicinesphaera* cf.*angulata* Antropov, *V.* cf. *squalida* Antropov, *Suleimanovella* cf. *suleimanovi* (Lipina), *S.* cf. *paracushmani* (Reitlinger), *Parathuramminites* cf. *cushmani* (Suleimanov), *Parathurammina* cf. *dagmarae* Suleimanov, *P.* cf. *spinosa* Lipina, *Cribrosphaeroides* cf. *ovalis* (Pojarkov), *Uralinella* cf. *bicamerata* Bykova, *Bisphaera* sp., *Corbiella* cf. *fungeiformis* Pojarkov, *Tuberporina* sp., *Rauserina notata* cf. *polycellata* Antropov, Eotuberitina *sp.,* Bituberitina *sp.*, Diplosphaerina *sp.*, Eotournayellina primitiva Lipina. Thickness:57м.

12. Alteration of limestones: 1) grey, thin-plate, medium-finegrained with thin interlayers of dark-grey silicium and 2) grey.medium-plate, coarse-medium-grained, bioclast-lithoclastic, gradation-layered

(grainstone) forming the Ta,b-rhythms. Thin-plate differences prevail. Foraminifera: *Neoarchaesphaera* sp., *Archaesphaera* sp., *Vicinesphaera* cf. *squalida* Antropov, *V*. cf. *angulata* Antropov, *Cribrosphaeroides* cf. *ovalis* (Pojarkov), *Suleimanovella* cf. *suleimanovi* (Lipina), *Parathurammina sp., Uralinella* cf. *bicamerata* Bykova, *Auroria ?* sp., *Bisphaera* sp., Eovolutina *cf.* elementa Antropov; problematic sphaeras *Asterosphaera* sp.,Thickness: 20 м.

13. Alternation of thin-plate and middle-plate (in different proportions) turbidite differences is similar to the layer 12. Horizons up to 0.5 m of medium-clastic breccias of grain flows are noted. Foraminifera: *Radiosphaera* cf. *basilica* Reitlinger, *Archaesphaera* cf. *grandis* Lipina, *Archaesphaera* cf. *crassa* Lipina, *Vicinesphaera* cf. *angulata* Antropov, *V*. cf. *squalid* Antropov, *Suleimanovella* cf. *suleimanovi* (Lipina), *Parathurammina* sp., *Cribrosphaeroides* sp., Auroria *cf.* ferganensis *Pojarkov, Bisphaera* cf. *grandis Lipina,* Eotuberitina *sp.,* Septaglomospiranella *sp.,* Quasiendothyra *cf.* konensis (Lebedeva); problematic sphaeras *Radiosphaera* cf. *basilica* Reitlinger. Thickness: 105 м.

14. Alternation of limestones: 1) grey, large-plate, coarse-grained bioclast-lithoclastic (up to 1 m of grainstone beds, - grain flow depositions); 2) grey, middle-large-plate, gradation-layered, coarse-middle-grained, bioclast-lithoclastic grainstones (turbidites Ta,b); 3) grey, middle-plate gradation-layered medium-fine-grained (turbidites Ta, b, c); and 4) thin-plate, up to 2 cm, carbonaceous-siliceous “in-situ” sediments with remnants of radiolarians. In the roof of the unit, there are single large re-deposited blocks of algal boundstone (2x7 m) in large-coarse-grained turbidites. Foraminifera: *Neoarchaesphaera* sp., *Archaesphaera* sp., *Vicinesphaera* sp., *Suleimanovella* cf. *suleimanovi* (Lipina), *Parathurammina quadrata* Brazhnikova et Vdovenko*, Bisphaera* sp., *Tubeporina* ? sp., *Caligella antropovi* Lipina, *Baituganella vulgaris* Lipina, Eotournayellina *sp.,* Tournayellina *cf. vulgaris* Lipina, *Clomospiranella* sp.; problematic sphaeras *Radiosphaera* sp.Thickness: 26 м.

15. Alternation of the beds, similar to that described in the unit14, except for the appearance the package of the gradation breccias grain flows (2-3 m thick) omnideveloped. The unrolled lithoclasts up to 70 cm in size are represented by different types of limestone. Floating packs. The cementing matrix is composed of a coarse-grained bioclast-lithoclastic grainstone. In most cases, breccias' bodies have erosive relations with underlying deposits. Foraminifera**:** *Neoarchaesphaera* ? sp., *Archaesphaera* cf. *crassa* Lipina, *A*. cf. *grandis* Lipina, *A*. cf. *magna* Suleimanov, *A*. cf. *minima* Suleimanov, *Vicinesphaera* cf.

Figure 8 – Outcrops of the upper part of the Lower Shalkiya Subsuite with biogerms

Figure 9 – Outcrops of the upper part of the Lower Shalkiya Subsuite with biogerms (detail)

Figure 10 – Outcrops of the upper part of the Lower Shalkiya Subsuite with biogerms, overlaid by deposits of the Upper Shalkiya Subsuite

squalida Antropov, *Suleimanovella* cf. *suleimanovi* (Lipina), *Parathurammina* cf. *tuberculata*Lipina, *P.* cf. *spinosa* Lipina, *Baituganella* cf. *vulgaris* Lipina, *Septaglomospiranella primaeva* cf. *minima, Septaglomospiranella* cf. *parva* Durkina, Tournayellina *sp.*, Quasiendothyra *cf.* communis *Rauser-Chernousova,* Quasiendothyra *cf.* konensis (Lebedeva), Quasiendothyra *aff.* baidjansaica globosa Durkina, *Quasiendothyra kobeitusana Rauser-Chernousova*. Thickness: 95 м.

Deposits of the Upper Shalkiya Subsuite compose the nuclear parts of the Karamurun and Mynbulak synclinals. Tectonic relations between the Upper and Lower parts of the Shalkiya subsuites are fixed everywhere.

Upper Shalkiya Subsuiteis represented by dark-grey to black medium-thin-plate, rhythmically built thin-layered micrite carbonaceous-clayey-siliceous-carbonate, siliceous-carbonate, clayey-carbonate, siliceous (in situ) deposits [20], grey, dark-grey, middle-plate, multi-grained (from coarse-grained to fine-grained differences) with admixture of terrigenous material, limestone, dolomitized limestone (turbidites Ta, b, c), represented by bioclast-lithoclastic packstones and wackestones. In situ carbonaceous-clay-siliceous-carbonate deposits are accompanied by unburdened body strike (first meter thick) and creep breccian lenses of poorly lithified deposits, formed by fragments of host rocks and dark carbonate micrite material. Horizons of breccias of grain and debris flows (first meters thick; much rare 15-25 m) are composed of unrolled fragments of skeletal bioclast-lithoclast algae limestone, gradation-layered limestone, silicon, carbonaceous-clayey-siliceous-carbonate thin-layered deposits, cemented by lithoclast-bioclast medium-coarse-grained matrix. Thin beded carbonaceous-clayey-siliceous-carbonate deposits are characterized by presence of the bed-by-bedthin syngenetic pyrite embedding. Numerous remnants of radiolarians and sponge spicula are observed in the beds of the essential siliceous composition.

The limestones are bioclast and bioclast-intraclastic micrograined (packstone), almost micrit, with numerous fragments of algae of various shapes and sizes. In algae limestones (packstones), beds and algal fragments are recrystallized, very poorly preserved. Intraclasts (calcite, dolomite) are often replaced by ore matter. Bioclasts are represented by organic residues of poor preservation (algae, radiolarians). The mycrite matrix is recrystallized, contains bioclasses of sludge dimension and the shale-developed carbonaceous substance. The carbonaceous substance is either distributed unevenly over the shale or thinly scattered over the entire slice. Inclusions of ore mineral of different shapes and sizes are found in slices, and small inclusions of ore mineral, including pyrite of cubic and hexagondohedral forms, are often scattered. Often the ore mineral is developed in veins and algae, sometimes it is unevenly distributed throughout the entire slice, often replacing organic residues. The rock is often flaky and permeated with two generations of calcite veins.

Numerous relics of undefined organic matter (small crustaceans or osrtacodes, radiolarians, algae) can be found in bioclastic limestones. There are single foraminifera of very poor preservation: *Parathurammina* ? sp., *Bisphaera* sp., *Diplosphaerina* ? sp., *Auroria* cf. *ferganensis* Pojarkov, *Auroria* sp., *Paracaligella* sp., *Parastegnammina* sp., *Tournaellina* sp. (*Tournayellina* cf. *primitiva* Lipina), *Quasiendothyra* (*Eoendothyra*) sp., and problematic *Archaesphaera* sp., encountered, mainly, in Famennian (D_3fm) and Tournaisian deposits (C_1t) of various regions [10].

The algae are: *Kamaena* cf. *delicata* Antropov, *Kamaena* sp., *Issinella* cf. *devonica* Reitlinger, *Issinella* cf. *grandis* Tchuvachov, *Parachaetetes? (Thomiliton) jonsoni* Masslov, *Epiphyton* sp., *Pseudonanopora* cf. *stockmansi* Mamet et Roux, *Conglutinella* aff. *tikhii* Shuysky, rare *Solenopora* (D_3-C_1) [8]. Found in slices were single fragments of recrystallized moss animals, foraminifera *Eotuberitina lesovaja* Michno and algae *Epiphyton* sp. (D_3fm). Spongolites (siliceous recrystallized limestone) with numerous sponges, radiolarians, and single algae are found, including *Kamaenidae*, more often *Renalcis*.

In the section, the main background of the foraminifera complex of the Upper Famennian are monocamerate forms. Present in large quantities are: *Parathurammina dagmarae, P. breviradiosa, P. sp.,* plenty of *Radiosphaera basilica, R. ponderosa, Vicinesphaera angulata, Asterosphaera pulchra.* Encountered: *Bisphaera paracompressa, B. malevkensis, Cribrosphaeroides simplex, Suleimanovella suleimanovi*, as well as *Auroria* sp., *Irregularina* sp., *Paracaligella* sp*., Rauserina* sp. Above, are rare multicamerate *Tournayellina vulgaris, T. pseudobeata,* single *Septatournayella rauserae*–of *Tournayellina pseudobeata* Zone of the Lower Tournaisian (figure 11).

The presence of monocamerate forms and rare representatives of *Tournayellina pseudobeata*, *T. beata, Quasiendothyra (Eoendothyra) communis* and the first primitive *Chernyshinella* brings the complex closer to Tn1b I Avesnois (Conil, Lys. 1969) or allows comparing it with the standard *Tournayellina pseudobeata* Zone [21].

The lower boundary of the Tournaisian in the Bolshoi Karatau was previously proposed to be located at the base of the *Bisphaera malevkensis - Earlandia minima* Zone. The *Bisphaera malevkensis* occurs in the Devonian [20] and is quite widespread in the Famennian Stage [14], and occur en mass, in the lower part of the Tournaisian, forming "bispherabeds".

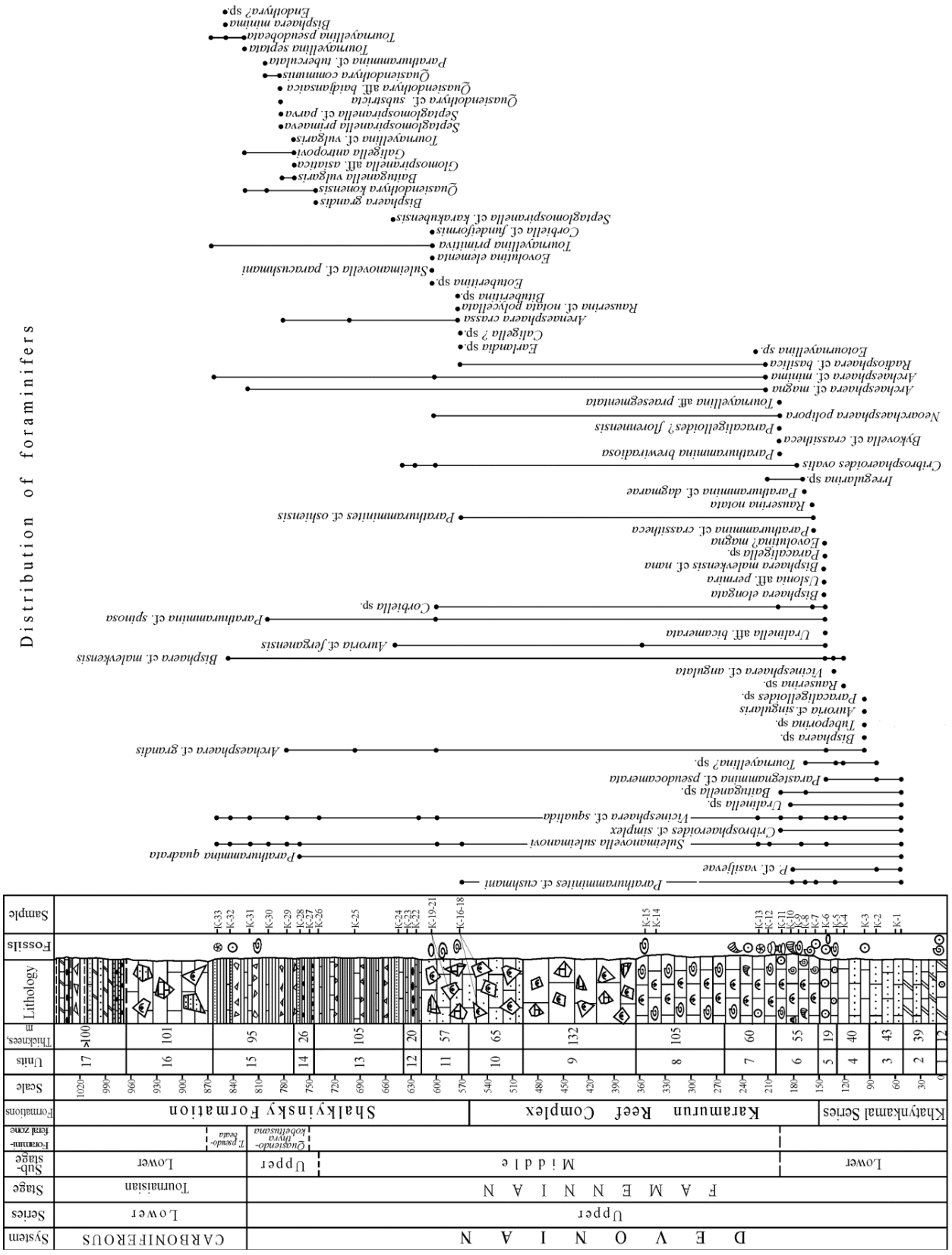

Figure 11 – The Karamurun section. Lithology and distribution of foraminifera in the Famennian-Lower Tournaisian deposits(A.E. Zorin, V.Ya. Zhaimina, 2003-2016)

The presence above of the *Earlandia minima* and *E. elegans*, rare *Tournayellina beata* allow correlating the strata with the *Bisphaera malevkensis–Earlandia minima* Zone of the Russian Platform (Unitized,... 1991) [8] and dating them as Tournaisian.

Thus, near the boundary of Devonian and Carboniferous systems, a significant reorganization of foraminiferal assemblage, are observed. It is expressed by extinction of the quasiendothyrins and the development of the Tournaisian *Chernyshinella* and *Endothyra*, i.e. the near-boundary level is marked by large biotic reconstructions, the main feature of which is the change of faunistic communities (figure 11). Biotic reconstructions were caused by abiotic changes, the shallowing in the near-boundary time.

One of the indicators of a major abiotic event in marine sections, at the boundary of the two systems, is dolomitization and the presence of breccias. With eustatic sea level fluctuations, the Carbonate platform collapsed, and coarse-clastic Carbonate fragments was formed.

It is necessary to study the section further, with a more detailed selection of all organic residues, their definition and monographic description to present it as a stratotype.

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ҚАРАМҰРЫН ҚИМАСЫНДАҒЫ ДЕВОН ЖӘНЕ ТАС КӨМІР ЖҮЙЕСІНІҢ ШЕКАРАЛЫҚ ҚАБАТТАРЫНЫҢ ЕРЕКШЕЛІКТЕРІ (ҮЛКЕН ҚАРАТАУ, ОҢТҮСТІК ҚАЗАҚСТАН)

Аннотация. Тас көмір жүйесі бойынша халықаралық комиссия жаһандық түзетулер мен тас көмір жүйесіне қатысты халықаралық бірыңғай стратиграфиялық шкала енгізу мақсатында тас көмір мен девон жүйелерінің тыңғылықты зерттеуде. Турней жікқабатының, Миссисипий ішкі жүйесі мен Тас көмір жүйесінің Жаһандық Үлгі Қимасы Оңтүстік Францияның Ла-Сиерр қимасында орын тапқан. Аталмыш шекара конодонттар мен басқа да фауналар мен флоралар (аммоноидтер, фораминиферлер, остракодтар, миоспорлар, маржандар мен брахиоподтар) бойынша анықтау өлшемшартына ие. Үлкен Қаратауағы Қарамұрын тіректі қимасының шөгінді жыныстар рифогенді фацияларда биогермалармен қоса байқалады. Шөгінділердің осы тұсы Қазақстан мен әлемде мұнай - газ кенорындарын табуда кеңінен қолданылады. Фораминиферлер, қазіргі таңда, жүйесі таңдап алынған басқа да аудандар мен девон мен таскөмір шекараларын анықтадуа аса маңызды роль ойнайды. Шекаралық деңгей абиотикалық өзгерістерге байланысты үлкен биотикалық өзгерістермен белгіленеді.

Түйін сөздер: шекара, девон, тас көмір, Қарамұрын, қима, рифтер, фораминиферлер, аймақтар, Халықаралық Стратиграфиялық шкала, түзету (корреляция).

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ОСОБЕННОСТИ ПОГРАНИЧНЫХ ОТЛОЖЕНИЙ ДЕВОНА И КАРБОНА РАЗРЕЗА КАРАМУРУН (БОЛЬШОЙ КАРАТАУ, ЮЖНЫЙ КАЗАХСТАН)

Аннотация. Международная подкомиссия по стратиграфии каменноугольной системы изучает и доизучает пограничные отложения каменноугольной и девонской систем с целью проведения глобальных корреляций и создания единой Международной стратиграфической шкалы каменноугольной системы. Глобальный Стратотипический Разрез и Точка (GSSP) основания турнейского яруса, Миссисипской подсистемы и каменноугольной системы установлены в разрезе Ла-Сиерр в Южной Франции. Граница имеет критерии определения по конодонтам и другой фауне и флоре (аммоноидеи, фораминиферы, остракоды, миоспоры, кораллы и брахиоподы). Однако в настоящее время положение этой границы пересматривается. В опорном разрезе Карамурун Большого Каратау пограничные отложения наблюдаются в рифогенных фациях с биогермами. Подобные обстановки осадконакопления и стратоуровни перспективны для обнаружения

месторождений нефти и газа в Казахстане и Мире. Комплексы фораминифер позволяют проследить зоны, выделенные в других регионах, приемлемые для корреляций и обоснования положения границы девона и карбона на современном уровне. Пограничный интервал отмечен крупными биотическими перестройками, обусловленными изменениями абиотическими.

Ключевые слова: граница, девон, карбон, Карамурун, разрез, рифы, фораминиферы, зоны, Международная Стратиграфическая шкала, корреляция.

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