

Analysis of the Geological Structure of the Ulytau-Arganata Structural-formational Zone

¹*DOSETOVA Gulnara, Doctoral Student, gulnara_joldasovna@mail.ru,

²KRYAZHEVA Tatyana, Cand. of Geol. and Min. Sci., Associate Professor, kryazheva_t@mail.ru,

¹NPJSC «Abylkas Saginov Karaganda Technical University», Kazakhstan, Karaganda, N. Nazarbayev Avenue, 56,

²JSC «Zhezkazgan Baikonurov University», Kazakhstan, Zhezkazgan, Alashakhan Avenue, 1b,

*corresponding author.

Abstract. The results of studying the stratotypes of Ulytau-the Arganatinskaya structural-formation zone located in the western part of Central Kazakhstan, are highlighted. Intensely metamorphosed volcanogenic-sedimentary strata and intrusive formations take part in its structure. The existing features of stratigraphic sections of Precambrian sediments allow us to distinguish different structures. Located in the central part of the Maytyubinsk structure is composed of rocks of the Borovian series of the Lower Proterozoic. The Karsakpai structure located to the east is made of rocks of the Karsakpai (Akdym) series of the Upper Proterozoic.

Keywords: structural and formation zone, Ulytau static massif, lithostratigraphic complex, tectonic block, quartzite amphibolites, leucocratic feldspar quartzites, graphite quartzites, graphite shales, facies changes of sediments, metamorphic basement.

Introduction. The Ulytau-Arganatinskaya structural-formation zone covers the Ulytau sialic massif (microcontinent), is oriented in the submeridional direction, has an elongated shape in plan [1, 2].

The Ulytau and Arganatinsky parts of the Sialic massif (structural and formation subzones), as well as scattered tectonic blocks exposed among Paleozoic strata, have common features of the structure of Precambrian formations, differ only in the varying degree of their metamorphic transformations, the degree of tectonic crowding of various tectonic plates and the intensity of their cover-folded deformations [3, 5, 6].

Lithostratigraphic complexes composing the Ulytau-Arganatinsky sialic massif, as well as on other massifs of the Central Kazakhstan folded region, form a Neoproterozoic (Late Riphean) complexly constructed metamorphic foundation and an unevenly metamorphosed Vendian-Lower Paleozoic cover [4, 9].

The first information about the metamorphic rocks of Ulytau appeared in connection with the discovery of the Kurgasyn lead deposit in the metamorphic strata on the Kara-Turgai River.

Research methods. When carrying out scientific research on the topic of the doctoral dissertation, field studies were conducted, rocks composing the structural and formation zone were studied. The upper age limit of their formation does not exceed 673 ± 2 million years and corresponds to the late cryogeny (late Riphean), determined by the time of crystallization of unmetamorphosed syenites of the Karsakpai

intrusive complex.

Deposits of Ediacaran-lower Cambrian age Ed-E1 (Vend) compose the visible bottoms of the section; in the central part they are divided into the Kurailinsky and Baikonur formations; in the eastern part – the Zhaltau and Satansky formations.

The Kurailin formation Edkr (Vkr) is developed in the central, deepest part of the structural-formation zone. The base of its incisions is not known. Overlapped by the Baikonur suite. The stratotype of the formation is located in the lower reaches of the Kuraila River, two kilometers from its mouth.

In the visible, lower part of its section lies a 2-3 meter horizon of carbonaceous siltstones and carbonaceous-clay shales. Above is a 120-meter pack of green siltstones and sandstones with rare and low-power layers of dolomites; up the section gradually replaced by a 60-meter pack of red-colored siltstones, sandstones and limestones. The section is completed by a 100-meter bundle of ribbon limestones and clay siltstones, variegated in the lower part, gray-colored, baritone-bearing in the upper part. The total capacity of the suite is about 275-300 m. The upper 100-meter pack of rocks by Yu.A. Zaitsev and T.N. Kheraskov (1964) was assigned to an independent Bosingen retinue [7].

The Zhaltau formation Ed žl (V žl) is located at the stratigraphic level of the Kurailinsky formation, distributed in the eastern part of the Baikonur zone in the area of junction with the Ulytau Sialic massif. According to tectonic contacts, it lies on the deposits of the Koksus series (Tnks) and is overlain by the Satan

(Baikonur) suite with erosion. It was first isolated by A.L. Knipper (1963). The stratotype is located in the Zhaltau Mountains. At the bottom of its visible section, it is composed of quartz sandstones and gravelites with lenses of conglomerates, coarse-grained sandstones and phyllites with a total thickness of up to 120 m; in the upper part – carbonaceous phyllites, carbonaceous-siliceous and carbonaceous-clay shales with rare interlayers of quartz sandstones and carbonate rocks.

In the roof there is a marking horizon of silicified (oolitic) limestones with microphytolites of the (Vendian) complex. The power of the Zhaltau formation varies from 230 to 430 m. Carbonaceous rocks contain a rich complex of microfossils of Vendian and Vendian-Cambrian age.

The Baikonur formation Ed-E1bk (V bk) is distinguished as a thickness of tillite-like conglomerates. In the central part, it is composed of conglomerates with scattered pebbles, usually called tillite-like, tilloids or turbidites, which are monotonous non-layered siltstones or clay shales of dirty green, rarely brown-green color with unsorted fragments, blocks and pebbles of older rocks, mainly of local origin. The size of the debris varies from 0.5-1.0 cm to 1.0 m, pebbles and boulders no larger than 20 cm predominate. Large fragments are distributed unevenly, in the form of distant boulders, boulders and pebbles, sometimes forming lenticular clusters having an irregular shape.

In the eastern part of the zone, the deposits of the Baikonur formation are wedged in places and its section is reduced to 100 m. In the lower part of its section lies a low-power horizon of conglomerates with scattered pebbles of exclusively silicified algal oncolite limestones, composing the marking horizon in the roof of the Zhaltau formation. Conglomerate cement rocks contain microfossils of the Vendian-Cambrian age (Grigaitis, 1989). The minimum age of detritus zircon isolated from the sandy matrix of tilloids corresponds to 650 million years (Kanygina et al., 2014).

The upper, most of its section, is composed of dark green-gray ribbon thin-layered siltstones and clay shales, which are rather sharply overlapped by carbonaceous-siliceous shales and phthanites of the Kurumsak formation (E1-2 krm).

The total thickness of the Baikonur formation in the central part varies between 300-400 m, the eastern one varies from 0 to 100 m.

The Satanite formation lies on the rocks of the Zhaltau formation, is composed of green-colored and greenish-gray, sometimes purple-gray phyllites containing scattered pebbles and loose lenses of conglomerates with flattened and oriented shale pebbles of dolomites, acidic effusions, granite porphyries and quartzites. The total capacity of the suite is about 600 m.

The composition of pebbles depends on the composition of nearby rocks. In some areas of its development, especially in the vicinity of the Basaltwaite Mountains, the Satanite suite has a binomial struc-

ture. Tillite conglomerates predominate in the lower part of the section, clay shales and phyllites predominate in the upper part.

The bundles of siliceous tuffites and tuffs, variegated tuff-sedimentary rocks previously included in the Satanite suite, obviously do not belong to it. They have a limited development and form fragments of independent complexly dislocated tectonic scales.

The Kurumsak formation E1-3 krm (E1-2 krm) consists of phthanites, jasper-like microquarcites, carbonaceous-clay and carbonaceous-clay-siliceous shales, with a total capacity of up to 370 m.

Phthanites and siliceous-carbonaceous rocks contain microfossils of the Vendian-Cambrian age, small nodules of phosphorites and, in places, low-power interlayers and lenses of vanadium-bearing and phosphate-bearing shales.

The sediments of the Cambrian system – lower division – Ordovician system of the subdivision include sediments of the Lower Cambrian-Lower Ordovician, corresponding in volume to the Kurumsak and Kokbulak undifferentiated suites. They are allocated in the west of the zone where formations, due to their small capacities, cannot be drawn on maps of a scale of 1:200, as well as in areas covered with loose formations, where it is also not possible to draw formations separately for single wells.

The undifferentiated deposits of the Lower Cambrian-Lower Ordovician are composed of phthanites, carbonaceous shales, calcareous siltstones, and limestones. The estimated capacity of the unit is about 300 m.

The Kokbulak formation (E4-O1kk) is represented by terrigenous-carbonate strata composed of carbonaceous limestones interspersed with siliceous and siltstone shales, marls.

Formations of the formation correspond to and gradually replace the deposits of the Kurumsak formation up the section, so the lower boundary of the formation is rather conditional. Limestones are dense, thin-crystalline, thin-layered, often with a bumpy surface due to the concentration of siliceous and carbonaceous matter in certain areas, have an indistinctly pronounced intermittent-striped texture. In some places they are dented and broken into thin slabs. Limestones contain layers of grayish-greenish and tobacco-green clay and lime-clay shales. The thickness of these interlayers ranges from 0.3 m to 2 m.

The most complete sections of the suite were opened on the right and left banks of the Baikonur River. The maximum capacity in the area is probably about 100 m.

The suite is characterized by a fauna of non-lock brachiopods, trilobites, which determine its age as late Cambrian-Early Tremadoc. The section of the Kokbulak formation is enlarged by carbonaceous siltstones of the Karasuir formation of the Lower Ordovician, the tops of the Tremadocian tier – the bottoms of the Sandbian tier. Thus, the age of the Kokbulak formation should be considered Late Cambrian-Early Ordovician.

Scientific results. Obtained in recent years, new data on isotopic dating of stratified metamorphic strata of Precambrian and Precambrian intrusive formations (Degtyarev, Tretyakov, Letnikova et al., 2012-2019; Ermolov, Antonyuk, 2012-2013) have significantly clarified and revised the existing stratigraphic schemes of dissection of metamorphic stratified and magmatic complexes [9, 10, 11]. Especially metamorphites, which were distinguished in the Bek-turgan (Zerendin) series, traditionally referred to the most ancient formations (Archaea, early Proterozoic). Isotope-geochronological dating of detrital (detritus) zircons isolated from para- and orthogneisses and crystalline shales of the Bekturgan series showed that

the formation of the protolith of these metamorphites occurred due to the destruction of rocks of predominantly acidic composition with an age of 834-716 million years [8].

Conclusions. Based on the above, we come to the conclusion that in the Ulytau sialic massif, there are no formations older than one billion years – the Neoproterozoic (Upper Riphean).

It was also found that the most metamorphosed and granitized rocks that were isolated in the Bek-turgan series and traditionally belonged to the most ancient formations (Archaea, early Proterozoic), according to isotope-geochronological dating of detrital (detritus) zircons, are younger.

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Ұлытау-Арғанаты құрылымдық-формацялық аймағының геологиялық құрылысын талдау

¹*ДОСЕТОВА Гульнара Жолдасовна, докторант, gulnara_joldasovna@mail.ru,

²КРЯЖЕВА Татьяна Владимировна, г.-м.ғ.к., доцент, kryazheva_t@mail.ru,

¹«Әбілқас Сағынов атындағы Қарағанды техникалық университеті» КеАҚ, Қазақстан, Қарағанды, Н. Назарбаев даңғылы, 5б,

²«Ө.А. Байқоңыров атындағы Жезқазған университеті» АҚ, Қазақстан, Жезқазған, Алашахан даңғылы, 1б,

*автор-корреспондент.

Аңдатпа. Орталық Қазақстанның батыс бөлігінде орналасқан Ұлытау-Арғанаты құрылымдық-формацялық аймағының стратотиптерін зерттеу нәтижелері баяндалған. Оның құрылымына қарқынды метаморфталған вулканогендік-шөгінді қабаттар мен интрузивті түзілімдер қатысады. Кембрий алдындағы шөгінділердің стратиграфиялық бөлімдерінің қол жетімді ерекшеліктері әр түрлі құрылымдарды бөліп көрсетуге мүмкіндік береді. Орталық бөлігінде орналасқан Майтөбе құрылымы төменгі протерозойдың Бурабай сериясының жыныстарынан тұрады. Шығыста орналасқан Қарсақпай құрылымы жоғарғы протерозойдың Қарсақпай (ақдам) сериясының жыныстарымен орындалған.

Кілт сөздер: құрылымдық-формацялық аймақ, Ұлытау статикалық массиві, литостратиграфиялық кешен, тектоникалық блок, кварциттік амфиболиттер, лейкократтық дала шпаты кварциттері, графитті кварциттер, графитті тақтатастар, жауын-шашынның фациялық өзгерістері, метаморфтық іргетас.

Анализ геологического строения Улытау-Арганатинской структурно-формационной зоны

¹*ДОСЕТОВА Гульнара Жолдасовна, докторант, *gulnara_joldasovna@mail.ru*,

²КРЯЖЕВА Татьяна Владимировна, к.г.-м.н., доцент, *kryazheva_t@mail.ru*,

¹НАО «Карагандинский технический университет имени Абылкаса Сагинова», Казахстан, Караганда, пр. Н. Назарбаева, 56,

²АО «Жезказганский университет имени О.А. Байконурова», Казахстан, Жезказган, пр. Алашахана, 16,

*автор-корреспондент.

Аннотация. Освещены результаты изучения стратотипов Улытау-Арганатинской структурно-формационной зоны, расположенной в западной части Центрального Казахстана. В её строении принимают участие интенсивно метаморфизованные вулканогенно-осадочные толщи и интрузивные образования. Имеющиеся особенности стратиграфических разрезов докембрийских отложений позволяют выделить разные структуры. Расположенная в центральной части Майтубинская структура сложена породами боровской серии нижнего протерозоя. Находившаяся к востоку Карсакпайская структура выполнена породами карсакпайской (акдымской) серии верхнего протерозоя.

Ключевые слова: структурно-формационная зона, Улытауский сиалический массив, литостратиграфический комплекс, тектонический блок, кварцитовые амфиболиты, лейкократовые полевошпатовые кварциты, графитовые кварциты, графитистые сланцы, фациальные изменения осадков, метаморфический фундамент.

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