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ON THE CLOSING DATE OF THE JUNGAR-BALKHASH PALEOBASIN

Abstract. Analysis of materials on the Southeast of Kazakhstan and the adjacent region of China shows that the development of the Paleoasian ocean occurred through the formation of island arcs and separate sedimentation basins. Dzhungaro-Balkhash sea basin existed from the early Ordovician to the middle of the Permian period, as evidenced by the presence of marine fauna in its individual parts. Stratigraphic materials adjacent to the East of Alakol area of China show that most young marine terrigenous deposits, Jungar-Balkhash basin are of Famennian-tournaisian the tournaisian age and overlap-cannabischarlie regional volcanic volcanic belt. This is followed by a break corresponding to the rise of the area, the subsequent accumulation of ground molasses of the Gzhel century, and then the contrasting lower Permian volcanic series. The youngest ophiolites in the area are of early Devonian age. These data indicate the autonomous time of laying the pools that make up the paleo-ocean and the close time of their closure (probably early Permian). Closing method-a collision in combination with a simple filling sedimentary material. The active edge of the Dzhungaro-Balkhash basin is the Ili plate separating It from the South Tien-Shan paleocean. Volcanic accumulation of the Devonian, Carboniferous and Permian periods are part of a volcanic belt that framed Jungar-Balkhash sea basin on the part of the Kazakhstan continent, talking about the geological and petrochemical data.

Key words: Paleoocean, ophyolites, island arc, active margin, Gzhel age, petrochemical data.

Introduction. Late Paleozoic history of South-East Kazakhstan and Tien Shan is connected with development of the Paleo-Asiatic ocean and adjoining areas of the Kazakhstan continent. Initial stage of subsidence the Paleo-Asiatic ocean was connected generally accepted opinion, with disintegration paleocontinent Rodiniya and the most further his(its) development was shown in shaping the row of the insular arcs and in accordance with them Ural, Obi-Zaysan, Kirghiz-Terskey, Dzhungaro-Balhash basins [1, 2]. Time of the closing the Paleo-asiatic ocean is a subject to discussions and is taken within late Carboniferous to Permian period.

Axial for that ocean is Dzhalair-Nayman ophiolite zone, terminated its development in early Ordovician [3]. The Second ophyolite zone, Itmurundy in North Balhash area- is taken as ensimatic island arc, torn right-side shift on Itmurundin and Tekturmas branches. Her(its) development was terminated in medium of Silurian period. The Large island arc system, separated Dzhungaro-Balhash and Obi-Zaysan basins, was Chingiz-Tarbagatay ensimatic insular arc, existed in Cambrian and Ordovician [4, 5]. From located south-west Dzhungar-Balhash basin she is separated with large Chingiz shift; northeast border of the insular arc was not well-marked, it was facial, with change island-arc sediments into ocean ones to axial for Obi-Zaysan paleoocean Char-Gornostaev ophyolite suture.

Dzhungar-Balhash paleobasin occupied the space to south-west from Chingiz-Tarbagatay arc and from Ili plate to northward. In modern cut he has a wedge-shaped outlines and is framed with three sides by volcanic belts. In the opinion of leading kazakhstan specialist Bespalov V.F, Afonichev N.A., Zaycev Yu.A., V.Ya. Koshkin and others Dzhungar-Balhash sea pool was gradually narrowed and migrated in south-east direction [4-7]. Right behind for basin and in the same side framing his(its) marginal volcanic belts moved.

The contour of Dzhungaro-Balhash sea basin is outlined it enough clearly. Inwardly it composed powerful sedimentary, mainly terrigenous and siliceous-terrigenous sediments of Devonian and Carboniferous systems. Devonian, Carboniferous and Permian volcanic accumulations surrounded the sea pool with north, west and south, on measure of the removing behind it with local develop changed with terrigenous by red-colour postponing intracontinental zone [6, 7]. The time of existence Dzhungar-Balhash basin from formation of marginal rifts at the beginning Ordovician to infilling by the end of Paleozoic [8-10].

Time of the full closing Dzhungar-Balhash paleoocean on that moment is object of discussion. In his(its) Kazakhstan part by majority of geologists it is taken as early Permian or as border early and late Permian period[11]. The Reason for such dating serves presence of Permian sea fossils in layers of Durnorechen suite beside north bottom of Main Dzhungar range [12]. Here V.A.Bush and others are described sea Low Permian sediments (the sandstones and siltstones with lenses of limestone, power 220 m, containing briozoa and rugosa). The last is presented by forms Artins complex similar known on Ural.

Northward from town Zharkent, near southern bottom of Dzhungar Alatau and in Toksanbay range it is known outcrops of different-colour conglomerate-sandstone of the postponing Jamanbulak suite, containing fauna brachiopodes, and foraminifers, the remainders of the flora and palinocomplexes of late Carboniferous age. In most top of her(its) sequence L.N.Sergeev was described late Carboniferous brachiopodes, but after M.M.Marfenkova – Hemifuzulines of upper part of the Moscow stage [13]. Palinocomplex is presented by forms typical of bottom, but from sequense of Toksanbay range - by a typical upper Carboniferous forms: Florinites luberae Samoil., Cordaitina rotata Samoil., nigritellus (Lub) Shurk and others.

Carboniferous sequence of the sediments of the south part Dzhungar Alatau within active margin of paleobasin Kugaly suite presented lake grey-yellow sandstone, siltstones, argillites,tuffites, flint and algae limestones with the remainders of the flora, palinocomplex and imprint amphibious crowns. The Remainder of the flora in her(its) is typical of upper Carboniferous and bottom перми. Palinologic determinations Potoniesporites novicus Bhar., Punctatisporites granifer Pot., Shophipollenites principalis Lub. Cordaitina sp and others give the narrower age interval of the accumulation of the sediments: late Carboniferous [13]. The Imprint of amphibian Protriton Brochiozaurus Gredu from these sediments in Kurty region also have late Carboniferous or early Permian age [14]. Thereby, we have given on different parts of the region about existence sea Dzhungar-Balhash basin in late Carboniferous and, may be in early of the Permian.

Sedimental and geohronological materials of chinese geologist, studied upper Paleozoic volcanic-sedimentary sequence in mountain Barleyk West Dzhungary (the Northwest China) helped to restore time of the closing Dzhungaro-Balhash ocean in his(its) the most east, chinese part [15] Upper Paleozoy sequence of this region includes from below upwards litoral sedimentary layers, containing glauconite sandstones of shallow shelf (Famen-Tourneous),volcanic rocks of orogenic belt of Tournaisian - Early Bashkir age, sandstones and conglomerates of Gzhel stage of with gradational bedding unrepresentative for sea sediments. The sequence has been terminated by bimodal volcanic assotiation, on geochronological data corresponding to Asselianian and Sakmarian stages of lower Permian.

Northward from Zharkent town, beside south bottom of Dzhungar Alatau and in Toksanbay range known outcrops of different-colour conglomerate-sandstones of the postponing Jamanbulak formation, containing fauna brachiopods foraminifer, the remainders of the flora and palinocomplexes of late Paleozoic age. In most top of her(its) sequence L.N.Sergeeva was described late Carboniferous brachyopodes, and M.M.Marfenkova – hemifusulines of bottom the Moscow stage [13]. Palinocomplex is presented by forms of bottom upper Carboniferous, but from Toksanbay sequence - a typical Late Carboniferous forms: Florinites luberae Samoil., Cordaitina rotata Samoil.,Nigrisporites nigritellus (Lub) Shurk and others.

Carboniferous sequence of the south part Dzhungar Alatau within active margin of paleobasin Kugaly formation presented with lake grey-yellow sandstones, siltstones, tuffites, flints and limestones with the remainders of the flora, palynocomplexes and imprints of amphibious. The remainder of the flora in her(its) layers are typical of upper Carboniferous and bottom Permian formes. Palinocomplex includes Potoniesporites novicus Bhar., Punctatisporites granifer Pot., Shophipollenites principalis Lub., Cordaitina sp. and others forms give the narrower age interval of the accumulation of the retinue: late Carboniferous

[13]. The Imprint amphibian Protriton Brochiozaurus Gredu from these postponing in Kurty region also are Carboniferous or Early Permian age [14]. Thereby, we have data on different parts of the region about existence sea facet Dzhungar-Balhash pool in late Carboniferous and, may be in early Permian.

Sedimentology and geochronology data of Chinese geologist, who have studied [ate Paleozoic volcano-sedimentary sequense in mountain Barleyk of West Dzhungary (the NorthWest China) helped to restore time of the closing Dzhungar-Balhash paleoocean in his(its) the most east, chinese part [15]. Upper Paleozoic sequense of this region includes from below upwards litoral sedimentary rocks, containing glauconitic sandstones of shallow shelf(Famenian-Tourneous age), volcanic serie of orogenic belt Tourneous-Early Bashcirian age,sandstones and conglomerates of Gjhelian stage which have gradational layers unrepresentative for sea sediments. Bimodal volcanic assotiation terminates that sequence, on geochronological data corresponding to Asselian and Sakmar grade of Lower Permian.

The most young age of detrital zircon from sandstone and U|Pb age of the volcanic rocks said that these rocks sedimented in Famenian-Tourneisian, Tourneisian – Early Bashkirian , in Gjhelian and Asselian-Sakmar stages accordingly. Tourneisian Early Bashkirian age of volcanic rocks and their overland look point to their probable attribute united with Pribalhash-Ili volcanic belt, his(its) east continuation. The Absence of Upper-Baskirian, Moscow and Kasimov of the postponing, in the opinion of chinese authors data, is obliged tectonic to ascent Dzhungar Alatau. Dzhungar-Balhash paleobasin, upon their opinion, was definitively closed before Gjhelian stage, close on time with others ocean pools of the south part of Paleo-Asiatic ocean [15]. The tops of that sequense composed with the Early Permian basalts and riolite-dacitic ignimbrites. One sample of dacite from this serie gave on zircon U-Pb age ~298 mln years [15] that is indicative of Asselian stage of time to crystallizations poured.

Alongside with stated stratigraphic material reliable paleomagnetic data show that Paleo-asiatic ocean was not an united broad ocean, but included several pools, prepared by volcanic arcs and continental blocks [15, 17]. In particular, as of Bo Liu , Bao-Fu Han and others [16], narrow age interval of the shaping ophiolites shows that between Boschekul and Zaysan arcs Early Ordovic ocean pool have been existed, too as a part of Paleo-asiatic ocean. Besides, on near-border of the territory of China, adjoining to Zharma-Saur and Chingiz-Bakanas Kazakhstan systems, there else row of the zones of ophiolite mélange were revealled. Some of they include the Cambrian gabbro blocks and are overlayed with Middle Ordovician chert rocks, but then unconformable – with an Low Carboniferous sediments [15]. In central part of West-Dzhungar block, verging with orient to Alakol trough, ophiolites associate to Late Devonian chert rocks of ocean bottom, overlapped by Low Carboniferous sedimentary rocks and is torned by Carboniferous granitoids with geochemical signs of subductional zones [15]. Thereby, probably, different basins, being included in Paleo-Asiatic ocean, were formed and developed enough autonomous, but their closing occurred by simple filling of sedimentary material.

Time of existence Dzhungar-Balhash sea pool in Chinese West Dzhungar covers the length of time from beginning of Devonian period to beginning or mediums Tourneisian centure [15]. In kazakhstan part of region it is more vast: from low Ordovician riftogenezis in Tekely zone to accumulation Low Permian Durnorechen suite of the retinue Alakol region [18]. The border Dzhungar-Balhash pool and paleocontinent, referred in chinese publications Ili plate, is facial, with gradual transition overland, mainly volcanic rock of the active margin in coastal ones, containing more significant share terrigenic material and then, on removing from coast line inside pool - in sea sedimentary with gradually decreasing admixture ash [18, 19]. Dzhungaro-Balhash pool within north part Dzhungar Alatau before medium Carboniferous period was an arena of the accumulation mainly siliceous and terrigenic sea sediments. Followed time of accumulation of carbonates was short, has occupied the Bashkirian stage and occurred only in Borotal region [5]. For Moscow stage characteristics of local accumulation variegated sandstones of Jamanbulak suite in coast part of pool[6]. The Internal space Dzhungar-Balhash basin in the second half of Carbononiferous period presented itself area, removed from the sources of the demolition with very faded clay-chert accumulation.

Relatively recently appeared the publications on Tien-SHan [8, 10, 11, 19] and others], characterizing South Eeast Kazakhstan and North Tien-SHan as active margin not Dzhungar-Balhash ocean, but located to south of it Turkestan (South-Tien-Shan ocean, which developed on background subduction ocean crust with south under Ili plate [11]. To such conclusion authors of enumerated publications come, outgoing from proximity Ili segment of the volcanic belt with South-Tien-SHan ocean basin, but without regard

petrochemical zones composition of the volcanic rocks of Ili belt. The Authors were repeatedly indicated on asymmetric petrochemical zones composition of the rocks of Ili volcanic belt fragment, first of all on growing potassium on measure of the removing from Dzhungar-Balhash sea in south direction on all his(its) length from Kurty region to China[20]. The most enriching potassium Devonian, Carboniferous and Permian volcanic rocks formed the rear synclines on narrow band along south edge paleocontinent in Kirghiz range, near Issykkul lake and in Karatau Ketmen. On the contrary, calc-alkaline, more sodium-volcanic rocks are typical of adjoining to Dzhungar-Balhash basin of the north edge of the belt, where they form the extensive fields, having transition to coast-sea facies. On figures 1, 2 there are brought comparison coeval main rocks of lower Carboniferous Dzhungar Alatau (the Guantobe suite, 145 samples and Altynemel series,149 samples) and ranges of North Tien-Shan (the Ketmen, 161 samples and Kuluktau series, 60 samples). Distinctly more high contentses of alkaline are seen in Djungar volcanites contentses ferric and lowered in contrast with alkalinity. For greater contrast SiO_2:100, but Al_2O_3:10 (in mass %).

The South border of Ili plates, presenting hercinides an active margin of Dzhungar-Balhash paleobasin, tectonic, passes on Atbashi-Inylichek shift, southward from which sea faces South-Tien-Shan sea basin are presented [19, 21]. Petrochemical materials on volcanic formations of Ili plate are indicative of growing in south direction of the powers of the eath crust[20].Usually on active Andy type margin her(its) growing occurs on measure of the advancement deep into continent and only large rifting breaks exist in rear parts these volcanic belt and are formed zones powerful basalt volcanism type to Provinces Pools and ranges of North America. The Similar situation existed in Carboniferous period on Ili plate, allowing to speak of possible take-off in medium Visean stage her(its) south edge (Issykkul block) from the main part on rear North-Kungey high angled fault. The torning away block with large Sonkul and Sarydzhaz batolites belonged inland part of Ili plate - the zone overland volcanic outlying-continental type. With south she was limited North-Kungey fault, providing in contact volcanic belt and synchronous him terrigen-carbonate sequences of rear Karatau-Nothern Tien-Shan- basin.

Saur phase of tectogenezis has caused the manifestations basalt volkanizm (basalt Satin suite of Kungey-range Dalashik and calcareous-basalt-rhyolitic series along Kokpak-river. It was formed sublatitudinal graben, during Visean and beginning of Serpuhov stages of Carboniferous period, filled with basalt, lenses and horizon organic limestones, arcoz and quartz sandstones, which the source served the

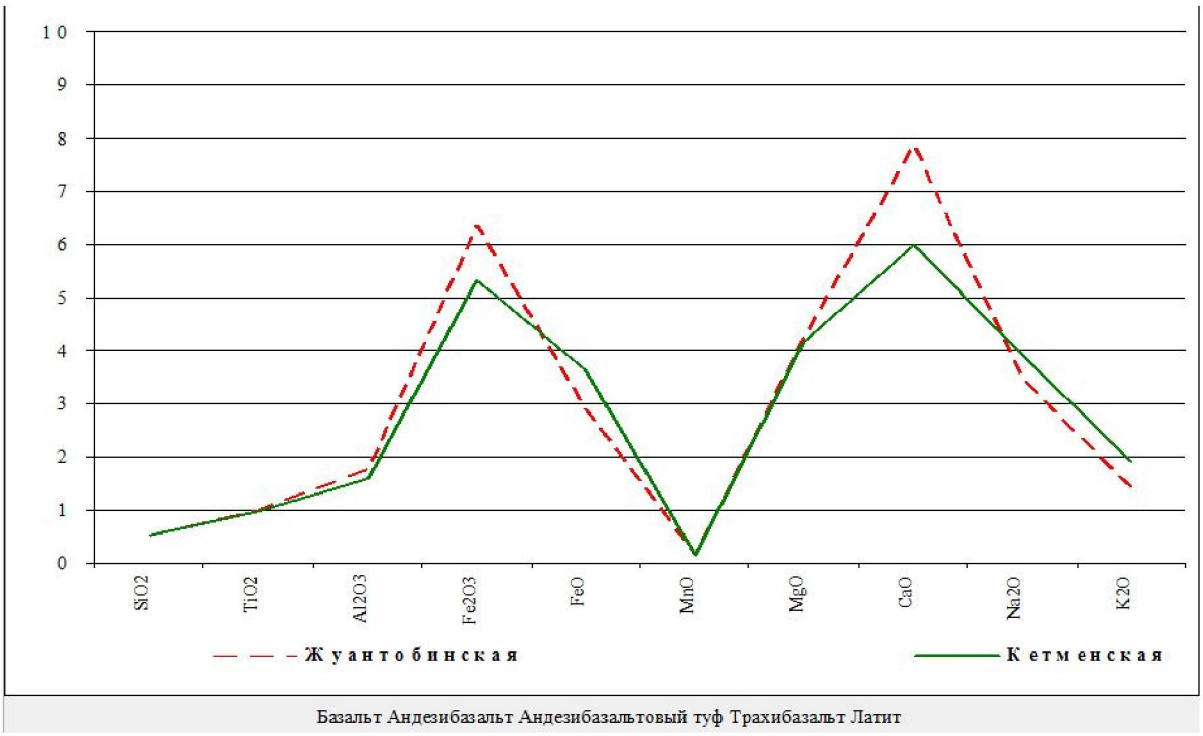

Figure 1 – Comparison of composition Tournaisian-low Visean basalts Dzhungar Alatau (Juantobe series,145 samples) and Ketmeni range (Ketmen series,161 samples)

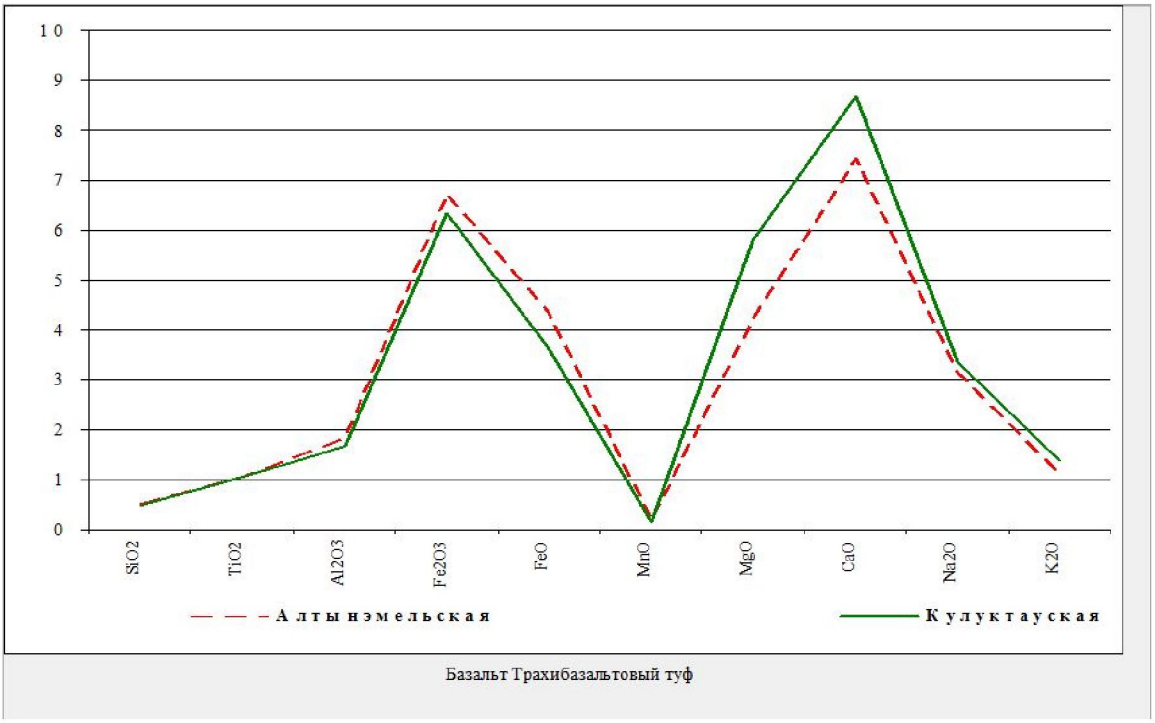

Figure 2 – The Comparison of composition Visean basalts Dzhungar Alatau (Altynemeli series,149 samples) and Ketmeni range (Kuluktau series,60 samples)

salients precambrin sediments and granites of Sarydzhas batolit. The Width of graben is more 10 km, visible extent is of the order 200 km. Southward from it wide-spread shallow calcareous sediments, including thin bedding/oncolitic limestones of Central Tien SHan, but here in after southward - a gneisses and eclogites,forming powerful zone of metamorphic rocks , belonged to South-Tien-Shan paleobasin.

Degradation of Karatau-North-Tyanishan rear basin was expressed in his(its) salting, appearance gypsum and shallowing By the end of Carboniferous period dominating his(its) sediments become the red coloured sandstones and siltstones with the remainder of overland flora (Tekes suite) and Late Cardoniferous complex spores and pollens. They formed outcrops in Kopyl range and along Karkara-river, where rumpled; creased in steep folds, places are pulled over on Low Carboniferous-bashkirian grey coloured complex [21].

Disappearance of the last sea basin and the beginning of accumulation continental the red coloured molass at the end of Asselian - the Sakmar century marks the beginning of a rigid collision on the Southern Tien Shan [11, 22]. Possibly, and for the North Tien Shan continent the beginning of a rigid collision with Tarim is necessary on Asselian-Sakmara centuries of Permian period.

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ЖОҢҒАР-БАЛҚАШ ПАЛЕОБАССЕЙНІН ЖАБУ УАҚЫТЫ ТУРАЛЫ СҰРАҚТАР

Аннотация. Оңтүстік-Шығыс Қазақстан және Қытаймен шекаралас облыстар бойынша материалдарды талдау арқылы Палеоазиаттық мұхиттың дамуы арал доғалары мен оқшауланған бассейндердің седиментациялық қалыптасу жолымен келип шыққандығы айқындалды. Жоңғар-Балхаш теңіз бассейндері ерте ордовик пен перм кезеңінің ортасына дейін қалыптасқан, оның шөгінділерінде теңіз фауналарының болуы

осыны дәлелдейді. Алакөл ауданымен шекаралас Қытай территориясы бойынша стратеграфиялық материалдар Жоңғар-Балхаш палеобассейнінің ең жас теңіздік терригенді шөгінділері фамен-ертетурней кезеңінде екендігін және шеткі вулкандық белдеудің турней-ерте башқырлық вулканиттері жауып жатқандығын айқындайды. Әрі қарай сәйкесті көтерілімді аудандарда үзілістер жалғасып, гжелдік дәуіріндегі соңғы жиналған жерүсті молассы, одан кейін контрасты төменгі перм вулканды сериясы жалғасуда.Бұл ауданның ең жас офиолиттері ерте девон дәуіріне жатады. Бұл деректер бассейндердің жатысы, құраушы палеомұхиттық және олардын жабылу уақыты (ерте перм болуы мумкін) туралы әртүрлі дәуірлерді айқындайды. Коллизия араласқан әдеттегі шөгінді материалдармен толтыру жабылу жолы болып табылады.

Жонғар-Балхаш бассейнінің белсенді шеті – оны Оңтүстік Тянь-Шань палеомұхитынан бөліп туратын Іле плитасы болып табылады. Девон, таскөмір және перм кезеңдерінің вулкандық жинақталуы Қазақстан континенті жағындағы Жоңғар-Балхаш теңіздік басссейні қоршап тұрған вулкандық белдемдің бөлігі болып табылады, бұл туралы геологиялық және петрохимиялық мәліметтерде айтылады.

Түін сөздер: палеомұхит, офиолиттер, аралдық доға, белсенді шеті, фауна, гжельдік ярус, петрохимиялық параметрлер.

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К ВОПРОСУ О ВРЕМЕНИ ЗАКРЫТИЯ ДЖУНГАРО-БАЛХАШСКОГО ПАЛЕОБАССЕЙНА

Аннотация. Анализ материалов по юго-востоку Казахстана и прилегающей области Китая показывает, что развитие Палеоазиатского океана происходило путем формирования островных дуг и обособленных бассейнов седиментации. Джунгаро-Балхашский морской бассейн существовал с раннего ордовика до середины пермского периода, о чем свидетельствует наличие морской фауны в его отложениях. Стратиграфические материалы по прилегающей к Алакольскому району территории Китая показывают, что наиболее молодые морские терригенные отложения Джунгаро-Балхашского палеобассейна имеют фамен-раннетурнейский возраст и перекрываются турнейско-раннебашкирскими вулканитами краевого вулканического пояса. Далее следует перерыв, соответствующий поднятию района, последующее накопление наземной молассы гжельского века, а затем контрастной нижнепермской вулканической серии. Наиболее молодые офиолиты этого района имеют раннедевонский возраст. Эти данные говорят о разном времени заложения бассейнов, составляющих палеоокеан и близком времени их закрытия (вероятно, ранняя пермь). Способ закрытия – коллизия в сочетании с простым заполнением осадочным материалом.

Активной окраиной Джунгаро-Балхашского бассейна является Илийская плита, отделяющая его от Южно-Тянь-Шанского палеоокеана. Вулканические накопления девонского, каменноугольного и пермского периодов являются частью вулканического пояса, обрамлявшего Джунгаро-Балхашский морской бассейн со стороны Казахстанского континента, о чем говорят геологические и петрохимические данные.

Ключевые слова: палеоокеан, офиолиты, островная дуга, активная окраина, фауна, гжельский ярус, петрохимические параметры.

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