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G. Zh. Zholtayev, N. M. Zhukov, Kh. A. Bespayev

The Institute of Geological Science named after K. I. Satpayev, the Satbayev University, Almaty, Kazakhstan.
E-mail: ignkis@mail.ru

THE THEORY OF FORECASTING AND EVALUATING THE MINERALS AND RAW MATERIALS BASE OF THE REPUBLIC OF KAZAKHSTAN

Abstract. The metallogenic researches over the past decades at the Institute of Geological Science named after K. I. Satpayev demonstrated the metallogenic analysis on the principles of new global tectonics is meant to be a reliable theoretical basis of forecasting and evaluating the minerals and raw materials base of the Republic of Kazakhstan. Each paleo-geodynamic situation corresponds to its own group of minerals on the territory of Kazakhstan. The small-scale pyrite occurrences of the Cypriot type (a basaltic layer of the oceanic crust) and iron and manganese occurrences (sedimentary layer) are associated with the formations of the ocean floor. The deposits of the banded iron formations are associated with the Precambrian sedimentary layer of the ocean crust. The pyrite-polymetallic, iron ore and gold mineralizations are in the ensialic island arcs, and pyrite copper zinc and gold mineralizations are in ensimatic arcs. The accretionary wedges of the volcanic belts and island arcs contain chrome occurrences and deposits, nickel-cobalt and gold mineralizations. Its magmatic belts are characterized by copper porphyric with molybdenum and gold and epithermal gold silver mineralization. A rare-metal, rare-earth and uranium mineralization is typical for the back-arc magmatic belts, and the coals, copper sandstones, manganese occurrences are for inter-arc (retro-arc) deflections. The large reserves of lead-zinc ores, phosphorites and vanadium shale rocks are contained in the passive margins formations. The large deposits of lead-zinc ores and iron and manganese are positioned in the continental rifts formations. The large gold reserves and copper-nickel mineralization (the simatic blocks), as well as rare metals and rare earths deposits are contained in the zones of collision. The large deposits of uranium, brown iron ore, bauxite, phosphorite, brown coals, titanium-zirconium placers, rare-earth and gold-bearing weathering crusts are associated with the Mesozoic-Cenozoic platform cover.

In the 70-80s of the last century, the papers are interpreting geological structure of a certain geographic areas of Kazakhstan [1] or any separate phases of its geological development [2] from the plate tectonics standpoint were originated in Kazakhstan. The 11-volumes monographic series of "Metallogeny of Kazakhstan. Ore Formations" was published in the Institute of Geological Sciences named after K.I. Satpayev in 1977-1983. A geotectonic confinement of the ore formations was contemplated there from the perspective of their geosynclinal-staged confinement, although in some regions the geotectonic environments were defined in terms of plate tectonics (the island arcs, rifts)

The map of a deep tectonic structure of Kazakhstan, the Mineragenetic map of Kazakhstan and the map of prediction of oil and gas potential of Kazakhstan made in 1: 2 500 000 scale have been produced in 2002. It was made by the group of geologists of the Institute of Geological Sciences named after K.I. Satpayev and the Geology Committee and Mineral Resources Protection of the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan. A geodynamic base of which is completely based on the principles of a new global tectonics, and a three-volume monography "A deep structure and the mineral resources of Kazakhstan" [3], that represents by its content an expanded Explanatory letter to these maps. The same principle was retained at producing the 1: 1,000,000 scale Mineragenetic map of Kazakhstan published in 2007 and the Explanatory letter thereto [4]. In fact, this map represents a map of paleo-geodynamic conditions with a reflection of the mineragenetic burden is typical for each of them. A clear dependence of the metallogenic burden on the type of crust, the consistence of enclosing rocks are identified at the result of these actions and, consequently, generated the geodynamic environments made it

possible to determine a set of minerals for each area of the territory of Kazakhstan and, therefore, those areas they can be identified for each deposit type. It became obvious that the metallogenetic analysis based on the principles of a new global tectonics may serve as a reliable theoretical basis for forecasting and evaluating the mineral resource base of the Republic of Kazakhstan.

The paleo-geodynamic environments of the oceans are distinguished on the territory of Kazakhstan: the basaltic and sedimentary layers of the ocean floor, the ensimatic island arcs (the oceanic islands); of transitaliyas: ensialic island arcs, marginal continental volcanic belts, passive continental margins, accretionary wedges, the Red Sea type rifts; of the continents: the Archaean-Low Proterozoic middle massifs, zones of collision, intermountain basins, the Mesozoic-Cenozoic platform cover. In the marginal and continental volcanic belts, the paleo-environment of frontal, central, back areas and retro-arc deflections (the intra-continental basins of sedimentation) are distinguished. The simatic and sialitic blocks, as well as the sutural zones are distinguished in the collision areas. The paleo-environments of the sedimentary cover are diversified: marine, coastal-marine and continental. The structures formed by the pillow lavas with rare lenses of chirts (a basaltic layer) and overlapping pelagic sediments, at times with inter-layers of the basalts (a sedimentary layer) are referred to the ocean floor formations. Pyrite deposits of the Cypriot type are confined to the basaltic layer across the globe. In Kazakhstan, the industrial deposits of this type are unknown, but their discovery is not excluded. Meanwhile, the metallogeny of the basaltic layer in Kazakhstan is limited by the small-scale occurrences of the copper-pyrite ores; a small-scale Tesiktas deposit is the most representative among them. The occurrences and small-scale deposits of manganese and iron are associated with the sedimentary layer. The Cambrian Middle Ordovician manganese and iron (the Kosagalinsk and other groups of occurrences) and ferromanganese (the Aigyrzhal group) mineralization is widespread in the Yerementau-Niyaz zone. More than 25 features of manganese ores (the Tasoba, Zhaksy deposits and etc.) are known in the sediments of the Tasobin suite of the Ordovic in the Ishim meander. The chirts of the Sakmarian suite of the Sakmarian zone of Mugodzhar have a Silurian age. The manganese ores in them (the Kosistek and Kargalinsk ore occurrences) are concretionary. The rocks of a sedimentary layer of the ocean floor in the south of Mugodzhar along the border of the Berchogur trough (the Shuldak manganese occurrence and etc.) have the Middle Devonian age. The late Devonian-Early Carbonaceous sedimentary layer of the oceanic crust is widespread in the North Zhongar and Gornostayev-Charsk metallogenic zones. In the North-Zhongar zone it is represented by the upper Devonian-Tournaisian Tasteau suite, wherein the manganese ore is confined to the horizons and jasper lenses. More than 30 manganese occurrences are known, the small-scaleKaramola deposit is the most explored. The manganese occurrences (the Arkalyk and others) in the Gornostayev-Charsk metallogenic zone are associated with the chirts of the Arkalyk suite of the middle-upper vize.

A poorly defined formations of the ocean floor are emphasized in the Proterozoic blocks. In the Karsakpaisk subarea of Ulytau they are represented by the volcanogenic-sedimentary Karsakpaisk series of the Burzyan-Yurmatin Riphean, which includes the horizons of banded iron formations. There are more than ten deposits and occurrences of the banded iron formations (the Balbraun and others). There is occasional information about gold deposits in the ores. The significant reserves of the banded iron formations are known in the south of Kazakhstan (the Gvardeisk deposit).

The island arc paleo-systems of Kazakhstan are divided into the ensimatic and the ensialic. The former ones have aroused on the oceanic crust, often independently of the subduction zones and in this case are parallel to the chains of modern oceanic islands, seamounts and guyots. They always include the blocks of the oceanic crust are underlying volcanogenic-sedimentary island-arc formations. The ensialic island arcs are always associated with the subduction zones and correspond to the modern island arc systems of the active continental margins. They usually include blocks of the more ancient continental crust.

The ensimatic island arc systems of Kazakhstan are characterized by gold ore and copper-zinc mineralization. The late Devonian-Carbonaceous ensimatic island arc formations are widespread in the West-Zharminsk zone and in the Manrak, Saur, Saikany ridges. They contain copper porphyritic (the Kyzylkain and etc.), gold-copper porphyritic (the Beskauga) and gold-copper quartz-veined (the Arsentyev and Khabanchad groups of occurrences) mineralization are connected with the sodium granitoid intrusions of the carbon age. In the Fedorov Middle-Late Devonian island arc zone the mineralization

is porphyritic, but when imposing ore processes associated with the carbonic magmatism, primarily found in the neighboring Valeryanov area, the deposits acquire a complex combined character. It is clearly seen in the case of the Varvarin deposit, in which the main elements accompanying gold (presence in ore is 2.1-10.0, average 6.2 g / t), are copper (1.57%), nickel (0.14%), silver (4.6 g / t), bismuth, selenium, tellurium, arsenic, antimony. The Middle Devonian island arc formations in the Zelenokamen zone of Mugodzhar, are represented by the Milyashin suite of the average composition volcanic rocks with a subordinate amount of basalts, dacites and sedimentary rocks. The volcanic rocks are breached by intrusions of the gabbro-plagiogranite complex. A mineralization is zinc-copper pyrite (the 50 years of October, Priorsk deposits and etc.). The Denisov zone of the Eastern Trans-Urals represents an Ordovician-Silurian ensimatic island-arc paleo-system. The rocks are represented by the basic effusives, jaspers, chirts, siltstones, sandstones, gravelstones, limestones in its Ordovician part. The volcanic rocks in the silurian part of the section are mainly of an average composition, the role of pyroclastics and sedimentary rocks increases. A mineralization is gold (the Tokhtarovka deposit) and a copper-porphyritic (the Spiridonovka deposit). The Sileti-Shingiz-Tarbagatay Ordovician ensimatic island arc of the Kendektian zone of ophiolites, which ,apparently, marks a route to a transform fault, is divided into two parts, the Shingiz-Tarbagatay and Selety-Bozshakol of a different metallogeny. If a pyrite mineralization is typical for the Shingiz-Tarbagatay part (the Maikain, Alpys, Akbastau and etc.), then the copper-porphyritic mineralization is widespread in the Selety-Bozshakol part (the Bozshakol, Sileti and etc.).

The Bestobe, Tortkuduk and others gold deposits are confined to the same zone.

The ensialic island arcs in Kazakhstan contain polymetallic, iron ore and gold mineralization. A different structure of foundation of the various island arcs has determined the difference in their metallogeny. The Valeryanov-early-middle-carbonic-ensialic island arc occupies the Valeryanov zone of the west side of Torgai and Irgiz zone of Mugodzhar. Its mining part is represented by the large and unique deposits of iron (the Aleshinsk, Kacharsk and etc.), by the rich zinc ores (the Shaimerden) and by copper porphyritic (the Benkala, Bataly) and molybdenum porphyritic (the Smirnov) mineralization. The mineralization of the Rudny-Altai ensialic island arc is pyrite-polymetallic. A cluster location of the deposits is clearly displayed. The main ore clusters are Leninogorsk, Zyryanovsk and Priirtysh. The pyrite-polymetallic deposits of the Rudny Altai were the main source of the associated gold in Kazakhstan. The gold (the Sekisovsk deposit) and the polymetallic with a majority of lead and insignificant share of copper (the Paryginsk and other deposits) mineralization are peculiar to the late Famennian-Carbonic stage of the development of Rudnoaltai island arc. The structural and formational zone of the Rudny Altai in the Beloubinsko-Sarymsaktinsk (Kholzun) has the manganese-iron ore mineralization (the Kholzunskoye and other deposits) and zincian-lead (a small-scale Pnevskoye and other deposits). In the North-Western Pribalkhash a separate outcrops of the Silurian island arc formations take place that are connected with the average lead-zinc Kokzaboi deposit and the small-scale Kyzylespe, Gulshad deposits of lead and zinc, Akchagyl of copper and zinc, Bapa of iron and a number of occurrences of these metals. The Stepniyak-Kendyktas Ordovician ensialic island arc extends from the Stepnyak metallogenic zone through the Sarysu-Teniz uplift to Kendiktas and further to Kyrgyzstan. Its separate outcrops take place at the eastern end of the Zailiyskiy Alatau and in the Ketmen and Terskey ridges. Its mineralization is primarily golden. It is represented by Vasilkov, Stepnyaki deposits and others in the north, and by the Kendiktas group of deposits and occurrences in the south. Except gold, the iron ores occurrences (the Zholdybay and other occurrences) are spread in the Stepnyak zone, and gold-copper-deposits in Kendyktas zone (the Shatyrkol, Zhusaly) and the uranium (the Kurdai deposit).

There are two marginal volcanic belts in Kazakhstan: the Devonian and Carbon-Permian (the Late Paleozoic). By present the concepts, a number of structures are distinguished in the marginal volcanic belts [5]: the outer arcs, including the accretionary wedges, external troughs, magmatic arcs, retro-arc (inter-arc) wedges, rear-arc magmatic belts. All these structures take place in the marginal volcanic belts of Kazakhstan too.

The accretion wedges of both Kazakhstan belts are accumulated by marine and coastal marine sediment rocks comprising ophiolite blocks which are more ancient than the enclosing rocks. The Metallogeny of the Devonian accretion wedge is limited by a small-scale lenses of chromite in ultrabasites, connected with them the nickel silicate occurrences, and a small-scale veined gold occurrences and zones of types mineralization, the origin of which is caused by subsequent collision processes. The

accretionary wedge of Late Paleozoic belt have a small-scale pyrite deposit of the Tesiktas Cyprus type. The Pustynnoye deposit of gold occurrence and others, due to the Perm collision are confined to its sedimentary rocks.

The magmatic arcs of the marginal volcanic belts of Kazakhstan are characterized by a wide spread of volcanic rocks alternating with continental, and in the frontal adjacent to the paleo-ocean area, and with marine sediments and intrusive rocks. The magmatic rocks of felsic, moderately felsic and average composition predominate. Basic and alkali rocks are less spread.

In the frontal part of the Devonian magmatic arc, the small-scale deposits and copper occurrences (the Koktaszhartas and others), related to the porphyry type or manto type, are known. One pyrite-polymetallic Shoptykol occurrence is also known. The metallogeny of the rest of the Devonian magmatic arc is quite diverse. The mining formations of copper-porphyry and gold ore type are the most widespread. The copper-porphyry deposits and occurrences (the Nurkazgan and others) are mainly associated with the porphyry intrusions of plagiogranites, granodiorites, quartz diorites. The gold content of the copper-porphyry ores depends on the composition of the enclosing rocks - it is generally higher in the deposits of medium-basic rocks, especially if ultrabasic rocks fall into the porphyry system. In fact, the gold and gold-silver deposits and occurrences (the Mynaral and others), as well as molybdenum (the Baital, Western Akkuduk) are also widespread. The small-scale deposits and occurrences of lead and zinc (the Rodnikovy and others) are come across in the Shuilii metallogenic zone. The molybdenum-uranium deposits are distributed in the southwestern chain of the magmatic arc, the blocks of Precambrian rocks (the Kyzylsay group, etc.) are found in its foundation.

The copper-porphyry deposits represent the basis of the metallogeny of the Late Paleozoic magmatic arc. The largest copper-porphyry deposits: the Konyrat, the Sayak and the Aktogay groups, the Koksai, and a number of small-scale deposits are assigned to the frontal zone of the magmatic arc. The rest of the arc area is denoted by medium and small-scale deposits and the numerous occurrences (the Borly, etc.). The deposits with porphyry and alongside with skarn mineralization are emphasized (the Sayak, Karatas). The molybdenum and gold are the common accompanied components of all copper-porphyry deposits and arrange the independent deposits. They are represented by quartz-vein-greisen and porphyry types for molybdenum (the Eastern Kounrad, etc.), and epithermal gold-silver type for gold (the Taskora, etc.). The copper deposits of manto type as (the Ai, Temerlik) are associated with the magmatic arc of the Late Paleozoic belt.

The large intrusions of granites are peculiar to the back-arc magmatic belts of Kazakhstan that associated with the rare-metal and rare-earth mineralization. The mineralization of the Devonian back-arc belt is mainly rare-metal, including the tin deposits and occurrences of Sarymbeti and others in Kokshetau region, Karagailyaktas in the Terskey Alatoo, the tungsten deposits and occurrences of the Bayan and others in the Kokshetau block, the Boguty, the Kurozek and others in the eastern end of the Zailiysky Alatau. A number of small-scale tungsten-tin occurrences associated with the Devonian intrusions of granites are known in the Ulytau-Arganatin anticlinorium. Under the apparent connection of the rare-metal deposits with leucocratic granites, the dependence of the mineralization composition on the rocks containing these intrusions is outlined. This dependence is clearly expressed in the Kokshetau block, in which all the tin ore deposits (the Sarymbet and others) are associated with the granite intrusions that intrude the carbonaceous shales of the Sharyk Riphean suite, and all the tungsten deposits (the Bayan and others) with granites that intrude amphibolites of the Archaean. In general, the tin mineralization is associated with the intrusions that intrude sedimentary strata containing clusters of carbon deposits. The tungsten prevails in the ore deposits are not associated with the carbonaceous terrigenous rocks. The rare earths (the Karagailyaktas), tantalum and niobium (the Sarymbet) are present in the ores of some rare-metal deposits. There are also independent deposits of these elements associated with the Devonian intrusive of the leucocratic granites - the Akbulak deposit and a number of rare earth occurrences in the Ulytau, the Losev niobium deposit in the Kokshetau block. The large and unique phosphorus-uranium and molybdenum-uranium deposits of the late Devonian age (the Grachevsk, Kosachin, etc.) are widespread in the Kokshetau block. The deposits of the gold-sulfide-quartz formation (the Akbakay, Svetinsky, etc.) are

associated with the Devonian granitoid intrusions of the Shu-Ili mountains, which break through the aqueous-terrigenous rocks of the Ordovician.

The Late Paleozoic back-arc magmatic belt in the most part coincides with the Devonian magmatic arc. The belt mineralization is mainly molybdenum-tungsten. There are two types of mineralization: the beryllium-molybdenum-tungsten (the Akshatau type) and the tin-molybdenum-tungsten (the Karaobin type). The ore mineralization is confined to the greisens, the quartz veins and veins in granites and in the enclosing rocks.

The inter-arc (retro-arc) deflections of the marginal-continental volcanic belts of Kazakhstan are spacely combined in the southwestern part and are disintegrated in the northern. In the Famennian-Tournaisian period, the subduction zone was shifted to the south. As a result, the Devonian and Late Paleozoic magmatic arcs were disintegrated, completely in the northern part, and with a considerable overlap in the southwest and northeast. The Late Paleozoic retro-arc deflection in the Shu-Sarysu and Teniz depressions has inherited the Devonian inter-arc, and in the north, it has shifted to the south, originating the Karaganda basin. The reddish terrigenous formations of the Devonian inter-arc deflection have poor mineral resources, there are only small-scale occurrences of copper sandstones (the Uytas and others) and small-scale deposits of manganese (the Zhezdy, Zhaksy-Kotr) here.

The deposits of the late Paleozoic retro-arc deflection have a great practical importance. The fossil coals of the Karaganda basin are situated where the Devonian and late Paleozoic deflections become separated in the north. In the Shu-Sarysuisky and Teniz depressions where the deflections are combined, a favorable situation has emerged for the formation of copper sandstone deposits as a Zhezkazgan unique deposit, the Northern Group deposits (the Saryoba, Itaus, Kipshakpai), Zhaman-Aibat in the Shu-Sarysuisky, and a number of small-scale occurrences (the Kenen, Vladimirov and others) in the Teniz Basin. The contingency to find on the boundary of the lower red molasse with the overlapping bituminous mass the deposits of copper schists type is not excluded. The copper-lead deposit of Tuyuk is also associated with the late Paleozoic sediments of a retro-arc deflection.

The accretionary wedges of the marginal-continental volcanic belts and the majority of the island arcs of Kazakhstan were involved in the subsequent collision processes and their metallogeny was mainly determined by these processes, and the chromite deposits are peculiar to the ophiolite wedges were destroyed and broken into a number of small-scale bodies, usually of no industrial interest. Only the Middle Ordovician Kempirsaysky, Khabarninsky and Daule-Kokpektinsky massifs with adjoining metamorphosed sediments of the Early Paleozoic ocean floor did not participate in the following collision processes. In the Khabarinsky and Daule-Kokpektinsky massifs, only the small-scale occurrences of chromites are known so far, and the industrial chromian mineralization is associated with the Kempirsay massif. More than 160 deposits, occurrences and the points of chromite mineralization (the Almaz-Zhemchuzhny, Million, 40 and 20 years of the Kazakh SSR, etc. have been revealed in general within the massif.

The accumulation of the thick sedimentary strata under an undeveloped magmatism is a peculiar feature of the passive continental margins. The conditions of sedimentation corresponding to the modern passive margins have existed throughout the Paleozoic period in Karatau on the territory of Kazakhstan. The vanadium deposits (the Kurumsak and Balasauskondyk deposits and a number of small-scale features) were accumulated in the Cambrian in the Kurumsak zone of a Big Karatau, in the northwestern spurs of the Talas ridge and in the Baikonur zone of Ulytau. In the Devonian and the Early Carbonic period in the Big Karatau, the carbonate strata have been accumulated including the large (with the millions of reserves) deposits of lead (the Mirgalimsai) and zinc (the Shalkiya) and a number of medium and small-scale deposits of these metals (the Achisay, Talap, Bugunskoye and others).

The ocean rifts, in which a basaltic layer of the ocean floor was formed and the metallogeny of which was considered when it was specified and continental are distinguished on the territory of Kazakhstan. The ocean rift of the Red Sea-type has been separately singled out. The Red Sea-type rifts are located between relatively close continental blocks; subsequently their metallogeny approaches to those of continental rifts. The distinguished rift of the Red Sea-type is represented by the Sarytum structural and formational zone of the South-West near Balkhash. The mineralization is a lead-zinc.

The continental reefs in Kazakhstan arrange the rift systems - the Atasuyskaya Devonian-Carbonic and the Tekeliiskaya Ordovician. The Atasuyskaya-Famennian-Tournaisian system of the continental rifts has appeared because of shifting the subduction zone and the marginal-continental volcanic belt bounded to it to the south. It includes the large industrial deposits of lead and zinc (the Zhayrem, Ushkatyn, etc.), iron and manganese (the Karazhal, etc.). The Tekeli rift is located in the Tekeli anticlinorium of Zhongaria. The two Ordovician [6] suites are ore bearing: the Tekeli and Suuktyubin. The largest Tekeli and Big Ozek deposits and a number of small-scale deposits and occurrences of lead-zinc and copper-lead-zinc ores are confined to the Tekeli suite. The Suuktyubin suite includes the small-scale deposits of Suuktyube, Telmanov and a number of ore occurrences.

The collision zones have been formed as a result of oceans closing, the continents collision or retro-arc basins closing because of the continents and the island arcs collision. At this, both non-subduction residuals of the ocean crust with overlapping marine and sub-aerial sedimentation masses, and the fragments of adjoining continents were involved in the collision. In the first case, the blocks were formed on a simatic platform, and in the second case the sialitic blocks. These blocks differ among themselves as by magmatism associated with collision so the metallogeny.

The flyschoid and molasses strata, often carbonic among which there are sometimes the blocks of island-arc formations, accumulate the simatic blocks of the collision zones. The ophiolitic belts that fixing the sutural joints are confined to the central parts of the zones. The small-scale intrusions of the gabbro-diorite-plagiogranite composition and the dikes mainly of medium-basic composition represent the magmatism. In the carbonaceous strata, the gold ore deposits were formed due to the zones of dynamometamorphism and gabbro-granodiorite-plagiogranite intrusions. In the gabbro-norites intrusions, the copper-nickel ores and titanium and iron ores were formed. The copper-nickel mineralization is confined to the Spassko-Uspensky and Bakyrchik-Suzdalsky Permian collision metallogenic zones. The Kamkor deposit and the Kenshi occurrence were revealed in the first zone, and the Maksut deposit and a number of occurrences in the second. The gold ore mineralization is the most developed within the Western Kalbina zone, which is composed of carbon-terrigenous flysch and molasses carbon deposits, torn by the small-scale intrusions of the kunush gabbro-plagiogranite series and the dykes of gabbro diorite composition. The numerous quartz-veined and beresite gold deposits (the Zhumba, Kuludzhun, etc.) are associated with the intrusions of the Kunush series. In spite of their large number, these deposits contain no more than 8-12% of the recorded reserves of the zone. The main reserves are concentrated in the deposits localized in the Kyzylov shear zone and arranging a single ore field (the Bakyrchik, Promezhutochnoye, etc.). The gold ore mineralization is also widespread in the Zhongar-Balkhash collision zone, where it is represented by the quartz-veined and stockwork type deposits and occurrences (the Pustynnoye, etc.).

The gold ore deposits of the Zhetykarinsky ore region of the Troitsk metallogenic zone (the Zhetygara and others) and also the gold deposits of the Western greenstone zone of the Mugodzhar and the East Mugodzhar anticlinorium (the Yubileynoye, Mynzhasar and others) are located in the Devonian-Carbonic collision zone. The titanium-magnetite deposits (the South Velikhov and others) are associated with the closed the Sakmara ocean zone in the Silurian and the introduction of gabbros, gabbro-norites and gabbro-pyroxenites intrusions. A large deposit of titanium-magnetite ores the Tymlai has been revealed and evaluated due to the singled out outcrops of the Cambrian rocks of the basaltic layer ocean crust and the ensimatic island arc in the southeastern part of the Jalair-Naiman collision zone.

The sialic blocks of the collision zones include the Kalba-Narym and Zharmin metallogenic zones, as well as the East Mugodzhar anticlinorium. The Kalba-Narym zone mineralization is represented by the albitite-greisen-tin-tantalum, pegmatite rare-metal and quartz-veined tin-tungsten types [7]. The tungsten-tin-niobium-tantalum-rare-alkali ore deposit of the Baken and Aksu-Bulak pegmatite ore fields is essentially significant. The rare-metal mineralization of the Zharma zone is associated with the Verkhne-Yespin, Keregetas and other intrusions. The pegmatite and albitite tantalum-niobium (the Verkhneirgiz, Borsyksai, etc.) and porphyry molybdenum (The Itastibulak) mineralization are associated with the carbonic granitic intrusions of the East Mugodzhar and Troitsky anticlinoria. The deposits are under-explored.

The Mesozoic-Cenozoic platform cover of the Kazakhstan possesses the considerable reserves of the minerals. The hydrogenous (the Uvanas, Mynkuduk, etc.) and uranium-phosphorus (the Melovoye and others) uranium deposits are confined to it. The coastal-marine (the Ayat, etc.) and alluvial (the Lisakov and other) sediments of the cover contain multibillion reserves of the oolitic iron ores. The titanium-zirconium placers in the coastal-marine (the Shokash and others) and proluvial-alluvial (the Karaotkel, Satpaev) sediments are of great interest. The main potential of aluminum raw materials and silicate nickel, as well as prospects for the manganese and rare earths are related to the crusts of weathering. A significant role the gold-bearing placers and crusts of weathering play in replenishing the gold reserve. The great perspectives are associated with the yttrium-rare-earth occurrences in the Cretaceous-Paleogene sediments of the Shu-Sarysuiskaya Depression (the Akkense, Tuma, etc.).

The performed metallogenic analysis has determined the geodynamic position and direction of exploration works for each type of the minerals in Kazakhstan. The link of deposits with geodynamic conditions reflects the most general consistencies of their distribution. A more detailed metallogenic analysis requires awareness about the causes and conditions of their formation: the sources of ore matter, the ways and methods of its transportation, the causes of concentrated sedimentation. By this reason, the researches are required to solve genetic problems in order to develop reliable predicting criteria when studying the deposits.

The main course to increase the mineral and raw materials base of Kazakhstan is to search for a blind and overlapped deposits, taking into account the detailed exploration of its territory. And, this is the challenge to improve the quality of the forecast and the methods of prospecting of such deposits. The issue may only be resolved on the basis of thorough and comprehensive scientific study of the specified features with the arrangement of geological and genetic models substantiated by the real information and the determination of remote and indirect prospecting indicators. Each deposit must be subjected to a comprehensive investigation: to determine its position in the regional and local structures, to study the material composition of ores and hydrothermalites, their interrelation, based on the study of stable and radioactive isotopes is to determine the age of mineralization, the sources of ore components and fluids and etc. The scientific support of exploration and development of the deposits should be obligatory. A full-scale mineralogical-petrographic, a fine geochemical, isotopic investigations, a study of fluid insertions is required to be resumed on a modern hardware basis, and provide the training of an appropriate personnel. This overall will afford to realize the prospects of reserves replenishment and expansion of the mineral and raw materials base of the Republic of Kazakhstan.

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Г. Ж. Жолтаев, Н. М. Жуков, Х. А. Беспаев

Қ. И. Сәтбаев атындағы Геологиялық ғылымдар институты, Сәтбаев Университеті,
Алматы, Қазақстан,

ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ МИНЕРАЛДЫ-ШИКІЗАТ БАЗАСЫН БОЛЖАУ МЕН БАҒАЛАУДЫҢ ТЕОРИЯЛЫҚ НЕГІЗДЕРІ

Г. Ж. Жолтаев, Н. М. Жуков, Х. А. Беспаев

Институт геологических наук им. К. И. Сатпаева, Сатбаев университет,
Алматы, Казахстан

ТЕОРЕТИЧЕСКИЕ ОСНОВЫ ПРОГНОЗИРОВАНИЯ И ОЦЕНКИ МИНЕРАЛЬНО-СЫРЬЕВОЙ БАЗЫ РЕСПУБЛИКИ КАЗАХСТАН

Аннотация. Металлогенические исследования, выполненные в последние десятилетия в Институте геологических наук им. К. И. Сатпаева, показали, что металлогенический анализ на принципах новой глобальной тектоники может служить надежной теоретической основой прогнозирования и оценки минерально-сырьевой базы республики Казахстан. На территории Казахстана каждой палеогеодинамической обстановке отвечает свой комплекс полезных ископаемых. С образованиями океанического дна связаны мелкие колчеданные проявления кипрского типа (базальтовый слой океанической коры) и проявления железа и марганца (осадочный слой). С докембрийским осадочным слоем океанической коры связаны месторождения железистых кварцитов. В энсиалических островных дугах оруденение колчеданно-полиметаллическое, железорудное и золотое, а в энсиматических – колчеданное медно-цинковое и золотое. Аккреционные призмы вулкано-плутонических поясов и островных дуг вмещают месторождения и проявления хромитов, никель-кобальтовое и золотое оруденение. Магматические пояса их характеризуются медно-порфировым с молибденом и золотом и эпитермальным золото-серебрянным оруденением. Для тыловодужных магматических поясов характерно редкометалльное, редкоземельное и урановое оруденение, а для междуговых (задуговых) прогибов – угли, медистые песчаники, проявления марганца. Образования пассивных окраин содержат крупные запасы свинцово-цинковых руд, фосфоритов и ванадиеносных сланцев. Крупные месторождения свинцово-цинковых руд и железа и марганца локализованы в образованиях континентальных рифтов. Зоны коллизии вмещают крупные запасы золота и медно-никелевое оруденение (симатические блоки), а также месторождения редких металлов и редких земель. С мезозой-кайнозойским платформенным чехлом связаны крупные запасы урана, бурых железняков, бокситов, фосфоритов, бурых углей, титан-циркониевые россыпи, редкоземельные и золотоносные коры выветривания.