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GEOLOGY AND GEODYNAMICS OF KARSAKPAY-ULYTAU GEOSUTURE ZONE AND ITS PROSPECTS FOR MINERALS

Abstract. Set out the results of geological studies in Karsakpay Ulytau-ore region. Shows the new unified stratigraphic scheme of the Precambrian formations of the area, typical for geosuture zones. The active manifestation of magmatic and metasomatic processes is determined by the localization of the area in the linear region with a characteristic geosuture diverse mineralization. This area, like most of the Kazakhstan territory is characterized by paleocontinental conditions and unknown components of the triad characteristic of the ophiolite association, such as basic volcanites and jasperoids. Facilities unlikely magmatic rocks of the complex to the ophiolite association is confirmed by field and laboratory studies. Formation of rocks that form the intrusive massifs, can be explained from the point of plume tectonics in geosuture zone. Formation of ultramafic, mafic and granitoid in geosuture zone may be associated with the process of separation of magma in the mantle of nucleation and granitoids areal nature outside geosuture – local manifestation anatexis and palingenesis in the continental crust. Data of geophysical research shows confinement and deep spread intrusions along geosuture zone. Spacegeological technology research, magmatic and metasomatic activity geosuture area and direct search features define mineralization prospect area for prediction of industrial minerals and scientific substantiation of prospecting.

Keywords: mineral deposit, magmatism, metasomatism, plumetectonics, petrochemistry, spacegeology.

Introduction. The region is characterized by its location in deep faults' zone, on this basis by development of linear geological-structural formations with specific thermodynamical conditions. Karsakpay Ulytau zone of basite-ultrabasites stands apart in geosuture region, which is marking its depth. Western-Ulytau deep fault, located along the border of Ulytau anticlinorium and Torgay syneclise, goes through this zone. It stretches out as a narrow streak meridionally and submmeridionally with approximately 300 km extension (Figure 1).

Intensity of thermodynamical situation is caused by zone's location in geosuture of Kazakhstan's second circle structure [3, 4, 9, 31-33] and is expressed in rocks' specific metamorphism, ore-controlling metamorphic and hydrothermal-metasomatic forming's development [13]. Analysis shows that features of Kazakhstan's geotectonics and geodynamics conform well with plumetectonical kind of their forming [9, 39, 40].

Precambrian, Paleozoic, Mesozoic-Cainozoic formations, intrusive and effusive igneous rocks are developed in geological structure of regarding region. The region is located in geosuture zone with specific geodynamical conditions, which determine features of ancient thick changes, allocation of igneous formations and related to them minerals.

Results of researches and discussion

Describing territory covers in geological attitude central part of Karsakpay-Ulytau tectonic zone. Premesozoic depositions of territory form large structural-formational zones: Baikonyr, Ulytau-Arganaty and Zhezkazgan.

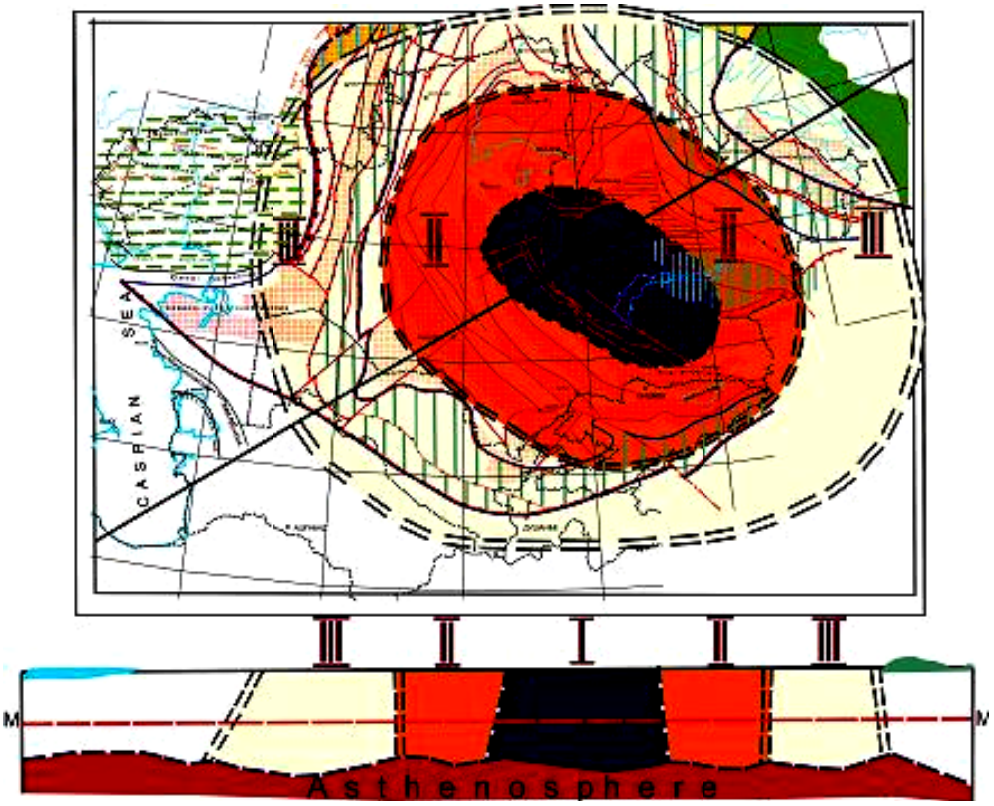

Figure 1 – Schematic structure of "Kazakhiya" continent: I – internal circle; II – middle circle;
III – external circle (was made up based on the scheme of Kazakhstan's paleozoides' tectonical zoning) [9]

Baikonyr zone is traced in western part of regarding zone and is characterized by primary spreading of lower paleozoic formings. Ulytau-Arganaty zone covers central part of area. Predominantly Proterozoic thick strips within it. The zone is subdivided into two subzones: Maytobe (area of paleoproterosoic deposits' spreading) and Karsakpay (area of mesoproterozoic and neoproterozoic or riphean deposits' predominantly spreading). Zhezkazgan zone covers Zhezkazgan-Sarysu depression's western flank within the area [16, 17]. Spread of upper paleozoic deposits is characteristic for it.

Proterozoic erathem is presented by formations of paleo- and mesoproterozoic (they were stood out as bekturgan, aralbay and karsakpay series with appropriate suites earlier [16]) and neoprpterozoic. Partition of area's Precambrian formations is actuated by unified stratigraphic scheme in accordance with international chronostratigraphic scale of 2016 (Table).

Paleoproterozoic deposits combines complex of primary terrigenous and volcanic rocks significantly, but irregularly refined by imposed metamorphic-metasomatic processes in later ages. Based on differences of petrographic composition, age relationships, spatial confined to one or other structural-formational zone lower Proterozoic formations are divided into three thicks (down up): the first (gneiss), the second (shale-gneiss), the third (porphyroid).

The first (gneiss) thick (PPR_1g) is confined to Karsakpay subzone of Ulytau-Arganaty zone and compose core of Bala-Zhezdi anticlinal of the second order. Afield outputs of gneiss thick form mound relief like ridges with rare root outputs and eruptions of ballast.

Leuco-, meso- and melanocratic kinds stand out among gneisses depending on quantitative correlation of quartz-feldspar and micaceous-dark color components. Content of micas, chlorite, epidote, amphiboles reaches 5 % for first, for the second – 15 % and for the third – 30 %, structure of gneisses is subhedral, they consist of plagioclase, quartz, biotite and muscovite, hardly ever single grains of potassium-sodium feldspar. There is zircon accessory.

On physical features gneiss thick is practically nonmagnetic, average density of its rocks is 2,60 г/см^3. Areas of gneiss' spreading register alternating magnetic field with intensity between -100 and +100 nT and form zones of gravity's gradient.

Scheme of South Ulytau Precambrian formations' partition (compiled using materials [18])

Eono-them	Era-them	Sys-tem	Characteristic of thick rocks	Index	Thick-ness, m
		Cambrian	*Ediacaran-cambrian undivided*: beneath – sandstones and gritstones quartzous, partly carbonaceous; overhead – carbonaceous-clayey, carbonaceous-siliceous shales and phtanites; limestones, barite rocks, aluminophosphate and managanese ore	V-ε	<800
Proterozoic	Neoproterozoic	Ediacaran	Conglomerates, tilloids, sandstones, tuffites, aleurolites	NPR_3	<700
			Rhyolite thick: volcanic rocks of felsic composition	$NPR_2\lambda$	~600
			Shale thick: shales and phyllites on greywacke sandstones and aleurolites	NPR_1s	~400
	Mesoproterozoic		*Basalt-andesite thick*: metavolcanics of basic and intermediate composition	$MPR_3\beta\alpha$	~1000
			Shale thick – *Upper part*: shales blastomeres psammitic, porphyroids, marbles, ferrous quartzites, quartzites	MPR_2s_2	600
			Shale thick – *Lower part*: shales and phyllites, rarely – gneisses on arkose sandstones and aleurolites; quartzites blastomeres psammitic	MPR_1s_1	<2000
	Paleoproterozoic		*The third (porphyroid) thick*: metavolcanics of felsic, intermediate-felsic composition	$PPR_3\lambda\xi$	<2000
			The second (shale-gneiss) thick: biotite-feldspathic, feldspar-biotite, feldspar-amphibloic shales; biotite spectacled and leucocratic fine-grained microcline-albite gneisses	PPR_2sg	~1000
			The first (gneiss) thick: medium- and coarse-grained, porphyroblastic albite gneisses	PPR_1g	>700

According to the results of works that had been done by Kazakhstan's Institute of Mineral raw materials' laboratory of geochronology, the age of porphyroblastic gneisses, which was determined by uranium-lead method on zircons «not younger than 1400 million years», however we can't say that it is authentically and, consequently, requires verification.

The second (shale-gneiss) thick (PPR_2sg), rocks of this thick are dedicated to Maytobe subzone of Ulytau-Arganaty structural-formational zone. They compose areas, which are not completely refined by processes of granitization in granite-gneiss zones. Formations of shale-gneiss thick suffered, apparently, most intensive, though uneven impact of variegated metamorphous-metasomatic processes. In the bottom of the thick pack of biotite gneisses (250-400 m) stands apart, on which leucocratic fine-grained microcline-albite gneisses lay (~800 m). Total thickness doesn't exceed 1300 m, and besides the share of lower part is not more than 400-500 m, higher – 600-900 m [18].

In compound of thick's rocks feldspar-biotite, biotite-feldspar, feldspar-amphibole shales, biotite spectacled gneisses, microcline-albite gneisses stand out, primary composition of them aren't determined at microscopic learning level. Considering domination in section about melanocratic kinds we can suppose, that volcanogenic, volcanogenic-sedimentary rocks of basic, intermediate-basic composition and products of their rewashing played essential role in their composition. Microcline-albite gneisses evolve, obviously, on leucocratic kinds: felsic vulcanites and terrigenous rocks of subarkosic series.

The third (porphiroid) thick ($PPR_3\lambda\xi$). The main type of rocks, which composes the thick, is metavulcanites of rhyolite, rhyodacite, dacite composition, which are combined on common title «porphiroids». They are characterized by grey, yellow-grey, "marshy" colors, shale, rarely massive texture and presence of distinctly distinguishable phenocrysts of quarts and rarely feldspars. Aphyric kinds are rare. In zone of transition to granite-gneiss complex's rocks porphiroids acquire massive texture and clear crystalloid, striped structure of main tissue, on the background relict phenocrysts of quartz are distinguishable. Hornfelsing is marked in contact with granitoides of zhaunkar complex.

During microscopic learning of about slightly modified rocks relicts of primary structures are setting up, which allows to pick out primary tufaceous and lava kinds among porphiroids.

Lava has rhyolite, rhyodacite, dacite composition. Usually oligophrenic, rarely polyphyric and close to aphyric kinds. Sometimes it is observed primary fluidal. Phenocrysts are submitted by quartz and plagioclase, rarely – potassium-sodium feldspar in rhyolites. Sizez of phenocrysts are between 0,5 and 2-3 mm. The bulk is fine-, close-grained, it is presented by quartz-feldspar aggregate with flakes of sericite, chlorite, grains of hematite and carbonate. Occasionally relicts of primary felsitic structure are observed.

Tuffs are usually observed by crystal kinds; rarely – lithic-crystal. Occasionally relicts of vitrophyric structure are occured. Feldspars, quartz, debris of the bulk are described in debris.

Metavulcanites of the lower Proterozoic thick are characterized by average density 2,60 г/см^3 and magnetic susceptibility within 0-120. Increasing of magnetism in rocks noted for hornfelsing kinds. Generally, porphyroids of lower Proterozoic are traced by weakly-varying magnetic field with intensity between -160 and +100 nT and decreasing of gravity field. So, vulcanites on eastern strip of spreading about Maytobe massive manifest by local negative anomaly of force of gravity with intensity -5 mGal and alternating magnetic field with tension between -100 and +100 nT.

Large fields of vulcanites within Maytobe subzone in the complex with granitoides of aktas and zhaunkar complexes (σ_{av} = 2,60 g/cm^3) are recorded by submeridionally extended strip of intensive negative anomalies of force of gravity and ambiguously stands out in magnetic field.

Increasing the intensity of magnetic field in this zone above vulcanites maps area of hornfelsing or small granodiorite figures and arrays of upper Ordovician, unopened by erosion.

So, on the background of negative magnetic field with tension between -100 and -160 nT above porphiroids in western exocontact of Zhaunkar massif, narrow local positive anomaly ΔT with tension 500 nT фиксирует apparently, unopened by erosion small granodiorite massif of upper Ordovician is recorded (Δ_{av} = 250).

The most ancient sedimentary rocks, covering with washing porphiroid thick are blastopsammitovye shales and quartzites, forming basal horizons of mesoproterozoic shale thick.

In regional plan described thick can be matched with fragments of unguly suite's section of North Ulytau, Sarysu-Teniz's karakopy and baysay suites, Shu region's kishkrin suite and with orkendeu suite of Atasu-Moiynty watershed [16-18].

Mesoproterozoic (lower riphean). Shown in the work [18] complexes of microfossils allowed, firstly, to set real time sequence of thick accumulation, and secondly to affirm, that: 1) depositions, stripping within Karsakpay subzone, generally, are not older than bottom of mesoproterozoic; 2) the age of rocks to the east and west from Burmashy section is, practically, identical, despite different level of manifestation of imposed metamorphic-metasomatozic changes. In general, it is characteristic for describing deposits sharp domination of metaterrigenous rocks, which are complemented by carbonaceous, ferrous and volcanogenous kinds at the top of section, which allows to divide shale thick into two parts - lower and upper.

Lower part (MPR_1s_1). Deposits of lower part of shale thick are the most widely spread within Karsakpay subzone, where they form two submeridional strips of outputs – eastern and western, separated by meso- and neoproterozoic vulcanites' area of spreading. To the west of Burmashy fault this thick combines [16] predominantly metaterrigenous fragments of maytobe serie's kumola, kaldybayshoky and tumyrza suites' section, except of carbonaceous kinds, and also fragments of section of bozdak serie's belkudyk, karasay and nadyrbay suites in areas, that we can say quite surely about their lower location about vulcanites of basic composition. Milk-white, plum cavernous quartz's veins are widespread.

It is characteristic for thick moderate in area sand-aleuritic primary lithological composition of rocks. However, because of primordial facial variability and different intensity of development of metamorphic-metasomatozic processes, sections of describing stratigraphy subdivision, which are observable in the area, notably differ from each other depending on the confinement to the one or other structure.

In most cases contacts of lower part of shale thick with older rocks are tectonically and only in single blocks we can say quite confidently about inviolate stratigraphy relations. Boundary of lower and upper parts of shale thick is very conditional. Thick is discordantly overlapping by deposits of ediacaran, ediacaran-cambrian and the second (rhyolite) pack of neoproterozoic. Thickness is about 2000 м.

By petrographic features there are gneisses, shale, fillites and quartzites among thick rocks. Primary composition of rocks, on which shale and quartzites are developed, in most cases is setting under nicroscopes by relicts of psammitic and aleuritic structures. Original rocks, obviously, were arkose sandstones and aleurolites, and in the case of quartzites - mono- and oligomictic quartz sandstones.

Significant mineral feature of these rocks is presence of lawsonite – indicator of high-pressure conditions of shale and gneiss forming.

Upper part (MPR_2s_2). Deposits of upper part of shale thick are connected spatial with areas of its lower part's spreading. In scheme of 1970 year describing part of section was [16] in bekturgan serie (upper subsuite of ornek suite), aralbay serie (fragments of kuzharma and ungirshat suites), karsakpay serie (significantly terrigenous with ferrous quartzites and marbles, subsuites and packs of burmashy, balbyrauyn, shagyrly and beiyt suites), maytobe serie (fragments of tumyrza, koldybayshoky and kumola suites' section), bozdak serie (part of belkudyk, karasay and nadyrbay suites).

Ferrous quartzites, apparently, form two levels: the first level is dedicated to middle parts of section, exactly with it Balbyrauyn and Keregetas deposits are associated; the second – lies near upper contact, sometimes associates with carbonaceous rocks. For ferrous quartzites it is characteristic expressed facies variability, appearing in change of thicknesses and number of interlayers in level, in change of ferrous minerals' content, in their transition on stretch into hematite shales. Thickness is hard to define by scattered sections, apparently it is more than 600 m, but hardly exceeds 800-900 m.

Group of metaterrigenous formations is presented by shales and gneisses, similar to described in lower parts of thick. Gneisses concentrate in eastern strip of outputs significantly. Metavulcanites of felsic composition are presented by shales and rarely by gneisses.

Marbles – rocks of white, light-grey, grey and brown colorings of different graininess, depending on the level of recrystallizing. In slightly modified version they are composed of fine (0,04-0,06 mm) isometric grains of calcite and indistinctly rhomboid grains of dolomite. Calcite-dolomite varies correlation within a wide range. Fine-flaked dolomite and quartz's grains present as impurity. During intensive silicification marbles turn into grained quartzites, sometimes cellular or cavernous structure.

In groups of ferrous quartzites there are quartzites, containing 10-15 %, and sometimes till 50-60 % of ore minerals. There are magnetite-hematite and magnetite quartzites by mineral composition. Magnetite-hematite quartzites are fine-grained rocks with finely banded texture. Hematite forms flakes, the size of them is 0,05-0,08 mm, they are distributed in fine-grained (0,02-0,05 mm) quartz aggregate of rocks as strips. Magnetite forms dispersed, correctly facetted grains in hematite-quartz mass. Structure of the rocks is microgranoblastic.

Magnetite quartzites consist of coarse-grained, often uneven grainy quartz with dispersed even or as strips octahedron crystals or irregular grains of magnetite. Hematite often develops on its grains as "casing" or in cracks. Sometimes magnetite passes into martite completely. On the rock fine-flaked sericite, chlorite is developed.

Average density of these deposits is about from 2,60 (quartz-sericite shales and gneisses) to 3,70 g/cm^3 (ferrous quartzites).

Till recent times rocks of describing thick were considered as "mute" on the basis of lack of organic remains in them. Found complex of microfossils allows to narrow age borders of thick to middle mesoproterozoic (Grigaitis and et al., 1989).

On the basis of geochronologic dating, determined in Laboratory of geochronology IMS NKO "Kaznedra" on zircons figure 1300 Mln years was taken from porphyroids of upper suites by uranium-lead method.

Age of lower boundary is determined on basis of discordant stratigraphic relations of shale thick with underlying porphyroids of paleoproterozoic. General theoretical historic-geological considerations about relations of porphyroids and rapakivi granites of zhaunkar complex allow to guess, that the beginning of accumulation of shale thick is close to boundary of paleoproterozoic-mesoproterozoic.

Mesoproterozoic undivided, basalt-andesite thick ($MPR_3\beta\alpha$) units metavulcanic rocks of basic, intermediate-basic, rarely intermediate and intermediate-felsic composition. In the first approximation it is characteristic for it binomial structure. In lower part dark-green, green often macroscopic massive kinds with relicts of porphyries and amygdaloidal structures of lumpy texture dominate. The bulk has been changed, laths of plagioclase replace by albite, in interstitiums – aggregate of chlorite, epidote, actinolite. Relict porphyries emissions are presented by intensively albited plagioclase, cataclastic and grained. Thickness of «lava» part is between 300 and 700 м.

Upper part of section consists of more motley on coloring: marshy, brownish, pale yellow kinds, giving platy, shaly separateness and often bearing relicts of primary clastic structures and they are treated as meta-tuffes and meta-tuffahs.

Conversion of existing analysis in order to determine geodynamical conditions of meso-neoproterozoic vulcanites' forming showed that in chart of T.G. Pirs et al. ("Petrochemical methods...", 1985) most of points gets into field of continental basalts, in chart of N.L. Dobretsov (Dobretsov, 1975) and B. T. Lunts (Lunts, 1960) points are in area of alkaline olivine basalts of continental rifts and oceans. Trend of basaltoids of described complex is in parallel to trend of vulcanites of continental rift areas. Generally it can be said rocks of this composition are widely spread on continents in areas of postorogenic activation and rifting, forming homogeneous by composition thicks without more acidic differentiates.

Subvulcanic complex (NPR_3). Essential components of neoproterozoic area's formations are subvulcanic solids of metagabbroids, metadiabases and metabasalts, syngenetic rocks of basalt-andesite thick. Size of solids varies from several meters in diameter and dozens of meters on stretch till hundreds of meters in diameter till several kilometers on stretch.

Morphological features of structures, insularity of solids, migration in neoproterozoic section can attest about intrusive nature of describing formations.

Metavulcanic rocks of this age have wide range of density from 2,63 g/cm^3 (chlorite-feldspar and feldspar-chlorite with epidotes of shale) till 2,97 g/cm^3 (amphibole shale). Average density of the most spread porphyritoids is 2,87 g/cm^3. Subvulcanic metadiabasesand metagabbroids have high density 2,85 g/cm^3. Generally, basalt-andesite thick has weighted density 2,82 g/cm^3 and is the most dense among stratified formations.

The closest to the real are relations of metabasalts and underlying terrigenous rocks with interlayers of ferrous quartzites in karsakpay serie of North Ulytau taking into account that in light ofmodern biostratigraphic dating their age must have been quite rejuvenated. Probably, analogue of this thick is zhaksykaiyndy suite of North Ulytau.

Neoproterozoic (NPR). Deposits of neoproterozoic in learnt area are presented by two thicks, differing sharply by lithological composition: metaterrigenous shale and rhyolite.

Shale thick (NPR_1s) predominantly consists of blastomere sand reckoner, blastomere aleuritic shales of greywacke sandstones and it is standing out as independent stratigraphic subdivision for describing area first. In general thickness in region, apparently, doesn't exceed 400 m.

By petrographic composition chlorite-sericite, chlorite, quartz-feldspar-sericite, quartz-feldspar-chlorite, quartz-chlorite shale show up among shales of thick. Primary clastic genesis of rocks sets under microscope practically in every polished section. Greywacke composition of primary rocks differs this thick from mesoproterozoic significantly arcose deposits.

On the conclusion of L.N. Ilchenko [18] presence of microfossils' complex allows to talk about neoproterozoic age of forming of inclosing rocks and reflects rapid blossoming of algae this time.

Rhyolite thick ($NPR_2\lambda$) is composed of motley complex of felsic vulcanic rocks, among them rhyolite and (rarely) rhyodacites and their tuffs lavas dominate. In chart (Zaytsev et al., 1970) rocks of east strip are combined into akkiyksay suite of beleuty serie. Describing thick overlaps discordantly with washout of ediacaran conglomerates. Thickness is 500-700 m. Level of metamorphic-metasomatic changes of rocks is different for west and east strips of outputs. On the west of rocks are not changed practically, except of feldspathization's development and primary structural-textural features set easily. On east strip describing vulcanites are turned into porphyroids, though even here level of changes is lower than in rocks of the third (porphyroid) thick of paleoproterozoic.

Radiological age of zircons from rocks of thickness 760±80 Mln years, changes till 870±80 Mln years for rocks of west strip and 870±90 Mln years for rocks of east strip (Zaytsev, Zhykov et al., 1974). In regional plan describing thick is correlated with sections of Big Karatau's kaynar suite, lower thick of Kokshetau region's imanburlyk serie, and with upper parts of Zhetymtau region's Big Naryn serie.

Ediacaran. Deposits of ediacaran (wend) have limited spread in the area. The most spread one is zone of Baykonyr and Ulytau-Arganaty zones' joint. These deposits are presented here by terrigenous rocks and form strip of scattered outputs to the east of Zhaltau fault. Another strip, less widescale, traces to the east, within Ulytau-Arganaty zone at joint of Maytobe and Karsakpay subzones.

The thick in western strip of spread has binomial structure of section. In the lower part pack of conglomerates and tylosoids of polymictic composition with thickness 140-150 m (conglomerates like tillites) stands apart; in upper pack – quite schistose sandstones, aleurolites and shale of them, often tufaceous with thickness about 550 м. In general thickness is estimated as 700 m in describing strip basal

conglomerates of ediacaran cover vulcanites of middle neoproterozoic rhyolite thick, well-rounded pebble of rhyolites and granitoids of aktas complex in them.

Sandstones of thick are usually inequigranular, from coarse- to middle- fine-grained, usually bad sorted; composition is greywacke-quartz-feldspar, greywacke-feldspar-quartz. Rock debrises are presented by bulk of felsic and basic effusive, quartzites, shales, ferrous quartzutes. In upper part of section group of rocks stands apart, containing tufaceous impurity - tuffites, tuff-sandstones and tuff-aleurolites.

Conglomerates are poorly sorted, pebble, often pudding. Medium size of debris is - 3-5 cm, but there are boulders of 30-40 cm too, their rounding is medium. There are felsic and basic vulcanites changed in different degrees, biotite and alaskite granites, granite-porhyry, diorite-porphyries, metasandstones and blastopsammite shale, dolomites, marbles, fillites in pebble. Cement is aleurite or clay, usually schistose.

Density of ediacaran formations ranges between 2,66 and 2,75 g/cm^3. Average density is 2,72 g/cm^3. In geophysics fields these deposits don't stand out. In gravimetric field often field of gravity gradient is marked above their outputs, rarely - bending anomaly. Outputs of ediacaran deposits are accompanied by calm negative magnetic field of various intensity.

By authors of GDP-50 (Zaytsev et al., 1973) describing deposits in western strip of their spread are considered in composition of four suites, and besides two of them – kumkudyk and shilisay formed ediacaran's akbulak serie, and satan and baykonyr suitetes were in ulytau serie of the same age, but they place in section above shilisay suite, separating itself by carbonaceous-terrigenous rocks of zhaltau suite [16]. It should be noted that deposits that referred to different suites before, in fact, represent unified terrigenous thick, it is characterized by: а) binomial structure; б) discordant with rewashing of correlation with covering deposits.

Ediacaran age of describing thick is set on basis of next data: 1) conglomerates include pebble of aktas complex's granites, its age on radiological data is close to lower boundary of ediacaran; 2) they are covered by deposits of black shale formations, containing at bottom mixed ediacaran-cambrian complex of microfossils and at the top - cambrian macrofauna.

In general described thick can be quite confidently matched with fragments of ediacaran deposits' sections of Middle and North Tian Shan, Ereymentau-Niyaz region (beimbet suite). Currently, apparently, described ricks should be matched with lower layer of tilloids of Big Karatau and contiguous areas.

Ediacaran-cambrian system, undivided (V-Є). To this lithostratigraphic subdivision wide developed in area terrigenous, siliceous-carbonaceous rocks were classified, in general column of Precambrian deposits (Zaytsev et al., 1970) they were placed on different stratigraphic degrees before. They were described [16] in sections of bekturgan serie's ornek suite, aralbay serie's kuzharma suite, karsakpay serie's balbyrauyn and burmashy suites, zhauynkar («zhauynkar horizon»), zhylandysay, tumyrza, kaldy-bayshoky suites of maytobe serie, nadyrbay suite of bozdak serie, zhaltau suite of ulytau serie and cambrian koktal suite.

Later it was found, that overwhelmingly these «different age» deposits have the same structure. In lower part of their section there is standing apart layer of variable thickness, composed of quartz sand-stones and gravelstones, pointing on perceptible washing of underlying thick. Tops of section is composed of, significantly, carbonaceous rocks with interlayers of aluminophosphates in lower part and carbo-naceous-barite rocks – in medium and upper.

Thick has binomial structure. In lower part of section pack of grey, light-grey, sometimes dark-grey because of carbonaceous matter of monomictic and oligomictic quartz sandstones and gravelstones stands apart. In single intersections among sandstones there are marked undisciplined lenses of conglomerates from fine-pebble till boulder black, dark-grey with quartz compound of pebble. Thickness of sand pack is variable, ranges between 40 and 300 m in differnet areas. Maximal thicknesses are noted in Baykonyr synclinal. Lower boundary of pack and thick is, generally, different, discordant. Above sand pack there is pack of fine terrigenous and chemogenic rocks: siliceous, clay-siliceous, siliceous-clay shale and their carbanaceous kinds (Figure 2). Right near the boundary of lower and upper packs in many intersections lenses and interlayers of brown iron ores and facially replacing them marlaceous limestones stood apart.

Lower part of pack contains light weakly carbonaceous clay and siliceous kinds of shale. Upwards in the section number of carbonaceous matter increases, rocks get black and dark-grey colors. Here they get interlayers of limestones (often packstones) and lenses of barite rocks. Thickness of fine pack is hard to be determined because of bad bareness and dislocating of rocks. It is about 360-500 m. Upper boundary of

Figure 2 – Sericite-siliceous-carbanaceous shale, zoom 100^x, crossed nicols

thick in describing area is on base of light grey, limonitized green siliceous shale and aleurolites' pack, that belong to lower-medium Ordovician faunistic characterized deposits. At this degree carbonaceous linds of rocks are disappearing from section.

Ediacaran-cambrian deposits have magnetic susceptibility between 0 and 36 and they are practically nonmagnetic formations. Average density is 2,62 g/cm^3. In gravity field these deposits don't stand out. In magnetic field ediacaran-cambrian deposits are accompanied by calm negative magnetic field with intensity from -20 till -160 nT. Its increase until 60-100 nT, rarely until 400 nT, above their outputs in area of Baykonyr and Zhylanbulak synclinals shows their low thickness and influence of partly underlying meso-neoproterozoic basic vulcanites ($æ_{av}$=500), partly presence of upper Ordovician granodiorite intrusives in depth ($æ_{av}$ =250).

Age of South Ulytau's terrigenous-carbonaceous deposits accumulation embraces interval from tops of ediacaria till the end of cambrian, and its section mostly matches with undivided [16] koramsak and kokbulak suites of regional stratigraphic scale.

Clear vanadium-bearing and phosphate-bearing of carbonaceous rocks helps to compare them with similar deposits of Big Karatau. Lower, coarse clastic part of thick section, in first approach, is comparable with layer of Middle and North Tian Shian upper tilloids. It is possible that in central parts of Baykonyr zone tops of allocable (Zaytsev et al., 1970) baykonyr suite's section can be analogues of this coarse clastic part.

Generally, according to field studies [18] Proterozoic total thickness of area is about 9-10 km, and number of stratigraphic subdivisions doesn't exceed 10 nomenclatures. On former data (Yu.A. Zaytsev, L.I. Filatova, 1970), total thickness of these deposits was about 35-40 km, and number of stratigraphic subdivisions (series, suites) reached 32 titles [16]. Such discrepancy of reality is related to the fact that the same stratigraphic subdivisions in different tectonic blocks considered independently and, consequently, there were multiple duplications. It is related to the fact that the same rocks because of different intensity of thermodynamical conditions went through different degrees of metamorphism in different tectonic blocks. For example, in geosuture zone rocks are subjected to deep metamorphism and they were mapped as Archaean-proterozoic, at the same time at a small distance from geosuture these rocks had quite fresh view and relatively calm occurrence, and respectively their age sometimes rejuvenated till lower Paleozoic.

In geological structure of region in forming of mineral deposits the leading role has magmatism, especially basite-ultrabasite deposits (Figure 3).

In the area aureoles of magmatic-thermal effect are wide spread, which differ by compound and size of intrusion on inclosing rocks. Areas of this influence's demonstration on its spectral characteristics are

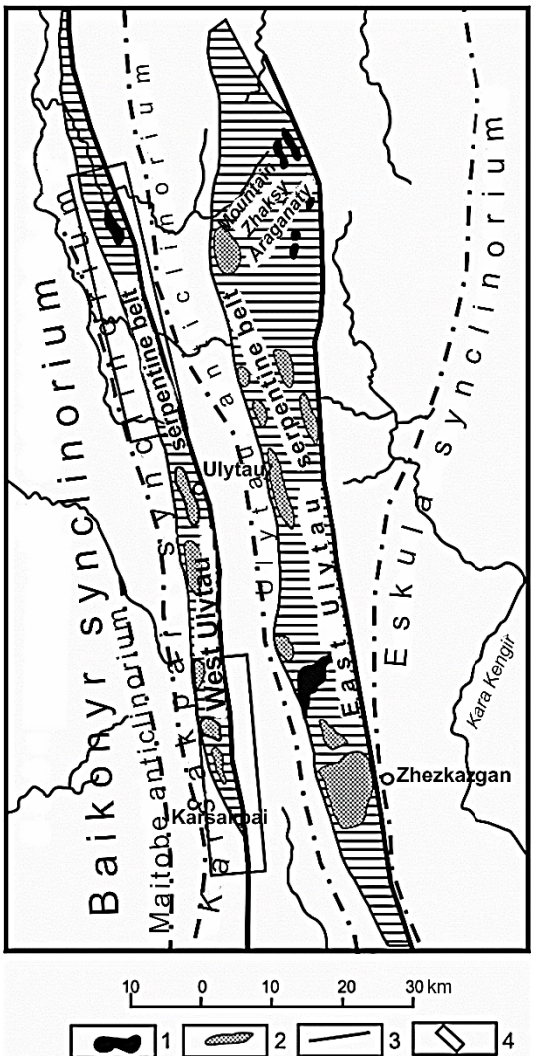

Figure 3 – Geological scheme of Ulytau ultrabasite zone: 1 – massifs of outcropping ultrabasites; 2 – hidden massifs of ultrabasites; 3 – deep faults; 4 – areas of making cosmostructure schemes

quite close on one hand to ultrabasic and basic rocks, and on the other hand – with hornfelsing terrigenous-volcanogenic rocks. It should be noted that areas of this process's demonstration coincides also with areas of basite-ultrabasite magmatism [12, 13, 15].

In the territory of Karsakpay ore region next intrusive complexes are allocated [18]: 1) paleoproterozoic zhauynkar complex of granites and leucocratic granites; 2) neoproterozoic complex of porphyroblastic granite-gneisses; 3) ulytau complex of serpentinized peridotites and pyroxenites; 4) karsakpay complex of alkali syenites; 5) aktas complex of subalkali, leucocratic and alaskite granites; 6) later ordovician complex of hypabissal intrusions of basic compound; 7) later ordovician kyrykkudyk complex of diorites, quartz diorites and granodiorites. Corresponding metasomatic conversions of rocks on different degrees and ore occurrence are related to these magmatic complexes, which are described fully in [12, 13].

In Ulytau region intrusive rocks also widely developed taking area over 950 km^2. Intrusions are characterized by various petrographic compound and age. Five intrusive complexes are highlighted among them, and the oldest one is complex of gabbro-amphibolites. Then at the time of implementation neoproterozoic granite-gneisses, Ordovician basic and ultrabasic rocks, intrusions of prelowerdevonian granodiorites and medium Devonian leucocratic and alaskite granites follow it. Basic and ultrabasic intrusions compose small figure and meet rarely [1, 11-25].

Precambrian gabbro-amphibolites (vNPR) compose tabular figure of various thickness, which lay among paleo- and mesoproterozoic rocks. The coarsest of them are marked on top streams of Karasay, on right bank of r. Zhaksy-Kaiyndy (0,5x3 km^2). Smaller figures are marked on r. Karatorgay and on its

inflows. Gabbro-amphibloites, generally being tabular figures, in some places have secant contacts with inclosing rocks. In structure of large gabbro-amphibolite figures it is often seen zoning. In marginal parts of figure rocks are fine-grained, in central areas of intrusions they have coarse-grained structure, herewith gabbro structure is often saved.

During interpretation materials of space shooting about 400 magmatic figures were highlighted (uncovered by erosion and viewless), including dykes. By spectral characteristics intrusions divided into ultrabasic, basic and felsic. Besides viewless (not opened by erosion) magmatic figures were gighlighted. Special attention during interpretation was spared to ultrabasic figures, which are over 100. All of them are stretched on north-west and form zone with extension over 20 km and width up to 1,5 km.

Among other magmatic formations the most widespread one is felsic rocks. Felsic deposits' figures predominantly spread in north-eastern part of area. By mode of occurrence they are batholithes and in some cases stocks.

Figures of basic magmatic rocks are spread on north and central parts of area. These magmatites form dyke figures and probably commit ruptures of depth inception.

Neoproterozoic granite-gneisses (γ NPR) form row of massifs, devoted to axial part of Ulytau anticlinorium. The largest of them – Suyktal massif has area about 200 km^2. Massifs of less area (up to 50-80 km^2) are at the top of rivers Tuyemoynak and Bekturgan.

Suyktal massif has oval form in plan and stretched to north-east. On the south-east granite-gneisses are broken by biotite porphyraceous granites of prelowerdevonian Sabasaldy-Torgay intrusion. Massif is composed of coarse-grained leucocratic porphyraceous granite-gneisses. Contact of granite-gneisses with Proterozoic metamorphic thick has erupted character. In outcrops granite-gneisses form layered injections in shale, as a result rocks have migmatite shape. In endocontact zone of granite-gneiss massif xenolites of metamorphic series (r. Zhaksy-Kaiyndy) rocks are frequent.

Granite-gneisses with massive texture form areas in central parts of massif with area up to 10-15 km^2. Injection gneisses, confined to contact zones of massifs, are related to schistose kinds. Massifs of granite-gneisses oriented due to inclosing rocks, and gneiss texture of granite-gneisses is parallel to their schistosity. Granite-gneisses break metamorphic paleo- and mesoproterozoic rocks. Granite-gneisses aren't observed with Precambrian thick and character of their ratio is not clear. This allows us to assume neoproterozoic age of granite-gneisses.

Ordovician basic and ultrabasic intrusions are met in area as small stockweise figures, tabular deposits or veins with thickness up to 300 m. Bigger intrusions were in two areas on r. Karatorgay. There are gabbro-diabases, gabbro-amphibolites, serpentinized peridotites and serpentinites in their compounds. These rocks break through Precambrian deposit.

Serpentinized peridotites and serpentinites (σO) are developed on r. Karatorgay. Form of intrusions is various – oval, irregular or extended oval in plan. They lay as concordant tabular figures in Precambrian shale. Area of intrusions rarely reaches 3 km^2.

In massif of ultrabasic rocks on r. Balga relicts of olivine are met and rarely veins of asbestos are in serpentinites with thickness of several millimeters. Among serpentinites there are small (20x10 m) outputs of talc-carbonaceous and siliceous rocks. Their age is ordovician on basis of matching with analogous rocks in more southern areas (Eskuly mountains), where they break through lower and middle ordovician thick and are covered by upper ordovician-silurian conglomerates.

Prelowerdevonian granitoids ($\gamma\delta aD_1$; γaD_1; γaD_1) are developed the most widespread. Western part of Kaptadyr, Sabasaldy-Torgay, Kogaly massifs, western part of Shili and also small intrusions of Kaiyn-dyshoky mountains are composed by them. Total area of intrusions is over 450 km^2.

Kaptadyr massif in the area takes about 145 km^2. On south-west massif has tectonic contact with Lower Carboniferous rocks. From north-west and west throughout 10 km it is limited by Precambrian rocks, and from north and south blocked by Cainozoic deposits. Massif in this part consists of grano-diorites and quartz diorites, related to mutual transitions. In the north granodiorites are broken through by middle Devonian lucocratic and alaskite granites.

Vein serie of prelowerdevonian intrusive complex is presented by fine-grained granites, aplits, pegmatites, granite-porphyries, syenite-porphyries, diorite-porphyrites and quartz veins. Fine-grained granites, aplits and pegmatites form low thickness veins; fine-frained granites, sometimes lay as small stocks.

Quartz veins with thickness up to 1,5 m are spread more north of lake Shoshkaly. They consist of grey quartz, sometimes vestiges of sulfide dissemination and they are the youngest vein deposits.

Sabasaldy-Torgay massif is located on right bank of r. Ulken Sabasaldy-Torgay. Intrusion is stretched meridionally and has oval form in plan. Its area is about 300 km^2. From west and east massif is limited by Precambrian metamorphic rocks. Its boundary in these parts matches with stretch of inclosing thick. Inclosing Precambrian rocks have undergone contact effect, shown in hornfelsing and migmatization.

In eastern part of massif in contact with amphibolites quartz-epidote-pyroxene hornfels were occurred. In this area of eastern contact, also in zone of western contact in Precambrian shale granite injections were met.

The main intrusive facie of Sabasaldy-Torgay intrusion has coarse-grained porphyraceous granites. In outcrops biotute granites have gentle, sometimes blocky cleavage.

Kogaly massif has irregular oval form and is stretched to north-west. Area of intrusion is about 6 km^2. Kogaly massif consists of coarse-grained porphyraceous biotite granites, completely identical to granites of Kaptadyr and Sabasaldy-Torgay massifs.

Intrusions Kaiyndyshoky are located in north-eastern part of plate, near Kaiyndyshoky mountains. It is two disjoint figures consisting biotite porphyraceous granites and biotite-hornblende porphyraceous granodiorites. In horizontal sections – it is irregular outline figures, stretched in north-west. Area of northern intrusion is 5,5 km^2, southern – about 4 km^2. They break through Precambrian deposits and ordovician complex's gabbro-amphibolites. Along the contact with Precambrian mica-quartzite shale there is zone of hornfelses with thickness up to 50 m. Granitoids in exocontacts change up to fine- and medium-grained.

Middle Devonian leucocratic and alaskite granites (γD_2) are developed in north-east part of area at the top of r. Kaiyndy. They break through granodiorites of Kaptadyr massif in northern part. Granites on outputs have well expressed pillow and rarely lump joint.

Age of intrusions is determined by that in southern parts of Kaptadyr massif they have active contacts with lower-middle Devonian effusions. In contacts effusions are turned into hornfels beyond 5-10 m. Upper age boundary is determined by presence of leucocratic and alaskite granites' debris in pebble of conglomerates of zhaksykon serie (D_2-D_3fr) in north-western part of area.

Space geological structure schemes of 1:200000 scale were made in order to predict of perspective for mineral deposits areas and their confinement to certain ore controlling structures, by materials of distance sounding the Earth for two areas of learnt territory: Karsakpay and Ulytau. As a result significant number of different structure elements was found which on one hand shows area's features of geological structure, on the other hand – can be used as criteria of mineralization. Within the area Karsakpay the main found elements, having ore controlling meaning, on our experience, are (Figure 4).

– linear structures, presenting single faults, zones of fracturing, areas of cleavage's development;

– circular and arc structures, showing over intrusive areas of rocks' decompression, focal structures of hydrthermal-magmatic character;

– intrusive figures of various compound and aureole magmatic-thermal effect on inclosing rocks.

So, possible perspective areas are given here allotted on basis of general geological thoughts, public materials on minerals of area. Based on this, in learnt area, it should be expected firstly hydrothermal-magmatic and metamorphic-metasomatic minerals [12-14, 19-21, 25-29, 31-36].

It should be noted that mineralizing of platinum group metals, chromite, iron and chrysotile asbestos can be related to figures of ultrabasic and basic intrusive rocks. In this case the most perspective area is central part of area, zone of "small" ultrabasic and basic rocks figures goes out on the surface.

It can be expected quartz-vein display of gold, polymetals, tin, tungsten with felsic intrusives in western part of area. In this case, potentially metalliferrous areas can be controlled by permeable structures (single disjunctive, nodes of linking multidirectional faults), located just near the uncovered by erosion intrusive figures.

Additional criteria of predicting ore-bearing can be telescoping systems of circle sructures. Spatial relations of gold, polymetals, tungsten, tin and etc. deposits with circle and arc structures are noted by many geologists-researchers [26, 27, 29]. In this case it should be paid attention to nodes of linking arc segments of circle structures with faults.

Figure 4 – Space geological structure scheme of Karsakpay area in 1 : 200 000 scale

It is recommended to use available geophysical, geochemical and mineragenic information and do geological-geophysical researches during emphasizing local areas for setting searching works.

As a result of works in Ulytau region it was also revealed significant number of various space geological structures, which on one hand show features of area's geological structure, on the other hand – they can be used as criteria of mineralization (Figure 5).

In our opinion in learnt area firstly it should be expected magmatic mineral deposits. It should be noted, that we can expect demonstration of chromite, elements of platinum group and chrizotile-asbestos with ultrabasic figures. In this case the most perspective area is whole west flank, where big number of "small" ultrabasic figures go out on the surface [14, 26-30].

Quartz-veins of gold, polymetals, tin, tungsten can be expected with felsic intrusive. Potentially, ore-bearing figures can be controlled permeable structures (disjunctives, zones of high fracturing, nodes of linking multidirectional faults), located just near o the uncovered by erosion intrusive figures or over domical parts of viewless massifs.

Additional criteria of predicting ore-bearing can be system of circle structures. We should pay attention to the nodes of linking arc segments of linear and circle structures with faults.

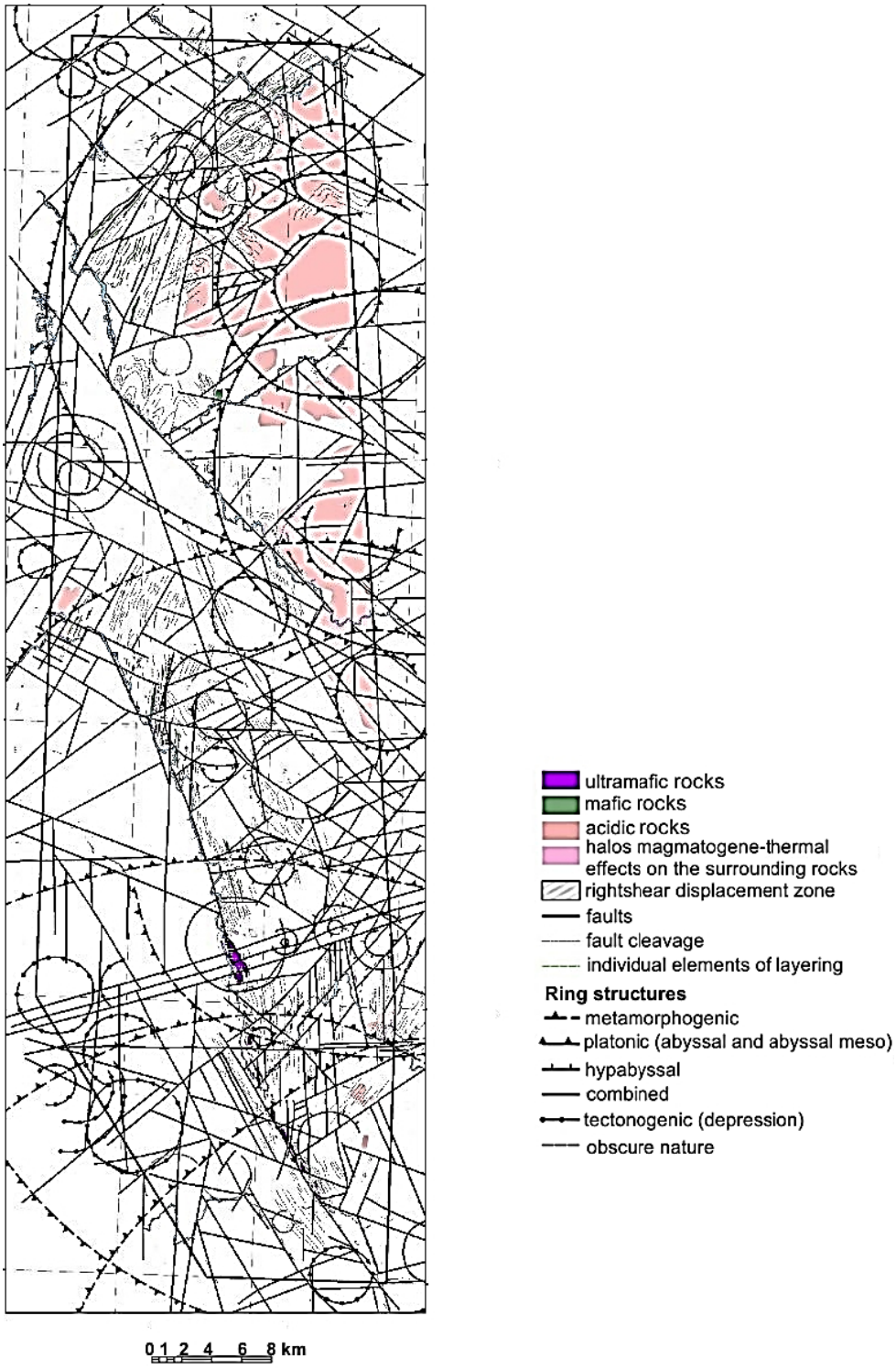

Figure 5 – Space geological structure scheme of West Ulytau area

Field geological works, held in this region showed specific prospects of Karatorgay area due to small figures of ultrabasites and basites, in which inclusions of copper and nickel sulfides were detected. During planning searching works we should pay attention to circle structures, which perhaps control localization of widescale copper-nickel mineralization in depth. Thereby we should project mapping-searching holes for determining deep-seated focus of mineralization accompanied with appropriate geophysical works in these structures.

Conclusions. Presented standardized stratigraphic Precambrian scheme (see Table 1) is characteristic for geosutures, where in view of the complexity of tectonic structure and the strength of the local thermodynamic conditions in the deep fault zone rocks undergo metamorphism complex and metasomatic changes. First in different tectonic blocks substantially the same thick considered individually and, as a consequence, there has been repeated duplication. For example, according to field research the total capacity of Proterozoic thickness in area is about 9-10 km, and the number of stratigraphic subdivisions (nomenclature) shall not exceed 10. Whereas on the same data (Y.A. Zaytsev, L.I. Filatov, 1970), the total power of these formations is estimated at about 35-40 km, there is the whole thickness of the earth's crust are approaching these values. If rocks in the zone of geosuture where they are subjected to deep metamorphism, mapped as the Archaean-Proterozoic, at the same time at a short distance from the geosuture the same breed were pretty fresh face and a relatively quiet attitude, and according to that their age rejuve-nated.

In the study of territory the intrusions of various composition and size and ghosting their magmatic-thermal effects on the host rocks are widespread. Lots of manifestation of such influence in their spectral characteristics are very similar, on the one hand, to the ultrabasic and basic rocks, and on the other – to hornfelsed clastic-volcanic rocks. Note that the area of occurrence this process coincides, including with occurrence areas of basite-ultrabasite magmatism.

The question of the formation of the rocks that form the mentioned arrays, remains controversial. Some researchers consider them part of the ophiolite complex, and their formation connects with the zones of destruction of continental crust (Pavlova T.G., 1977; Kuznetsov, I.E., 1975, et al.).

Zavrazhnov V. N. [18] provides some evidence to show that the largest in this zone *Eshkiolmes* array is displaced block layered intrusive complex. Thus, there is an array: 1) The vertical zonation, which reflects the general trend of differentiation of basite-ultrabasite melt; 2) Cr-spinels in the diagram Al-/Fe + Fe/-Cr form a trend characteristic for ultrabasic "stratiform" layered intrusions; 3) in the diagram SiO_2-FeO/FeO + MgO point compositions of Eshkiolmes massif's rocks of in large quantities lie outside the field of cumulates ophiolite ultrabasite, which suggests a low probability accessories rocks massif of Eshkiolmes in the ophiolite association. Yet clearly it is shown in the diagram FeO-MgO-CaO + Na_2O + K_2O, here ultrabasites come to the chrome and containing nickel ultramafic rocks, which is not typical for the ophiolite associations; 4) in some arrays Ulytau group observed poikilitic harzburgites and lherzolites. The rocks of this type are virtually unknown in the basite-ultrabasite ophiolite complexes, however they are described in some "stratiform" arrays.

Considering all of the above data we can talk about the proximity array Eshkiolmes and other arrays area to intrusive "stratiform" foliated ultrabasite complexes. It should also take into account the fact that the area is not known to other components of the triad characteristic for the ophiolite association as basic volcanics and jasperoids.

The genesis of granite-gneiss is still problematic. Most geologists consider that granitization process is a combination of geological, physical and chemical processes that often occur simultaneously, for example, recrystallization, metasomatism, anatexis and others without isolation of anyone. Granites of complex in the south of the area subject to an insignificant later greisenization, resulting in the formation of fan-shaped aggregates and clusters of small scute of green biotite and xenomorphic secretions of fluorite.

By chemical composition of granites of zhauynkar complex belong to granites of the normal range of potassium-sodium series with a predominance of potassium over sodium, a high-alumina group. In addition to the normal range of granites occasionally observed difference close to leucocratic and subalkalic. The nature of sustainable chemistry of granite set in various arrays. Granites of zhauynkar complex characterized by positive specialization in ytterbium, yttrium content, molybdenum and tin above and close to Clarke for acidic rocks. The iron content of less than Clark, the ratio of element-adulteration is monotonous.

Granitisation process in the region may be associated with the stage of closing the Meso-Neoproterozoic rift and is a reflection of the underlying processes within conjugated with rift of blocks continental crust, folded Paleoproterozoic rocks. There rift appears and closes when the vertical displacement of deep faults multidirectional batice in the geosuture zone [8, 12-18, 30-40].

Thus, the actual material [18] does not support the idea of characteristic mobility of different blocks in single larger structure, in this case, Karsakpay-Ulytau zone. The association of all the geological

formations to the narrow elongated zone submeridional bearing with strained thermodynamic conditions is be accounted for its localization in the geosuture of the second ring continent of Kazakhiya [8]. Activity of geosutures, expressed in the introduction of the asthenosphere material in the continental lithosphere in the form of linearly elongated figures of ultrabasites, it is related to a time interval of the Lower Paleozoic. Consistent sliding ultrabasites and basites along the linear geosuture can be regarded as a manifestation of separation of the material of the upper mantle, introduced in the Earth's crust. Formation of granitoids along geosuture can also be associated with the process of separation of magma, and granitoids areal nature outside geosuture on both sides – a local manifestation anatexis and palingenesis in the continental crust. Throbbing tectonic and magmatic and related to it metasomatic activity of geosuture zone determines its prospects on the mineralization and the scientific validity of the forecast at natural resources areas.

For a reasonable forecast of minerals it is promising to use cosmic geological technology to identify ore-controlling structures.

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ҚАРСАҚБАЙ-ҰЛЫТАУ ГЕОСУТУРА ЗОНАСЫНЫҢ ГЕОЛОГИЯСЫ МЕН ГЕОДИНАМИКАСЫ ЖӘНЕ ПАЙДАЛЫ ҚАЗБАЛАРҒА ПЕРСПЕКТИВАСЫ

Аннотация. Қарсақбай-Ұлытау кенді ауданын геологиялық нәтижелері баяндалған. Аудандағы прекембрий жаралымдарының бірізділендірілген стратиграфиялық сұлбасы келтірілген және ол геосутура зоналарына тән болады. Магматизм және метасоматизм процестерінің белсенді білінуі ауданның өзіне тән санқилы минералданғандығы геосутура сызықтық зонасында орналасуына байланысты анықталады. Бұл аудан, Қазақстан аумағының көпшілігіндегідей, палеоконтиненттік жағдайларымен және офиолит ассоциясына тән ультранегізді интрузиялар, вулканиттер мен яшмоидттар сияқты триаданың болмауымен сипатталаады. Магмалық таужыныстар комплексі офиолит ассоциясына жататындығына ықтималдығының жеткілісіздігі далалық және лабораториялық зерттеулермен де қуатталады. Интрузиялық массивтерді құрайтын таужыныстардың қалыптасуын геосутура зонасындағы плюм-тектоника тұрғысынан түсіндіруге болады. Геосутра зонасында ультрамафиттер, мафиттер және гранитоидтар қалыптасуы мантияда жаралған магманың жіктелуіне байланысты болуы мүмкін, ал геосутура аумағынан тыс жердегі алаңдық сипатты гранитоидтар – континенттік қыртыста анатексис пен палингенездің жергілікті білінуімен байланыстырылады. Геофизикалық зерттеу деректері интрузиялардың геосутура зоналары бойында орналасқанын және тереңге таралғанын көрсетеді. Зерттеулердің ғарышгеологиялық технологиясы, геосутура зонасының магмалық пен метасоматоздық белсенділігі және кенденудің тікелей іздеу белгілері ауданның өнеркәсіптік пайдалы қазбаларға перспективалылығын және іздеу жұмыстарын жүргізудің ғылыми негізделгендігін анықтайды.

Түін сөздер: кенорын, магматизм, метасоматоз, плюм-тектоника, петрохимия, ғарышгеология.

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ГЕОЛОГИЯ И ГЕОДИНАМИКА КАРСАКПАЙ-УЛЫТАУСКОЙ ЗОНЫ ГЕОСУТУР И ЕЕ ПЕРСПЕКТИВЫ НА ПОЛЕЗНЫЕ ИСКОПАЕМЫЕ

Аннотация. Изложены результаты геологических исследований в Карсакпай-Улытауском рудном районе. Приведена новая унифицированная стратиграфическая схема докембрийских образований района, которая характерна для геосутурных зон. Активное проявление магматизма и метасоматических процессов определяется локализацией района в линейной зоне геосутур с характерной разнообразной минерализацией. Данный район, как и большинство территории Казахстана, характеризуется палеоконтинентальными условиями и не известны составные триады, характерной для офиолитовой ассоциации, такие как мафит-ультрамафиты, основные вулканиты и яшмоиды. Маловероятность принадлежности пород магматического комплекса к офиолитовой ассоциации подтверждается данными полевых и лабораторных исследований. Формирование пород, слагающих интрузивные массивы в зоне геосутур, можно объяснить с позиции плюм-тектоники. Формирование ультрамафитов, мафитов и гранитоидов в зоне геосутуры может быть связано с процессом расслоения магмы, зарожденной в мантии, а гранитоидов площадного характера за пределами геосутур – локальным проявлением анатексиса и палингенеза в континентальной коре. Данные геофизических исследований показывают приуроченность и глубинное распространение интрузии вдоль геосутурной зоны. Космогеологическая технология исследований, магматическая и метасоматическая активность геосутурной зоны и прямые поисковые признаки оруденения определяют перспективность района для прогноза промышленных полезных ископаемых и научного обоснования проведения поисковых работ.

Ключевые слова: месторождение, магматизм, метасоматоз, плюм-тектоника, петрохимия, космогеология.

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