International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081
Online International Journal Available at http://www.cibtech.org/jgee.htm
2022 Vol. 12, pp. 265-274/Farrukhand Jasurbek
Research Article (Open Access)

METALLOGENIC FEATURES OF TIN ORE FORMATIONS IN UZBEKISTAN

[1]Rakhmatullayev Farrukh* and [2]Rakhmatullayev Jasurbek
[1]Department of Digital Mapping, state enterprise "Institute of Mineral Resources" at the University of Geological Sciences, Tashkent, Uzbekistan
[2]National University of Uzbekistan
**Author for Correspondence*

ABSTRACT
The article deals with the tin formations of Uzbekistan. Dadatabases of tin-ore objects of various ranks (deposits, ore occurrences, ore spots) have been created. A classification of tin ore formations is proposed, which takes into account the possibility of formation of monoformational and polyformational tin deposits. Regularities in the formation and distribution of tin ore formations were revealed on the example of the Karnab, Lapas, Semizkuduk deposits. It is shown that there are prerequisites for increasing the resource potential of tin deposits in Uzbekistan.

Keywords: *Tin formations, Uzbekistan, Ore Occurrences, Classification, Patterns of Placement, Mineral Type*

INTRODUCTION
Tin is a characteristic element of the upper part of the earth's crust. Its content in the lithosphere is 2.5·10-4% by weight. In igneous rocks 3·10-4%, in basic rocks 1.5·10-4%. It is less in the mantle than in the basic rocks.

Demand for tin as one of the key metals of the carbon-free economy in the world is increasing due to the introduction of innovative technologies and the metal's environmental friendliness. According to the forecast of the International tin Association (ITA), the growth rate of world tin consumption in the current decade can reach 3-4% per year.

Tin objects of Uzbekistan located in the Uzbek segment of the Tien Shan orogenic belt are of scientific and practical interest. More than 100 ore occurrences and 3 tin deposits are known in Uzbekistan. All of them are small with complex morphology. Geological and economic assessment of tin objects in Uzbekistan has not been carried out in the last 20 years. In connection with the changed conditions of the world tin market, the real industrial reserves and the profitability of the development of Uzbek deposits require a serious geological and economic assessment.

MATERIALS AND METHODS
The work used published articles, monographs on tin deposits of the world and Uzbekistan, Internet resources.

To prepare the database, geological data from the production reports of field exploration organizations stored in the State Geological Funds of the Republic of Uzbekistan (primary documentation of mine workings - ditches, boreholes; results of mineralogical and spectral analyzes) and personal field research of the author were used. As a result of the systematization of these materials, a database on tin objects of the Republic of Uzbekistan was prepared. It consists of 34 positions and contains information about the location of each object, its scale, geological, structural-tectonic position, mineral composition, near-ore metasomatic changes, analytical studies, metallogenic potential and sources of information received.

The methods used in the work are formational metallogenic analysis, statistical analysis (Usmanov *et al.*, 2006). The prepared computer database on deposits and ore occurrences of tin in Uzbekistan was the basis of the analysis.

RESULTS AND DISCUSSION
World deposits of tin are located mainly in China and Southeast Asia - Indonesia, Malaysia and Thailand. There are also large deposits in South America (Bolivia, Peru, Brazil) and Australia . Of the total world tin reserves, about 70% is contained in alluvial deposits (Rundqvist, 1986).
Tin deposits in Uzbekistan are indigenous. They are found in 3 segments of the Tien Shan orogenic belt: Northern, Southern, Middle (Fig. 1).

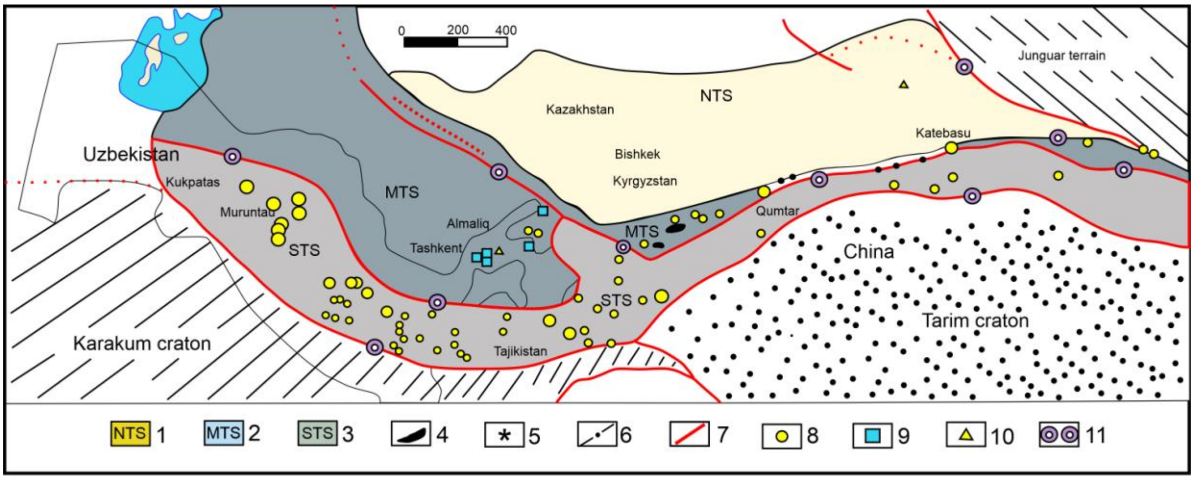

Figure 1: Location of ore deposits in the Tien Shan orogenic belt
(Compiled by Zh.Zh. Movlanov according to Zu , B., Xue , C., Seltmann , R. et al., 2020). Symbols: 1-Northern Tien Shan; 2-Middle Tien Shan; 3-Southern Tien Shan; 4-Ophiolites; 5-etamorphic rocks of high pressure; 6-Suture zone; 7-State border; 11-Deep faults: 1-North Tien-Shan fault, 2-Nikolaev line-Northern Nalati fault , 3-Atbashy-Inylchek-South Nagatinsky fault; 4-North-Tarim fault; 5-Hissar fault, 6-Talas-Fergana fault.

The main mass of tin objects is concentrated in the Zirabulak-Ziaetdin region of the Zarafshan-Alai metallogenic zone of the Southern Tien Shan (Mirkamalov *et al.*, 2019; Razikov *et al.*, 2020). The largest objects are Karnab, Semizkuduk , Karmana, Changalli , Kochkarly , Lapas (Pirnazarov *et al.*, 2020).
An analysis of the existing classifications of tin deposits showed their complexity and fragmentation. Most of the proposed classifications of tin deposits (Babaev, 1974; Baimukhamedov , 1973; Cherepanov, 1972) were created on a formational or genetic basis. The mineralogical and geochemical composition of mineralization and the technological and economic features of the deposits were chosen as signs. Tin-ore formations identified on the basis of the similarity of mineral associations, with a wide variety of geological conditions for the formation of tin deposits, often do not cover the entire variety of its mineral forms and types.
V.N. Ushakov (1987) identified two tin ore formations: rare metal- tin and polymetal -tin with four industrial genetic types: cassiterite- skarn, cassiterite - greisen, silicate-cassiterite and sulfostannate .
Cassiterite - skarn the formation type of tin ore is represented by tungsten -bearing (Kyzkurgan , Chashmazar , Siob) or magnetite (Chuyankan , Yangikan) skarns and near- skarn rocks confined to the endo- exocontact of C_3 -P_1 granitoid intrusions with carbonate rocks D_{1-2} -C_1 . Morphological type - reservoir and secant veinlet along the longitudinal and transverse contact zones of increased fracturing . Industrial value - small objects.
Cassiterite-quartz-greisen (quartz-cassiterite) formation type of tin ore is genetically related to the granitoid complex of two-mica and leucocratic granites (P_1), which has a distinct geochemical specialization in tin. Objects of this type are confined to the apical ledges of acid granitoids intrusions, partially capturing their host granodiorites (Barkrak, Altyntau, Changalli, ore points in the Karatyubinsk intrusive). Morphologically, these are quartz veins with greisenization zones, developed along systems of zones of increased fracturing. Surround changes - silicification , muscovitization , albitization . Geochemical association - tin, beryllium (with tungsten, copper and bismuth). Among

foreign analogues, medium-sized objects (Onon , Cornwell , Zinvald) with rich ores, as well as large ones (Sarydzhaz) are known .

Silicate-cassiterite formation type of tin ore is paragenetically related to the monzonitoid complex of variegated dikes P2 (Divaev *et al*., 2022). Morphologically, it is represented by a complex branching system of quartz-tourmaline veins and veinlets, as well as metasomatic bodies confined to the junctions of longitudinal and diagonal fracture zones in rocks of various lithological compositions: granitoids (Karnab, Aimakly), shales (Semizkuduk , Karmana), carbonate rocks (Sukaites , Lapas). Change Petropoles : sericite-quartz-tourmaline metasomatites , carbonate- quartz- sericite - pyrite beresitoids . Geochemical association: tin with lead, copper, zinc, silver, arsenic, bismuth, tungsten, gold.

The silicate-cassiterite type is the main type in tin mining abroad. Medium and large facilities are concentrated mainly in Malaysia and Bolivia; on the territory of Russia, these are Ege -Khaya (Yakutia), Khapcheranga (Eastern Transbaikalia), Tigrinoe (Far East).

Within Eastern Uzbekistan, the silicate-cassiterite industrial-genetic type is represented by poorly studied vein-stockwork manifestations of quartz-chlorite-cassiterite mineral type (Shavaz , Naugarzan) with polymetal (lead, zinc, copper) geochemical specialization.

Sulfostannate type (P_2 -$T_{1?}$) is singled out as an independent type in Western Uzbekistan for the first time. At the Karmana and Karnab deposits, it belongs to the mineral type of the silicate-cassiterite formation as products of the late stages of ore formation (Pavlovsky, 1985).

At the tin deposits of Karnab, Lapas and Changalli , reserves were calculated by industrial categories (Otroshchenko *et al*., 1982).

The Karnab deposit belongs to the silicate-cassiterite type and is located in the eastern end of the Zirabulak-Ziaetda mountains. Administratively, it is part of the Samarkand region. The Karnab ore field is confined to the southwestern endocontact of the C_3 -P_1 biotite granite intrusion, which cut through the core of a large anticline fold, on the wings of which Marbled Devonian limestones and Ordovician terrigenous rocks are exposed (Fig. 2).

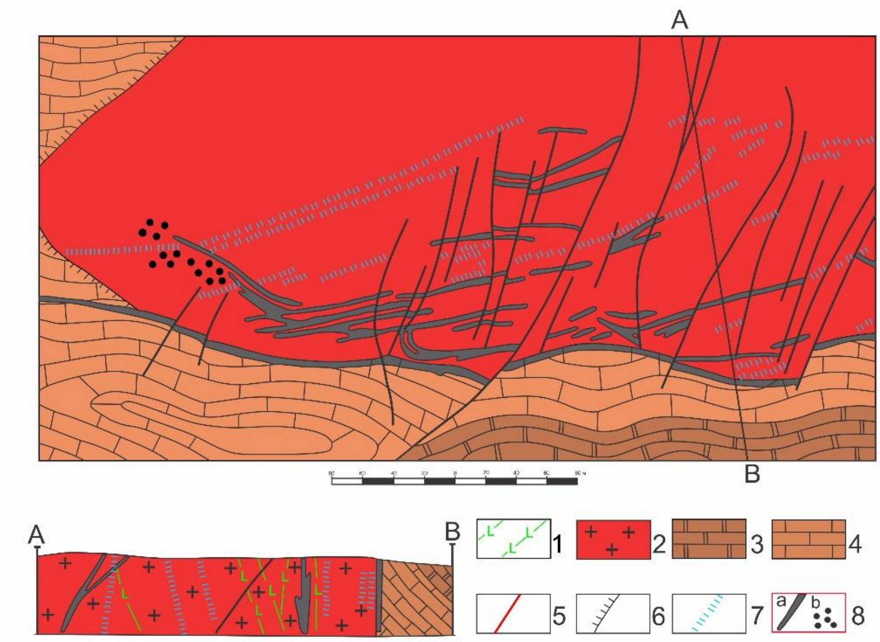

Figure 2: Schematic geological map of tin ore field Karnab. (based on the materials of the state geological funds of Uzbekistan). *1 - Karnab complex (P_2 -T_1): lamprophyres , monzogabbro - porphyrites; 2 - Karatube-Zirabulak complex (C_2 -P_1): granites; 3 – Maidan suite (D_2): dolomitic limestones; 4 – Dzhalkyraimakhal suite (D_1): limestones; 5 - faults; 6 - thrust; 7 - quartz veins; 8 - ore bodies: vein (a) and stockwork (b)*

The lower part of the section of host rocks is represented by phyllite -like shales, quartz siltstones and sandstones with intercalations of gravelstones, siliceous rocks, argillaceous limestones and andesidacite tuffs (Altyaul suite O_{2-3}). The thickness is more than 500 m. The carbonate sequence, which has tectonic relationships with the underlying rocks, is composed of two packs. The lower one (D_1) is essentially limestone (350-400 m thick), with rare interlayers of dolomitic limestones and dolomites. The upper one is represented by carbonaceous, often clayey limestones with lenses and nodules of flints.

The Karnab intrusive, containing mineralization, is a C_3-P_1 granitoid complex. Contacts of an intrusion with a folded structure are secant.

The northern contact is steep, the southern one is more gentle, complicated by a series of ruptures of the Karnab- Lapas deep fault. Dikes and stock-like bodies of leucocratic granites, aplites, and, to a lesser extent, pegmatites, are widespread in the exocontact zone.

One of the main and characteristic features of the deposit is the wide development of post- granitoid dikes of the Ziaetda gabbromonzonitoid complex P_2 -T_1 (Dalimov *et al.,* 2010), which spatially mark the largest ore bodies of the deposit. Most of the dikes have a northeastern and sublatitudinal strike; at a thickness of 0.5–5 m, they can be traced at a distance of up to 100–300 m. The composition of the complex is extremely diverse. These are: 1) gabbro-porphyrites, onzogabbro -porphyrites , 2) biotite-amphibole and biotite-pyroxe - new gabbro-diorite porphyrites, monzogabbro -diorite porphyrites , monzogabbro -diorites , 3) quartz monzodiorite porphyrites, 4) monzogranodiorite - porphyries, 5) minettes , minetta- kersantites. The complex is specialized in tin.

The general structure of the area is a sublatitudinal anticline fold, the hinge of which gently plunges to the west, where it goes under the Meso-Cenozoic deposits . The southern flank of the fold is complicated by a large contact fault, which mainly runs at the boundary between the carbonate sequence and the granitoid intrusion. In the latter, fault tectonics is widely manifested with a predominance of sublatitudinal and northeastern faults and zones of increased fracturing .

The geological and structural position of the tin deposit is determined by confinement to the northern block of the Karnab- Lapass regional fault, one of the main sutures of which is the Contact Fault. The sublatitudinal zone of increased fracturing with a general southern dip represents its feathering system. Dikes of the gabbro-monzonitoid-granite complex P 2 -T 1 are spatially combined with this zone , fields $_{\text{and}}$ linear $_{\text{zones}}$ of beresites and thick (up to 8-10 m) extended (up to 1-2 km) quartz veins. The latter are confined to cleavage cracks and are practically barren . Tin ore bodies are located in the northeastern and sublatitudinal ruptures that feather the main latitudinal structures.

There are two structural and morphological types of mineralization: vein-veinlet bodies in the eastern part of the deposit and linear-stockwork mineralized zones in the western part. The vein type is formed under conditions of shear deformations along the Contact Fault, in the fractures feathering it.

More than 20 steeply dipping ore bodies have been delineated. The morphology of ore bodies is complex - it is a system of steeply dipping branching veins with a thickness of 0.3-0.5 to 1.5-2 m, their length is from 100 to 550 m. Individual zones are traced to a depth of up to 400 m. Mineralization is distributed unevenly, tin content from 0.1 to 0.9%. A pillar-like distribution of mineralization is outlined with its range of 300-450 m for individual veins and 600-700 m for vein systems.

The main type of near-ore changes is beresitization. It is controlled by sublatitudinal and feathering fissures. Of the dikes of the Ziaetda complex, which are widely distributed in the Karnab ore field, they are weakly beresited. minettes and monzogranodiorite are porphyries. The thickness of the altered rocks is from 0.1 to 1.5 m, the mono-quartz core is from 1 to 20 cm, the sericite-quartz zone is from 2 to 30 cm, the intermediate zone of sericite-quartz-K-feldspar is from 5 to 50 cm, the outer zone with albite is up to 1 m.

The ore bodies are composed of dark gray quartz and intensely beresitized (quartz, sericite, tourmaline, sphene, rutile, fluorite) cataclased granites with veinlets of tourmaline and sulfides (pyrite, arsenopyrite, sphalerite). Cassiterite is present in the form of disseminated, thin veinlets, individual grains. Quantitative content in the composition of ore bodies: cassiterite - 0.3-0.5%, galena - 0.3-0.5%, sphalerite - 0.1-0.3%, chalcopyrite - 0.1-0.3% , pyrite - 1-2%. Varlamovite , mushistonite , acanthite , pyrargyrite , proustite, stannin , tillite , frankeite , and others are also present .

Karnab belongs to the type of hydrothermal deposits with accompanying (associated) mineralization i.e. is polyformational Mineralization replaces beresitization and is associated with the neutralization of solutions during the transition from acid leaching to late alkaline leaching .

The following stages are distinguished in the actual ore process: 1) cassiterite, 2) arsenopyrite (arsenopyrite, pyrrhotite-I, chalcopyrite-I); 3) pyrite (pyrite-I), 4) sphalerite (sphalerite-I, chalcopyrite-II, pyrrhotite-II, cosalite , native bismuth-I); 5) bournonite (burnonite , geocronite); 6) silver- fahlore (fahlore, stannite , galena, chalcopyrite-III, native bismuth-II, silver, gold); 7) pyrite - melnikovite - marcasite (pyrite II, melnikovite , marcasite).

Lateral zoning is outlined in the distribution of ore minerals. The association dominates in the lower parts of the Eastern area: tourmaline, cassiterite, arsenopyrite. Within the Western area, the association of cassiterite with galena, sphalerite, and bournonite is more common .

In the composition of ore bodies, the following are established: tin - 0.3-0.4%, lead - 0.3, copper - 0.1-0.2, zinc - 0.1, silver - 72 g/t, arsenic - 0, 1, antimony - 0.1. The same elements represent geochemical halos over ore bodies. Generalized series of geochemical zoning (bottom-up): tin-copper-lead-arsenic-silver. The vertical range of mineralization exceeds 500 m.

The mining conditions of mining are complicated by the peculiarities of morphology and small thicknesses of ore bodies, as well as high water saturation .

The main ore-controlling factors of the deposit are: large, repeatedly activated longitudinal faults; their articulation with diagonal and transverse shifts; endocontact of a granitoid intrusion; dike belts, bundles, swarms of the P2-T1 monzonitoid complex; halos and beresitization zones ; geochemical halos of tin, lead, copper, zinc, arsenic, silver.

The Lapas deposit is located in the western part of the Zirabulak-Ziaetda mountains. Administratively it belongs to the Nurabad district of the Samarkand region. In terms of mining and economic features, it is identical to the Karnab deposit, with which it is connected by a dirt road (10 km).

The Lapas ore field (Fig. 3.) consists in the Lapas, Semizkuduk deposits and sites Tourmaline, Daikovy occupies the southern exocontact zone Chirakdzhurinsky intrusive in carbonate-terrigenous sediments $O_{2\text{-}3}$ -D_2. Carbonate rocks in the form of two ridges stand out on the northern and southern flanks of the field.

The central part and the eastern flank are composed of terrigenous rocks. The most ancient deposits of $O_{2\text{-}3}$ (Altyaul suite) are represented by quartz-sericite shales, siltstones, sandstones with interlayers of conglomerates, limestones and tuffs of acidic composition. The thickness of the suite is more than 1000 m. The intensely hornfelsed, essentially terrigenous Daraitut suite ($S_{1\text{-}2}$) is exposed in the northwest of the field, in the core of a large anticline fold. The carbonate stratum (S_1 -D_2) makes up the bulk of the area. The lower part of the section is represented by dolomites and limestones with mudstone interlayers (200-400 m), the middle part is essentially limestone (600-800 m), the upper part is composed of carbonaceous limestones with interlayers and nodules of siliceous rocks (350-450 m).

Intrusive formations are widespread along the periphery of the ore field. From the north - this is Chirakdzhurinsky , east - Zirabulaksky , south - Ketmenchinsky intrusives, represented by biotite granites, gneiss -granites C_3 -P_1 . Within the ore field (Central and Eastern sections), stocks and dikes of the final phases of the granitoid complex are limitedly developed - leucocratic granites, aplite-granites, pegmatites.

Vein igneous rocks, predominantly pregranitoid (Dalimov *et al.,* 2010; Divaev *et al.,* 2022) complex (C_2-$_{3?}$). These are gabbro-diorites, dioritic porphyrites, lamprophyres . Single dacite dikes have been noted . Form of occurrence - dikes, sills , thickness 0.5-10 m, length - a few hundred meters. They are confined to ruptures and zones of increased fracturing. sublatitudinal and northwestern direction; the highest density is observed, as a rule, within the tin-bearing areas.

Post-granitoid dikes (P_2 -T_1) of gabbro - monzodiorite - monzogranitoid complex in the ore field have a limited distribution and are represented by single bodies of monzodiorite porphyrites occurring among terrigenous formations of the Altyaulskaya suite.

Metamorphic transformations of rocks are associated with contact metamorphism and are represented by spotty, knotted shales, quartz- feldspar -biotite and calc-silicate hornfelses. A halo of contact metamorphism stands out on the eastern flank of the field from the Lapas deposit to the Zirabulak

International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081
Online International Journal Available at http://www.cibtech.org/jgee.htm
2022 Vol. 12, pp. 265-274/Farrukhand Jasurbek
Research Article (Open Access)

intrusive, from the south it is bounded by the main suture of the Karnab- Lapass fault. The second large halo, 0.5-1 km wide, adjoins the Chirakdzhura intrusive from the south. Fragmentary spotted shales are developed on the western flank of the field within the Semizkuduk deposit.

The geological and structural position of the ore field is a keyboard system of isolated blocks of terrigenous and carbonate rocks. The central part of the field is crossed by the regional Karnab-Lapassky fault, represented by a series of contiguous faults. The thickness of the fault zone is up to 500 m, individual seams are 5-30 m.

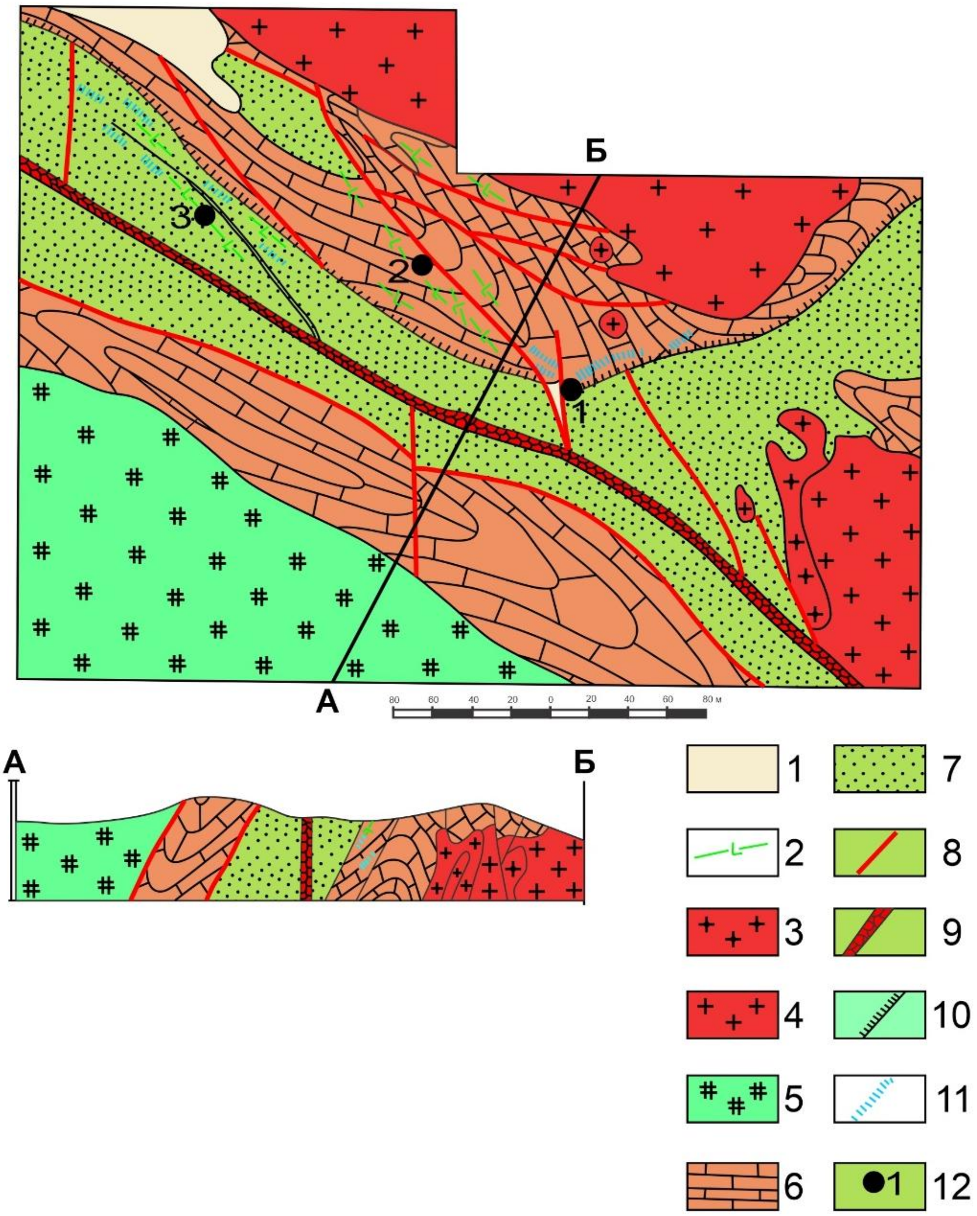

Figure 3: Schematic geological map of tin ore field Lapas. (based on the materials of the state geological funds of Uzbekistan). *1 - Quaternary deposits. Karatube-Zirabulak complex: 2 – lamprophyres , gabbrodiorites, diorite porphyrites (C3) ; 3 - leucocratic granites (C_3 -P_1); 4 - biotite granites (C_3 -P_1); 5 – gneiss - granites; 6 - limestones (O_{2-3} -S_1); 7 – shales, siltstones, sandstones (OS); 8 - faults; 9 - crushing zone; 10 - thrusts; 11 – ore-bearing quartz veins; 12 - deposits and ore areas: 1 - Lapas , 2 - Western, 3 - Semizkuduk .*

The main seams of the Karnab-Lapas fault are located along the contacts of carbonate and terrigenous blocks. The main zone is accompanied by a series of feathering structures, to which tin ore deposits and sites are confined (Lapas , Semizkuduk , "Western", "Turmaline", etc.).
Lapas tin ore deposit (Fig. 4) is confined to the northwestern zone of increased fracturing, feathering the Karnab-Lapas fault.

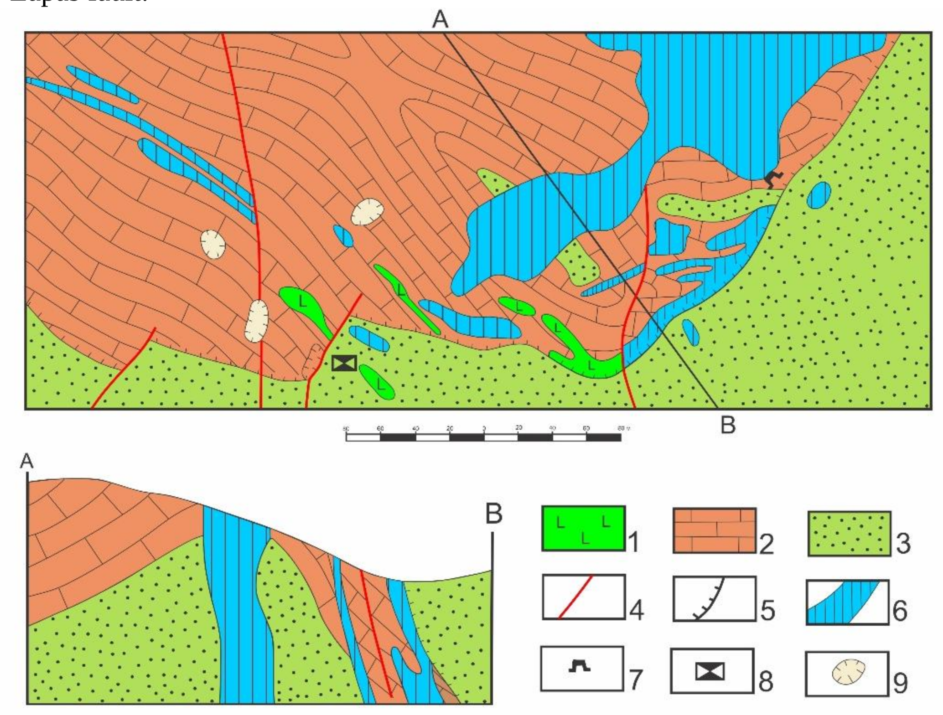

Figure 4: Schematic geological map of Lapas tin deposit. (based on the materials of the state geological funds of Uzbekistan). *1 - lamprophyres ; 2 - limestones (S_2 -D_2); 3 - shales, siltstones, sandstones (O_{2-3} -S_1); 4 - faults; 5 - thrusts; 6 - areas of development of quartz veins; 7 - the mouth of the adit; 8 - mine; 9 - ancient mine workings.*

At the junction of these structures, the Central section is localized, 1.5 km northwest - the Western one. The zone is accompanied by crushing, limonitization , pre- ore metasomatic dolomitization, lenticular bodies of quartz-sericite-carbonate metasomatites and ore-bearing quartz veins 1-2 m thick and up to 150 m long.
Structurally, the Central section belongs to the intersection of faults of very different directions: sublatitudinal - Karnab-Lapasssky; north-western - Chuyun-Lapassky; submeridional - Meridional-I; northeastern - faults No. 1,2,3; Lapa thrust. Less significant discontinuities of various directions between the main faults together form a powerful permeability zone in the area of 300x300 m.
There are separate horizons (up to 2 m thick) of quartz-sericite metasomatites (after quartz-micaceous sandstones), lenticular bodies of greisenized , beresitized leucogranites (up to 1.5 m thick, up to 30 m long), in some places turned into quartz-sericite metasomatites (beresites).
Hydrothermal-vein formations are represented by tin-bearing quartz veins distributed in limestones along the contact with terrigenous rocks. The forms of quartz veins are very bizarre, they form branches, bulges, pinches, sharp wedgings, break up into a series of small veins. The thickness of the veins is from 0.1 to 15 m, the length is up to 150 m.
The Semizkuduk deposit is located 4 km northwest of Lapas, in the zone of development of terrigenous deposits of the Altyaul suite, and is represented by an ore-bearing zone 5 km long and 0.5 km wide. More than 20 ancient workings 30-150 m long, 0.5-2 m wide, up to 15-20 m deep have been found here. Mineralization is confined to linearly elongated quartz-tourmaline veins and quartz - sericite metasomatites .

25 veins with a length of 150-400 m along the strike and 100-200 m along the dip , with a thickness of 0.8-3.0 m , were identified on the site .

The fall of the veins, like that of the host rocks, is steep to the south. Tin contents range from 0.1 to 2.5%. The most productive ore bodies are associated with ore columns formed at the intersection of sublatitudinal and longitudinal fissures, at the junction of individual veins , at bends in mineralized zones .

Tin ore site Tourmaline is represented by mineralized quartz-tourmaline veins accompanying intensively altered dikes of dioritic porphyrites.

The site Daikovy" (located to the north-east of the Lapas deposit) is confined to sublatitudinal faults filled with porphyrite and lamprophyre dikes, as well as apophyses of tin-bearing beresitized leucocratic granites.

The processes of metasomatism within the ore field are very widespread, covering almost all types of rocks (granites, limestones, sandstones, dikes). Three main types of metasomatic transformations have been established: greisenization, beresitization, dolomitization .

Greisenization (quartz, muscovite, fluorite, cassiterite) has a limited distribution and is superimposed mainly on leucocratic granites .

The main near-ore process is beresitization (listvenitization) - widespread and marks all fractured zones . According to granites and terrigenous rocks, its association includes: quartz , sericite , albite , pyrite ; on gabbro-diorite porphyrites and lamprophyres – sericite , carbonate (ferruginous dolomite), quartz , chlorite ; on carbonate rocks - sericite , ankerite . Dolomitization is widely represented along fault structures within the carbonate strata in the form of bands, wings 0.5-2 m thick, 10-100 m long. Within the Western Area, tin is concentrated exclusively in dolomitic limestones .

There are three main stages of tin mineralization:

1) high temperature , in greisenized leucocratic granites of the Central and Western sections ; 2) medium temperature , in quartz-sericite-carbonate metasomatites and dolomitic limestones; 3) low-temperature, in dolomitic crushed limestones of the Western area .

The material composition of ores varies depending on the composition of the surrounding medium . On Semizkuduk - this is quartz, tourmaline , sericite , albite , on Lapaz - quartz , sericite , carbonate , chlorite . The composition of ore minerals in individual areas is qualitatively identical - it is cassiterite , pyrite , chalcopyrite , galena , arsenopyrite , sphalerite , argentite , differing markedly in quantitative terms (sulfides sharply prevail at the Lapas deposit).

As a part of ores are established: tin (from 0.2-0.5 to 3.9%), copper, lead (0.1-0.8%), silver (20-50 g/t). In addition to tin , silver can serve as a useful component. Vertical span of mineralization was more than 400m.

The Semizkuduk and Lapas deposits are the products of a single ore process in different lithological environments. Tin mineralization at these objects is characterized by almost the same complex of basic minerals (cassiterite, pyrite, arsenopyrite) with slight variations. The Semizkuduk deposit is referred to the cassiterite-tourmaline-cassiterite mineral type in terms of the material composition of ores, the Lapas ore occurrence is classified as quartz-cassiterite-pyrite. According to the conditions of occurrence, both of these objects belong to the secant vein-metasomatic structural-morphological types, and according to the conditions of formation, to the hydrothermal-metasomatic types.

The most favorable ore-controlling factors of the ore field are: the intersection of meridional, submeridional faults with sublatitudinal zones, with the formation of areas of increased permeability; junction of zones of latitudinal and sublatitudinal directions, in which crushed, fractured areas are formed, favorable for the circulation of ore-bearing solutions; sharp bends of discontinuous faults with the formation of cavities to be filled with ore veins; formation of cavities in the cores of folds in limestones, followed by their filling with ore formations; reverse -fault movements with small amplitudes, contributing to the formation of fractures, crushed and brecciated zones of increased permeability.

The age of mineralization is assumed to be T_{1-2} on the basis of its imposition on monzonitoid dikes P_2 -T_1 (by absolute age) and subsequent beresitization.

CONCLUSIONS

The prospects for the mineral resource base of tin in Uzbekistan are determined by the following circumstances.

Tin deposits and ore occurrences of the Zirabulak-Ziaetda ore region require a reliable geological and economic justification for involvement in industrial development. It is proposed for a detailed study of the ore-bearing zones, two ore zones Karnab - Lapasskaya and Sappen-Kutchinskaya with the development of silicate-cassiterite geological- industrial type. Within these zones, the Karnab, Semizkuduk , Lapas ore fields , as well as promising areas - Karmana, Kochkarli , Akmazar , Koshkuduk , Turytau , South Karnab, Aimakhal , South Tym , have been delineated and studied to a depth . According to their indicator geological and geochemical characteristics, these areas represent ore fields of small-medium rank, the total resources of which make it possible to more than double their potential mineral resources.

Ore occurrences with limited prospects are known in Eastern and Southern Uzbekistan. At the same time, the statistical metallogenic analysis of databases of the results of prospecting and survey work with previously known fragmentary data and in comparison with large industrial facilities in the neighboring countries of Kyrgyzstan and Tajikistan make it possible to identify a number of potential zones and areas in Western Uzbekistan.

The sulfostannate type of tin in Uzbekistan has been little studied, although large objects of this type, Mushiston and Kaznok , have been identified in the continuation of the Zarafshan-Alai zone in Central Tajikistan in recent years . Identical mineralogical and geochemical associations and points of mineralization with high parameters (with content of up to 1.0% and above) were found in the Zakhkuduk area in the Central Kyzyl Kum. The presence of quartz-tourmaline stockwork indicates the polyformational nature of the object and, possibly, high prospects.

REFERENCES

Babaev KL (1974). Genetic classification of tin deposits. *Metallogeny and geochemistry of Uzbekistan*. - Tashkent: Fan,. - S.40-47.

Baimukhamedov HN (1959). Peculiarities of tin metallogeny in the Zirabulak-Ziaetda mountains (Western Uzbekistan). *Proceedings. Central Asian Polytechnic Institute*. New series. - Tashkent, **6**. 47-63.

Cherepanov AA (1972). Tin manifestations in magnesian skarns of the Western Tien Shan. *Sov. geology*. **4** 127-130.

Dalimov TN, Ganiev IN (2010). Evolution and types of magmatism in the Western Tien Shan. Tashkent, University, 227.

Divaev FK, Mirkamalov RKh, Mamirov BR, Khazhibaev PB (2022). Evolution of the Hercynian intrusive magmatism of the Southern Tien Shan (Uzbekistan). Proceedings of the international scientific and technical conference. *Actual issues of geology, innovative methods for forecasting, mining and processing technologies for minerals, Tashkent*, 44-47.

Mirkamalov RKh, Chirikin VV, Divaev FK (2019). Geodynamic reconstruction of the orogenic belt of the Western Tien Shan and forecasting of endogenous deposits in the basement rocks (guidelines - T .: State Enterprise *Institute of Mineral Resources*, 162 p.

Otroshchenko VD, Golovanov IM, Chernyavsky YuA (1982). Geological foundations of prospective assessment of tin content in Uzbekistan. Geology of tin-ore regions and deposits of Kazakhstan and Central Asia,*Tr. KazIMS. Alma-Ata*.

Pavlovsky AB (1974). Genetic types and main patterns of distribution of tin deposits in the Tien Shan. *Soviet Geology*. 1.

Pirnazarov MM, Khoshzhanova KK, Ashirov MB (2020). Geological formations and ore content of the Zirabulak-Ziaetda mining region. *Mountain Bulletin of Uzbekistan*. No. 1, Navoiy,. - 28-32 p.

Razikov Oh T, Akbarov KhA, Zhu g aev MN (2020). Metallogy of the Zeravshano - A l a y Belt (South Tianshan). *The Amtrican Jour nal of Applied Sciences*, **276** 44-49.

Rundkvist DV (1986). Criteria for predictive assessment of territories for solid minerals. *L.: Nedra*, 751 p.

Usmanov FA, Maripova ST, Yuldashev OA (2006). New methods and computer technologies for quantitative forecasting of ore deposits. Formation conditions, placement patterns and forecasting of mineral deposits. Tashkent: *Tashkent State Technical University* S. 217-221.