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Research Article

CONDITIONS FOR FORMATION OF VOLCANOGENIC-SEDIMENTARY STRATA OF MOUNTAIN KULJUKTAU

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ABSTRACT
The volcanogenic-sedimentary Taushan suite is distributed mainly in the center and northern parts of the Kuljuktau Mountains. The main gold ore objects in Mount Kuljuktau are localized to the Taushan suite. There are different opinions on the formation of gold mining objects in the Kuljuktau Mountains. However, these opinions have not yet been sufficiently proven. Studying the conditions for the formation of the flysch olistrotromic strata of Taushan is of great importance to determine the genetic formation of gold ore objects.

INTRODUCTION
Mount Kuljuktau, located in the Zarafshan-Alai metallogenic belt, is an ore district with many gold deposits (Taushan, Yangikazgan), ore occurrences (Kyrkcherta , Aktosty, Adylsai, Geokhimicheskoe) and ore points.

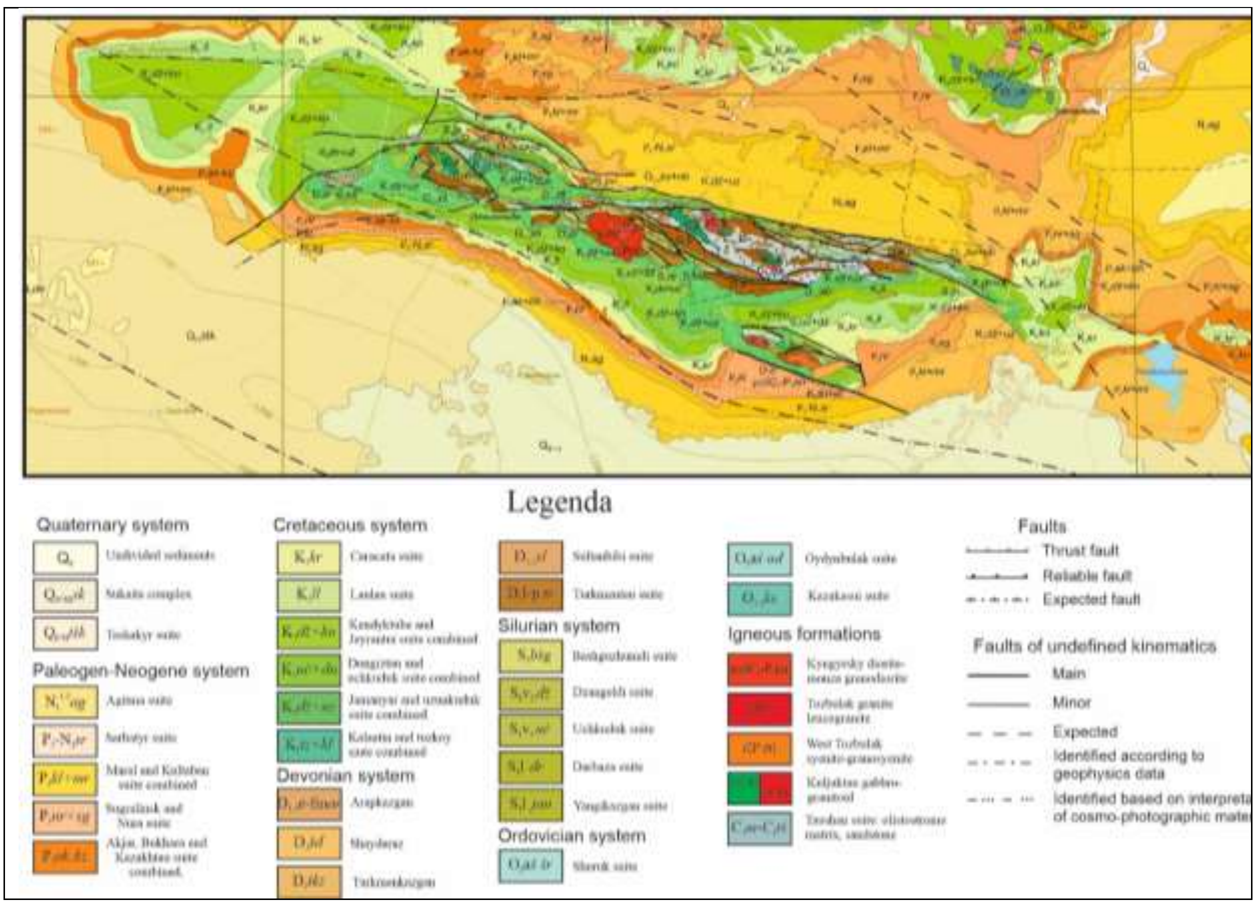

Figure 1: Geological map of Uzbekistan scale 1:500 000 (Mirkamalov *et al.*, 2023)

The Paleozoic section of the Kuljuktau Mountain involves sediments from Cambrian to Carboniferous age. The Paleozoic complex includes volcanic-terrigenous and partially carbonate formations of the Ordovician, carbonate formations of the Silurian, Devonian, Lower Carboniferous, volcanic-terrigenous and molasse strata of the Middle and Upper Carboniferous (Aysanov, 1978).

The ore-bearing rocks are terrigenous-sedimentary deposits of the Taushan suite (C_2m-C_3tš) - blocky conglomerates (olistostromes), siltstones, sandstones, gravelites and igneous rocks of basic composition. The breeds are epigenetically altered. Alteration processes led to the transformation and recrystallization of sedimentary rocks and the formation of shales of varying composition.

Researchers who studied ore formation in the Taushan Formation expressed different opinions. According to researchers who studied those areas that, located in the Taushan suite, play a role in ore formation by steeply dipping tectonic disturbances in the northwest-sublatitudinal direction, north-northwest ore-controlling faults and hydrothermal processes (Djurabayev, 2020; Razikov, 2023), structural - screens and barriers that provide favorable conditions for the sedimentation of ore-bearing solutions and the formation of industrially significant accumulations, zones of shearing and crushing, thrust-upper positions and contacts of terrigenous strata with intrusions of granites and gabbroids of the Taushan area (Mirkamalov, 2020; Khalilov, 2021).

MATERIALS AND METHODS

As a result of the analysis of samples taken from the Taushan suite, geological exploration and scientific research previously carried out on Mount Kuljuktau, it was established that there are 16 main types of rocks in the Taushan suite (table 1).

Table 1: Types of rocks in the Taushan suite

Terrigenous rocks	**Metasomatic rocks**	**Tuffaceous rocks**	**Carbonate rocks**	**Extrusive rocks**
Sandstone	Shale	Tuff sandstone	Limestone	Liparite dacite porphyry
Gravelite	Metasandstone	Tufosiltstone	Dolomite	Andesite-porphyry
Conglomerate	Metaleurolite	Tuff gravel		
Breccia	Metasomatite			
	Hornfels			

The rocks are distributed in different quantities in the suite. According to petrochemical features (39 analyses), among the terrigenous rocks of the Taushan suite the following are distinguished (FAK method, %): arkoses–41, greywackes – 21, hydromica clays – 15, subgreywackes – 10, greywackes transitional to clays – 10, felsic tuffs – 3, which is an indicator of the sharply contrasting structure of the demolition area (Djurabayev, 2020).

The performed lithologic-facial analysis of the rocks of the volcanic-sedimentary strata (Aysanov, 1978), composing the Taushan suite, made it possible to distinguish rock differences according to the degree of their distance from the centers of volcanism (Popov, 1979).

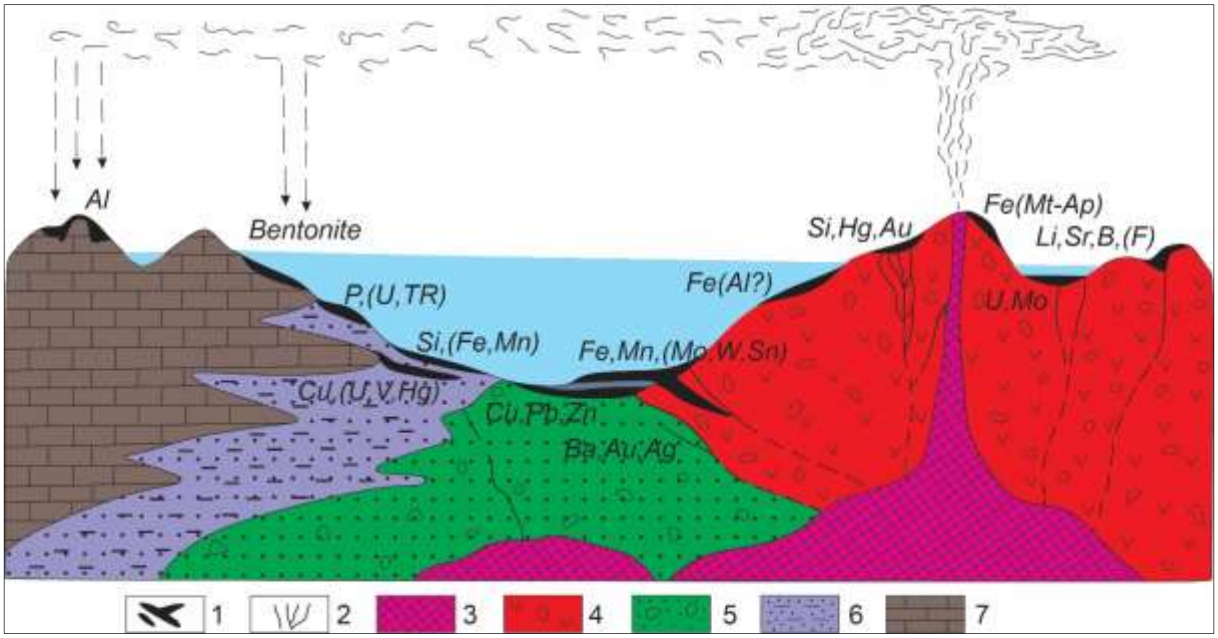

Figure 2. Scheme of location of volcanic-sedimentary deposits in relation to centers of volcanic activity (Popov 1979). 1-mainly stratiform ore bodies; 2-section (vein and metasomatic) ore bodies (feeder channels); 3-magma chamber; 4-lavas and coarse pyroclastics; 5-tuffs and tuffites; 6-volcanomictic sedimentary rocks, including siliceous rocks; 7-reef carbonate rocks.

RESUTLS AND DISCUSSION

Vent facies rocks. Among the sediments of the lower taushan suite there are lenses and lens-shaped interlayers of iolites and their tuffs. In the lower part of the upper taushan strata, among the shales, lenses (from 0.1 to 5 m) of altered, relatively dense, gray andesitic porphyrites and their tuffs are noted (Aysanov, 1978).

Rhyolites (liparite porphyry) consist of quartz phenocrysts, microcline, and a recrystallized microfelsic groundmass of essentially quartz-feldspar composition.

Porphyritic andesite consist of porphyry segregations (20-40%) and the main mass (60-80%) of secondary minerals (sericite, chalcedony, opal, kaolin), among which relict fragments of plagioclase and hornblende are visible.

Rocks of the near-vent and intermediate facies: *Tuff sandstones* are greenish-gray, consist of angular fragments (up to 1 mm) of spilite-like, siliceous-quartz and siliceous jasper-like rocks, volcanic glass, siltstones, limestones and quartz, cemented by an aggregate of clay, sericite and microgranular quartz.

Tuff siltstone is basaltic andesite, irregularly grained, with sporadic groups of basaltic glass fragments of psammite size. Tufosiltstone 85-90%, sand fragments 10-15% (basaltic glass and foliated andesites).

Rocks of removed facies: Fine-grained *sandstone* , densely packed fragments of psammitic size 80-85% (quartz 40-45%, fine-grained feldspar-quartz meta-siltstones) 35-40%, ferruginous carbonate (siderite) 7-50%, silty cement 3-5%.

Siltstone (thickness from 0.1 to 5 m) gray and dark gray, thin-foliated, platy, often carbonaceous, thin-horizontally layered, consisting of angular-rounded grains of quartz, siliceous, siliceous-mica rocks, chlorite and phyllite schists, feldspars, rare scraps of colorless mineral, zircon grains, staurolite, ore mineral.

Gravelite , gravel fragments 55-60% (cherts and siliceous shales 45-50%, siliceous-siderite rocks 7-10%), quartz 15-20%.

Conglomerate. The bulk is composed of detrital quartz grains and fragments of various rocks (schist, microquartzite , siltstone). According to the composition of the fragments, the conglomerate is polymictic

. The diameter of the fragments is up to 1-2cm. In terms of the size of the fragments, the rock corresponds to small pebble conglomerates. The shape is rounded, semi-rounded , splintered . The cement contains siliceous matter, sericite, clay particles, and relicts of carbonaceous matter.
Limestone. It consists mainly of calcite, with less frequent fragments of quartz. The rock is foliated. Quartz is colorless and transparent. The grains are small enough to see the wavy extinction. The shape of the grains is not rounded, acute-angled, often elongated along the foliation. Grain size ranges from 0.01-0.0n to 0.1-0.1mm.
Wall-ore altered rocks: *Metasandstone* is silty, intensely sheared (gneissed), siderite-(sideroplesite)-feldspathic quartz. Feldspar (mainly albite in the silty component of the rock) 45-50, quartz (mainly in the psammitic component of the rock) 25-30, sideroplesite 3-5, chlorite 10-15, sericite 2-3%.
Metasiltstone is composed of microfragments of the groundmass of andesite and fragments of lath-shaped plagioclase crystals. The bulk of the siltstone is chloritized and dissected by microveined deposits of iron hydroxides. Some of the largest andesite grains are intensely albitized, apparently autonomous from the rest of the rock mass. These are probably fragments of earlier andesites and tuffs of andesitic porphyrites, albitized under conditions of propylitizing lithification.

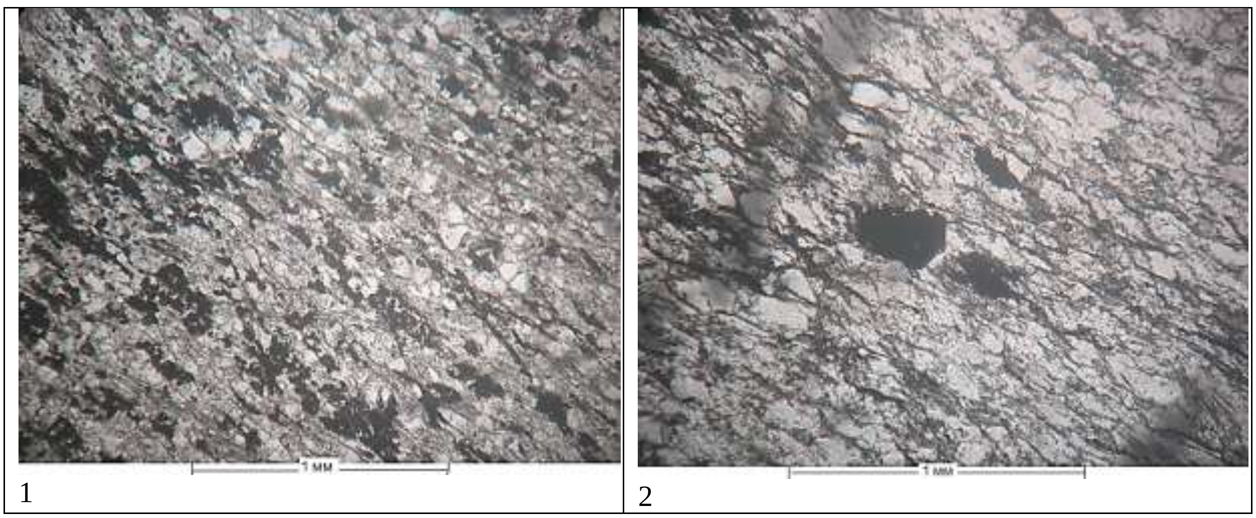

Figure 3. Metasandstone fine-grained silty volcanomictic quartz-sideroplesite-feldspathic, intensely foliated (1); Metasiltstone andesitoid crystallo-lithoclastic quartz-feldspathic schistose (2);

Metasomatite. Metasomatic alteration is represented mainly by silicification and sericitization. The main material in the rock is quartz, as well as an admixture of feldspars. Quartz is colorless and exhibits wavy extinction. The shape of the grains is not rounded, angular, rarely acute-angled; grains with corroded edges are also observed. In some places the grains fit tightly to each other. The size of the fragments is from 0.0n to 0.1-0.2m, with a predominance of sizes 0.05-0.1mm. The quartz content among fragments in thin section is up to 80-85%.
Shale. The composition includes quartz, feldspar, as well as feldspar replacement products and ore minerals.
Quartz is colorless and transparent. In crossed nicols, a wavy extinction is observed. The shape of the grains is not rounded, angular. Grain size up to 0.01-0.1mm. The content in thin sections is 50-60%.
Feldspar (albite) has grayish interference colors. The shape of the grains is not rounded, rarely fragments are tabular. The grains exhibit a twinning system. The mineral is partially sericitized and pelitized. Grain size 0.01-0.15mm. The amount of feldspars is up to 10-20%.

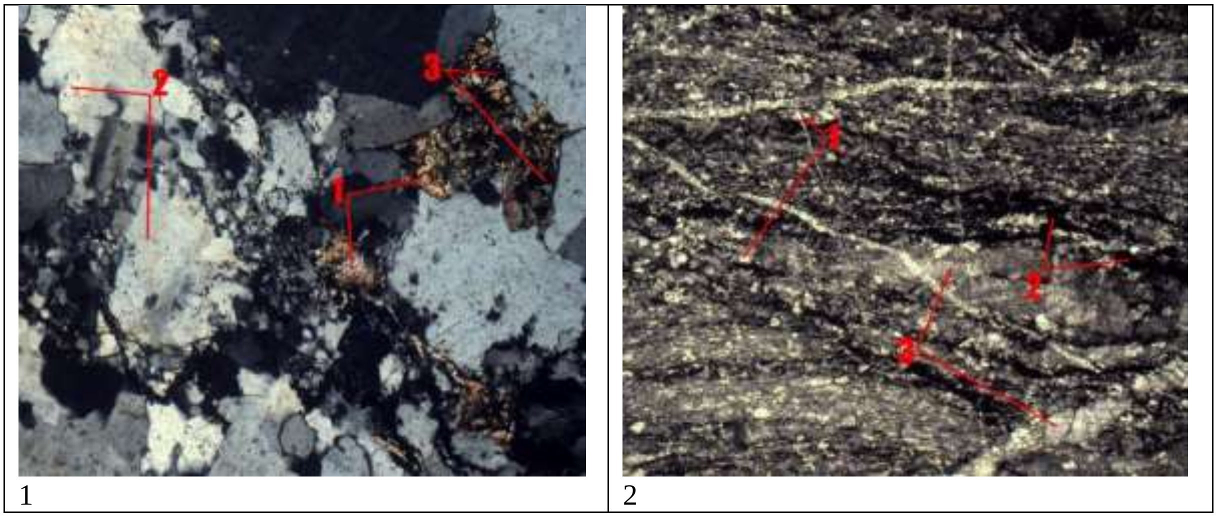

Figure 4. 1-Accumulation of sericite in intergranular spaces (1-sericite; 2-quartz; 3-ore minerals); 2-Slate texture with multidirectional carbonate veins (1-quartz; 2-ore minerals; 3-carbonate);

CUNCLUSION

The lithological diversity, folding and very complex dislocation of the deposits of the Taushan suite make it difficult to explain the genesis of ore formation. But analysis of the distribution of vent, near-vent, intermediate and distant facies of volcanic-sedimentary rocks gives us the opportunity to determine the stratigraphic formations of the taushan suite rocks.

The mechanism of formation of volcanogenic-sedimentary ore deposits is very diverse and corresponds to a combination of known endogenous and exogenous processes. Thus, the combination of a hydrothermal process with chemogenic sedimentation and infiltration leads to the formation of hydrothermal-sedimentary and hydrothermal-infiltration ore sediments, the outpouring of an ore melt immiscible with magma or magma enriched with any element on the surface leads to the formation of ore flows and metal-bearing lavas, selective ejection of preliminary segregated igneous material and its exogenous differentiation - to the formation of pyroclastic placers, etc. Within specific ore fields, one or two types of deposits usually predominate sharply, others are of subordinate importance.

The genetic type of ore sediments and the type of mineral depend primarily on two main parameters - facies conditions (including both the environment of ore deposition and climate) and the composition of the "parent" (or, rather, related) formations. These two important parameters are in turn determined mainly by the type of structures of the earth's crust and the stages of their development, which is especially well studied in mobile belts (Popov, 1979).

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