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GEOLOGY

Formation Conditions of Deposits of the Gold–Quartz Formation in the Muya Zone (Northern Transbaikal Region)

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The Muya structural zone, one of the regions with a high potential of gold mineralization, incorporates more than 300 gold occurrences and deposits. Ore occurrences of the gold–quartz formation are most widespread in this region (Fig. 1).

Deposits of the gold–quartz formation in the Muya zone are primarily associated with island-arc volcano-plutonic complexes [1]. Gold ore occurrences are confined to cratonic, turbidite, and island-arc terranes [2]. However, many issues about their distribution and for-

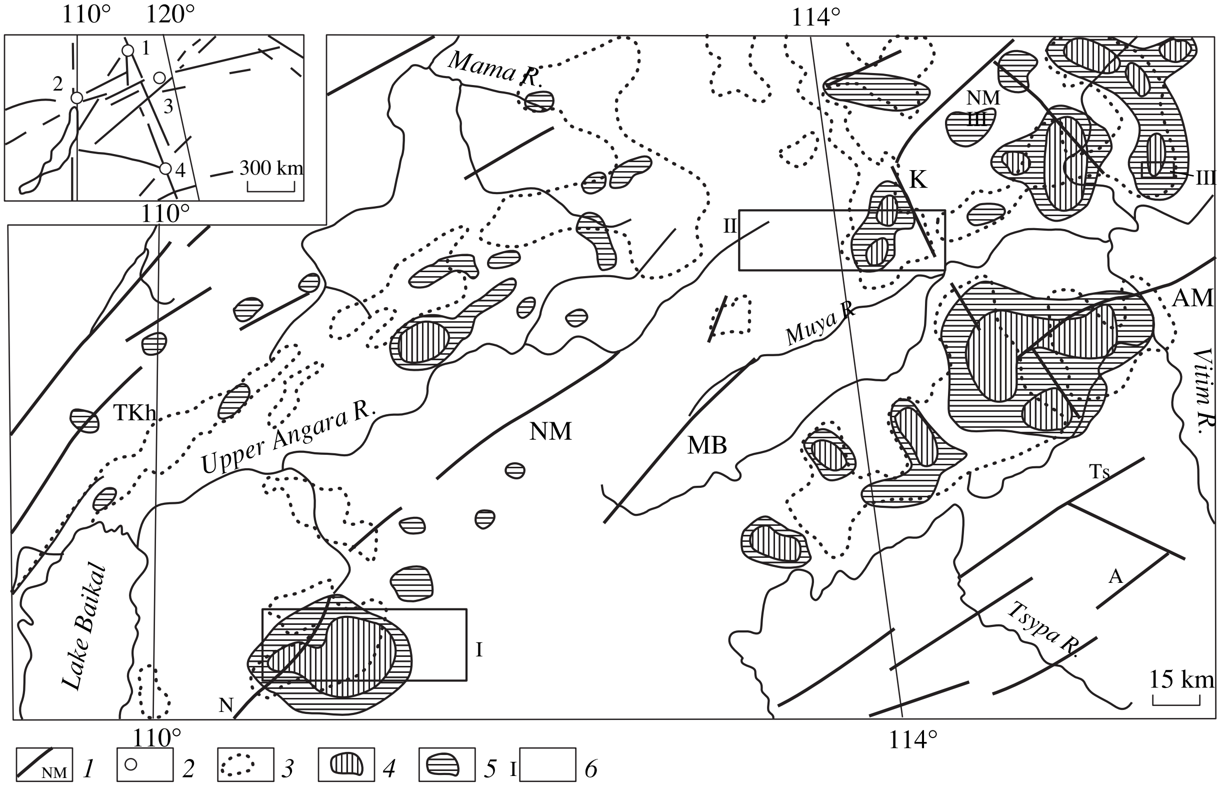

Fig. 1. Schematic distribution density of ore occurrences of the gold–quartz formation in the Muya zone. (*1*) Deep faults: (NM) North Muya, (N) Namama, (MB) Muya–Barguza, (K) Kelyan, (AM) Aku–Mudirikan, (Ts) Tsipino, (A) Amalat, (TKh) Tyya–Kholodninsk; (*2*) deposits (inset): (1) Sukhoi Log, (2) Kholodninsk, (3) Udokan, (4) Balei; (*3*) domains of volcanosedimentary rocks of the Kelyan and Nyurundukan formations, as well as intrusive rocks of the Muya and Param complexes; (*4, 5*) distribution density grades of gold ore occurrences (per 100 km^2): (*4*) up to four ore occurrences, (*5*) more than five ore occurrences; (*6*) ore fields: (I) Namama, (II) Kelyan, (III) Bakhtarnak gold deposit area.

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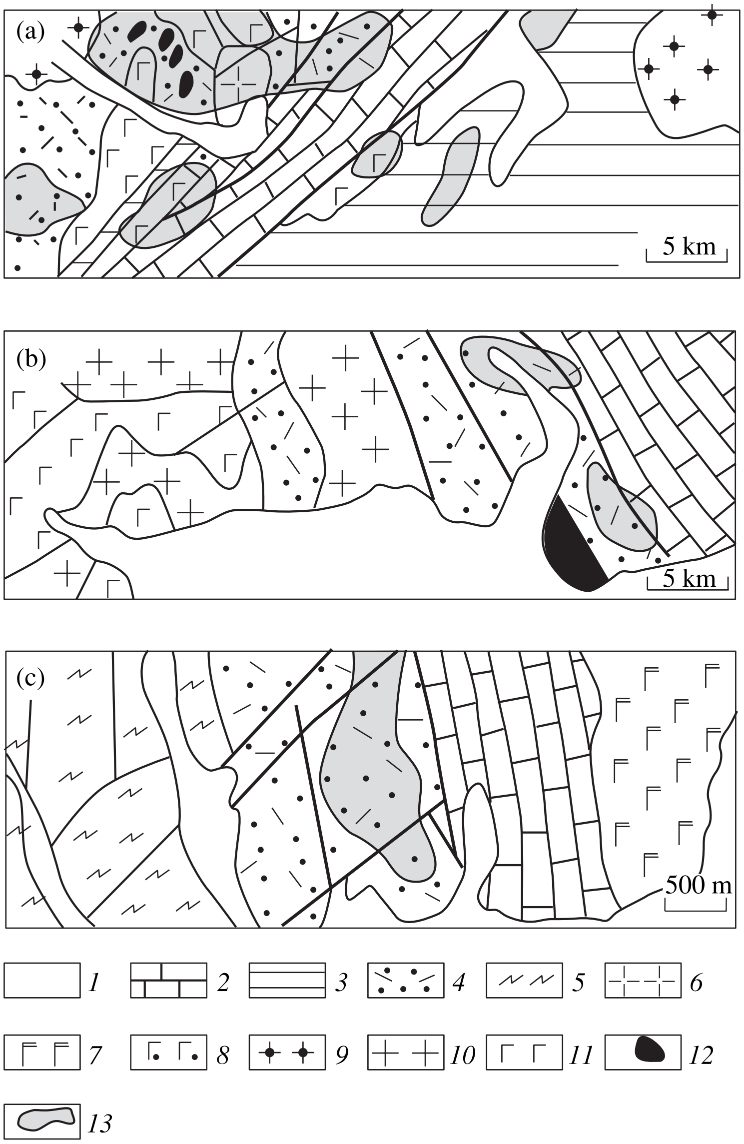

Fig. 2. Schematic geological structure of some gold ore fields in the Muya zone based on the geological map of the BAM zone [7]. Ore fields: (a) Namama, (b) Kelyan, (c) Bakhtarnak gold deposit area. (*1–4*) Sedimentary rocks: (*1*) Quaternary, (*2*) Cambrian, (*3*) Riphean, (*4*) Precambrian volcanosedimentary; (*5*) Archean crystalline schists; (*6, 7*) Paleozoic intrusions: (*6*) granitoids, (*7*) gabbroids; (*8*) Precambrian granitoids; (*9*) granitoids of the Barguza Complex (PR_2); (*10, 11*) Muya intrusive complex: (*10*) granitoids, (*11*) gabbroids, (*12*) ultramafic rocks of the Param Complex (PR_2); (*13*) domains of auriferous quartz veins, sulfide dissemination, metasomatic alteration of rocks, and dikes.

mation constraints, as well as the relationships between disseminated and vein types of gold–sulfide mineralization, are insufficiently studied.

The Muya zone is crosscut by meridional and NE-oriented lineaments [3]. Tectonically active sectors with highly permeable crust are characterized by the maximum ore potential in deep fault zones [4].

Lineaments of the Muya zone are traced by intrusions of the Muya and Param complexes, along with volcanosedimentary rocks of the Kelyan and Nyurundukan formations. A significant part of gold ore occurrences of the Muya zone is confined to the Muya and Param complexes (Fig. 1).

The geochemical similarity of granitoids of the Muya Complex with basalts of the Kelyan and Nyurundukan formations [5], the common structural setting, and the high Au content in these rocks suggest their formation in a single tectonomagmatic cycle.

Gold ore occurrences of the Muya region are represented by the predominant gold–quartz and the subordinate gold–sulfide–quartz veins confined to deep fault zones and their auxiliary faults. Galena, sphalerite, pyrite, chalcopyrite, and fahlore are the major ore minerals.

Based on the sliding window method, we determined the distribution density of ore occurrences of the gold–quartz formation. We calculated the number of native ore occurrences at the sliding window center (grid 10 × 10 km^2) and constructed isolines along the fields of similar values. The maximum density of gold occurrences is observed in the South Muya block (Tuldun River basin) characterized by the intersection of meridional and NE-oriented deep fault zones.

Areas with very high density of gold mineralization (basins of the Namama, Kelyan, and Bakhtarnak rivers) have the following common features of the geological setting (Fig. 2): (1) the abundance of intrusive rocks of the Muya Complex and volcanosedimentary rocks of the Kelyan or Nyurundukan Formation; (2) the development of nearly meridional interfault troughs filled with Cambrian sedimentary rocks; (3) the abundance of primarily intermediate and basic rocks of the dike complex; and (4) an intense development of metasomatic processes (albitization, silicification, sericitization, and so on).

The study of sulfide mineralization in rock complexes mentioned above revealed a significant concentration of sulfide dissemination in auriferous quartz vein zones (Fig. 3). The disseminated mineralization is confined to deep fracture zones. Pyrite and chalcopyrite are the major ore minerals. Pyrrhotite, galena, sphalerite, and fahlore are subordinate. The metasedimentary genesis of ores is indicated by the stratified or stratified-lenticular distribution and segregation mode of ore minerals.

Gold in the sulfide–quartz veins was mainly derived from sulfide zones. This is suggested by the following facts: (1) the confinement of high Au contents in sulfide–quartz veins to sulfide dissemination zones; (2) the similarity of mineral assemblages in sulfide–quartz veins and sulfide dissemination zones; and (3) the close correlation between Au and Ag ($r > 0.5$) in sulfide–quartz veins and sulfide dissemination zones. These facts indicate that quartz veins formed during the mobilization of gold from the enclosing sulfidized zones. Similar mechanisms of gold concentration in quartz veins within sulfidized rocks have also been reported from other regions [6].

The redistribution and concentration of gold were fostered by the hydrothermal metasomatic reworking of rocks. The earlier alkaline metasomatism promoted the albitization of rocks, whereas later solutions of the acidic stage were responsible for the beresitization (listvenitization) of rocks with gold concentration.

Thus, ore mineralization in the Muya zone is characterized by the following specific features: (1) deposits of the gold–quartz formation are confined to deep fault zones traced by intrusions of the Muya and Param complexes, as well as volcanosedimentary rocks of the Kelyan and Nyurundukan formations; (2) the ore field includes sectors with high tectonomagmatic activity manifested in the form of interfault troughs, dike complexes, and hydrothermal metasomatic alteration of rocks.

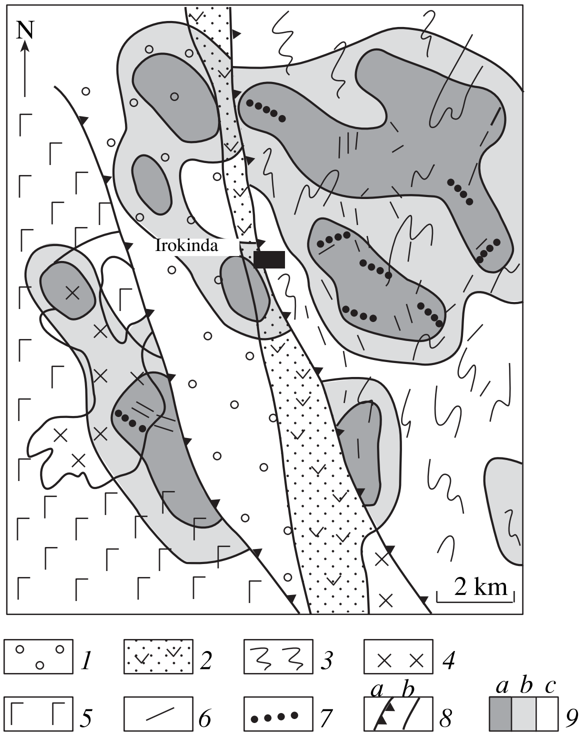

Fig. 3. Scheme of the distribution of sulfide dissemination density in the Irokinda gold deposit (based in [53]). (*1*) Volcanic olistostrome (Tuluin Formation, PR$_2$); (*2*) volcanic rocks (Kelyan Formation, PR$_2$); (*3*) Archean crystalline schists; (*4–6*) Muya intrusive complex: (*4*) granitoids, (*5*) gabbroids, (*6*) dikes; (*7*) auriferous quartz veins; (*8*) tectonic faults: (*a*) overthrusts, (*b*) other faults; (*9*) distribution of sulfide dissemination density (vol %): (*a*) < 3, (*b*) 1–3, (*c*) > 3.

Gold in the ore-bearing quartz veins was primarily derived from sulfide dissemination zones.

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