TUVA-MONGOLIAN SEGMENT OF THE CENTRAL ASIAN FOLD BELT: GEOCHRONOLOGICAL AND METALLOGENIC ASPECTS

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The territory of Tuva and transboundary territories of North-Western Mongolia are part of the Central Asian mobile belt, resulted from the geodynamic evolution and closing of Paleo-Asian Ocean [1, 6, 12, 28]. The areas of *maximum disclosure of Ocean* (640-550 Ma) are Agardag (570 Ma), Shishkhid (631-590 Ma), Kaakhem, Kurtushibinsky, Western Tuva, Monguntayga and several other areas in which there was a formation of ophiolite associations with manifestations of gold-platinoid ultramafite-mafite formations; Vendian–Early Cambrian island arc systems, particularly Ondum, Ulugoi, Eastern Tannuola and others with gold and silver-bearing copper-pyrite and pyrite-polymetallic formations belong to the ocean closing structure [3, 4, 5, 12]. The longtime nature of the evolution caused multi-act accretionary nature of the belt with age-fault of accretionary, collisional and post-collisional processes, each of which is conjugated to a well-defined set of ore formations [4, 24]. This was the main reason of manifestations of general lateral metallogenic zoning within the assigned time intervals, as well as spatial coincidence of multi-staged mineralization in the same tectonic zones [2, 4, 15, 16, 18]. The reason of this is the inherited character of zones development,

predetermined by the specificity of accretionary processes behavior, which is motivated by the presence of "bay-like" fold of the single subductional limit of Paleo-Asian ocean to the direction of Siberian craton in Tuva area (Fig. 1), which is a hindrance to subduction and optimizing oceanic lithosphere fullness and chilling effect [13, 14, 27, 34].

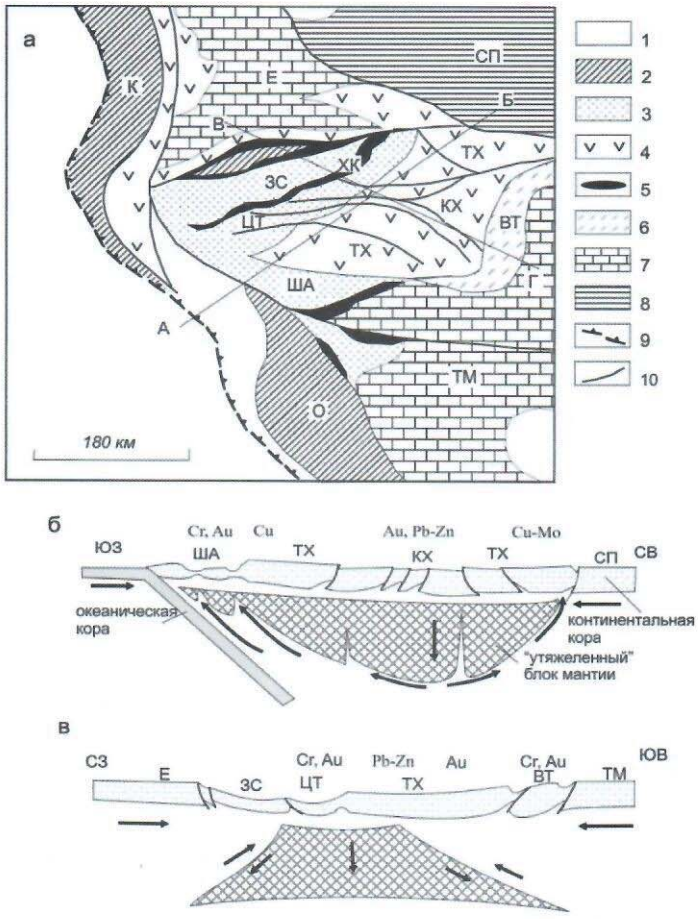

Fig . 1. Geodynamic model of Tuva region development [34]
Scheme of the main geodynamic complexes of Vendian–Low Cambrian margins of Paleo-Asian Ocean (a) and diagrammatic cross-sections along АБ lines (b) and ВГ lines (c) illustrating the geodynamic model of Tuva region development influenced by merging "heavy" block of mantle behind convergence (collision) of adjacent lithospheric plates with a trace of its Early Paleozoic metallogenic zonation. 1 – Paleo-Asian Ocean 2 – Kuznetsky (K) and Ozyerny (O) Early Cambrian

accretionary prisms with fragments of oceanic rises (Seamount), 3 – Vendian-Cambrian accretionary prisms (ЗС – Western Sayan, ЦТ – Central Tuva, ША – Shibetu-Agardag); 4 – island arcs (ТХ – Tannuola-Khamsara, КХ – Kaakhem rifting zone); 5 –oceanic ophiolites (ХК – Khemchik-Kurtushibinsky zone); 6 – epicontinental rifting zones (ВТ – Eastern Tuva), 7 – microcontinents (Е – Yeniseysky, ТМ – Tuva-Mongolian); 8 – Siberian continent (СК); 9 – subduction zone; 10 –large-scale faults .

The features of the geological position of the metamorphic complexes (Naryn, Moren and Erzin) are determined. The Naryn complex composition consists of carbonate, terrigenous-carbonate and terrigenous strata of Balyktygkhem, Chartys, Naryn and Chinchilig suites, the rock of which are referred to deposits of shallow-water epicontinental sea basins of Late Proterozoic. The Moren complex consists of influenced by amphibolite facies metamorphosed volcanic and sedimentary rocks formed in the rifting structures of passive continental margins. The Erzin complex is composed of intensely migmatized biotite and garnet-biotite gneisses with relics of metamorphism granulite rock facies, protoliths of which are sediments peculiar to basins of passive continental margins. The Erzin complex also consists of hypersthene and two-pyroxene crystalline schists of Low Erzin tectonic plate, primary rocks of which can be regarded as fragments of paleo-island-arc and paleooceanic formations. Data on the age of detrital zircons from metaterrigenous rocks of the Moren complex (750 Ma) and Erzin complex (800 and 900 Ma) are obtained, which determines the lower age limit of their accumulation by U-Pb method (SHRIMP) [9, 10, 11].

The features of the geological position of intrusive formations localized within the Tuva-Mongolian segment, as well as Eastern Tannuola and Kaakhem zones of its Caledonian framing are studied. Absolute age of these formations is determined by U-Pb zircon method (SHRIMP) [8, 9, 10, 11]. Crystalline complexes have been formed during

the Archean and Early Proterozoic tectogenesis within the Tuva-Mongolian massive are not identified. Results of geochronological studies of these objects [16, 17, 23, 29, 34, 36] allow to determine the formation stages and establish the nature of the early Caledonides of the Central Asia. Tuva-Mongolian segment of CAFB can not be regarded as a fragment of the craton, it was formed as a result of tectonic articulation of low-gradient metamorphite and non-metamorphosed rocks of the continental margin within 496.6 ± 3.5 – 521 ± 12 Ma. The formation age of the main structures is determined as 496.6 ± 3.5 Ma, as well as forming interval of thrusts is dated, with which the excretion of granulites is connected in the upper structural stages: 489.4 ± 2.6 - 480 ± 5.4 Ma. The latest value fixes the end of high-gradient metamorphism and faulting. Tuva-Mongolian segment of CAFB has been isolated as a rigid stabilized structure till 464.6 ± 5.7 Ma. Manifestation of intense strains in its framing is fixed by intrusion of tonalites of Tannuola complex in Kaakhem and Eastern Tannuola areas dated as 451 ± 5.7 and 457 ± 2.9 Ma. In general, the formation of Tuva-Mongolian segment of CAFB associated with accretionary processes during the closing of Paleo-Asian Ocean. Discrete strata fragments were initially tectonically jointed and then "brazed" during regional high-gradient metamorphism, manifested in the deep sections of this heterogeneous structure [8, 9, 10]. Subsequent geological events of this area are determined by the processes of intraplate magmatism associated with the development of hot mantle field (the main part of the North Asian superplume) based in the southwestern framing of the Siberian platform [19, 30, 31, 32, 33, 35, 37]. Intraplate indicators [25, 32] are sub-alkaline and alkaline gabbroid massifs magmatism (Korgeredabansky, Kharlinsky), alkaline granites

and syenites (Ulugh-Tanzek, Koktyg-Khem, Terben), lithium-fluoride granites and pegmatites (Solbeldyr, Tastyg), nepheline syenites (Bayan-Kol, Zhin-khem, Kogeredaban) and etc.

Metallogenic zones of the Tuva-Mongolian segment of CAFB are predominantly noble-rare-metal–rare-earth and copper-molybdenum-porphyry specializations coincide with manifestations areas of intraplate plume magmatism represented by Middle Paleozoic alkaline-ultrabasic and Late Paleozoic alkaline-granitoid massifs in Eastern Tuva, by Middle Paleozoic lithium-fluoride granites in Western Tuva, by Mesozoic carbonatite massifs in Central Tuva and deposits of Cenozoic alkaline-basaltic volcanites – on the east of Tuva [18]. The formation of unique deposits are connected with some of the mentioned plume manifestations: Karasug group of rare earth carbonatites, Bayankol aluminum, Ulugh-Tanzek rare metal, Tastyg lithium, Ak-Sug gold-copper-molybdenum porphyry [12, 15, 17, 23]. One of the representatives of the plume magmatism of rare-metal specialization are spodumene granitoids of Solbeldir deposit dated as 494 Ma. New distribution areas identification of plume magmatism of particularly carbonatite iron ore–rare earth, increase rare metal potential of the region. Metallogenic zones of predominantly noble-rare metal and polymetallic specialization coincide with area development of volcano-plutonic complexes, the formation of which is caused by the manifestation of various geodynamic states (spreading, subductions, accretions, collisions) at the stages of origin, existence and closing of the Paleo-Asian Ocean [2, 5, 17, 18, 24, 26]. Gold-platinoidal mineralization of ultramafite-mafites are typical for Kaakhem, Monguntayga, Agardag, Kurtushibinsky, Bilin-Busyingol and Shishkhid-Gol ophiolite zones [20, 21, 22]. Auriferous copper-pyrite and

pyrite-polymetallic high-argentiferous formations are coincided with Ondum, Ulugoi and Eastern Tannuola island-arc zones [3, 4, 5].

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