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LATE PALEOZOIC EPITHERMAL GOLD AND SILVER DEPOSITS RELATED TO GRANITE–PORPHYRY INTRUSIONS IN THE KURAMA OROGENIC BELT (CENTRAL ASIA)

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Late–Paleozoic Kurama orogenic volcano–plutonic belt is one of the scarce examples of regions where well preserved pre–Tertiary epithermal gold and silver deposits were identified. These deposits can be classified as of sericite–adularia or acidic–sulphate type (according to Heald et al.1987) and subdivided further into sulphide–poor and sulphide–rich types.

Sulphide–poor gold–silver deposits of sericite–adularia type (Kyzylalmasay, Chadak, Kauldy, Shkolnoye et al.) are characterized by a low sulphide content (1–3 vol %), they are enriched in silver (gold fineness is low – 150–600). Acanthite, naumannite, rarely hessite, minerals of tetrahedrite-freibergite series and Ag–Sb sulfosalts represent silver mineralization. Besides quartz, as a gangue mineral, carbonates, sericite, adularia are important. Sulphide–poor silver–base metal (with gold) deposits of this type (Lashkerek, Kanimansur, Taryekan etc.) contain galena, sphalerite, chalcopyrite, pyrite, sometimes bornite in predominance. Native gold (fineness 750–850) does not form detectable accumulations. Silver mineralization is represented mainly by native silver, along with acanthite and by various Ag–Sb and Ag–Pb–Bi sulfosalts. Quartz and carbonates prevail, sericite, chlorite and adularia occur in veins as gangue minerals. Ore mineralization of acidic–sulphate type forms pipe-shaped bodies (enriched in sulphides) of explosion–hydrothermal breccia (Kochbulak deposit), quartz-sulphide veins at Akturpak deposit, lenticular bodies at Burgunda deposit, as well as sulphate rich (barite, anhydrite), but sulphide–poor ore shoots (Kayragach deposit). Among ore minerals pyrite , Te–sulphosalts goldfieldite, minerals of famatinite–luzonite series, enargite, various minerals of tellurium with gold, silver, bismuth and other metals, as well as Ag–Cu–Pb–Bi sulphosalts (often seleniferous) are of considerable representation in these deposits. Among gangue minerals there occur diaspor, andalusite, sericite, kaolinite. Adularia is absent and quartz predominates over carbonates. High Au finesses (800–995) is characteristic of this type.

The deposits usually occur in Late–Paleozoic (C_{2-3}) andesite–dacite volcanics and less commonly in metamorphosed sediments and magmatites of pre–orogenic (S–D) basement (sulphide–poor Au–Ag deposits of sericite–adularia type), or in younger (C_3 – P_1) acid volcanics (sulphide–rich silver-base metal deposits of sericite–adularia type). Both types of deposits show a spatial association with stocks and dykes of porphyry granitoids of increased alkalinity, whose age (280–290 m.y.) is close to that of the deposits. This fact, as well as the results of stable and radioactive isotope studies allow us to suppose that the porphyritic granitoids were the main source of heat and ore components for the origin of epithermal mineralization. According to these data, ore–forming fluids had mixed meteoric–magmatic origin. The contribution of magmatic water to the fluids of acidic–sulphate type was higher than to the fluids responsible for sericite–adularia type of mineralization.

Of special interest are the rare cases of a spatial coincidence of both type mineralization, namely in Kochbulak, Kayragach and Akturpak deposits. Moreover, ore veins of Akturpak deposit were spatially combined with Au–Cu–Mo porphyry mineralization of Kalmakkyr deposit (Almalyk ore field). There are numerous geophysical, mineralogical and geochemical indications, that below the epithermal mineralization of Kochbulak the body of porphyry granitoids (of elevated basicity and alkalinity) with Au–Cu–Mo porphyry mineralization occurs. Its generation is likely to be closely linked with the formation of pipe–shaped bodies of explosion–hydrothermal breccia with Au–Cu telluride ores of acidic–sulphate type.

THE MAJOR ROLE OF TRANSFER ZONES IN THE CRUSTAL STRUCTURE OF THE MID–EUROPEAN VARISCAN BELT

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The Mid–European "Variscan" belt is basically situated within a weakened marginal area of Gondwana lithosphere, at the boundary region to the paleocontinents of Baltica and Laurentia. In this area, the most important structural imprints occurred between 390 and 400 Ma, after the collision between these paleocontinents. This "Variscan" deformation is concentrated into several crustal scale mega–shear zones which emplaced a collage of tectonic blocks that are extremely variable in tectonometamorphic histories. Tectonic blocks were subdivided into (a) blocks of metamorphic rocks which were uplifted from various crustal depths showing a large variety of PT–paths and (b) basins containing more or less continuous Lower Paleozoic stratigraphic sequences that are weakly or unmetamorphosed as they stayed in a near surface position. While in the metamorphic tectonic blocks earlier episodes of crustal thickening are inferred by mineral relics of medium and high pressure stages the basin sediments show no evidence of substantial earlier thickening. Rapid uplift of individual crustal blocks between 390 and 300 Ma is indicated by (1) various mineral cooling ages with different closure temperatures which are in a close range within individual metamorphic bodies and (2) by a change to coarse grained clastic sedimentation in the adjacent basins suggesting fast steepening of the submarine relief. In general, tectonic contacts between metamorphic and sedimentary blocks are wide zones of ductile deformation including large amounts of strike slip movements. These contain a huge variety of tectonic slices differing in maximum PT– conditions and PT–paths. The strike slip shear zones are transtensive or transpressive and acted as transfer zones that link two crustal sections contrasting in displacement geometries during activity of the faults. This is examined in three model regions in which the uplifted crustal slices display rather different pre–shearing histories: (1) In the Odenwald region previously thickened and thinned crustal sections were confined by NE–SW trending sinistral zones of strike shear, and (2) along the N–Erzgebirge margin by NE–SW trending sinistral and NW–SE trending dextral zones of strike shear showing transtensional geometries. In both regions the previously thickened wedge underwent extension along zones of normal shear linked with the strike slip fault zones. By contrast, (3) in the Schwarzwald and Vosges area ENE–trending zones of dextral shearing connect systems of shear zones that reflect alternating episodes of transpression and transtension. Synkinematic plutons that intruded into these shear zones are ubiquitous. In any case, displacements on normal rsp. reverse fault zones geometrically related to strike slip zones cause upward transport and juxtaposition of metamorphic slices against Paleozoic basin sediments. Concomitant opening and closure of minor oceanic pullapart basins (e.g. in the Rhenohercynian realm) are also related to strike slip motions. This general tectonic pattern results (i) from lateral movements and rotation of Gondwana relative to Laurasia after collision, (ii) from body forces excerted by previously (i.e. before 400 Ma) thickened wedges on surrounding areas and (iii) from lateral E–W–extrusion of fault bounded crustal blocks within the Variscan realm.