GOLD OCCURRENCES IN POREČ-STARA PLANINA METALLOGENETIC ZONE

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ABSTRACT

One of the most prominent tectonic units in Europe, Karpathian-Balkan region, runs in form of "bended chain" from east end of Alps up to Black Sea. The area of Eastern Serbia is a part of Karpathian-Balkan metallogenetic province which from Romania extends into Bulgaria through Serbia. Within it in Serbia four metallogenetic zones are identified with characteristic geological development and mineral associations: Ridanj-Krepoljin zone (A), Neresnica-Beljanica zone (B), Bor zone (C) and Poreč-Stara Planina zone (D), Fig. 1).

Within the Poreč-Stara Planina zone (the subject of this paper) several gold occurrences and deposits are identified. Main metallogenetic features of this area rocks of diabase-phyllitoid formation which are metamorphosed to the greenschists facies, as well as the rocks that intruded them: Gornjan granitic rocks, Deli Jovan gabbro in the north as well as Zaglavak gabbro and granitic rocks on Stara Planina.

BASIC GEOLOGY OF POREČ-STARA PLANINA METALLOGENETIC ZONE

In the area covered by Poreč-Stara Planina metallogenetic zone there are several formations and associations of formations that range from Proterozoic to Quarternary (Fig. 2).

Gneiss and crystalline schist, of amphibole facies, association of formations belong to Proterozoic. Here are also volcanogenic-sedimentary rocks that are metamorphosed to the facie of green schists.

The rocks of Riphean-Cambrian are represented by an association of formations of green schists, crystalline schists of amphibole facies and gabbro-diabase formation (crystalline schists of Poreč and Stara Planina). Part of green schists and crystalline schists of amphibole facies originates from felsic metavolcanics and metamorphosed volcanogenic-sedimentary rocks.

Lower Palaeozoic is represented by aspid formation, an association of terrigene-carbonaceous and volcanogenic-sedimentary formations.

The Upper Palaeozoic is much more wide spread. Carboniferous is represented by terrigene-calcareous formations (Poreč area), volcanogene-sedimentary rocks on Stara planina and Hercynian granitic intrusions that are found in Plavna and Gornjani in the north and Suvodol, Ravno buje and Janja on Stara planina. Permian is represented by terrigene sediments, red sandstones with rare conglomerates and siltstones, as well as by smaller masses of vein magmatic rocks.

The rocks of Mesozoic are also wide spread in Poreč-Stara planina metallogenetic zone. In the lowest part (Triassic) sandstones, siltstones and limestones are deposited that transition upwards into sandy limestones and dolomites. The volcanic activity during the Triassic was not registered. The Jurassic sediments are represented by sandstones, conglomerates, siltstones and limestones. Significant widespread have volcanogene-sedimentary rocks composed of basic volcanics with occurrences of pyroclastic material. The Cretaceous sediments are mostly limestones and rarely sandstones and conglomerates.

The Tertiary formations are found in form of proluvial and limnic-river sediments with coal occurrences.

The Quarternary is represented by alluvial sediments.

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As a consequence of the process of concentration of gold and structural-lithologic features where these processes took place, in Poreč-Stara planina metallogenetic zone there are various morphogenetic types. The main metallogenetic feature of this zone are magmatic complexes (gabbro and granite massives) as well as the rocks that were intruded by magmatic activity (schists).
According to mineral composition, the condition of formation and the manner of distribution of mineralization there are several morphogenetic types of deposits and gold occurrences identified. The most significant occurrences are shown in table 1, and their position is shown in Fig. 2.

Figure 1. Metallogenetic zones in Karpatho-Balkanides of East Serbia
Table 1. Morphogenetic types and occurrences

<table>
<thead>
<tr>
<th>Genetic type</th>
<th>Morphologic al type</th>
<th>Host rocks</th>
<th>Type of mineralization</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydrothermal</td>
<td>veins</td>
<td>gabbro</td>
<td>Au, Ag</td>
<td>Glogovica(Deli Jovan)</td>
</tr>
<tr>
<td>hydrothermal</td>
<td>veins</td>
<td>granite</td>
<td>Au, Cu, Ag</td>
<td>Mali gabar</td>
</tr>
<tr>
<td>placer</td>
<td>lenses</td>
<td>sand and clay</td>
<td>Au</td>
<td>Porečka reka</td>
</tr>
<tr>
<td>volcanogene-</td>
<td>veins and</td>
<td>diabase</td>
<td>Au, Pb, Zn, Ag</td>
<td>Mijin kladenac</td>
</tr>
<tr>
<td>sedimentary</td>
<td>dissemination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hydrothermal</td>
<td>veins, lenses</td>
<td>gabbro, granodiorite</td>
<td>Au, Bi, Cu, Pb, Zn, Ag</td>
<td>Gradište</td>
</tr>
<tr>
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<td>veins</td>
<td>gabbro, granodiorite</td>
<td>Au, Fe, Cu</td>
<td>Aldinac-Repušnica</td>
</tr>
<tr>
<td>hydrothermal</td>
<td>veins</td>
<td>granite</td>
<td>Au</td>
<td>Janja</td>
</tr>
<tr>
<td>metamorphogene</td>
<td>lenses</td>
<td>pyritic schists</td>
<td>Au, V</td>
<td>Crmovška reka</td>
</tr>
<tr>
<td>placer</td>
<td>lenses, veins</td>
<td>schists, diabase</td>
<td>Au, Pb, Zn, Ag</td>
<td>Srebrna glava</td>
</tr>
<tr>
<td>placer</td>
<td>lenses</td>
<td>sand and clay</td>
<td>Au</td>
<td>Staro korito</td>
</tr>
<tr>
<td>placer</td>
<td>lenses</td>
<td>sand and clay</td>
<td>Au</td>
<td>Kalina</td>
</tr>
</tbody>
</table>

**Deli Jovan ore field**

Within Deli Jovan ore field in gabbro-peridotit complex, and partly in Gornjan granitic complex, several quartz veins with gold were discovered, that are accompanied by polymetal sulphides. This area was well known in Roman times, with minor excavations.

Numerous quartz veins with variable content of gold are grouped in three large fault zones with a general strike of NW-SE. The most significant zone is Rusman-Ginduša where mining operations were carried out up to 100 m in depth.

The dimensions of quartz veins are variable. Along the strike they are most often up to 100 m long, rarely up to 700 m. The thickness of these veins varies from few centimeters to 3 m, usually from 0.5 to 1 m.

The quartz veins contain pyrite and gold, locally with concentrations of chalcopyrite and galena. The gold content is highly variable, from traces to over 150 ppm. (Janković, et al., 1990).

In Mali gabar locality several quartz veins with gold were registered, accompanied by increased copper content. This occurrence was not investigated in detail. The gold content in these veins varies from 0.1 to 2 ppm, with silver ranging from 2 to 100 ppm. The thickness of these veins is under 1 m.

**Gradinište ore field** is found in the southern part of Zaglavak gabbro massif. Polymetallic mineralizations are found by the granitic and diabase intrusions in gabbros. This area is promising for further investigations for gold.

**Stara planina region**

In the area of Stara planina gold does not form its deposits but is found in association with other elements (Cu, Bi, Fe, W etc.), so that its investigations were neglected up to recently.

Within Stara planina region several ore fields and ore zones were identified that can be significant in relation to discovery of gold mineralizations.

**Vratarnica ore field** is found in the northern part of Stara planina. The mineralization in Mijin kladenac locality is found in intensely altered schists, within a zone that can be followed several hundred meters, while mineralization occurs in intervals in form of complex, mutually parallel, veins. This polymetallic mineralization mainly contains pyrite, markasite, galena, sphalerite and arsenopyrite, with significant gold and silver content. Although previous investigations report mean content of 7.2 ppm of gold and around 400 ppm of silver (Buković, et al., 1985), these results are in question and probably the grades are much lower. The dimensions of mineralized veins are still unknown. Although the genesis and age of the mineralization that has characteristics of stratiform type is still not confirmed, its supposed volcanogene-sedimentary origin is acceptable. Thus, the mineralization was formed in the process together with host rocks and with them underwent all changes induced by regional metamorphism.

Within this ore field several mineralized millonitic zones of various dimensions were found. Mostly they can be traced along strike for several hundred meters, with thickness from 1 to over 10 m. These zones were not investigated below surface. In all of them gold is present, mostly accompanying chalcopyrite, pyrite, and arsenopyrite, locally sphalerite and complex bismuth mineralizations. The gold content in mineralized zones range from 1 to over 100 ppm, 7 ppm in average. The copper and silver content in these zones is also significant (Ag cca 20 ppm, Cu cca 1%) (Kovačević, 2002).

**Aldinac-Repušnica ore zone** is situated in southeast part of Zaglavak gabbro massive along contacts with granodioriteporphyrite intrusions.

In this locality a large mineralized zone was discovered, traceable over 1.5 km in length, with a variable width of 10-60 m. This zone was not explored under surface. The mineral composition, as well as quantity of ore minerals in this zone is variable. The most common ore minerals are pyrite, chalcopyrite, magnetite, and hematite with sporadic galena, tetraedrite, arsenopyrite, molybdenite, scheelite, wolframite, cassiterite, pystromel, pyroluzite, as well as elementary copper, silver and gold.
The gold content in this ore zone ranges from 0.4 to 30 ppm, 1 ppm in average (Kovačević). The presence of copper and iron is characteristic for this ore zone, and higher contents of gold are related to quartz-hematitic mineralizations. The compilation of all available data suggests that mineralizations in Aldinac-Repšnica ore zone are epigenetic and are promising as gold potential.

**Janja ore field** is found in central part of Stara planina within Janja granitic massif.

Within this ore field small pyritized quartz veins, 0.1 to 0.5 m thick, with gold content of 0.1 to 2 ppm have been registered. As these veins are also short (few tenths of meters) they are not particularly interesting. As an exception is a mineralized zone above Gabrovica village that can be traced for 1 km, with a thickness of 10 to 50 m. It is a millonite zone placed in gneisses near the contact with granite and gabbro. Besides the gold content of 0.1 to 0.3 ppm there is also an increased content of copper and molybdenum.

**Crni vrh ore field** is composed of rocks of diabase-phyllitoid formation-green complex with marble lenses. Within this ore field a large zone of black pyritized shales was found that can be followed for over 300 m, with visible thickness over 15 m. This zone was little explored and scarce samples show that the content of gold in the black shales is 0.13 to 1 ppm, with 8 ppm of silver, 300 to 2300 ppm of copper and up to 3000 ppm of vanadium, and slightly increased values of lead and zinc. This ore field deserves more attention than it got so far.

**Srebrna glava ore field** is in the southeasternmost part of Stara planina that is in Serbia.

Within this ore field composed of diabase-phyllitoid formation (green schists and diabases) several occurrences of mineralized quartz veins were discovered, mostly along contacts of diabases and schists. The quartz veins have a strike of NE-SW. The size of the veins is highly variable, few to over 100 m in length with width rarely over 2 m. Besides gold (0.3 to 5 ppm) the mineralization is accompanied by 70 ppm of silver and minor quantities of lead, zinc and rare copper.

**PLACER GOLD**

In Poreč-Stara planina metallogenetic zone there are several occurrences of gold in alluvial deposits. As most significant the alluvial deposits of Porečka reka, Trgoviški Timok and its tributaries on Stara planina and Koritska reka should be pointed out. The common feature of these alluvial deposits is large alluvial mass over large surface. The exploitation of placer gold took place so far in Porečka reka and Trgoviški Timok near Kalna. The volume of these alluvial deposits is cca 20,000,000 m³ with the following mean content of gold: Porečka reka-0.16 g/m³, Trgoviški Timok(Kalna)-0.3 g/m³, Koritska reka (smaller alluvial volume)-0.4 g/m³.

The conclusion for above mentioned is that so far geological explorations were limited but enough to point out to the potential for gold in Poreč-Stara planina metallogenetic zone.

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