



Listwaenite type wall-rock alterations in Bulgaria – peculiarities and gold ore perspectives

Лиственитов тип околорудни изменения в България – особености и златорудна перспектива

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Introduction

The great variation of listwaenite occurrences in nature have provoked constant interest of researchers for study of their conditions of formation, peculiarities and relation to deposits of some ore minerals (Сазонов, 1984; Buisson, Leblanc, 1985; Halls, Zhao, 1995; Uçurum, 2000, etc.).

The created classification models are based on a wide range of features that reflect their geochemistry, mineral composition, petrology, genesis, repeatability, conditions of transformation, etc. According to the Commission on Systematics of Metamorphic Rocks listwaenites form during the process of beresitization of ultrabasic rocks (Zharikov et al., 2007). Using the formulations of these authors these are rocks built of quartz+Fe-Mg carbonates+fuchsite+pyrite and accompanied by associated ore veins.

Distribution

Listwaenites on the territory of Bulgaria are insufficiently studied and the ore mineralizations in them are on a very initial stage of investigation. The data show that they are localized mainly in Ihtiman Sredna Gora (Yamkite), Central Srednogorie (Panagyurishte ore region), Central and Eastern Rhodopes (Svetulka-Ardino, Madan ore field, Lozen ore field, Golyamo Kamenyane, Avren-Krumovgrad, Dobromiritsi-Zlatograd, etc.). More detailed studies on the ore mineralizations are available only for the ore occurrences “Sveta Marina” and “Yamkite” (Цветанов, Бресковска, 1984; Velinov, Nokov, 1992). Just lately, at the end of last century (1997/98), there have been performed systematic studies on the content and the form of presence of gold in metasomatites (as

well as in listwaenites) from the region of Ihtiman Sredna Gora (Zheliaskova-Panaiotova at al., 2000). The gold content in the listwaenites varies in a wide range either between the separate occurrences or in the frame of each of them.

Peculiarities

The presence of Fe-carbonate (ankerite, siderite, breunnerite) is important differentiation marker. A listwaenite type alteration on marbles has been reported for the Madan ore field (Кольковски, Манев, 1988) accompanied with formation of manganocalcite, quartz, trolleit, hematite, talc.

Our data for the region of Svetulka village show that the hydrothermal activity in serpentinites composed of lizardite, antigorite, and chrysotile has resulted in formation of listwaenites. They form a body as a halo to north of the cropping out ultrabasites and there can be followed smooth transitions between the two types of rocks, which have varying composition and the main rock forming minerals are represented by Fe-containing carbonates and chalcedony (Колчева, Желязкова-Панайотова, 1982).

Two zones bounded by carbonate rocks are formed in the listwaenites of the chromite deposit Golyamo Kamenyane. Listwaenites from the outer zone are composed of quartz, calcite, siderite, breunnerite and ore incorporations (Желязкова-Панайотова, 1960).

Conditions of formation. Relations to other metasomatites

The listwaenite type rocks on the territory of Bulgaria are near surface formations. The role of the original rocks and the fault structures is of no doubt when

Table 1. Selected electron-microprobe data of Au phases in listwaenites from Svetulka village, Central Rhodopes

No	Matrix	Element, at. %				Hallmark
		Au	Ag	Cu	Ni	
1.	goethite	78.13	12.66	6.98	2.23	781
2.	quartz	57.79	23.64	6.13	12.44	578
3.	calcite	58.74	35.52	-	5.74	587
4.	calcite	82.96	5.58	7.81	3.65	830
5.	goethite	69.61	13.57	9.15	7.67	696
6.	calcite	77.11	13.21	4.35	5.33	771
7.	calcite	69.04	26.76	4.20	-	690
8.	calcite	64.25	18.70	17.05	-	642
9.	calcite	69.69	24.03	6.28	-	697
10.	goethite	71.02	16.94	6.91	5.13	710

defining their formation. The listwaenite bodies are elongated and their fault dependence is well expressed. Their dimensions reach several tens of meters. In some cases the closeness of the separate bodies in the lateral metasomatic zonality creates the impression for a larger area alteration.

The listwaenites are relatively independent and rarely display interrelations with other wall-rock alterations. Quartz-adularia type alterations dispose over listwaenites in only one case (Velinov, Nokov, 1992).

Metasomatic zonality

The study on the listwaenites from "Sveta Marina" ore occurrence in Lozen ore field (Цветанов, Бресковска, 1984) outlines the following zones: ultrabasites → quartz-sericite-carbonate (calcite, dolomite, ankerite, rarely siderite) → central zone (dolomite, quartz, chlorite, breunnerite and traces of ankerite).

Паздеров и др. (2005) have reported that the listwaenites from the region of Svetulka village display varied composition — from more than 90% SiO₂ to more than 90% carbonate minerals. Probably those are indications for not well-expressed metasomatic zonality with a tendency to single mineral composition. Marbles with incorporated calcite mineralization dispose just after the listwaenites.

In "Yamkite" ore occurrence the intensive alteration is marked by silification, quartz-mariposite, and imposed sulphide mineralization. The following tendency is marked for the hydrothermal metamorphites: silification → quartz-mariposite → quartz-sericite → altered rocks of propylite type.

Metallogenic specialization and importance

The ore perspective of the listwaenites on the territory of Bulgaria remains still not clarified, although in many ore occurrences they are gold bearing, despite the fact that many analyses shoed gold contents below 0.03 ppm. These data additionally confirm the conclusion already made that the gold content in

listwaenites varies in wide ranges both among separate occurrences and in the frame of each of them.

In respect to the metallogenic specialization of listwaenites on the territory of Bulgaria an interesting fact is the establishment of precious metal mineralization in the listwaenites from the region of Svetulka village, where in one sample there have been observed grains of Au phases, native Pt, native Ag, and association of native Ag and acanthite. With the exception of this association all other grains from this mineralization are independent and included mainly in the carbonate matrix. Only some of the Au phases are found in goethite (about 25% of the grains) or in quartz (about 10%).

The ore minerals accompanying the precious ore mineralization are represented mainly by spinellides, more rarely by goethite, pyrite (often oxidized and partly transformed to goethite), pirrhotite, and pentlandite. Excluding the spinellides, which have dimensions of up to several millimeters, all other grains are small — up to 50 μm in the longest direction.

The content of Ni in the composition of the majority of grains (Table 1) may be accepted as an indicator for the "vapouring" of the ultrabasites by the hydrothermal solutions, that has lead to formation of precious metal mineralization. The native Pt is composed only of Pt and Fe in quantities 83.20–82.65 and 16.80–17.35 (at. %) respectively.

Conclusion

On this stage of investigations of the listwaenites in Bulgaria it is very difficult to give entire evaluation for their metallogenic importance. Obviously they represent very interesting geological objects for which we still have not a clear idea about their significance for industry. In this sense it must be noted that on the majority places where thorough studies have been performed on the gold bearing capacity of these rocks the data show unminable contents. Gold contents of up to several tens of grams are rarely found. In future it makes sense to conduct exploration in the zones near the faults where listwaenite type alterations are observed as well as manifestations of ore mineralization. This will help to give a clear answer in this direction.

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