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GOLD GRAIN MORPHOLOGY AND COMPOSITION IN SOME LOCALITY IN R. MACEDONIA

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ABSTRACT

During the water transport alluvial gold is affected by various physical and chemical factors. It was selected three locality where was studied changes in chemical composition and morphological forms of gold aggregates: Borov Dol, Plavica and Alshar where is carried schlich prospection. Studies have shown that the size of the tested gold aggregates ranges from 30 microns to 1 mm., usually present form of gold aggregates is isometrich-irregular shape.

Flakes-flattened shape also quite prevalent as elongated for. .Gold aggregates in a Borov Dol as a whole is characterized by constant chemical composition, more exactly, it is homogeneous and high grade almost everywhere with purity that ranges from 834 to 981st In Alshar despite the presence of gold in chemical analysis, with schlich prospection were not discovered gold aggregates.

Key words: schlich prospection, placer gold, morpology, high-gold grain

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1. INTRODUCTION

In Macedonia known many metallic and non-metal minerals, including gold. Studies of gold in Macedonia have a long history. There are many areas in which established the presence of endgenic gold. Elluvial-alluvial gold undoubtedly bears the marks of the endogenic gold. The physico-chemical characteristics of such gold affect many factors among which are: the nature of the primary gold, water power, the morphology of the river and along the transport and chemical composition of river water.

The importance of these factors varies depending on the climate, the intensity of erosion etc.. As a result of these processes, the characteristics of primary gold change. The most characteristic morphological and chemical changes (dissolution and precipitation), and the chemical changes are usually represented by forming parts rim offsets that are enriched with gold.

The large number of occurrences of gold, about thirty, are more or less studied and provide further impetus for serious research ([17], [12], [3], [4], [5], [15], [16],[20],[21],[25],[8], [27], [28], [9], [34], [29]).

Most of these appear economically not interesting but because of genetic aspect can be quite interesting.

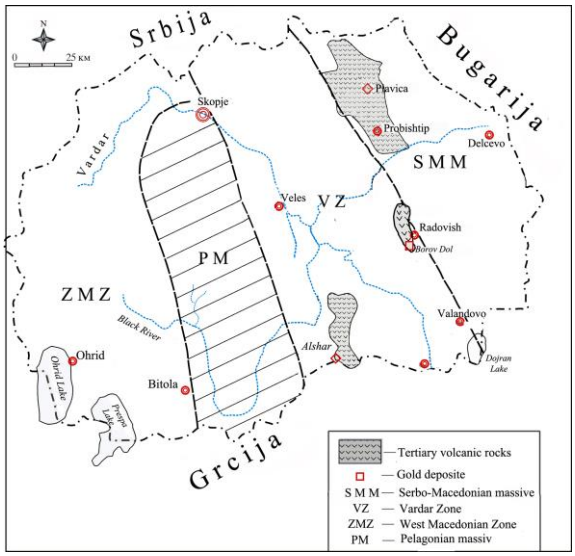

Figure 1: Geological map with placer gold occurrences in R. Macedonia

The main objective of this research was to study the gold aggregates were found with schlich prospection in three locality wich were selected as representatives of different genetic types of deposits: Borov Dol, Alshar and Plavica (Figure 1).

2. Geological setting

The territory of Macedonia is located in the central belt of Cu-Pb-Zn-Au-Ag mineralization and can distinguish three different types of gold deposits: 1. carline type; 2. epithermal deposits of gold and silver 3. prophyry deposits of copper with gold ([22]).
The first type belongs Alshar locality, second type Plavica and third type belongs locality Borov Dol. In all these localities ore mineralization is related to Tertiary magmatizam.

Borov Dol deposit is part of the Bucim-Damjan-Borov Dol ore district and occupies the southern regions. Metallogeny of this area is closely related to the evolution of the Tertiary magmatizam presented with subvolcanic-faces of volcanic andesite, latite, kvarclatite, trahiriolite etc.. which are the product of intermediate to acidic calc-alkaline magmatism. For this magmatism are related numerous interesting mineralization of Cu, Fe, Pb-Zn mineralization and Au ([2], [33], [24], [26]).

At Borov Dol set is over 60 minerals of which the most common are: pyrite,chalcopyrite, magnetite, molibdenite, hematite, native gold ([19], [32], [33]).

The deposit Plavica affecting eastern parts of Kratovo-Zletovo volcanic area or rather it is located in the central parts of Plavica volcanic apparatus ([7]).
Ore mineralization in Plavica is located in the central part of a large blighted caldera. It is characterized by a complex structure construction and extensive hydrothermal changes ([18]). At the locality Plavica discovered a rich and varied mineralization represented by: pyrite, chalcopyrite, pirotine, magnetite, chalcopyrotine, shelit, hematite, martite, molibdenite, sphalerite, galena, bornite, tenantite, native gold etc. ([18], [12], [25]). Silificate zones (so-called secondary quartzite) are particularly important as carriers of gold with average content ranging around 1.29 ppm ([20]).

Alshar locality geotectonic belongs to Vardar tectonic zone, which stretches north from Belgrade to Thessaloniki-Greece to the south. Specifically Alshar locality, with an area of 21 km^2

belongs to Kozuv district. Kozuv area is a large volcanic complex located in the southern part of the Republic Macedonia and has been developed in the area of the mountain Kozuf. Pliocene magmatizam wich is important for geology of Alshar is related to Sb-As-Tl-Au-Cu-Pb-Zn mineral association.

3. Metodology and samlping

Shlich method during fieldwork was applied. For this method was taken material from 15-20 kg depending on the availability of material. Then it approached to flushing material and received shlih undergo further processing laboratory which includes magnetic separation and then determination of minerals under stereomicroscope. Aggregates of gold allocated manually.

To determine the morphological characteristics of gold applied scaning electron microscopy in the laboratory for electron microscopy in Chemistry Faculty of Sofia University. Tests were performed on skaning JMS-electron microscope JEOL-5510. For this method first forms is covered with a thin gold layer in an inert environment using cathode rasprashuvach-JFC-1200Fine Coater.

Quantitative analysis of gold grains do with electronic microprobe. This analyses were conducted in: Evrotest-Control-Inc-Lab Analysis X-ray microanallyser X-TRACTOR NORTHERN TN-2000 energy dispersive system as part of an electronic microscope JEOL LMS 35 CF. Microprobe analyses also were performed in the laboratory at the Institute for photoprocesses the BAS-Sofia. It was used for energy dispersive systems electron microscope Philips CEM 505 firm model EDAX 9100/60 with tension of 20 kV.

4. Results and discusion

When grains of gold will get rid of the parent rocks, physically and mechanically deform depending on the length of transport. Measuring the shape of gold grains mostly circular form, the degree of curvature and folattness may indicate the type of source and length of transportation ([11], [10]). According to Styles, ([30]), measuring the size and shape of the gold aggregates provide little information about the origin of alluvial gold. Many angular and irregular shapes, show that alluvial gold is near its primary source as abrasive and circular forms suggest the transport of several kilometers.

The size of the found gold aggregates at the Borov Dol locality ranges from 150 microns up to 1 mm. The morphology of the aggregates is different. Commonly occur: an elongated shape, isometric form, scaly and globular shape (Figure 2). These forms indicate the proximity of primary mineralization. If gold is subjected to secondary processes, then there was curvature of the edges and smoothing the surface and increases the flattness of grains. Flattened form of gold due to the significant transport of gold and primarily due to the small fortress and malleable of gold as a mineral.

Morphology of gold aggregates in Borov Dol locality is relatively preserved and roundness indicates that it was subjected to seconary processes. Such characteristic suggests that this gold probably has similar characteristics as the primary gold ([13]) and it has long undergo because transport form of gold depends on the length of transport.

Taking into account these data we can say that the gold from Borov Dol belongs to the group of high grade gold ([35]) with a purity that ranges from 834 to 981. As impurities in the composition of gold Borov Dol, contains silver which varies from 0.82-15.87% and average content is about 7%. Low content of silver may indicate a higher temperature mesotermal deposits, ([30]). It may have noticed an increase of finesse of gold over transportation. In a number of aggregates is common zonality where the central parts of the grains are richer in gold and peripheral or peripheral parts are richer in silver. ([28]).

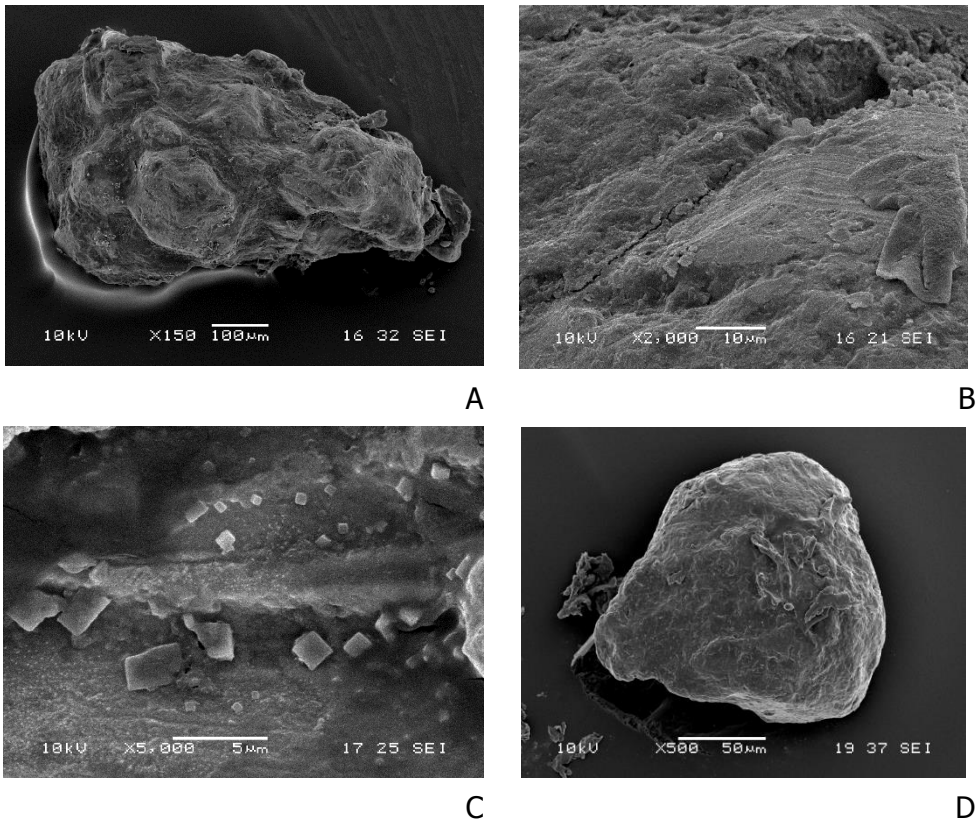

Figure 2: Morphological forms of appearance and details of gold aggregates from theBorov Dol locality
A- general appearance of elongated spindly gold aggregate
B- detail of previous aggregate-layered structure
C- detail of larger crystals of the same aggregate
D- general appearance of the loaf, gold round aggregate

From these tests for chemical composition is determined that it is native gold which is characterized by high purity (Table 1).

Table 1: Medium Golden aggregates content in samples from Borov Dol

	Au	Ag	Cu	Fe
BD-4	91.60	7.62	0.46	0.026
BD-5	90.79	8.47	0.47	0.048
BD-6	98.15	0.99	0.46	0.056
BD-9	88.44	10.55	0.60	0
BD-10	87.04	11.73	0.48	0.052
medium content	**91.20**	**7.87**	**0.49**	**0.036**

Studies on the relationship between the composition of gold and length of transportation, have shown that there is no change in microchemical entry od alluvial gold during transport, which is not the case with morphological forms or form of aggregates of gold ([6]). Taking into account the fact that gold aggregates in general have a homogeneous composition (measurment performed in the center of the aggregates) can be assumed that the gold aggregates come from one source.The composition of gold and its morphological forms can be used as a direct prospecting indicator for porphyry copper mineralizations ([23]).

The deposit Plavica is epithermal system of high sulfidenization type of mineralization ([20]). Polymettalic ocurrences in this system have been studied since Roman times for the remaining of the old mining - slag, old undermine etc. Research in this area is conducted with larger or smaller cuts until today and can say that this is one of significant copper deposits with polymetallic character.Our investigations were aimed at egzogenic gold and for that purpose from Plavica locality were taken 15 schlich probe and found a total of 44 gold grains of different sizes. In order to examine the morphology of the gold aggregates were found, tests are performed on scaning electron microscope in which was reported that the size of the grains is different and varies from about 50 to 200 microns.

Grains are mostly characterized by irregular shape-isometric form. In general form can be distinguished: isometric elongated shapes that can be deemed to have beads that are suspended near the roots sources. Then there are irregular shapes dendritic, flakes forms probably postpone away from primary sources and also can be transported at considerable distances, ([31]) (Figure 3).

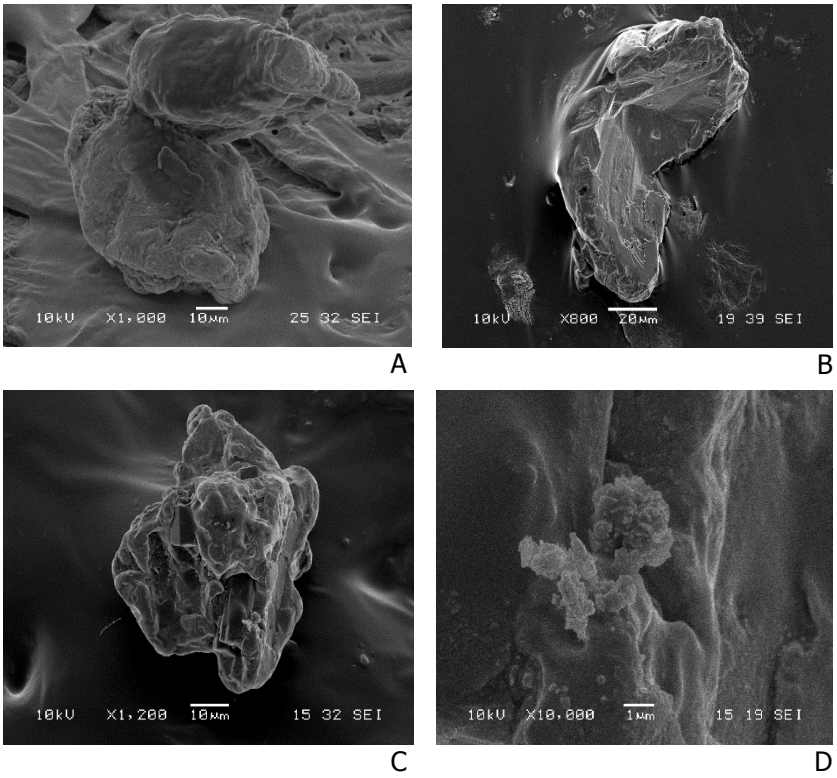

Figure 3: Morphological forms of appearance and details of gold aggregates from Plavica locality

A-isometric form of aggregate gold

B-gold sets with irregular shape

C-isometric form of gold aggregate

D-Druze of crystals-tiny detail from Fig. C

The ability to transfer or transport among others depends from the thickness of the grains. Gold grains fromPlavica by size fall into the class of very small grains. ([13]). Almost all grains of gold were observed stratified construction of gold aggregates. In the gold aggregates are observed small crystal forms. In general basic feature of alluvial gold are characteristic different morphological forms. Near the primary deposit, prevailing elongated and dendritic forms while octaedral crystal forms are very common. With increasing length of transport, prevail flakes forms.

To determine the chemical composition of gold aggregates analyses of microprobe are made (Table 2).

Table 2: Medium Golden aggregates content in samples from Plavica locality

	Au	**Ag**	**Cu**	**Fe**
Pl - 1	96.08	2.94	0.45	0.073
Pl -3	93.79	5.52	0.44	0.052
Pl - 4	93.56	5.81	0.42	0.095
Pl - 5	79.01	20.47	0.40	0.113
Pl - 11	97.56	1.76	0.44	0.073
Pl -12	86.51	12.74	0.40	0.123
Pl - 13	95.35	3.78	0.42	0.073
Pl - 14	94.38	4.75	0.55	0
Medium content	**92.03**	**7.22**	**0.44**	**0.075**

The accompanying results show that gold from Plavica is high grade (842-994). Chemical analyzes of gold aggregates show that silver is an element that is commonly found as admixture and can sometimes be found copper and iron content in a few %. The content of silver ranges between 0.18% to maximum 21.7%. Average silver content in Plavica is 7:22%. In alluvial gold, silver content can vary from 32 to 50 weight percent (with an average of 630 finesse) and other elements not spend a 1 wt.%. ([1]). Taken as a whole aggregates of gold are characterized by constant composition, ie it is homogeneous and visokoprobno almost everywhere.The other impurities found in gold is copper with content between 0.25 - 0.68%. Iron is much smaller content ranging from 0:08 to 0:28%.

The third locality on which conduct schlich prospetion is Alshar which is a deposit of arsenic and antimony as well as significant quantities of gold content. Gold mineralization was first mentioned in the 1974th The analysis of the results showed that the geological, mineralogical and chemical characteristics and hydrotherm alteration suggest similarities with carline type of gold in the U.S. ([14], [16]) by the Alshar mineralization gold is stored not only in sediments but also in volcanite. Alshar deposit is divided into three parts: northern part dominated mineralization of talium, central part of Sb-As mineralization with interesting content and gold, south which is characterized as carline type of mineralization.

Despite the established presence of gold with schlich prospection not found gold aggregates. Probably for this reason submicorscopic size of gold (<0.2 μm) wich is one of the features of carline types of gold deposit ([36]).

Taking into account all previous findings and the results we can say that gold aggregates were examined according to the size of grains form, indicate the proximity of primary mineralization from which originated the gold.

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