GEOLOGY AND ORIGIN THE GOLESH VEIN MAGNESITE DEPOSIT: A BRIEF SURVEY

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ABSTRACT: In this paper geology and origin of the Golesh vein magnesite deposit (in the Golesh ultramafic massif, Kosovo, Yugoslavia), the largest of its kind in the world, are presented briefly.

Key words: geology, origin, vein, magnesite, deposit, Golesh, Yugoslavia

INTRODUCTION

The Golesh vein magnesite deposits is located on the Golesh mountain (1.019 m) which is predominantly built up of ultramafic rocks (the well known Golesh ultramafic massif), 15 km southwest from Prishtina, Kosovo (Yugoslavia). This is the largest vein magnesite deposit both in Yugoslavia and in the world with total reserves of cryptocrystalline magnesite about of 5 million t. This deposit has been mined since 1923, and about 2,500,000 t of magnesite have been mined out for needs of the Industry of Refractory Materials MAGNOHROM in Kraljevo.

THE PRINCIPAL GEOLOGICAL CHARACTERISTICS

The Golesh magnesite deposit is located in the Golesh ultramafic massif having the surface of about 15 km^2 (Fig. 1). The massif is mostly built up of fresh ultramafites: dominant harzburgite, lherzolite, enstatite-dunite, and dunite; serpentinite and fossil lateritic weathering crust of ultramafites (mostly harzburgite) occur in places. Serpentinite occurs in marginal parts of the massif, around larger fractures as well as around magnesite veins. Fossil (Palaeogene) lateritic wathering crust occurs (in the form of erosional remnant) in massif edges, mostly in the eastern one (Fig. 1). Accoding to *Maksimovich* (1981) the crust contains four zones: 1. silicified zone, 2. goethite zone, 3. smectite zone, and 4. altered harzburgite with magnesite stockwork. The depth of the first three zones is 5-15 m, and the fourth one is 15-70 m.

Magnesite mineralization within the ultramafic massif forms few separate concentration centres as: Magura (the most important), Medvedce, Mirena, Stankovci and Ariljacha (Fig. 1). These concetration centres altogether form the Golesh magnesite deposit. Magnesite mineralization forms the following structural-morphological types: simple veins, complex veins (with apophyses), irregular lenticular bodies, and stockwork (Fig. 2). Within structural-morphological types, the following textural types of magnesite mineralization occur: massive, banded, and brecciated.

Magnesite veins (simple and complex) have regular, tectonically predetermined orientation because they were formed by filling of open fractures (faults and cracks) in the Golesh ultramafic massif. They form two perpendicular systems: the main one of approximate N-E strike and 50-70^0 dip towards E, and the second of approximate W-E strike and a dip of 40-50^0 towards N (Fig. 1).

The gratest part of magnesite veins that have been mined or investigated have a thickness of 0,5-3 m while its maximal value is about 20 m (Magura 1). Vein legth mostly ranges between 100 m and 500 m, while its maximum is about 1,200 m (Magura 1). Veins spread into depth ranges between few tenths to a couple handred meters, while the maximum depth spread is above 300 m (Magura 21) (Fig. 2).

The magnesite from the Golesh deposit is dense, cryptocristalline to microcrystalline. It is snow white when is clean, but could be yellowish or reddish owing to limonite staining. The main impuritites in magnesite are silica, lime and sesqioxides (R_2O_3) in case of increased contents. Mineralogical examinations showed that carriers of these impurities are the following minerals: silica - opal, caldedony, quartz, sepiolite and serpentine; lime – dolomite; iron - magnetite and limonite.

Silica (opal, chalcedony and quartz) occurs in form of crack and cavity fillings in magnesite. In uppermost parts of some veins, silica could prevail and form a "hat" above magnesite. These "silica hats" often make pronounced reefs on the surface.

Dolomite appears in the way similar to silica, but is less abundant.

Sepiolite also appears in the form of crack and cavity fillings in magnesite but in some places in form of thicker veins.

Chemical examination of great number (few hundreds) of magnesite samples from the Golesh deposit, showed that contents of the main components are within following limits:

MgO 44,00-47,50%

CaO	0,20-1,50%	
SiO_2	0,20-5,00%	$R_2O_3 = Al_2O_3 + Fe_2O_3 + FeO$
R_2O_3	0,20-1,80%	
L.O.I.	48,00-51,50%	

ORIGIN OF THE DEPOSIT

Authors of this paper think that the Golesh magnesite deposit is of hydrothermal origin, so that they join the view previously given by *Ilich* (1964, 1969). This view is based on numerous arguments from which the following one are the most important: data obtained by the geologic exploration of the deposit, results of the study of Hg content in the magnesite and results of the isotopic study of the magnesite.

The following data of the geologic expolration are the most important: great length (up to 1,200 m), great thinckness (up to 20 m) and significant spread into depth (over 300 m) of magnesite veins, as well as "blind" veins apophyses (that do not reach surface) what is characteristic for hydrothermal formations.

Study of Hg content in the Golesh magnesite (using atomic absorption method: Maksimovich and Dangich, (1974) showed incraesed content of this microelement (ā=201 ppb) relating to its content in fresh harzburgite (ā = 9 ppb), that indicates that Hg was introduced by hydrothermal solutions.

Isotopic study of the Golesh magnesite (*Fallick, Ilich & Russell,* 1991) showed the values $\delta^{12}C$ = -14,28 up to 14,52 ‰. PDB and of $\delta^{18}O$ = 24,86 - 25,52 ‰ SMOW. On the basis of these values, it was concluded that the magnesite was deposited at the temperature of about 70^0C from a hot water of meteoric origin. CO_2 component probably originated by thermal decarboxyllation of organic matter of some deeper-lying sediments.

In accordance with *Ilich's* view the Golesh magnesite deposit was formed from the meteoric water. Cold meteoric water, along the fractures, sunk by gravity into deeper terrain parts (2-3 km), then was heated (most probably at $75\text{-}100^0C$) and was enriched with CO_2 content (the gas was released during thermal decarboxyllation of the organic matter that begins at about 75^0C), and after that, along fractures, too, flowed towards the surface. Therefore, meteoric water was subjected to convection flow (most probably artesian) and was heated in the depth due to the Earth's heat. Some deeper-lying magmatic chamber could have icreased geothermal gradient of that terrian; it could have also emit ascedenting juvenile fluids. Increased Hg content in magnesite points to certian mixing of meteoric water and juvenile solutions; however, isotopic composition of the same mineral shows that juvenile solutions, in it's formation, were not present in siginificant quantities.

During its ascending flow, alredy mentioned hydrothermal solutions leached magnesium from deeper-lying rocks rich in this element (ultramafites, dolomite marbles), while silica and lime were leached in lesser quantity.

After serpentinization, silica content in above mentioned solutions was mostly low. Magnesium was leached out of serpentinite, too, and bonded in soluble bicarbonate - $Mg(HCO_3)_2$, as well as calcium; together with a low quantity of soluble silica, they were transpoted upwards. When the solutions approached open fractures within the Golesh massif (in its upper parts), owing to pressure decrease, it came to removal of CO_2 from the solutions, decomposition of bicarbonate and precipitation of magnesium carbonate ($MgCO_3$).

Magnesium carbonate was precipitated at temperature of about 70^0C, probably in the form of gel which, after certain time, crystalized as a very fine-grained (cryptocristalline to microcrystalline) magnesite.

Small quantities of calcium were deposited the same way as magnesium, but in the form of dolomite.

Silica deposited later on, in form of crack and cavity fillings in magnesite.

After deposition of magnesite hydrothermal activity in the Golesh ultramafite massif gradually let up, until complete termination. During this late hydrothermal activity, mostly sepiolite deposited in form of crack and cavity fillings in magnesite and, in some places, in form of thicker reins.

Finally, we would like to point out that in the Golesh ultramafite massif, besides hydrothermal-vein, another genetic type of magnesite deposits occurs: the infiltration one. As previously mentioned the latter one forms a separate zone within lateritic weathering crust of the Golesh ultramafite massif and is represented by magnesite stockwork. More data about deposits of this genetic type (Vrelo, Glavica) could be found in the papers if *Ilich, Lapcevich and Chvorovich* (1987) and *Maksimovich* (1981).

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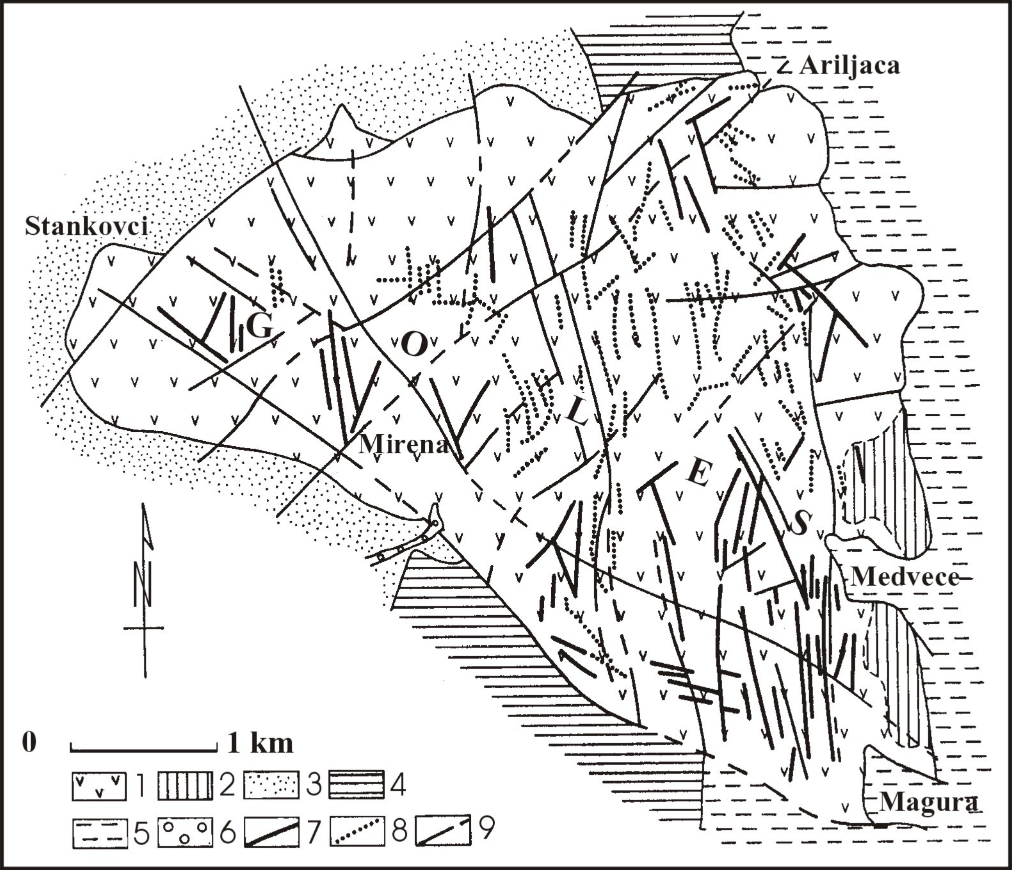
Fig. 1. A simplified geological map of the Golesh ultramafic massif with major magnesite veins. Legend. 1. ultramafite; 2. weathering crust; 3. Diabase-Chert Formation of Jurassic age; 4. Palaeozoic schist of the Velesh series; 5. neogene sediments; 6. alluvium; 7. magnesite vein; 8. magnesite vein with the "silica hat"; 9. fault.

Fig. 2. Geologic crosscut of the Golesh vein magnesite deposit.


Ariljaca
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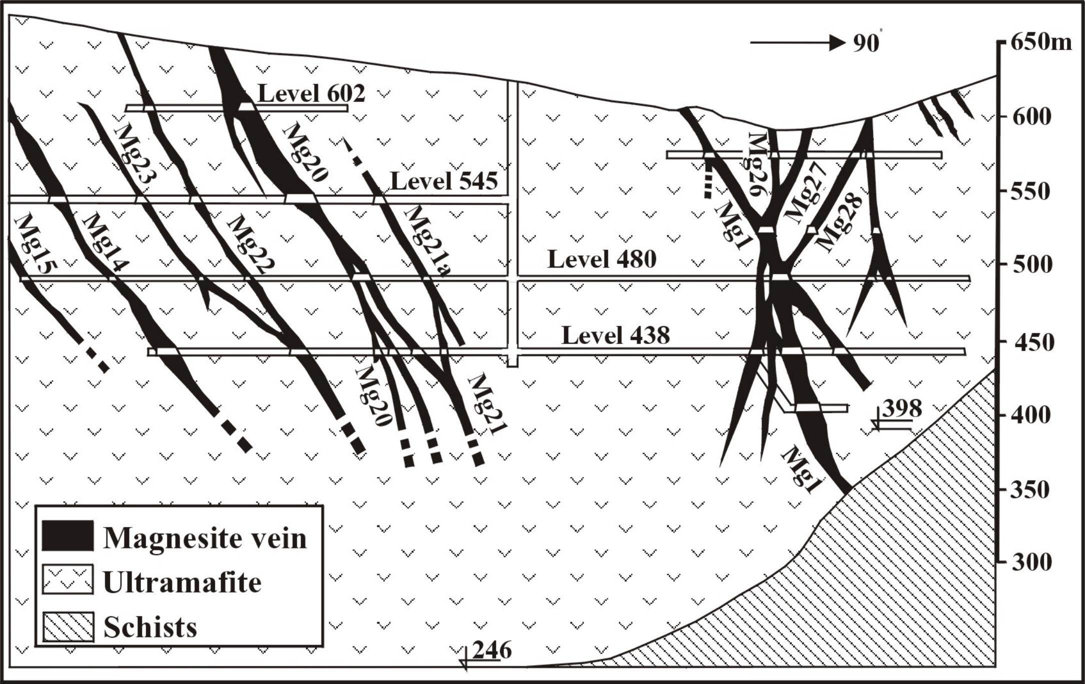

90°
650m
600
550
500
450
400
350
300
Level 602
Level 545
Level 480
Level 438
Mg23
Mg20
Mg22
Mg21a
Mg15
Mg14
Mg20
Mg21
Mg26
Mg1
Mg27
Mg28
Mg1
398
246
Magnesite vein
Ultramafite
Schists