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

M. ILICH and R. TOSHOVICH

Faculty of Mining and Geology, Belgrade, Djushina 7, Yugoslavia

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 km² (Fig. 1). The massif is mostly built up of fresh ultramafites: dominant harzburgite, Iherzolite, 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). According 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 concentration 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° dip towards E, and the second of approximate W-E strike and a dip of 40-50° towards N (Fig. 1).

The greatest 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 length 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 hundred 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 impurities 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, calcedony, 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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MgO</td>
<td>44,00-47,50%</td>
</tr>
</tbody>
</table>
CaO  0,20-1,50%
SiO₂  0,20-5,00%   \( R₂O₃ = Al₂O₃ + Fe₂O₃ + FeO \)
R₂O₃  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 exploration are the most important: great length (up to 1,200 m), great thickness (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 increased content of this microelement (\( \bar{\alpha} = 201 \) ppb) relating to its content in fresh harzburgite (\( \bar{\alpha} = 9 \) 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. CO₂ component probably originated by thermal decarboxylation 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 75-100\(^0\)C) and was enriched with CO₂ content (the gas was released during thermal decarboxylation of the organic matter that begins at about 75\(^0\)C), 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 increased geothermal gradient of that terrain; it could have
also emit ascending juvenile fluids. Increased Hg content in magnesite points to certain mixing of meteoric water and juvenile solutions; however, isotopic composition of the same mineral shows that juvenile solutions, in its formation, were not present in significant quantities.

During its ascending flow, already 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 \(-\text{Mg(HCO}_3\text{)}_2\), as well as calcium; together with a low quantity of soluble silica, they were transspoted 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 (\(\text{MgCO}_3\)).

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


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.