

## Listvenite from Serbia as Gemstone Resource

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Listvenite occurrences in Serbia are mostly related to Jurassic ophiolites of Vardar zone, but also to the Palaeozoic ophiolites in Eastern Serbia, as hostrocks which were altered by hydrothermal fluids genetically related to Late Oligocene-Early Miocene volcanic activity. In the last decades listvenite exploration was mainly focused on potential ore mineralisation, while minor attention was related to study the gemstone within listvenite. Therefore, this paper focuses on the study of mineralogical and petrologic characteristics of listvenite in terms of utilisation as a gemstone and, in addition, to estimate preliminary the overall potential of listvenite as a resource of gemstone and decorative stone.

Samples of listvenite were obtained from trenches and outcrops. Optical and scanning electron microscopy methods were used to study gemstone minerals, which were also subjected to trial lapidary processing.

In the Fruska gora listvenitized serpentinites the Kozje Brdo deposit and numerous smaller deposits and minor occurrences of silica gemstones were explored. Relatively small masses of Late Oligocene – Early Miocene volcanic rocks had enough heat source which enabled formation and circulation of hydrothermal fluids which altered serpentinite along the tectonised zones and led to formation of listvenite. The gem raw materials of the Fruska Gora mountain are represented by chalcedony and carbonate-silica breccia with agate. Magnesite is the oldest mineralisation phase of hydrothermal activity, highly tectonically shattered, and subsequently pervaded and cemented by dolomite, ankerite and calcite with admixed silica.

The Vuckovica deposit of carbonate-silica breccia and greyish-blue agate is located around 15 km southwest of Kragujevac in a small listvenite/serpentinite mass in tectonic contact with Cretaceous sediments. Numerous magnesite-dolomite-silica veins 0.1 - 3 m thick occur in this serpentinite, among which the most decorative is serpentinite breccia cemented by carbonate and silica minerals. In the veins magnesite is tectonically broken and subsequently cemented by dolomite and silica (opal-chalcedony) of green, greenish-dark or yellow colour.

The Sirca occurrence is located around 5 km ENE of the Kraljevo town. Gemstones occur within small lens of hydrothermally altered serpentinite, which is in tectonic contact with surrounding Early Cretaceous sandstone and marlstone. During Late Oligocene – Early Miocene volcanic activity, listvenite was formed and later on partly covered by labradorite andesite and pyroclastics of the third volcanic phase. Post volcanic hydrothermal fluids reacted with serpentine minerals forming carbonate-silica onyx, colourless chalcedony, opal, silicified magnesite and quartz crystals.

Palaeozoic listvenite in Eastern Serbia is hosted in structures within an obducted ophiolite sequence of mainly gabbroic rocks with associated serpentinite. Listvenite as gemstone resource was studied at the Antina cuka deposit, around 15 km SSW of the Kucevo town. The Antina cuka listvenite appears as small lenses formed at the contact of andesite and serpentinite. According to mineralogy and petrography, they are subdivided into serpentine-rich, silica-rich and silica-carbonate-rich varieties, all of which can be used as an attractive gemstone.

The potential of listvenite deposits and occurrences in Serbia as a resource of dimension stone is restricted due to the small volume of deposits. On the other hand, favourable aesthetic and polishing properties of the listvenite make them a very potential resource of gemstone and decorative stone.

Acknowledgments: This research was partly financed by the Ministry of Education and Science of the Republic of Serbia (Projects number 176006, 176016 and 176019).