

Abstract

The samples of garnets used in this study come from clastic sediments from the drillcores Tř-1 and T-31, selected localities of the České středohoří Mountains and garnet-bearing ultramafic rocks sampled by the drillcore T-7. The contents of the major and some minor elements were determined by an electron probe microanalyzer. The garnets from the sediments were divided into 3 groups according to the contents of the end-members: 1) pyrope-, 2) almandine – pyrope- and 3) grossular – almandine-rich. Garnets from the drillcore T-7 were classified according to individual rock types in which they occurred: lherzolite, hazburgite, pyroxenite, eclogite and granulite. Chemical analyzes of garnets displayed the presence of positive correlations Cr vs. Ca vs. Ti Mn in pyrope grains.

The contents of trace elements in garnets were studied by an LA-ICP-MS. After normalization to the CI-reservoir, garnets most often show lherzolite profiles of rare earth elements. Garnets of intense red and purple colors show slightly sinusoidal REE profiles.

Inclusions enclosed in garnets were studied by a scanning electron microscope. If their dimensions allowed, the major and minor elements were determined by electron microanalysis for inclusions. Inclusions of amphiboles in association with spinel group minerals, carbonates and apatites were found in lherzolite and pyrope-rich garnets. Inclusions of quartz, rutile, zircon, sulphides and apatite are most common in almandine – pyrope-rich garnets, sometimes associated with by mica. Inclusions of quartz with feldspar and apatite occur in grossular – almandine-rich garnets.

Garnets and inclusions were also studied by Raman spectroscopy. The garnets show spectral band shifts from data reported in the literature for pure end-members. Raman spectra of minerals in inclusions confirmed their identification based on EPMA data. The photoluminescence spectra of the garnets were measured with a Raman spectrometer. Garnets with chromium contents below 1.3 wt. % do not show photoluminescence. With increasing Cr content, the intensity of photoluminescence increases until it completely dominates in the Raman spectra.

The data were used to determine the provenance of the garnets. The classification schemes used to determine the source material in diamond prospecting as well as graphs for garnets of metamorphic origin were used. Most of the garnets from Tř-1 come from granulite and lherzolite, only a few grains were classified as eclogite. The drillcore T-31 provided samples corresponding to lherzolites and granulites. In the drillcore T-7, rock types were known in advance and the composition of the garnets could be used to test established classification schemes.

Key words: garnets, almandine, pyrope, inclusion, provenance, České středohoří Mountains, electron probe microanalysis, Raman spectroscopy, LA-ICP-MS, lherzolite, eclogite, granulite.