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Raman spectra of reduced carbonaceous matter as a tool for provenancing marbles: examples of graphite marbles from Czech localities

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Raman microspectrometry is a useful method for the estimation of the structural order and the presence of structural defects in carbonaceous matter. The modifications of Raman characteristics of the carbonaceous matter are strongly connected to the intensity of metamorphism, the mode of occurrence of the organic matter (accumulated versus disseminated) and the orientation of laser beam to the polished section (in relationship with the foliation).

Former provenance studies focused mainly on the pure white calcite marbles. Based on those results the combination of geochemical methods (stable isotopes, trace elements study, etc.) with quantitative petrography (image analysis, grain size etc.) is the most effective way for the marble sourcing. However the Czech Republic is rich in numerous varieties of inpure crystalline marbles (calcitic or dolomitic) which include common admixtures of non-carbonate minerals (silicates) and/or organic matter transformed due to various degree of metamorphism. Geochemical methods are questionably applicable due to various results for this types of marbles. As it turns out, unconventional methods making use of different characteristics of crystalline marbles e.g. Raman microspectroscopy, magnetic susceptibility etc. are more useful.

This pilot study tries to distinguish types of so called “graphite marbles” according to the Raman spectra of the carbonaceous matter disseminated in these rocks. Graphite marbles involved with different metamorphic condition (regional metamorphism = low-grade greenschist or amphibolite metamorphic facies and contact metamorphism = carbonates and granite plutons contact), with different geological age and with distinct mode of occurrence were chosen from the Czech localities. Three general types

of Raman spectra confirm differences between well-ordered carbonaceous matter including graphite of higher-grade metamorphosed marbles (2 types) and rather amorphous organic compounds of low-grade metamorphosed marbles (1 type).