ABSTRACT

This PhD thesis is focused on methodology for the provenance determination of marbles from historic quarries and marble artefacts, respectively. Various petrographic, geochemical, and physical data were compiled to distinguish among different marble types, as well as to explore the suitability and limits of experimental techniques for such provenance studies. Moreover, by comparing the data obtained with the results from the artefacts the importance of the selected methodology was tested in detail.

The correct determination of the source locality for marbles represents a difficult task, due mainly to both the variable characteristics of marbles coming from any one locality; and the converse, the similarity in properties between samples from different areas. Facing this complex situation, a multivariate approach proved to be necessary. Most of the previous analytical studies on marble provenance have been conducted on pure white marbles from the Mediterranean area where the methodology, based upon a combination of various mineralogical-petrographic and chemical criteria, was originally established. However, the Czech Republic is also rich in 'impure' crystalline limestones containing common noncarbonate admixtures (*e.g.* silicates, magnetic minerals, and carbonaceous matter) which led to the introduction of some techniques that had never before been used for marble provenance studies (*i.e.* Raman microspectrometry and bulk magnetic susceptibility).

In this research work, mineralogical, petrographic, geochemical, and physical methods have been tested on 84 marble types from 29 historic quarries and 3 historical artefacts in order to assess provenance determinations of marbles. Mineralogical-petrographic patterns obtained by a combination of optical and electron microscopy, petrographic image analysis, and the cathodoluminescence of microfacies proved to be of the greatest importance. The digitalized data obtained, allowed both a qualitative as well as quantitative overview and the distinction of essential petrographic parameters, which were correlated with other analytical techniques. X-ray diffraction of the insoluble residuals has had its importance questioned, due to the high material consumption needed, and variable mineral content of different types of marbles within any one locality. In spite of the frequent overlap of stable isotopic-fields, $\delta_{13}C$ and $\delta_{18}O$ proved to be helpful (especially in combination with petrographic data). A greater attentiveness needs to be paid to any discrepancy between the values of the carbonate groundmass and the secondary veins or silicate-rich portions. Raman microspectrometry of the carbonaceous matter proved very useful for fingerprinting impure marbles, which include organic matter transformed due to various degrees of metamorphism. As the graphitic substances represent a common minor admixture in various marbles, Raman spectra exhibit the important output for distinguishing among marble types. The bulk magnetic susceptibility of the whole rock confirmed its importance, in those cases where accessory minerals with different magnetic characteristics are v

present. Analogous to stable isotopes, various kappa data from a single sample can complicate the determination of an artefact's origin.

The large database acquired has implications for further investigation in geoscience, as well as for its utilisation in practice in the architectural, archaeological, and historical fields.