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Methods for tracing the origin of white marbles used in antiquity

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The topic of this paper is to given an overview of the methods to pinpoint the origin of white marbles and to discuss the progress made in this field during the last years. To pinpoint the place of origin of the marble to an area or even to a special quarry may be of appreciable importance in investigating ancient trading routes and trade relations. A material-specific classification can be conducive to understand if the workshops of an area used marbles of acceptable quality from a local quarry or quarrying areas or if they used imported marbles in or without combination with local ones. Furthermore during restoration activities the knowledge of the origin of the marbles used in architecture may be of importance for supplying more or less original types of marbles. It may also be of interest for evaluating the authenticity of artifact information on the provenance of the used material.

The first attempt to discriminate between different marbles used petrographic methods followed by instrumental chemical analyses, especially the analysis of trace elements. In the last decades multi-element neutron activation analysis (NAA) of various trace elements was attempted to pinpoint the origins of marbles. A few decades ago stable isotope analysis seemed to be the solution of this problem and became the standard methods for investigation the origin of white marbles. However, with the rapidly increasing number of historical marble quarrying sites and with the increasing number of analyzed samples in general, the compositional fields in the isotope diagram became larger and many classical marbles show large ranges of overlap. Therefore special attention is drawn to a new method to characterize the chemical properties of microinclusiones of the marbles additional to the conventionally used methods to ascribe their origin to a special quarry or at least to a defined geological formation of a given area. Several case studies will be presented:

Different types of marbles were mined in the area of Ephesus, the ancient capital of Roman Asia Minor, and were of appreciable importance for the whole province (e.g. for the city of Pergamon). More than 300 quarry samples from ancient quarries in the area were analyzed to establish a database. Examples from the Achaean and the Late Hellenistic Artemison, and further Ephesian Architecture will be presented.

Further case studies concern architectural marbles used in the Balkans from Hellenistic to Byzantine times. Architecture from the Episcopal centre of Stobi and a series of sculptures found in Macedonia were investigated.

The application of the above-explained combination of methods for the determination of the provenance of marbles finally will be demonstrated by examples of sculptures of white marbles like the Pergamene Dedication (Capitoline and Ludovisi Gauls etc.) and elaborate Roman sarcophagi.