



## **A multivariate statistical discrimination scheme of garnet chemistry for use in sedimentary provenance analysis**

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Sediment provenance analysis and fingerprinting relies on the discrimination of detrital material derived from different sources. Among several bulk-sediment and single-grain techniques to discriminate sediment provenance, garnet geochemistry has been widely used because garnet (i) is among the most frequent heavy minerals in clastic sediment and (ii) has a particular wide compositional range as solid solution between several petrogenetically distinct endmembers. We present a new step-wise multivariate statistical scheme for discriminating the composition of detrital garnet derived from ultramafic, magmatic, and metamorphic rocks (amphibolite, eclogite, and granulite facies rocks). Especially the latter exhibit more or less strong overlap in the classical garnet discrimination diagrams. These discrimination schemes are typically based on graphic representations in ternary diagrams using three or four of the major garnet endmembers and strict boundaries between garnets from different source rock types. In contrast, our approach applies linear discriminant analysis (LDA) using all relevant variables at each discrimination step. The new approach is further characterized by (i) a large data base covering most of the relevant garnet-bearing rocks, (ii) robust multivariate statistics considering the compositional nature of garnet geochemistry, and (iii) output data in the form of probabilities of belonging to a specific type of source rock instead of strict boundaries suggesting clear “either-or” decisions. The new discrimination approach will be tested using literature data from different source-rock types and will be applied to selected case studies in sedimentary provenance analysis.