USE OF MULTIVARIATE STATISTICAL METHODS IN INTERPRETING GRANITIC PLUTONS

John C. Davis1 And Hans-Jürgen Förster21Kansas Geological Survey, Lawrence, KS, USA 2GeoForschungsZentrum, Potsdam, Germany

Multivariate statistical procedures can be used to interpret genetic relationships among granite plutons characterized by geochemical composition. Most effective geochemical variables for characterizing Late Variscan granitic rocks from the Erzgebirge metallogenic province of Germany were found by combining forward-addition and backward-elimination ANOVAs with stepwise MANOVA. Selected variables were used in canonical classification to confirm a 5-group petrographic classification of these granites based on major (i.e., type) plutons. In a more detailed analysis, the same variables were used to classify both granite and rhyolite specimens of unknown affinity and to subdivide the group of low-F biotite granites into distinct plutons. Tungsten mineralization in low-F biotite granites was confirmed to be affiliated with a geochemically distinct granite body encountered at depth by drilling and not with the granitic pluton exposed at the surface. Most Erzgebirge leucogranites classified as high-F, high-P2O5 granites are altered to a degree which can be subjectively assessed from petrology, appearance, and abnormal enrichment or depletion of easily mobilized elements. ANOVAs using degree of alteration as nominal classes confirm that heaviest rare earth elements (Er, Tm, Yb, Lu) are least mobile and can be used to identify relatively unaltered specimens from which baseline concentrations of more mobile elements can be estimated. Degree of enrichment or depletion of mobile elements in other specimens can be estimated quantitatively by departure from these baselines. Statistical techniques allow genetic relationships and history of plutons in the Erzgebirge to be deduced, and are adaptable for use elsewhere if high-quality geochemical data are available.