ASSESSMENT OF GEOCHEMICAL, SAMPLING AND ANALYTICAL VARIABILITIES IN ENVIRONMENTAL SURVEYS

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Environmental surveys are in many cases carried out toward the detection of spatial and/or temporal variations of geochemical parameters measured in samples of naturally occurring materials. Total data variability of analytical results from these surveys is therefore made up of the variability of interest (geochemical or among-stations variability) plus sampling and analytical variabilities (procedural variability). Ideally, the geochemical variability should be the major component of total variability, otherwise significant geochemical information may be lost or disturbed by the procedural variability.Nested analysis of variance provides a means of assessing the statistical significance of sampling and analytical variabilities, both in relation to one another and also in relation to the geochemical variability. In its simplest and most practical format, the method is based on the collection of duplicate field samples in all or some of the sampling stations and on the subsequent duplicate analysis of the duplicate samples. From the data structure so generated, the relative proportion of each source of variability (among-stations, sampling and analytical) in the composition of the total data variability is also estimated. This latter feature is most desirable inasmuch as individually pre-defined precision levels for sampling and analytical procedures (say, 5% to 20% for each) may or may not be adequate, depending in each survey on the magnitude of the variability of interest in the target material.Results from the application of nested analysis of variance to soil and stream sediment geochemical data are discussed, supporting the successful applicability of this technique in routine environmental surveys.