Details of the GeoPT Proficiency Testing Scheme

Rationale: Proficiency testing is one of the most effective ways for a laboratory to monitor its performance against its own expectations, an external criterion and the standards of performance set by other laboratories participating in the test. Proficiency testing represents, therefore, an 'external' form of quality control which helps to highlight not only reliable determinations made by a laboratory, but also measurements that may be subject to unsuspected bias.

Procedure: The test involves distributing a sample of established homogeneity to participating laboratories. These laboratories are required to analyse the sample using established techniques following their routine procedures and analytical conditions. The results must be returned to the organisers by the deadline which must be adhered to strictly. Late results cannot be entered into the analysis of the test. Contributed data are then compared with assigned values and a 'z-score' calculated for each analytical result submitted by each laboratory. An evaluation of individual 'z-scores' allows each contributing laboratory to assess their analytical results in comparison with the specified standard of performance and to investigate discrepancies, if appropriate.

Aim: The overall aim is to allow participating laboratories to decide whether their analytical performance matches their expectations and to correct their procedures if they judge this to be necessary.

Protocol: Part of the protocol for conducting a Proficiency Test is that results should be compared with a specific standard of performance which is related to the use that will be made of the analytical results. Participating laboratories can then judge whether they are providing data that match their chosen 'fitness-for-purpose' criterion. It will also then be possible to quantify the overall improvement in the performance of laboratories when comparing results from this with subsequent Proficiency Tests. However, although users usually have expectations concerning data quality, there is no internationally accepted standard of performance. Accordingly, the Steering Committee will adopt the same standards of data quality used in previous rounds. Participating laboratories are, therefore, requested to select the appropriate standard for data quality as either (i) *'Pure Geochemistry' (Data Quality 1),* where analytical results are designed for geochemical research and where care is taken to provide data of high accuracy, sometimes at the expense of reduced sample throughput rates, or (ii) *'Applied Geochemistry' (Data Quality 2)* where, although accuracy is still important, the main objective is to provide results on large numbers of samples collected as part of geochemical mapping projects or geochemical exploration programmes. Contributing laboratories are asked to indicate on the Results Report Sheet in which category they would like their data evaluated. The standards of performance will be calculated using a modified form of the Horwitz function whereby the acceptable standard deviation (H_a) is related to the assigned analyte concentration (X_a) by the expression $H_a = kX_a^{0.8495}$ where $k = 0.01$ (pure geochemistry) or 0.02 (applied geochemistry). Examples of the relative standard deviations calculated using this function are as follows:

Concentration	Data quality 1 RSD %	Data quality 2 RSD %
100% m/m	1.0	2.0
10% m/m	1.4	2.8
1% m/m	2.0	4.0
1000 μg g^{-1}	2.8	5.7
100 μg g^{-1}	4.0	8.0
10 μg g^{-1}	5.7	11.3
1 μg g^{-1}	8.0	16.0
0.1 μg g^{-1}	11.3	22.6

Z-scores will be calculated as $(X - X_a) / H_a$, where X is the analysed result from a laboratory, X_a is the assigned value and H_a is calculated according to the above expression. Z-scores falling between ± 2 will be classified as 'satisfactory'; z-scores falling outside ± 2 may indicate that 'remedial action is recommended'. Further details of procedures and data analysis can be found in reports of previous rounds published in Geostandards Newsletter: The Journal of Geostandards and Geoanalysis and in 'Protocol for the operation of the GeoPT proficiency testing scheme', published by the International Organisation for Standardisation and available on **www.geoanalyst.org**.