GeoPT24 – AN INTERNATIONAL PROFICIENCY TEST FOR ANALYTICAL GEOCHEMISTRY LABORATORIES – REPORT ON ROUND 24 (Longmyndian greywacke, OU-10) / Jan 2009

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Abstract

Results are presented for GeoPT24, round twenty-four of the International Association of Geoanalysts' Proficiency Testing programme for analytical geochemistry laboratories. The sample distributed for this round was OU-10, a Longmyndian greywacke from Bayston Hill quarry, Shrewsbury, Shropshire, England, and prepared at the Open University. In this report, contributed data are listed, together with an assessment of consensus values, z-scores and charts showing both the distribution of contributed results and the overall performance of participating laboratories.

Introduction

This twenty-fourth round of the international proficiency testing programme, GeoPT, was conducted in a similar manner to earlier rounds. The programme is designed to be part of the routine quality assurance scheme of analytical geochemistry laboratories and the aims of the programme can be reviewed at http://www.geoanalyst.org/geopt.html. The programme is organised by the International Association of Geoanalysts and is conducted in accordance with a published protocol (http://www.geoanalyst.org/GeoPt-protocol.pdf). The overall aim of the programme is to provide participating laboratories with z-score information for each reported elemental determination, from which the laboratories can decide whether the quality of their data is satisfactory in relation to both their chosen fitness-for-purpose criterion and results submitted by all the other laboratories contributing to the round and, therefore, choose to take corrective action if this appears justified.

Steering Committee for Round 24: M. Thompson (Statistician), P.C. Webb (Results coordinator), P.J. Potts and J.S. Watson.

Sample GeoPT24: OU-10, Longmyndian greywacke, was prepared and packeted at the Open University. The test material was analysed by WDXRF at the Open University for a range of major and trace elements and the data tested for consequential degree of homogeneity according to the Fearn test. In none of the cases for which valid data were obtained was any significant lack of homogeneity found, therefore the sample was considered suitable for use in the GeoPT proficiency testing programme.

Timetable for Round 24:

Distribution of sample: September 2008.

Deadline for submission of analytical results: 12th December 2008.

Distribution of draft report: February 2009

Submission of results

Results were submitted by 76 laboratories and are listed in Table 1. All of these data were used for the assessment of assigned values. Data are also listed for one laboratory (Y77) that submitted results too late for inclusion in the results.

Assigned values

Following procedures described in earlier rounds, a robust statistical procedure was used to derive assigned concentration values [X_a], these being judged to be the best estimates of the true composition of this sample. Data in Table 2 lists assigned and provisional values for 11 major components and assigned and provisional values for 39 trace elements. Values were assigned on the basis that: (i) sufficient laboratories had contributed data for an element, (ii) the statistical assessment gave confidence that the results showed a central portion approximating to a normal distribution. Part of this assessment involved examining a bar chart for each element to judge the distribution of results.

Bar charts for 50 elements/components that were judged to have satisfactory distributions for assigned or provisional values to be given, as listed in Table 2, are shown in Figure 1, namely: SiO_2, TiO_2, Al_2O_3, Fe_2O_3T, MnO, MgO, CaO, Na_2O, K_2O, P_2O_5, LOI, Ba, Be, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Eu, Ga, Gd, Hf, Ho, La, Li, Lu, Mo, Nb, Nd, Ni, Pb, Pr, Rb, Sc, Sm, Sr, Ta, Tb, Th, Tl, Tm, U, V, Y, Yb, Zn, and Zr. Of these, only provisional values could be given to the elements/components: LOI, Be, Cd, Ce, Li, Mo, Ni, Sb, Sm and Tl.

Bar charts for the 12 elements/components, Fe(II)O, CO_2, H_2O^+, As, Bi, Cl, F, Ge, S, Sb, Sn, and W are plotted in Figure 2 for information only, where the data were not amenable to a reliable determination of the consensus.

Z-score analysis

As in previous rounds, laboratories were invited to choose one of two performance standards against which their analytical results would be judged:

Data quality 1 for laboratories working to a 'pure geochemistry' standard of performance, where analytical results are designed for geochemical research and where care is taken to provide data of high precision and accuracy, sometimes at the expense of a reduced sample throughput rate. 1273 results of data quality 1 were submitted.

Data quality 2 for laboratories working to an 'applied geochemistry' standard of performance, where, although precision and accuracy are still important, the main objective is to provide results on large numbers of samples collected, for example, as part of geochemical mapping projects or geochemical exploration programmes. 1389 results of data quality 2 were submitted.

The target standard deviation (H_a) for each element assessed was calculated from a modified form of the Horwitz function as follows:

$$H_a = k.X_a^{0.8495}$$

Where X_a is the concentration of the element expressed as a *fraction*, and the factor $k = 0.01$ for pure geochemistry labs and $k=0.02$ for applied geochemistry labs.

Z-scores were calculated for each elemental result submitted by each laboratory from:

$$z = [X - X_a] / H_a$$

where: X is the contributed result, X_a is the assigned value and H_a is the target standard deviation.

Z-score results are listed in Table 3. Participating laboratories are invited to assess their performance using the following criterion:–

Z-score results in the range $-2<z<2$ are considered to be 'satisfactory' (in the sense that no action is called for by the participant). If the z-score for any element falls outside this range, it would be advisable for contributing laboratories to examine their procedures, and if necessary, to take action to ensure that determinations are not subject to unsuspected analytical bias.

Overall performance

A summary of the overall performance of individual laboratories in this round is plotted in Figure 4 as a multiple z-score chart. In this chart, the z-score performance for each element is distinguished by symbols that make it simple to identify whether the results were satisfactory or gave z-scores that exceeded the action limits. This chart is designed to help individual laboratories to judge their overall performance in this proficiency testing round.

Participation in future rounds

The benefit from proficiency testing arises from regular participation and laboratories are invited to contribute to the GeoPT25 round, the sample for which will be distributed during March 2008.

Appendix 1

Publication status of proficiency testing reports

GeoPT1
Thompson M., Potts P.J., Kane J.S. and Webb P.C. (1996) GeoPT1. International proficiency test for analytical geochemistry laboratories - Report on round 1. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis, 20, 295-325.

GeoPT2
Thompson M., Potts P.J., Kane J.S., Webb P.C. and Watson, J.S. (1998)
GeoPT2. International proficiency test for analytical geochemistry laboratories - Report on round 2. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis, 22 127-156.

GeoPT3
Thompson M., Potts P.J., Kane J.S. and Chappell B.W. (1999a) GeoPT3. International proficiency test for analytical geochemistry laboratories - Report on round 3. Geostandards Newsletter: The Journal of Geostandards and Geoanalysis, 23, 87-121.

GeoPT4
Thompson M., Potts P.J., Kane J.S., Webb P.C. and Watson J.S. (1999b)
GeoPT4. International proficiency test for analytical geochemistry laboratories - Report on round 4. Published in the electronic version of Geostandards Newsletter: The Journal of Geostandards and Geoanalysis (Summer 2000).

GeoPT5
Thompson M., Potts P.J., Kane J.S., and Wilson S. (1999c) GeoPT5. International proficiency test for analytical geochemistry laboratories - Report on round 5. Published in the electronic version of Geostandards Newsletter: The Journal of Geostandards and Geoanalysis (Summer 2000).

GeoPT6
Potts P.J., Thompson M., Kane J.S., Webb P.C. and Carignan J. (2000)
GEOPT6 - an international proficiency test for analytical geochemistry laboratories - report on round 6 (OU-3: Nanhoron microgranite) and 6A (CAL-S: CRPG limestone). International Association of Geoanalysts: Unpublished report.

GeoPT7
Potts P.J., Thompson M., Kane J.S., and Petrov L.L. (2000) GEOPT7 - an international proficiency test for analytical geochemistry laboratories - report on round 7 (GBPG-1 Garnet-biotite plagiogneiss). International Association of Geoanalysts: Unpublished report.

GeoPT8
Potts P.J., Thompson M., Kane J.S., Webb, P.C. and Watson J.S. (2000)
GEOPT8 - an international proficiency test for analytical geochemistry laboratories - report on round 8 / February 2001 (OU-4 Penmaenmawr microdiorite). International Association of Geoanalysts: Unpublished report.

Figure 1: GeoPT24 – Longmyndian greywacke, GM-10. Data distribution plots for the metals (cont.)

GeoPT24 - Barchart for Eu
Baseline is median

GeoPT24 - Barchart for Ga
Baseline is median

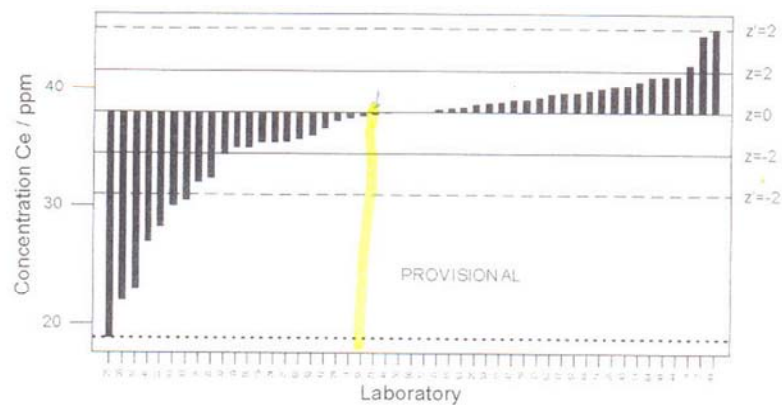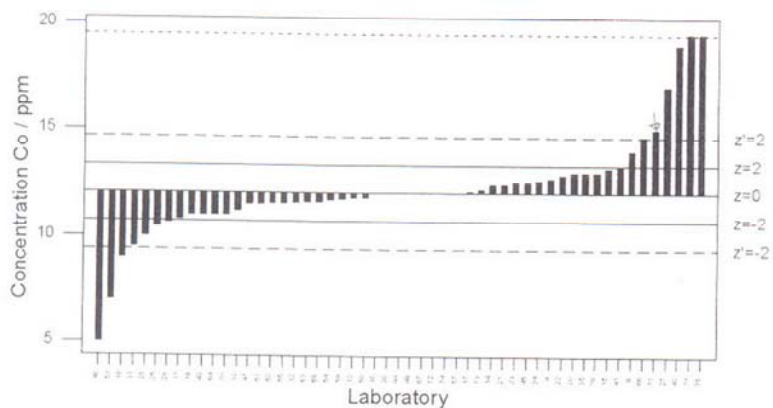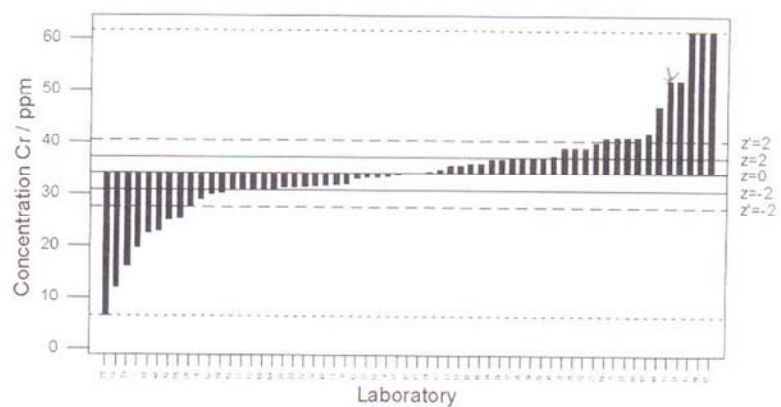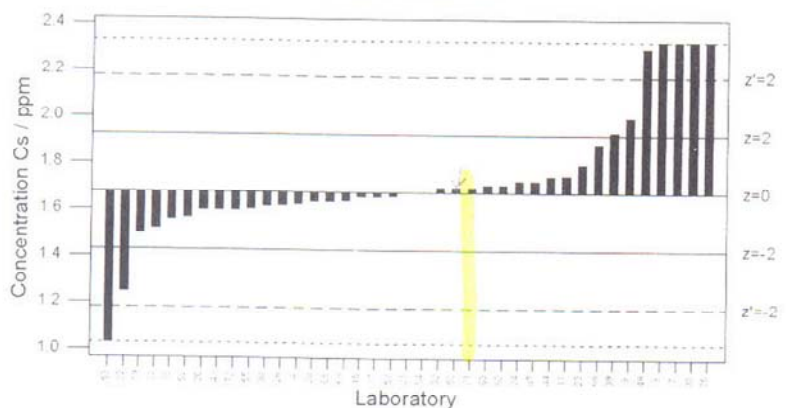GeoPT24 - Barchart for Gd
Baseline is robust mean

GeoPT24 - Barchart for Hf
Baseline is median

GeoPT24 - Barchart for Ho
Baseline is median

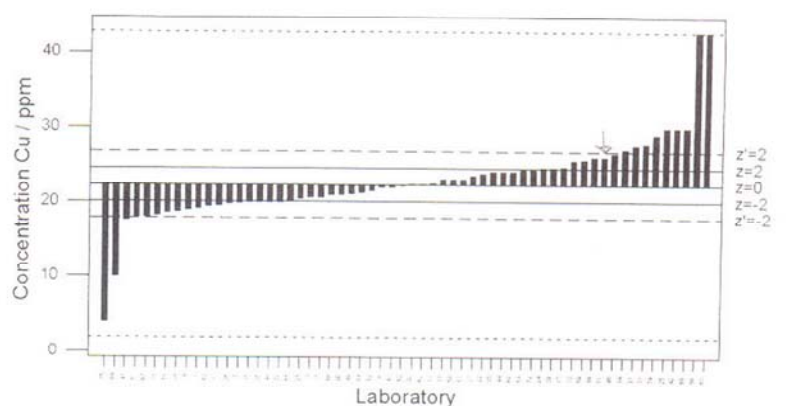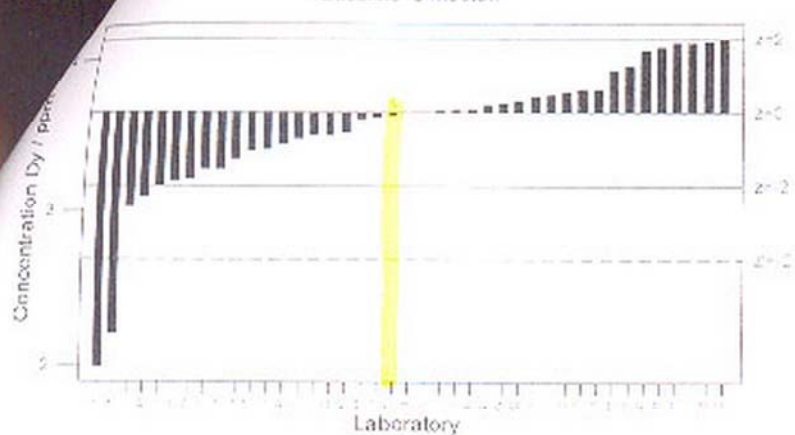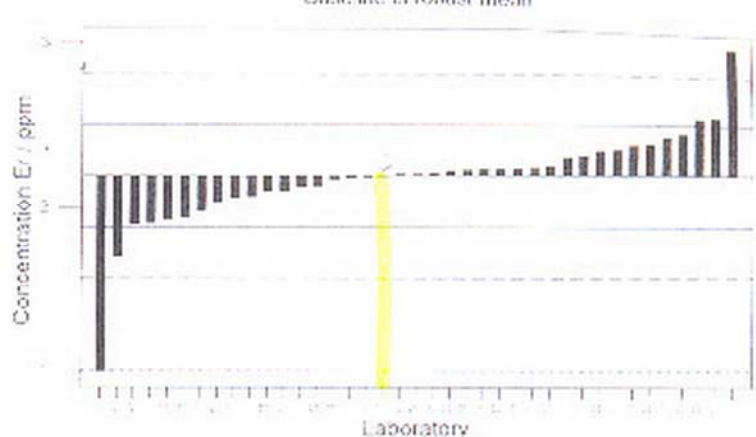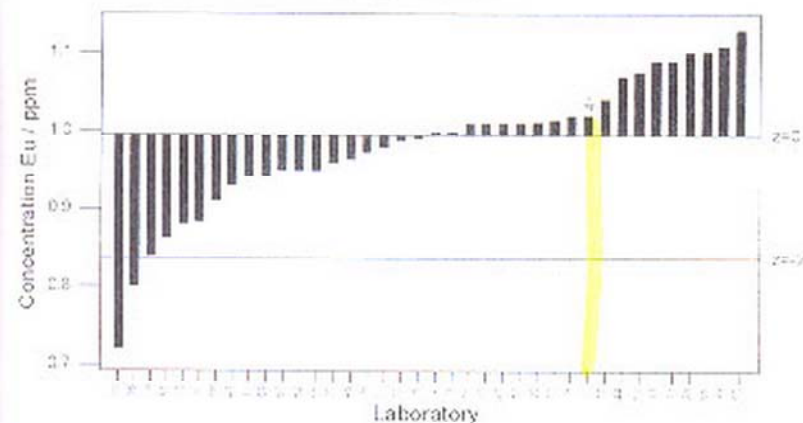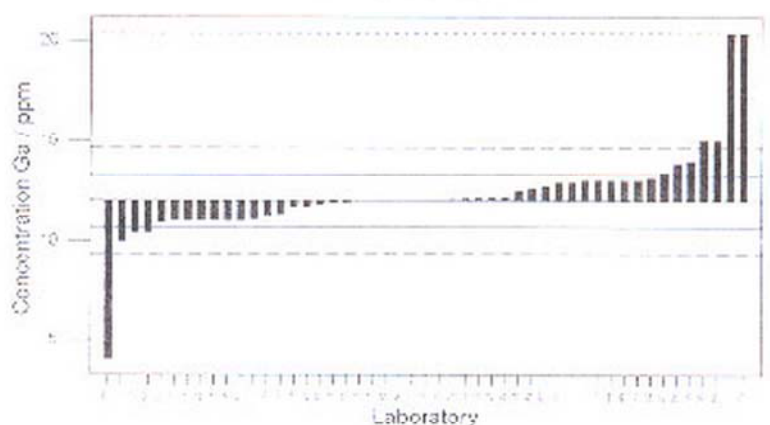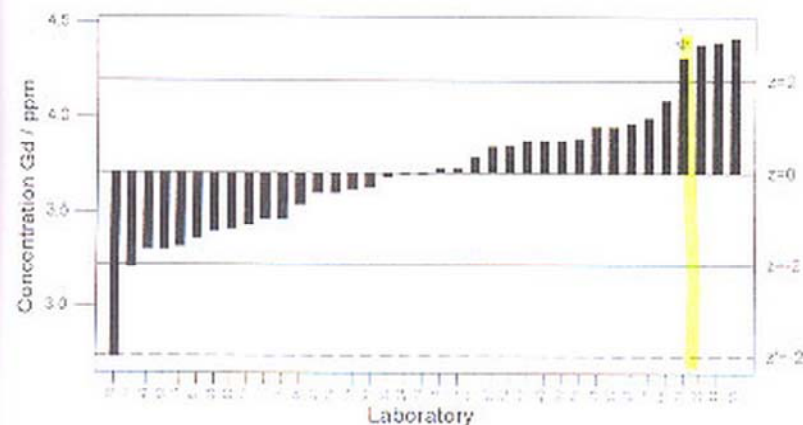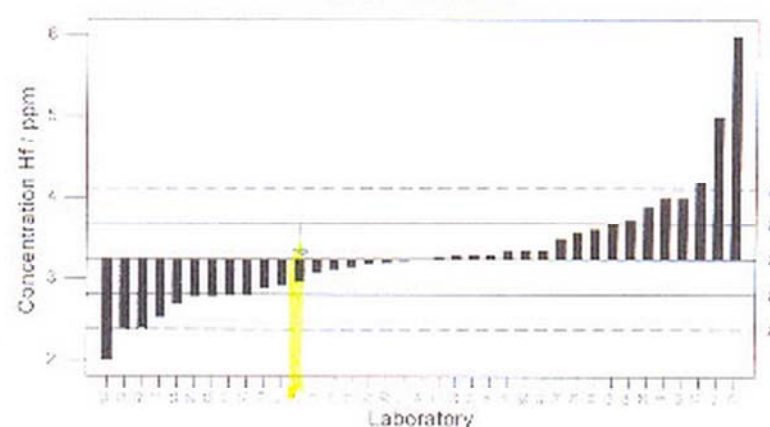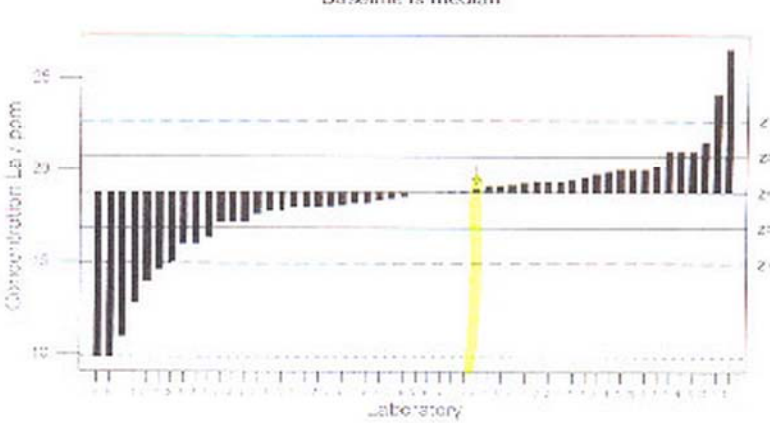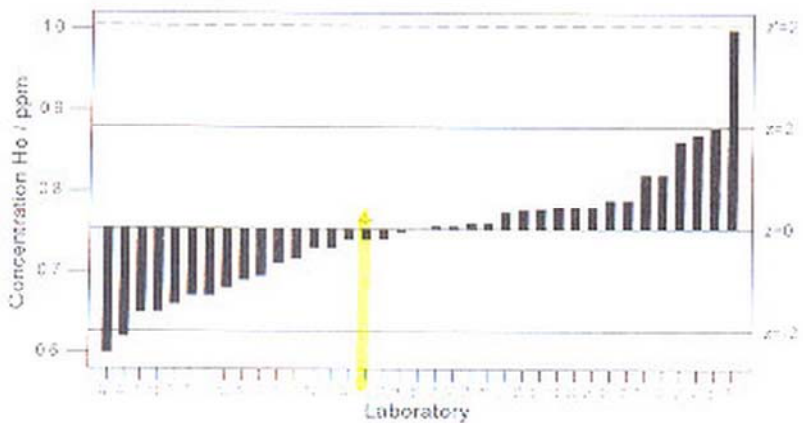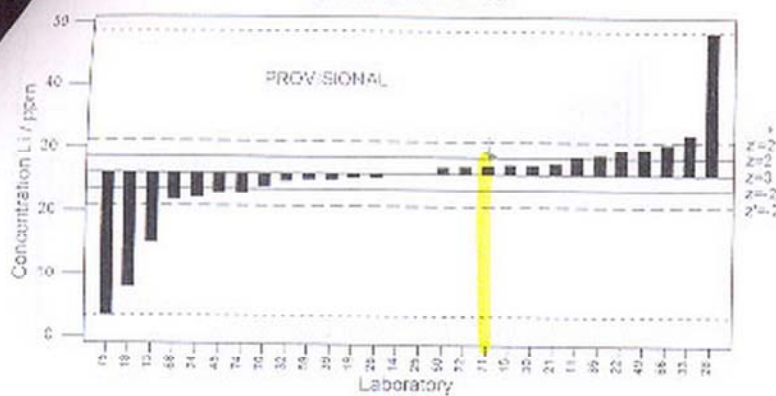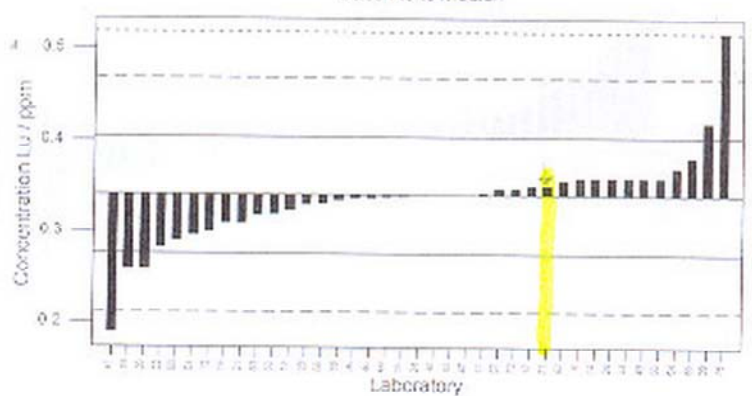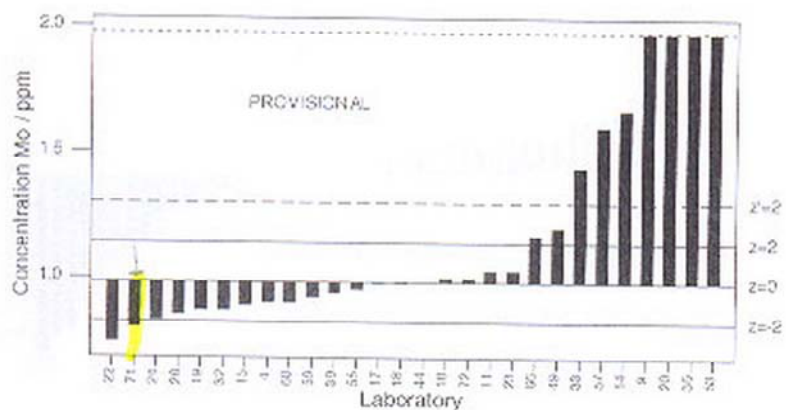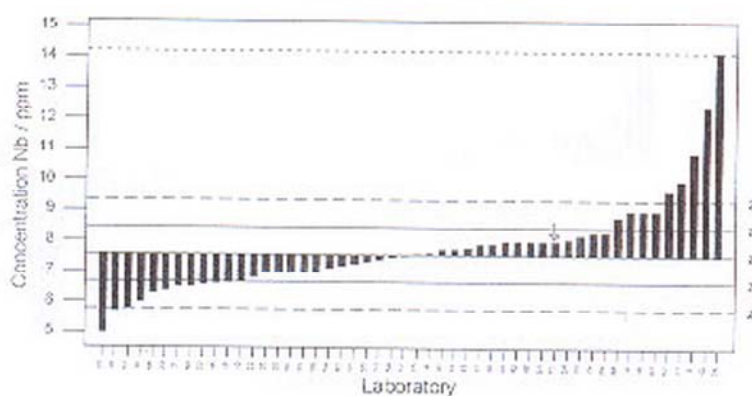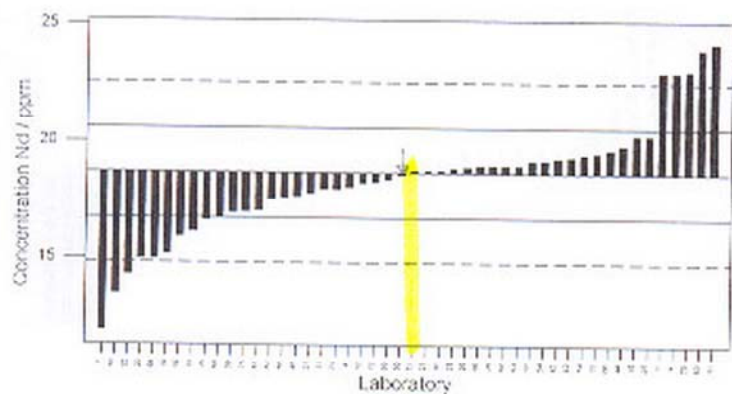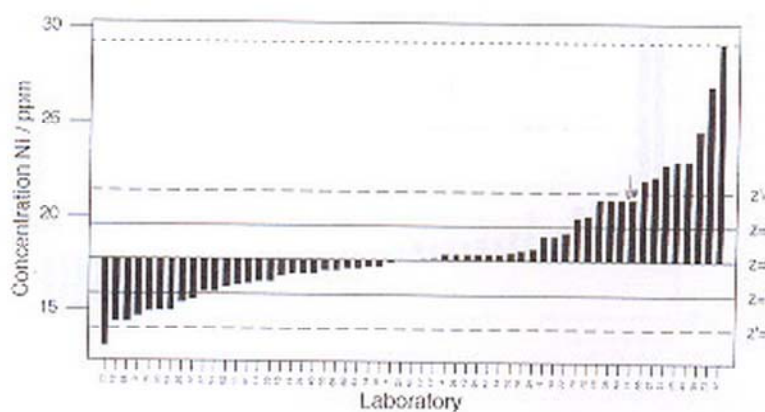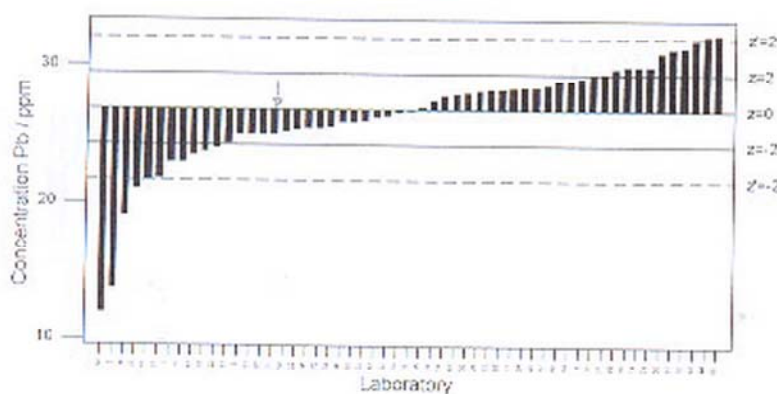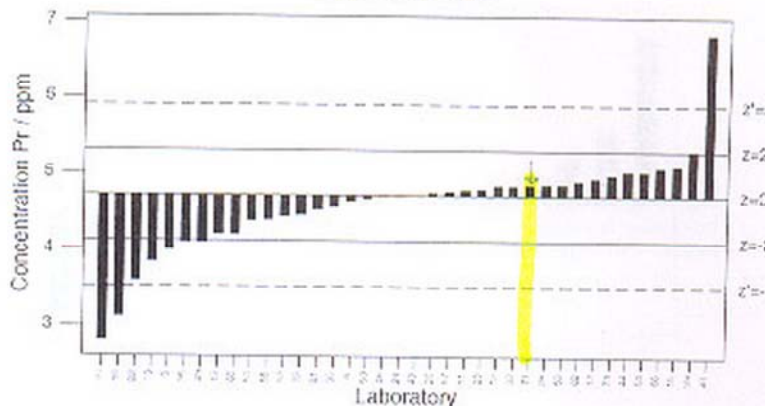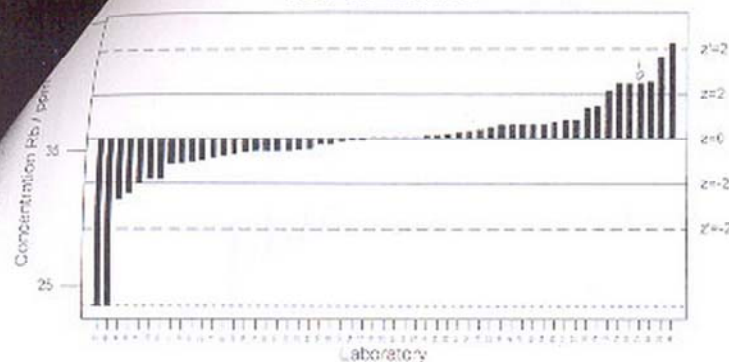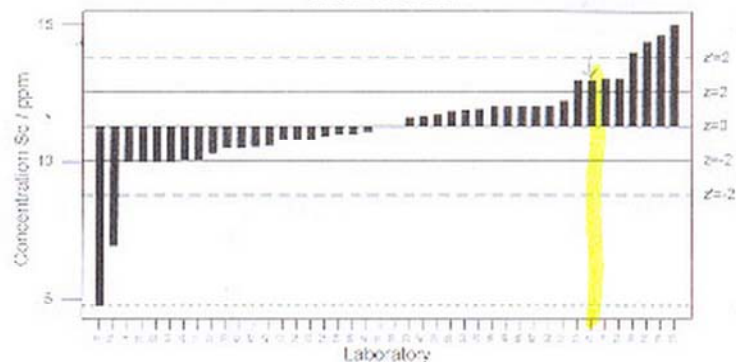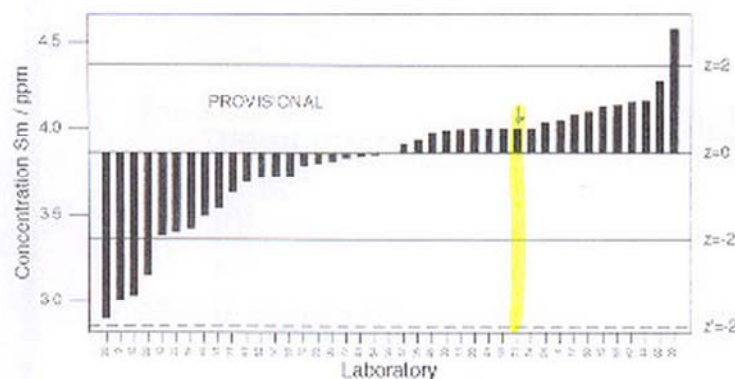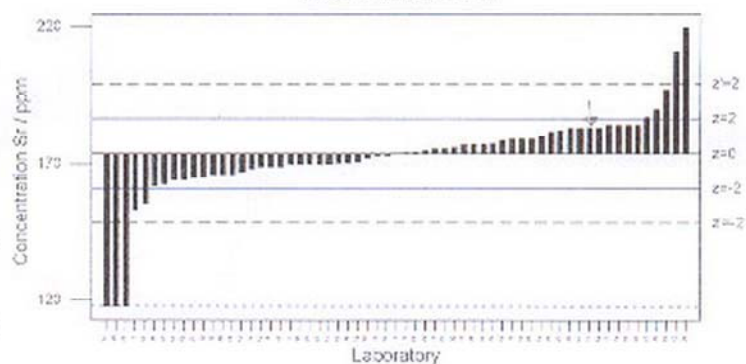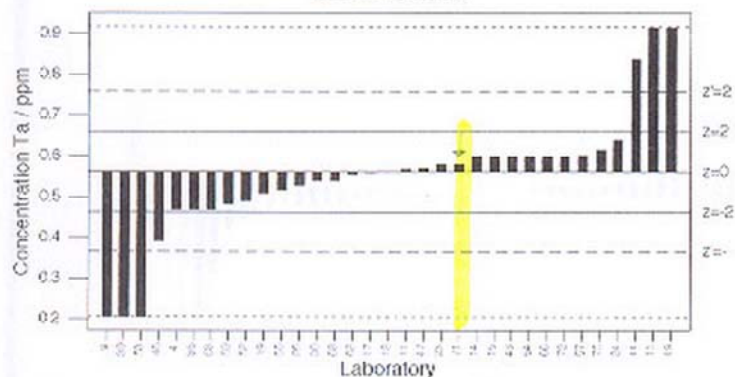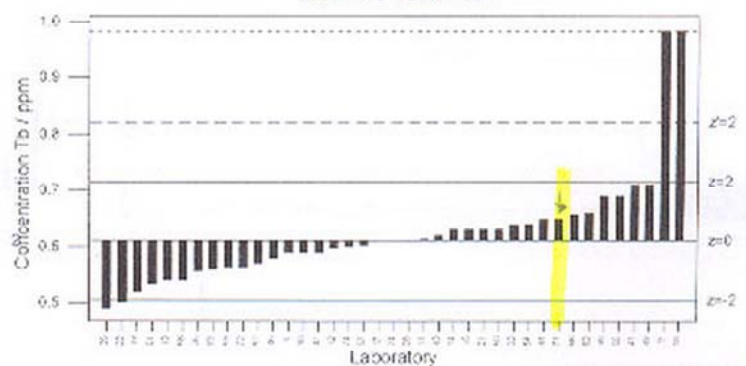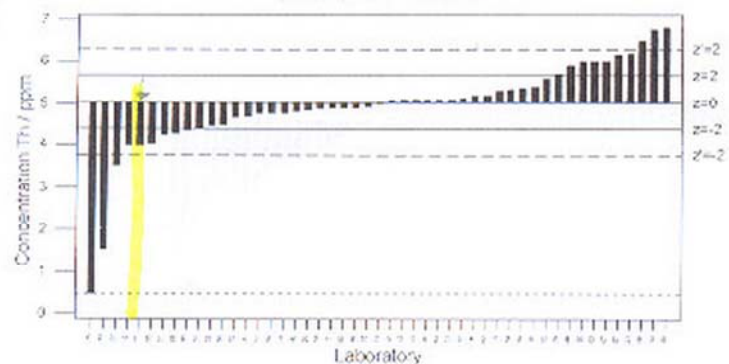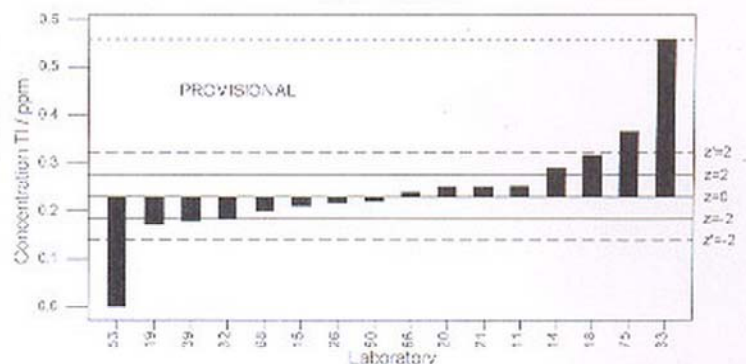GeoPT24 - Barchart for La
Baseline is median

Figure 1 (cont'd): GeoPT24 – Longmyndian greywacke, OU-18. Data distribution charts for Li, Lu, Mo, Nb, Nd, Ni, Pb and Pr.

GeoPT24 - Barchart for Rb
Baseline is robust mean

GeoPT24 - Barchart for Sc
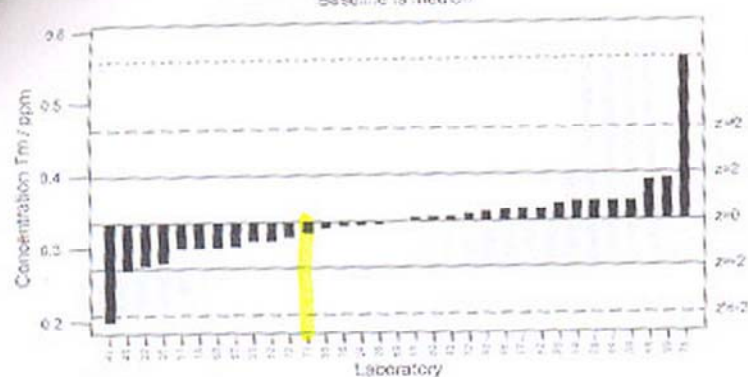Baseline is median

GeoPT24 - Barchart for Sm
Baseline is median

GeoPT24 - Barchart for Sr
Baseline is robust mean

GeoPT24 - Barchart for Ta
Baseline is median

GeoPT 24 - Barchart for Tb
Baseline is robust mean

GeoPT 24 - Barchart for Th
Baseline is robust mean

GeoPT 24 - Barchart for Tl
Baseline is median

Figure 1 (cont'd): GeoPT24 – Longmyndian greywacke, OU-10. Data distribution charts for elements for which values were assigned or provisional values given for guidance. Horizontal lines show the limits for -2<z<2 for pure geochemistry labs (solid lines) and
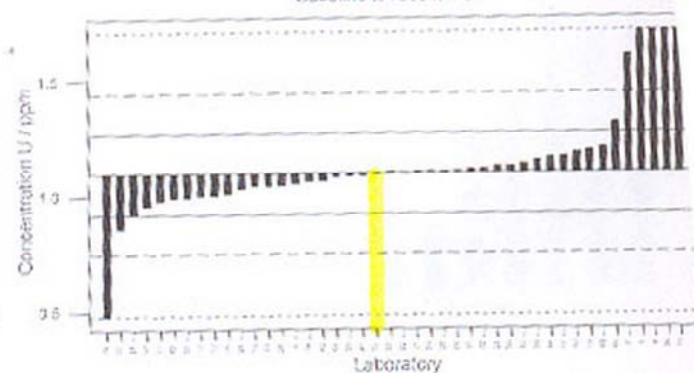
GeoPT 24 - Barchart for Tm
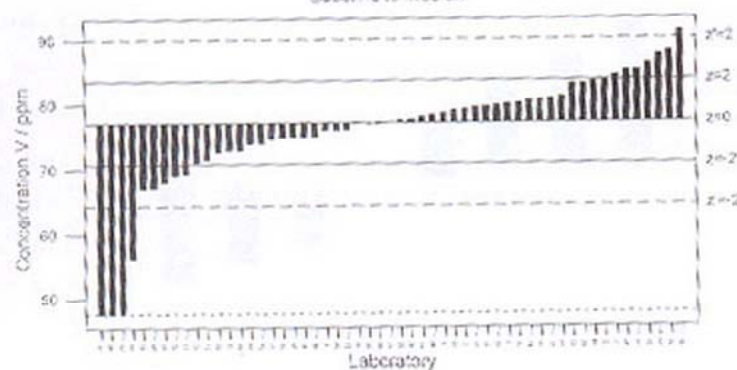Baseline is median

GeoPT 24 - Barchart for U
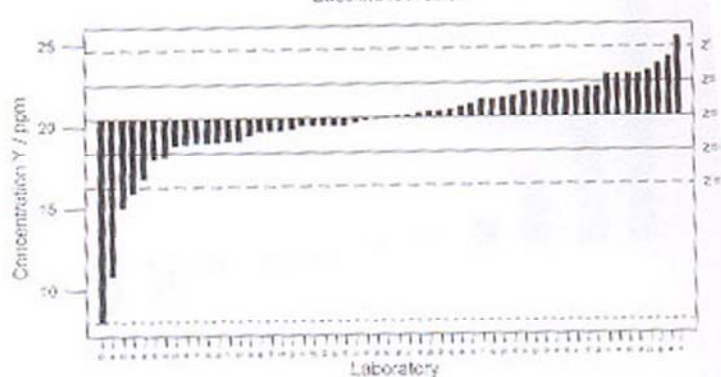Baseline is robust mean
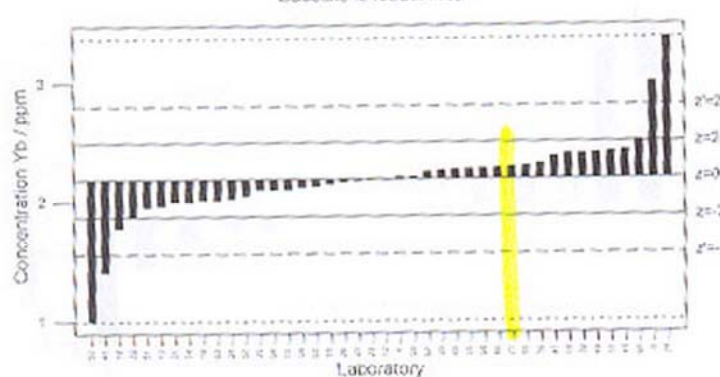

GeoPT 24 - Barchart for V
Baseline is median

GeoPT 24 - Barchart for Y
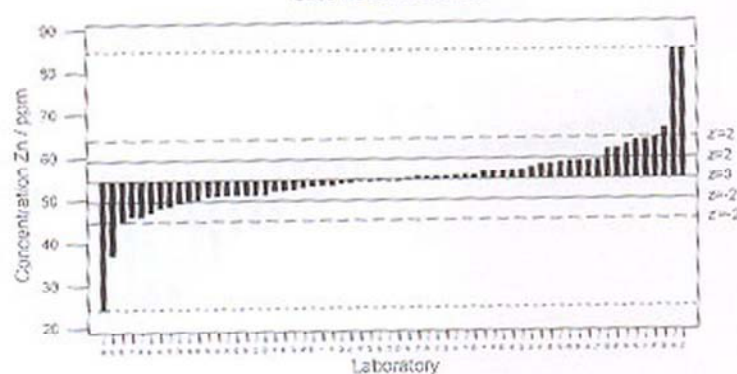Baseline is median

GeoPT 24 - Barchart for Yb
Baseline is robust mean

GeoPT 24 - Barchart for Zn
Baseline is robust mean

GeoPT 24 - Barchart for Zr
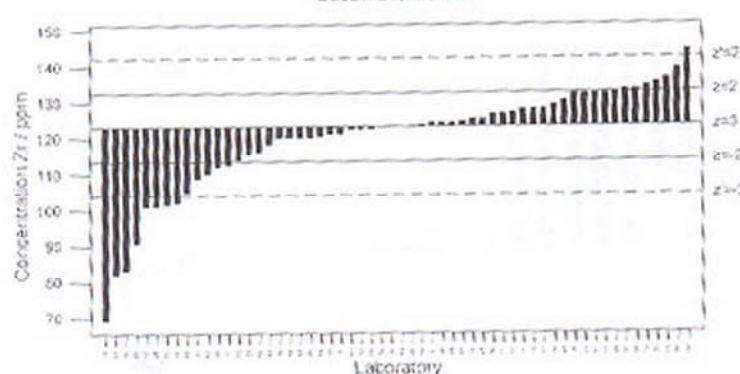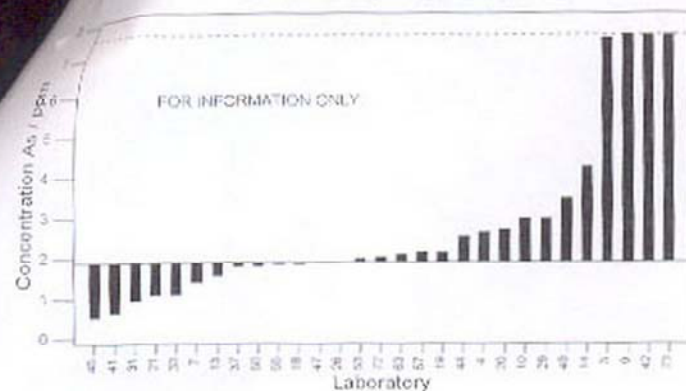Baseline is median

Figure 1 (cont'd): GeoPT24 – Longmyndian greywacke, OU-10. Data distribution charts for elements for which values were assigned or provisional values given for guidance. Horizontal lines show the limits for -2<z<2 for pure geochemistry labs (solid lines) and

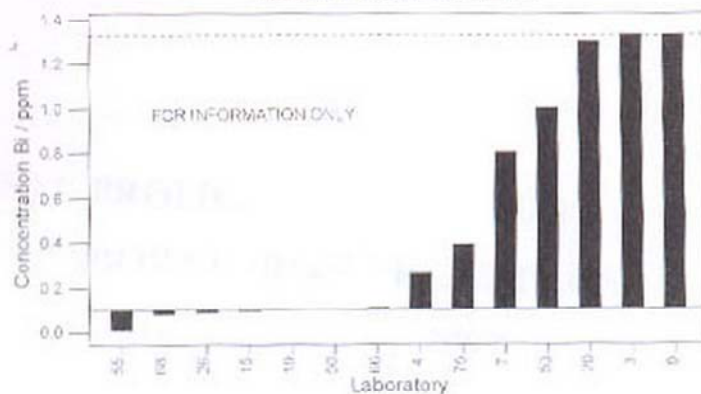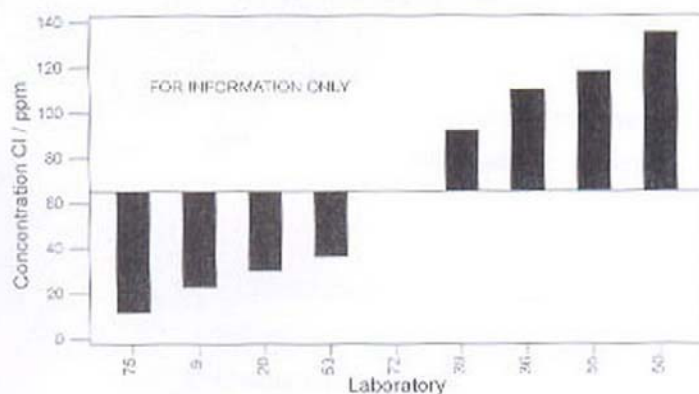## GeoPT24 - Barchart for As
Baseline is subjectively defined

FOR INFORMATION ONLY

GeoPT24 - Barchart for Bi
Baseline is subjectively defined

FOR INFORMATION ONLY

GeoPT24 - Barchart for Cl
Baseline is robust mean

FOR INFORMATION ONLY

GeoPT24 - Barchart for F
Baseline is subjectively defined

FOR INFORMATION ONLY
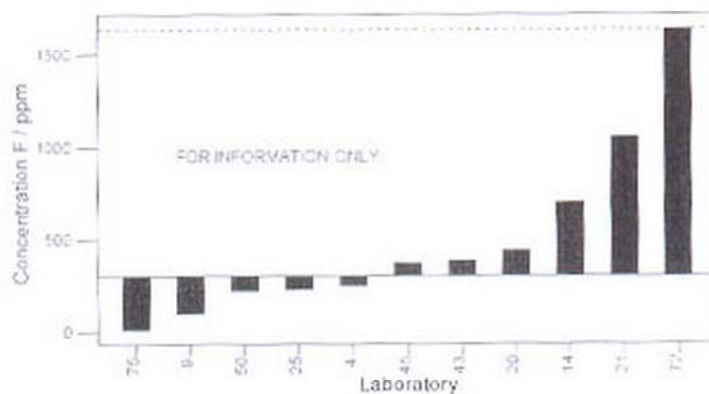
GeoPT24 - Barchart for Ge
Baseline is median

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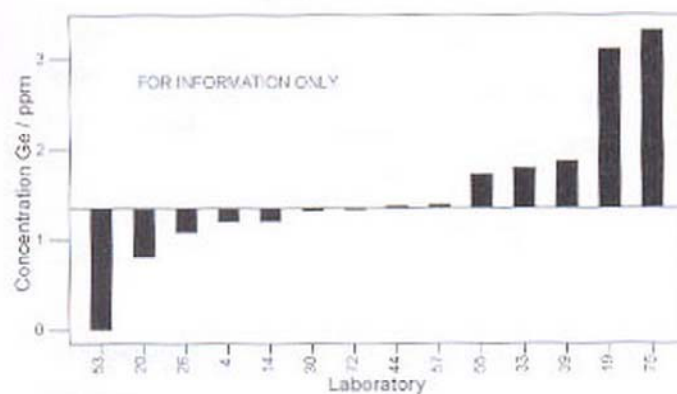
GeoPT24 - Barchart for S
Baseline is median

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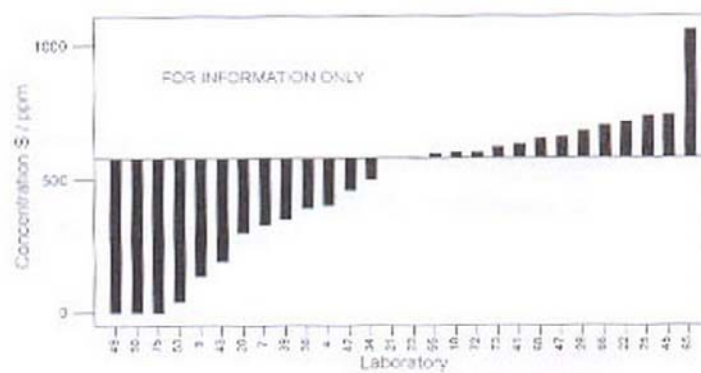
GeoPT24 - Barchart for Sb
Baseline is subjectively defined

FOR INFORMATION ONLY
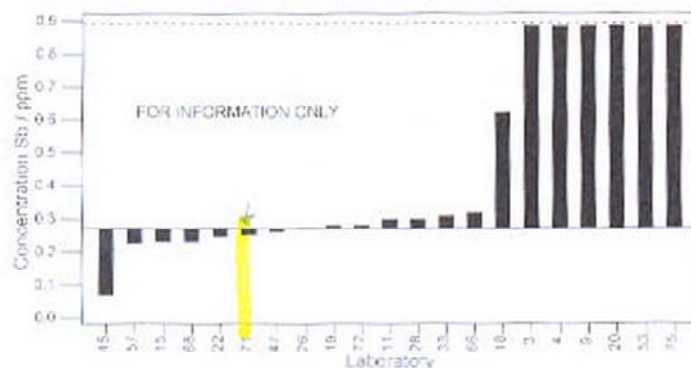
GeoPT24 - Barchart for Sn
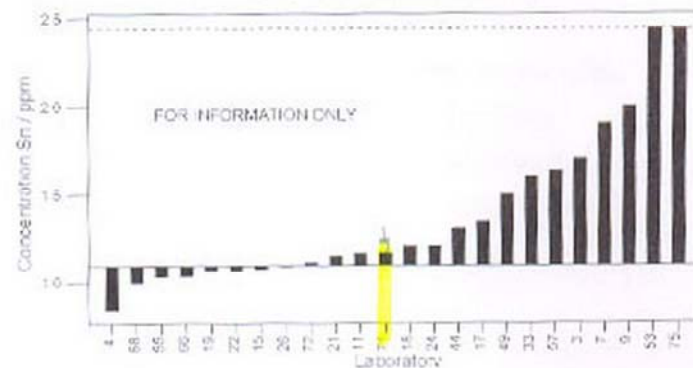### Baseline is subjectively defined

FOR INFORMATION ONLY

Figure 2. GeoPT24 – Longmyndian greywacke. OU-10. Data distribution charts for information only for elements for which values