

GEOCHEMICAL DATA SET AIR CORE SAMPLES OF REGOLITH, COBAR-GIRILAMBONE AREA

The accompanying Excel spreadsheet is a compilation of geochemical data obtained on samples through the regolith in the area between Cobar and Girilambone. These samples were collected from a total of 247 air core drill holes along road traverses (Figure 1).

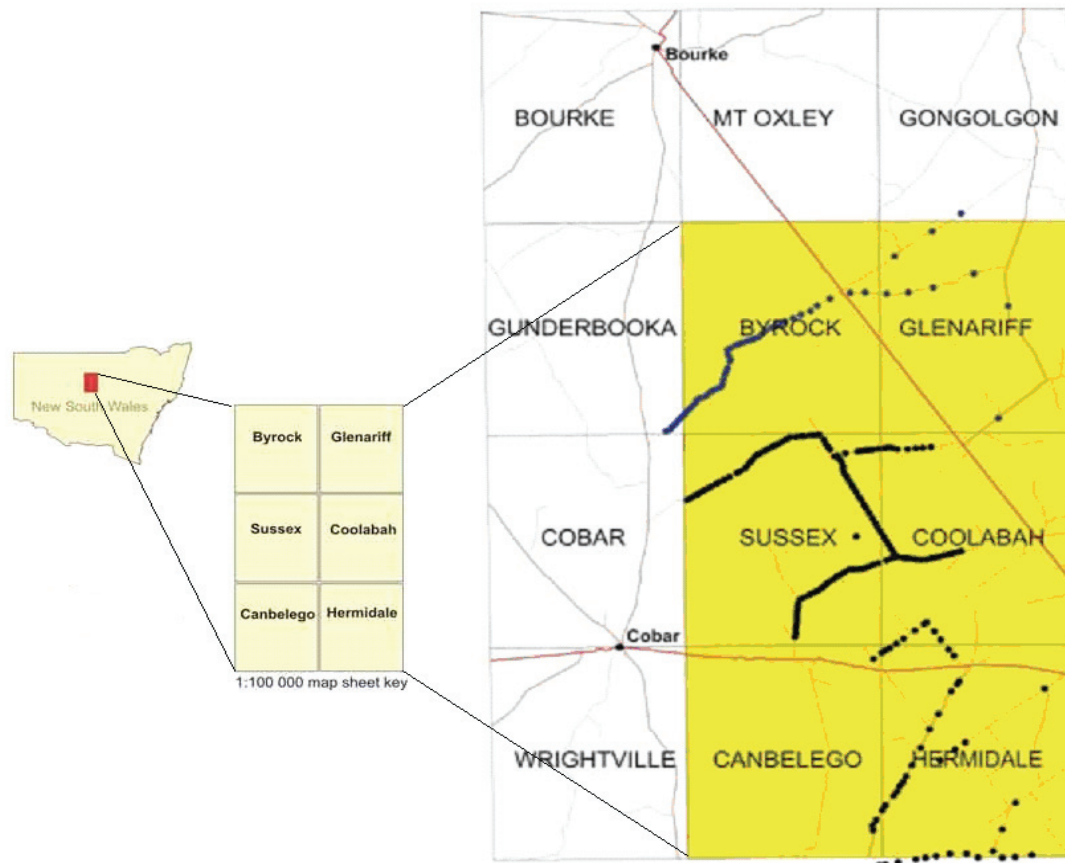


Figure 1. Location of the Girilambone terrain in western New South Wales. Large map shows the position of air core drilling traverses and the 1:100 000 sheet areas investigated.

The drilling and sampling were part of a joint project between the Cooperative Research Centre for Landscape Environments and Mineral Exploration and the New South Wales Department of Primary Industries. The work was carried out in three stages between 2000 and 2004:

- Stage 1 covered the Sussex-Coolabah 1:100 000 sheet areas;
- Stage 2 covered the Hermidale 1:100 000 sheet area;
- Stage 3 covered the Byrock and part of the Glenariff 1:100 000 sheet areas.

Detailed reports were completed for each stage of the work (see Chan et al., 2001; 2002; 2004). Staff involved in the field work included P.M. Buckley, R.A. Chan, G. Fleming, R.S.B. Greene, M.G. Hicks, M. Le Gleuher, B.E.R Maly, K.G. McQueen, J. Needham, K.M. Scott, and A. Senior. Students involved in the project were D.H. Glanville, K. Khider, D.C. Munro, J. Schifano, and S.E. Tate.

Drilling and Sampling

Shallow (3-82 m), mostly vertical, holes were drilled into the regolith using an air core rig mounted on a six-wheel drive Toyota, operated by Geological Ore Search of Cobar. Holes were drilled along public road easements at variable spacings (1-3 km), depending on regolith and geological indications. To avoid cross-hole contamination, a preliminary hole was drilled at each new site to purge the vacuum system before moving the rig a short distance and commencing the main hole. The air core drill holes were designated by the prefix CBAC (Cobar air core).

Bulk samples were collected during the drilling at 1 m intervals and stored in large plastic weave bags. From these samples, ca. 4 kg sub-samples were collected into calico bags for submission to the analytical laboratory. These samples were for 1 m intervals for at least the first 9 m. Below this depth samples were collected at 1 m intervals or in some cases composite samples were collected over mostly 2 m intervals (by taking a scoop from each of the larger bags, material considered to be reasonably homogenised). A separate sample was collected of the cuttings from the bottom of each hole (BOH samples) and these were submitted for separate analysis by X-ray fluorescence spectrometry (XRF). A total of 3364 samples were collected

Regolith materials were logged on site (field-logs), representative samples stored in chip trays, and an additional sub-sample collected for more detailed laboratory logging, PIMA analysis and XRD analysis.

Geochemical analysis

Three laboratories were used for sample preparation and geochemical analysis.

For the Stage 1 Sussex-Coolabah program (Sussex) preparation and analysis was by Analabs in Cobar. Samples were analysed for Au (by *aqua-regia* digest, solvent extraction and graphite furnace AAS analysis) and on a separate split for 21 other elements (Al, Ca, K, Fe, Mg, Mn, Ag, As, Ba, Bi, Co, Cr, Cu, Mo, Ni, Pb, S, Sb, V, W, Zn) using a combination of ICP OES and ICP MS techniques following a multi acid "total" digest (HF-HNO₃HClO₄ digestion, HCl leach).

For Stages 2 and 3 on Hermidale and Byrock-Glenariff (Hermidale, Byrock) samples were prepared and analysed by ALS-Chemex in their Orange and Brisbane laboratories. Samples were analysed for Au (by *aqua-regia* digest, solvent extraction and graphite furnace AAS analysis: method Au-TL42) and on a separate split for 28 other elements (Al, Ca, K, Fe, Mg, Mn, Na, P, Ti, Ag, As, Ba, Be, Bi, Cd, Co, Cr, Cu, Mo, Ni, Pb, S, Sb, Sr, V, W, Zn, Zr) using a combination of ICP OES and ICP MS techniques following a multi acid "total" digest (HF-HNO₃HClO₄ digestion, HCl leach: methods: ME – ICP61 and ME-MS61).

It should be remembered that the multi-acid (4 Acid) digest followed by ICP analysis is not a total analysis technique for a number of elements (e.g. elements in resistate minerals such as rutile, ilmenite, chromite).

Bottom of the hole samples were analysed at Geoscience Australia in Canberra by major and trace element XRF techniques and ICP MS after digestion of fused glass disks (XRF Package). This provided better results for some major elements and a number of minor and trace elements, such as Ti, Cr and Zr, hosted in insoluble or partly soluble minerals. These immobile elements are commonly used to discriminate major rock suites.

The data set format and content have been audited by Dr M. Whitbread of Io Geochemistry. The Stage 1 (Sussex) data have been examined and commented on by Dr N. Rutherford (2001).

Data interpretation has not been included in this file, but details are available in the listed references.

Analytical Precision

As a test of analytical precision for the multi acid digest and ICP-MS and ICP-OES methods, replicates of a reference sample were analysed with different sample batches. The results of the replicate analyses are presented in Table 1. They show that the multi acid digest approach achieved very good precision for most major elements, except K (possibly reflecting non-total digestion of muscovite or variable formation of potassium perchlorate during the digestion process used), and to some extent Al (which is the most abundant element, with variability possibly reflecting imperfect homogenisation of the sample). Minor elements likely to be largely or partly hosted by resistate minerals, such as Ti, Cr, and Zr show significant variability. For most trace elements precision was good except for As and Bi and several elements at or very close to the limit of detection (Cd, Co, Mo and Sb). The replicate analyses for gold show values around 3-4 ppb, a little above the detection limit of 1 ppb. Comparisons between replicate analyses for Stage 2 (Sussex) and Stage 3 (Byrock) are shown diagrammatically in Figures 2 and 3.

Laboratory Precision and Accuracy

A series of laboratory duplicates were analysed for 136 of the samples submitted to ALS-Chemex Laboratories. Results of these duplicate determinations are presented in Appendix 13. A number of internal standards were also analysed by the laboratory during analysis of the Byrock samples and results are also shown at the end of Appendix 13.

Table 1: Replicate analyses and standard deviations for samples from CBAC150 (31-33m).
 Bold samples submitted with Byrock sample batch. Other samples from previous Hermidale batch.

Sample No.	Au (ppm)	Ag (ppm)	Al (%)	As (ppm)	Ba (ppm)	Be (ppm)	Bi (ppm)
CB1791	0.004	-0.5	11.16	12	824	4.3	4
CB1792	0.004	-0.5	11.46	11	833	4.7	-2
CB1793	0.002	-0.5	11.61	17	849	4.7	7
CB1794	0.002	-0.5	10.13	13	760	4.7	6
CB1795	0.002	-0.5	9.78	14	716	4.8	6
CB4042	0.004	-0.5	12.05	12	810	5	-2
CB4043	0.003	-0.5	13	14	880	5.1	2
Stand dev	0.001	0.00	1.1	1.98	55	0.3	3.8

Sample No.	Ca (%)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	K (%)
CB1791	0.01	-0.5	2	96	33	5.37	2.21
CB1792	0.01	-0.5	2	104	36	5.49	1.11
CB1793	0.01	-0.5	2	110	35	5.48	2.57
CB1794	-0.01	-0.5	2	114	35	5.23	1.98
CB1795	-0.01	-0.5	2	115	35	5.21	1.9
CB4042	0.02	0.6	-1	116	37	5.66	3.42
CB4043	0.02	0.5	1	118	37	5.8	2.85
Stand dev	0.01	0.51	1.13	8	1	0.26	0.74

Sample No.	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Ni (ppm)	P (ppm)	Pb (ppm)
CB1791	0.52	67	-1	0.09	24	574	32
CB1792	0.52	70	-1	0.09	26	692	33
CB1793	0.53	70	1	0.09	26	667	32
CB1794	0.47	68	-1	0.09	25	647	28
CB1795	0.45	65	-1	0.09	25	645	26
CB4042	0.55	74	1	0.1	27	710	30
CB4043	0.57	74	1	0.1	26	730	30
Stand dev	0.04	3	1.07	0.00	1.0	52	2.5

Sample No.	S (%)	Sb (ppm)	Sr (ppm)	Ti (%)	V (ppm)	W (ppm)	Zn (ppm)
CB1791	-0.01	6	41	0.13	124	-10	84
CB1792	-0.01	-5	42	0.37	131	-10	86
CB1793	-0.01	-5	44	0.34	130	-10	86
CB1794	-0.01	9	35	0.27	132	-10	85
CB1795	-0.01	-5	34	0.31	131	-10	84
CB4042	-0.01	-5	38	0.34	132	-10	86
CB4043	-0.01	5	45	0.48	136	-10	89
Stand dev	0.00	6.4	4.3	0.11	4	0.00	1.7

Sample No.	Zr (ppm)
CB1791	93
CB1792	105
CB1793	106
CB1794	102
CB1795	103
Stand dev	5

Table A7-1: Replicate analyses and standard deviations for samples from CBAC150 (31-33m).

Sample No.	Au (ppm)	Ag (ppm)	Al (%)	As (ppm)	Ba (ppm)	Be (ppm)	Bi (ppm)
CB1791	0.004	-0.5	11.16	12	824	4.3	4
CB1792	0.004	-0.5	11.46	11	833	4.7	-2
CB1793	0.002	-0.5	11.61	17	849	4.7	7
CB1794	0.002	-0.5	10.13	13	760	4.7	6
CB1795	0.002	-0.5	9.78	14	716	4.8	6
Stand dev	0.001	0.00	0.8	2.30	56	0.2	3.6

Sample No.	Ca (%)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	K (%)
CB1791	0.01	-0.5	2	96	33	5.37	2.21
CB1792	0.01	-0.5	2	104	36	5.49	1.11
CB1793	0.01	-0.5	2	110	35	5.48	2.57
CB1794	-0.01	-0.5	2	114	35	5.23	1.98
CB1795	-0.01	-0.5	2	115	35	5.21	1.9
Stand dev	0.01	0.00	0.00	8	1	0.13	0.54

Sample No.	Mg (%)	Mn (ppm)	Mo (ppm)	Na (%)	Ni (ppm)	P (ppm)	Pb (ppm)
CB1791	0.52	67	-1	0.09	24	574	32
CB1792	0.52	70	-1	0.09	26	692	33
CB1793	0.53	70	1	0.09	26	667	32
CB1794	0.47	68	-1	0.09	25	647	28
CB1795	0.45	65	-1	0.09	25	645	26
Stand dev	0.04	2	0.00	0.00	0.8	44	3.0

Sample No.	S (%)	Sb (ppm)	Sr (ppm)	Ti (%)	V (ppm)	W (ppm)	Zn (ppm)
CB1791	-0.01	6	41	0.13	124	-10	84
CB1792	-0.01	-5	42	0.37	131	-10	86
CB1793	-0.01	-5	44	0.34	130	-10	86
CB1794	-0.01	9	35	0.27	132	-10	85
CB1795	-0.01	-5	34	0.31	131	-10	84
Stand dev	0.00	6.9	4.4	0.09	3	0.00	1.0

Sample No.	Zr (ppm)
CB1791	93
CB1792	105
CB1793	106
CB1794	102
CB1795	103
Stand dev	5

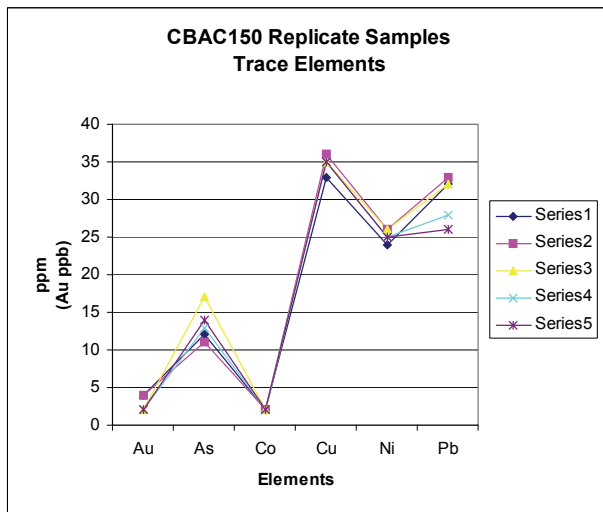
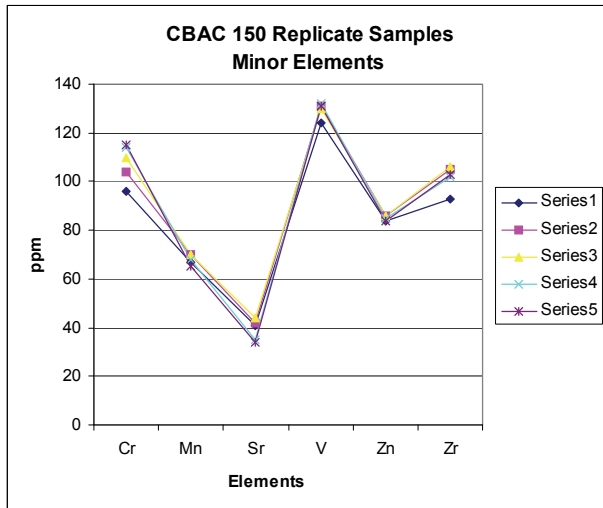
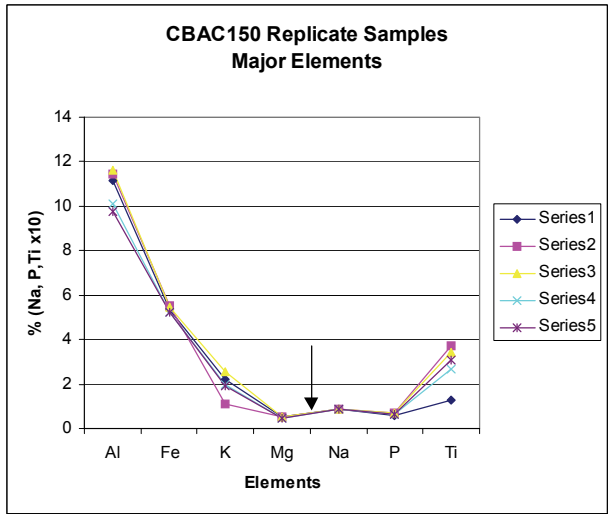


Figure 2. Plots showing results of replicate analyses of major, minor and trace elements for 5 subsamples from CBAC150 32-33m (analysed during Stage 2 Sussex).

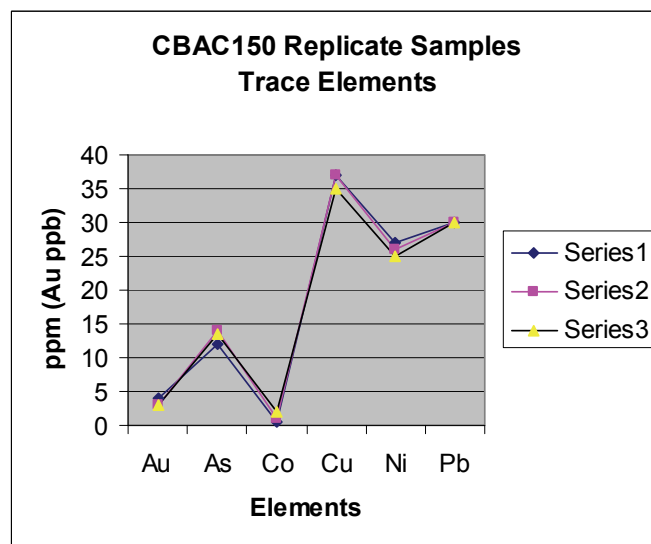
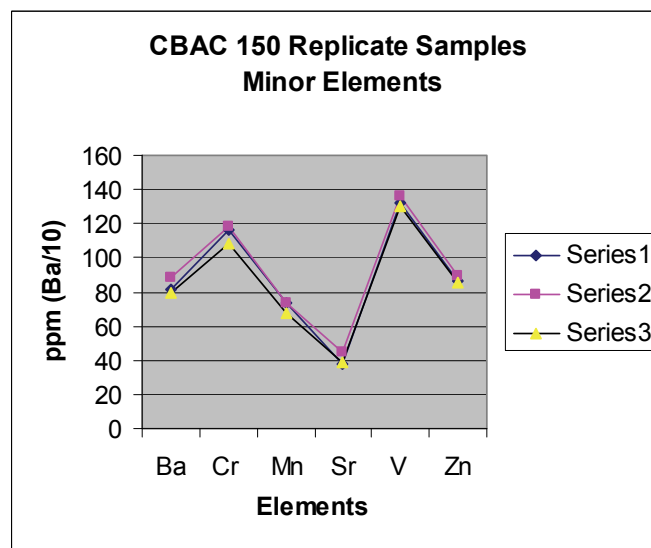
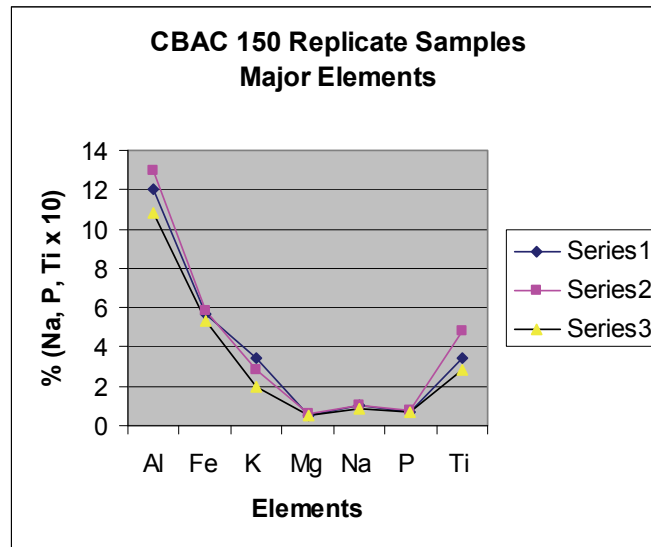


Figure 3. Plots showing results of replicate analyses of major, minor and trace elements for subsamples from CBAC150 32-33m. Series 1 and 2 are CB4042 and CB4043 (analysed during stage 3, Byrock). Series 3 is mean of 5 samples analysed during Stage 2 (Sussex).

Sample Representativeness

To test the degree to which samples are representative of the bulk interval sampled by air core drilling, duplicate samples were collected from the same bulk samples. Most of the duplicates were collected from the bulk sample bags during a second stage of re-sampling, one month after the original sampling. Comparisons for major, minor and trace elements for ten pairs of duplicates are presented in Figs 4-9. Most duplicates show good comparison, except for some elements including Al, K, Mn, As, Bi, Mo and Au. Some of these elements (Al and K) showed variability in the replicate samples suggesting lower analytical precision. Aluminium in particular shows poor results for this set of duplicates, especially where its abundance is greater than about 6%. This may partly reflect lower precision for Al at high concentrations. The Stage 1 (Hermidale) results showed better comparison of Al in duplicates but Al abundance in these previous duplicates was less than 8%. Also a large number of the duplicates for Stages 2 and 3 (Hermidale and Byrock) were composite samples (amounts combined from a number of sample intervals) and there may have been insufficient attention paid to proper sampling, resulting in greater heterogeneity of bulked duplicates. This effect will show up most in major elements that are hosted by particular components of the sample e.g. clay versus quartz. Gold in the duplicates does not compare as well for Stages 2 and 3 and for Stage 1, again possibly reflecting poor sampling procedure of duplicates from composite samples. Iron and elements associated with iron oxides/oxyhydroxides (such as Cu, Zn, Pb, Cr and V) compare well and have been less effected by heterogeneity between duplicates (possibly because these oxide phases are more evenly distributed between samples). The duplicates compare poorly for As and Bi, probably reflecting poor analytical precision for these elements. These results suggest that the bulk samples from the air core drilling technique are reasonably well homogenised and that samples down to 0.5 kg from a single bulk sample give a good representation of the total sample. However, care needs to be taken when making up composite samples from several sample intervals to ensure that the same volume of sample is taken from each bulk. Equal amounts should be carefully taken from each sample with a sampling spear, rather than using a grab sample approach.

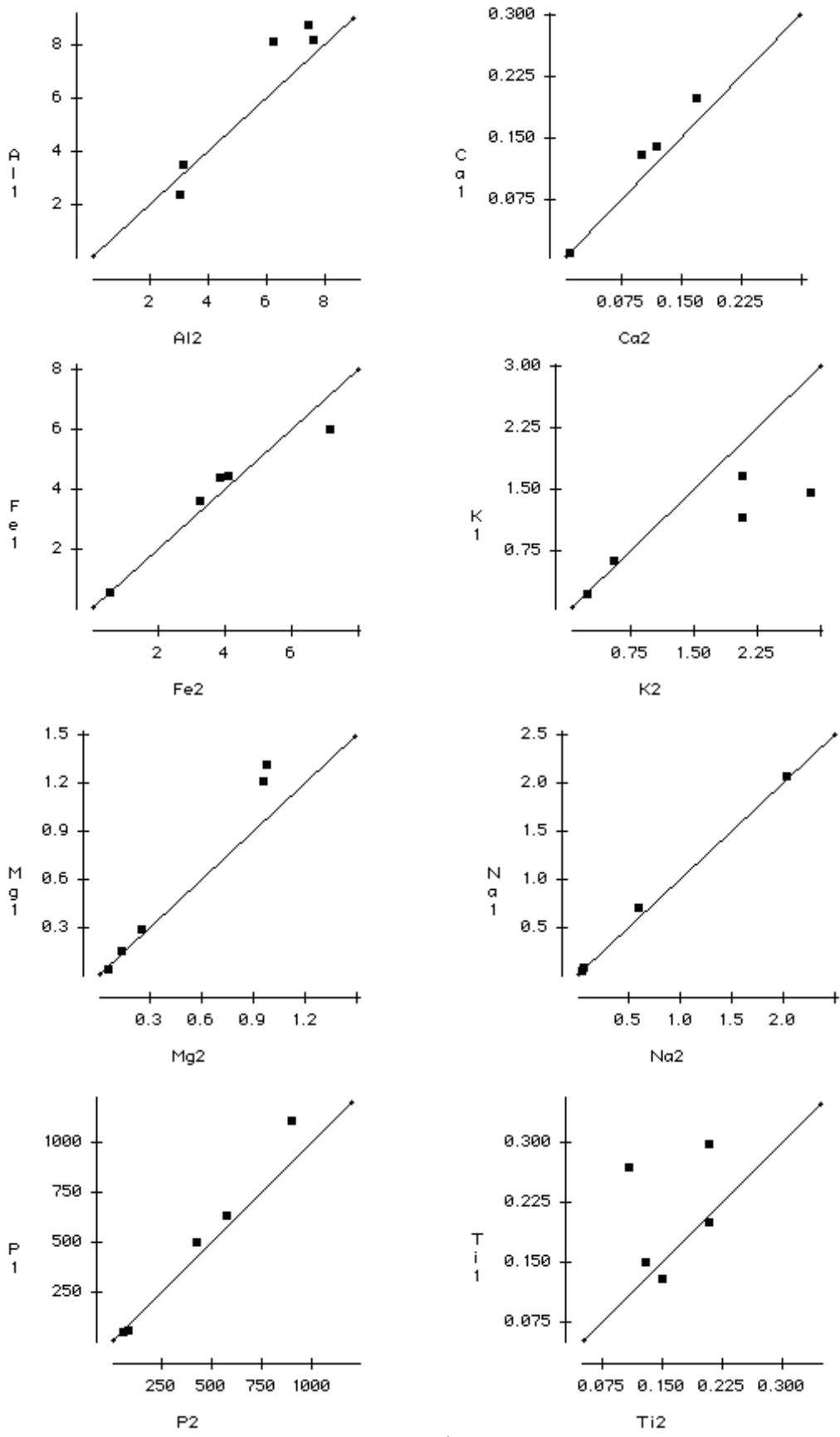


Figure 4. Determinations of duplicate samples for Al, Ca, Fe, K, Mg, Na, Ti (%) and P (ppm).

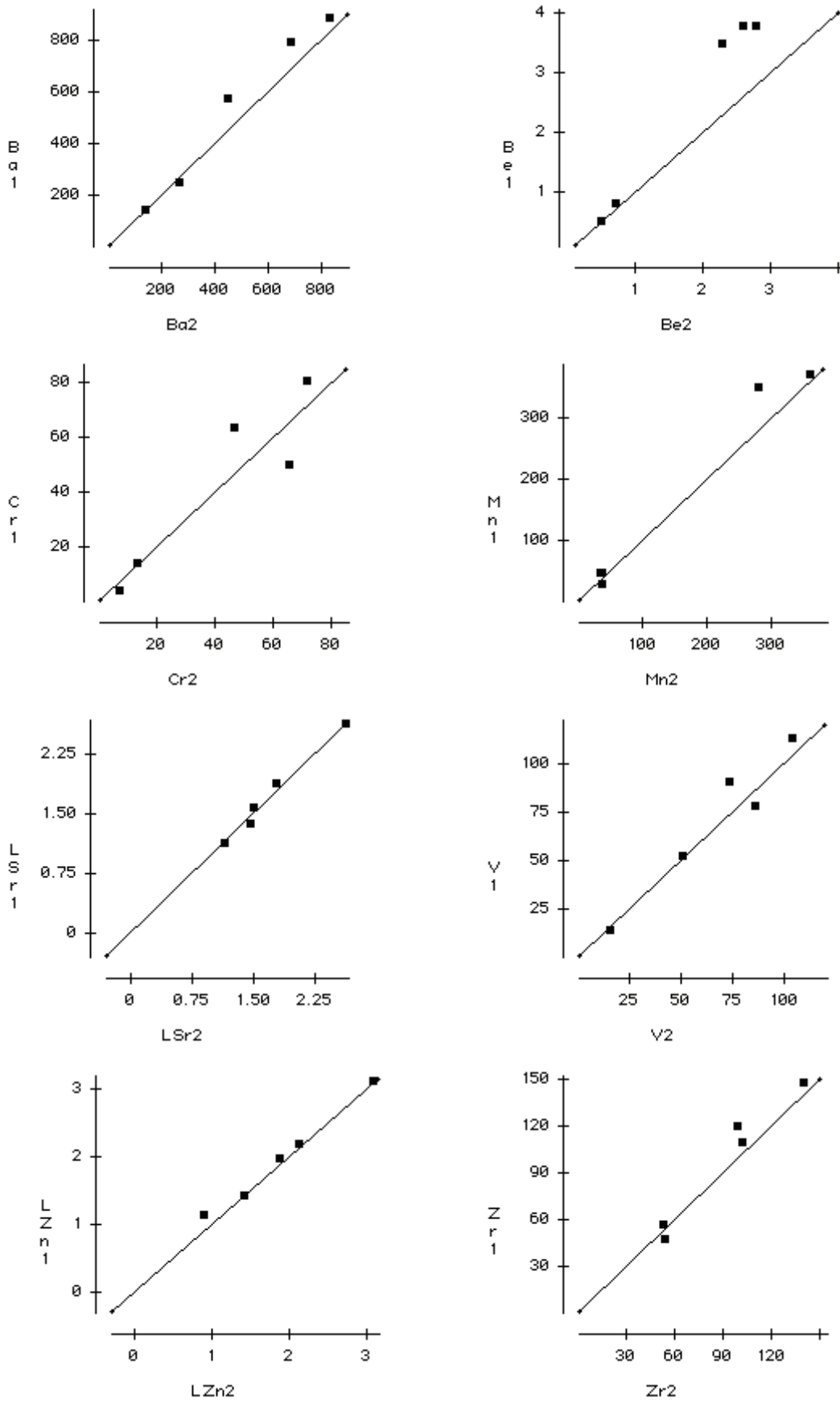


Figure 5. Determinations of duplicate samples for Ba, Be, Cr, Mn, log Sr, log Zn and Zr (ppm).

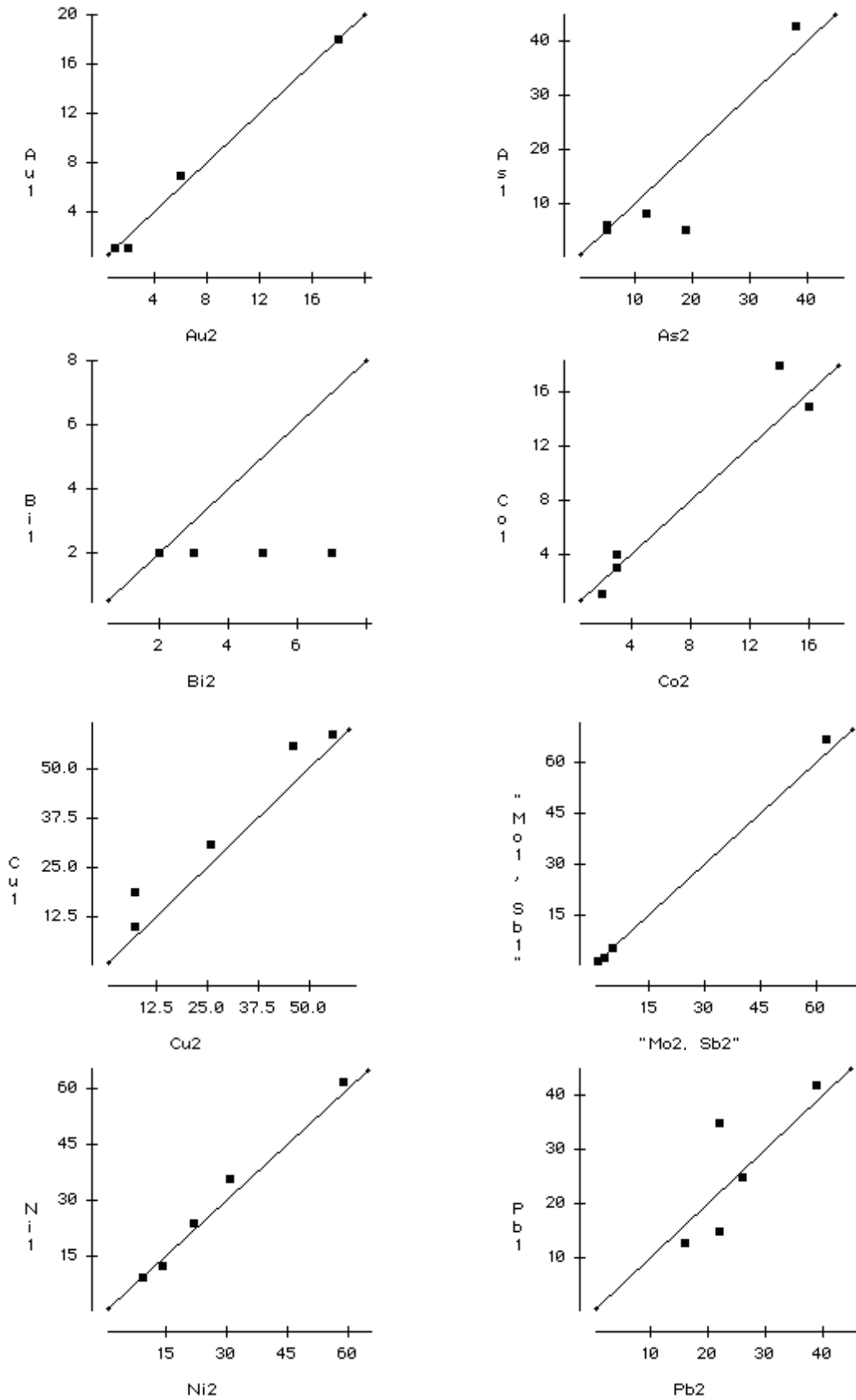


Figure 6. Determinations of duplicate samples for Au (ppb) As, Bi, Co, Ni, Pb (ppm).

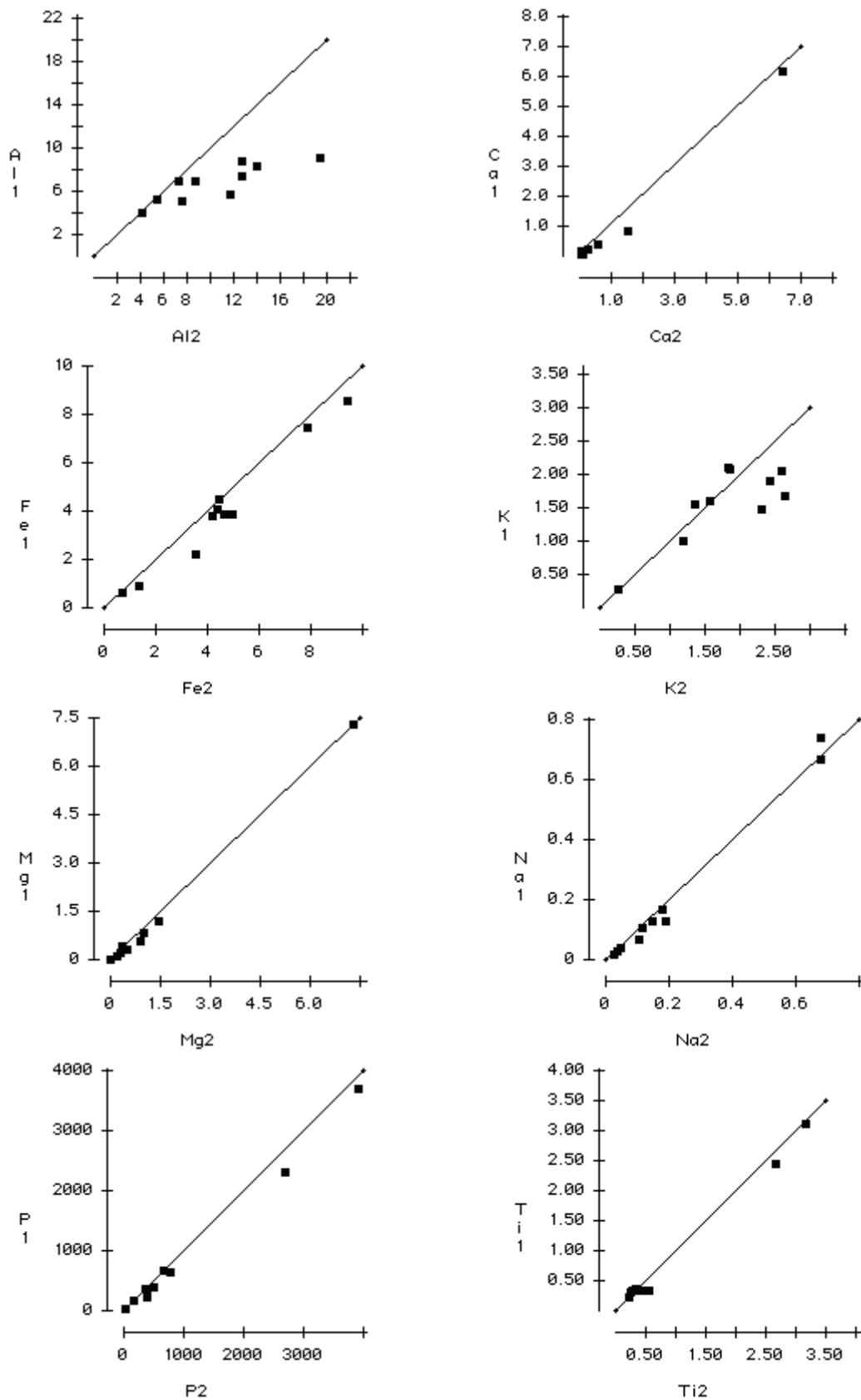


Figure 7. Determinations of duplicate samples for Al, Ca, Fe, K, Mg, Na and Ti (%) and P (ppm) for the Byrock program.

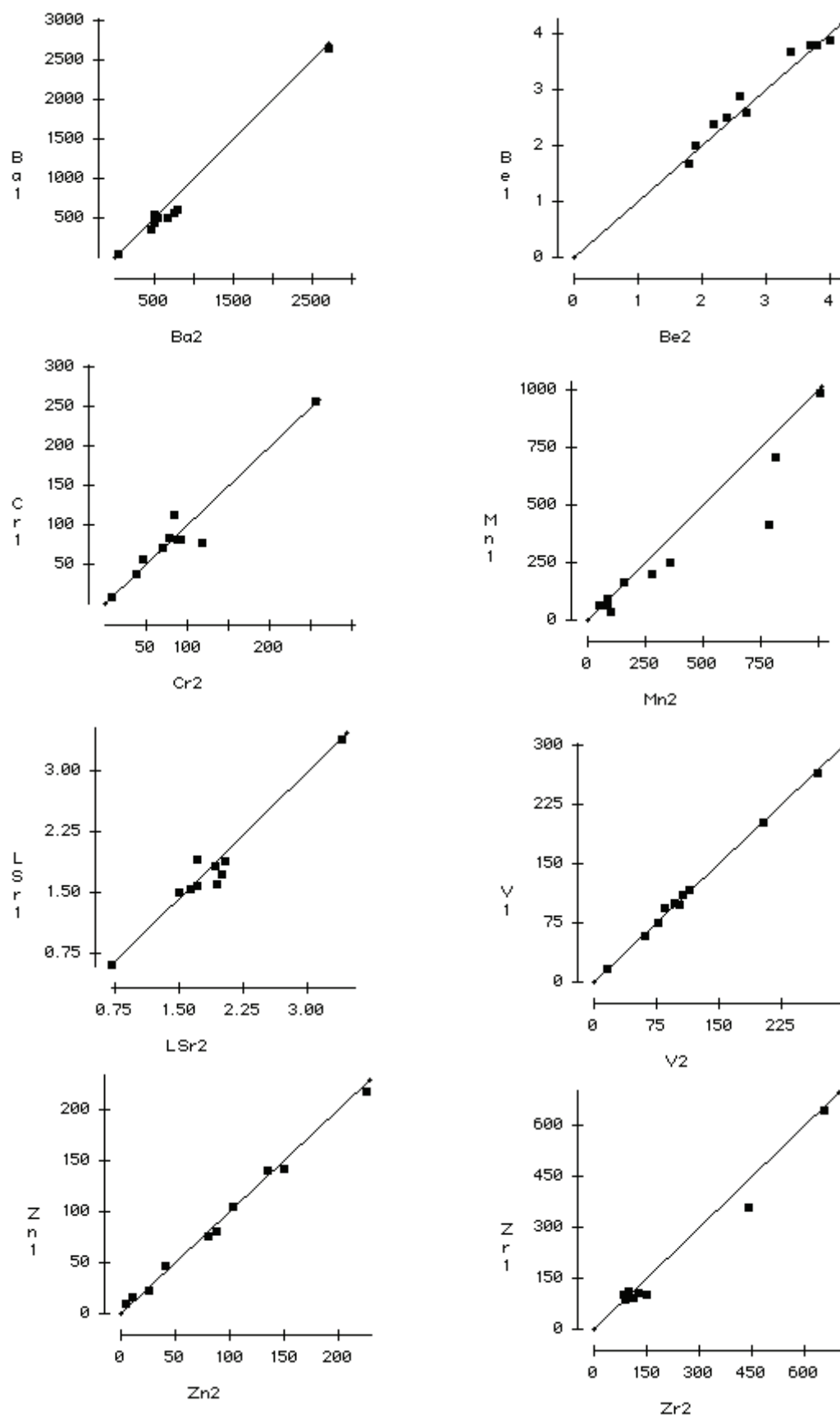


Figure 8. Determinations of duplicate samples for Ba, Be, Cr, Mn, log Sr, Zn and Zr (ppm).

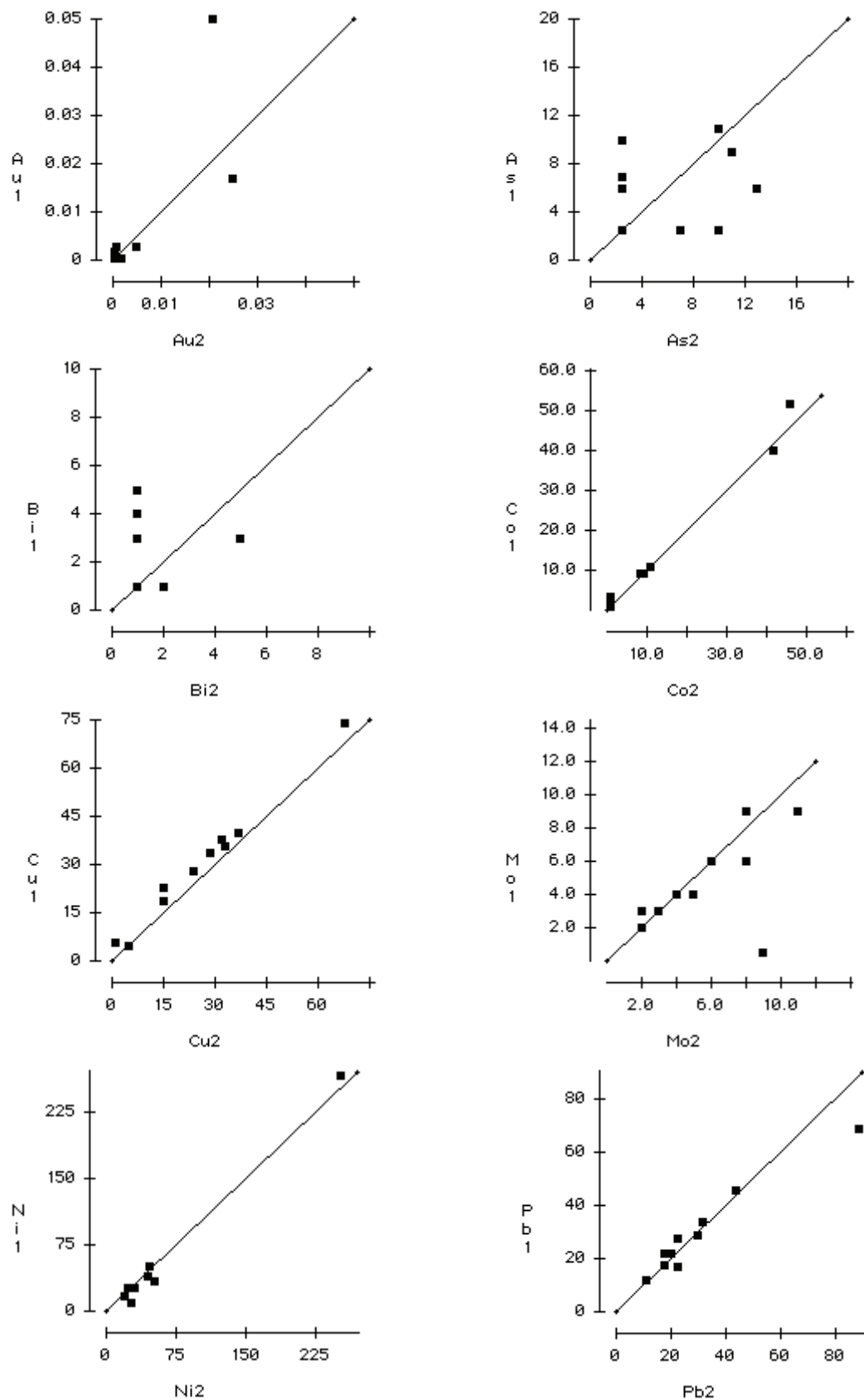


Figure 9. Determinations of duplicate samples for Au, As, Bi, Co, Cu, Mo, Ni and Pb (ppm).

References

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