Winning the 5th international Reynolds Cup quantitative mineralogy competition

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Substantial advances in instrumentation, computing power and software in recent years have enabled an increasing number of laboratories to use XRD and ancillary techniques for quantitative mineralogical analysis. However, these techniques are often treated as "black-boxes" and in the hands of inexperienced users can lead to gross inaccuracies. Unfortunately, very few opportunities are available for analysts to test their proficiency and this is compounded by a lack of reference materials of known composition. The biennial Reynolds Cup competition, which is now in its 5th edition, has therefore rapidly become the premier round-robin event in the world of quantitative mineralogy. Since commencing in 2002 with 15 brave souls returning results from 40 participants to 63 returns from 76 participants in 2010 (Figure 1), the competition has established itself as an invaluable means of assessing laboratory proficiency and teaching aid.

Our laboratory has placed in the top 10 in 4 out of the 5 competitions, culminating with equal third place in 2008 and first place in 2010. "Standardless" quantitative analysis software, SIROQUANT© from Sietronics Pty Ltd (Taylor, 1991) was used in all 5 contests, initially straight out of the box, then subsequently with significant improvements made by preparing in-house modified "calibration" files against pure reference materials (Figures 2 to 4). Extensive use was made of grain separation techniques, calcium saturation, orientated magnesium and glycerolated clay mounts and calculated interstratified clay mineral patterns using NEWMOD©.

This talk will detail the methods and techniques used to improve accuracy in the analysis of complex mineral mixtures such as those found in the Reynolds Cup competition.

References

Taylor, J.C. (1991). Computer programs for standardless quantitative analysis of minerals using the full powder diffraction profile. *Powder Diffraction*, 6, 2-9.

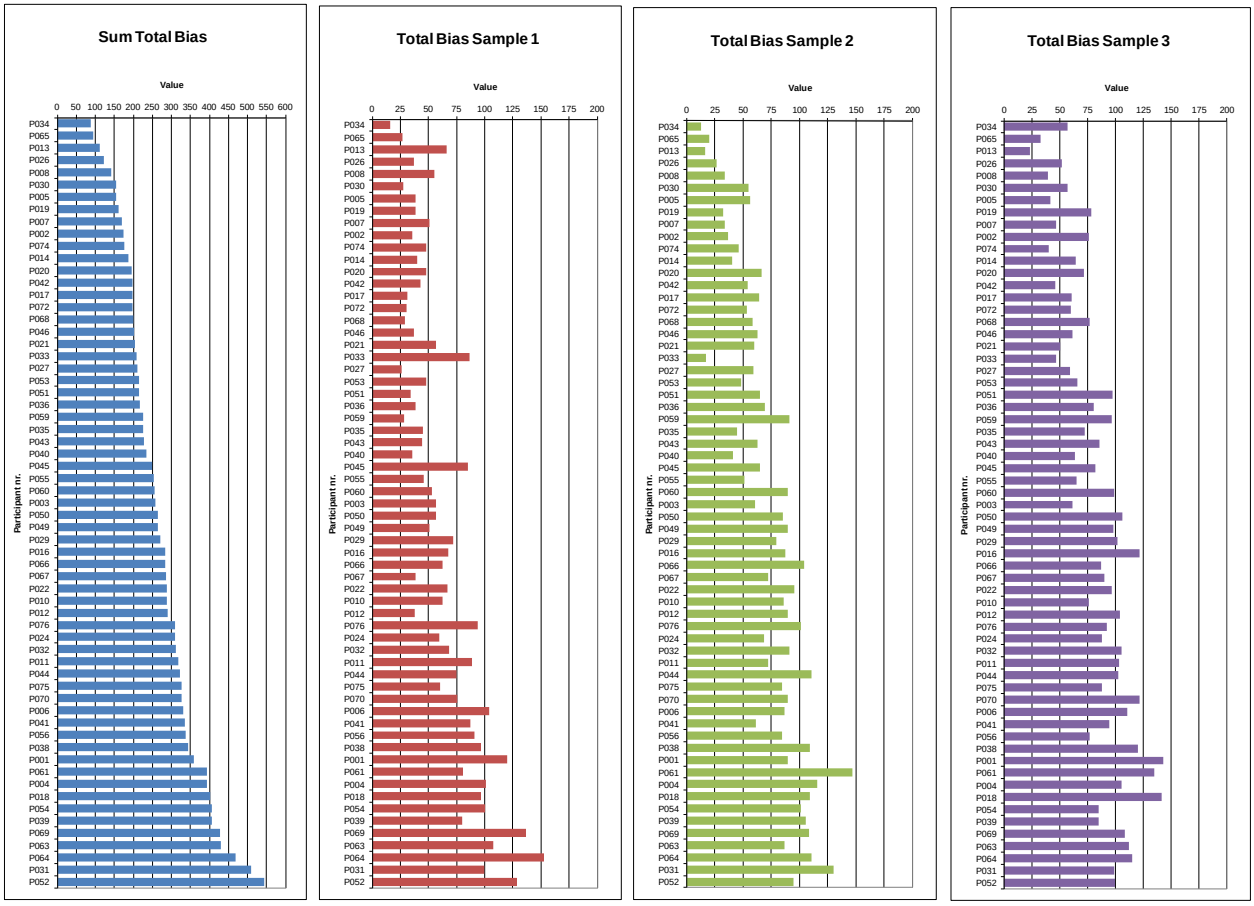

Fig. 1. Plots of total biases between weighed and reported compositions for all samples and contestants.

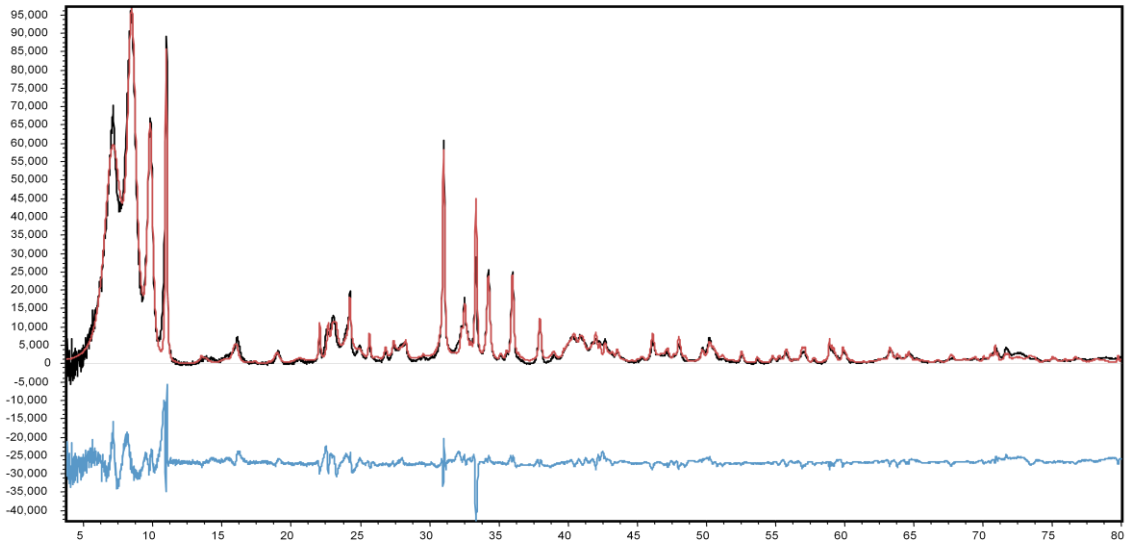

Fig. 2. XRD pattern of Reynolds Cup 5 sample 1 showing observed (black), calculated (red) and difference (blue).

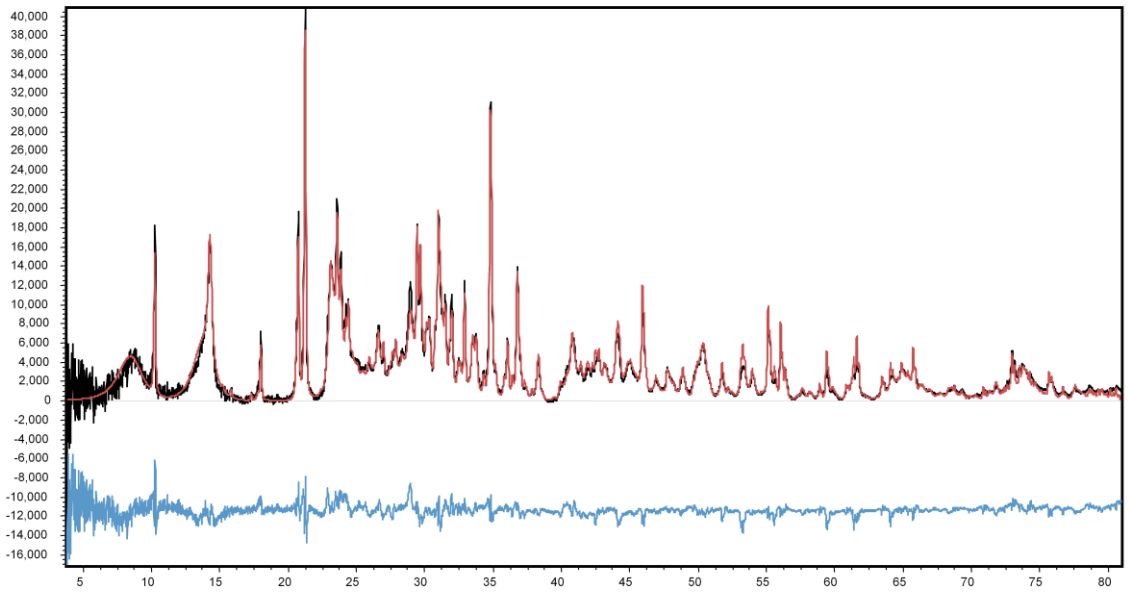

Fig. 3. XRD pattern of Reynolds Cup 5 sample 2 showing observed (black), calculated (red) and difference (blue).

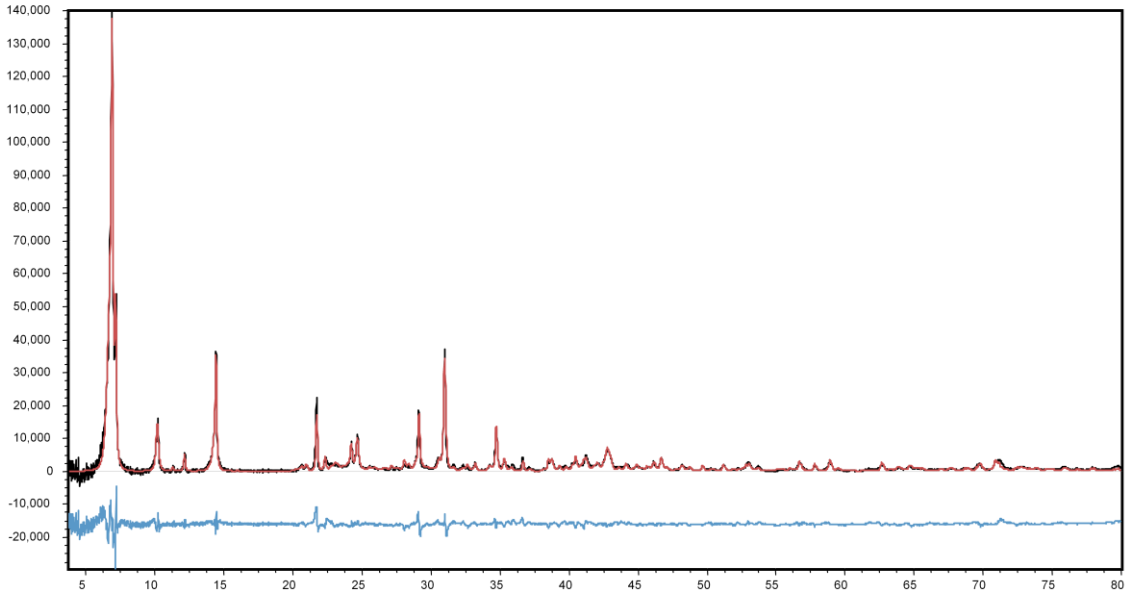

Fig. 4. XRD pattern of Reynolds Cup 5 sample 3 showing observed (black), calculated (red) and difference (blue)

Notes