Reconciling modal mineralogy and chemical compositions of a sample

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Knowledge of the grade of valuable elements and its variation is not sufficient for geometallurgy. Minerals define not only the value of the deposit, but also the method of extraction and concentration. However, mineralogy is quite rarely used as the key information in geometallurgy and it is even more exceptional in mineral resource estimation.

One of the reasons is the lack of fast, low-cost but still reliable modal analysis. The other is that the results from various methods of modal mineralogy such as automated mineralogy and quantitative XRD are not consistent with chemical assay. In other words, the chemical composition back calculated from modal analysis does not match with the true chemical assay.

Element-to-mineral conversion is the known method to get modal mineralogy that matches with the chemical composition of samples. However, in complicated mineralogy or the lack of enough chemical components assayed, it fails to provide accurate results.

Reconciling the results of a modal analysis with chemical assays can improve the agreement between chemical assays and back-calculated chemical composition. This is achievable by doing minor adjustments to modal mineralogy. The method used here is called combined method and it principally uses Levenberg-Marquardt algorithm to minimize differences (residuals) between chemical assays and back-calculated chemical composition of a sample. The advantage of the method over other combined methods is that it does not use weighting factors. Additionally, the adjustments are minor unlike other methods that can cause mineral grades to drift away significantly. These features make it possible to apply the method for a large number of samples unsupervised.

References:

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