

## Determining the heterogeneity of reference materials

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A new method is proposed to determine the heterogeneity of a reference material to separate the analytical and inter-lab errors from the standard deviation. Reference materials are used by geoscientists to assess the quality of a geochemical analysis. Certified Reference Materials are reference materials for which an accepted concentration and standard deviation have been determined by independent labs. Ideally, geoscientists can use Certified Reference Materials to determine laboratory error, and apply it to geological samples with a similar concentration and matrix. However, the accepted standard deviation is a function of Certified Reference Material heterogeneity, lab error, and inter-lab error. Inter-lab error is caused by variations in procedure among the laboratories that determined the certified values. Furthermore, the accepted standard deviation only applies to the sample mass for which the element was certified. Procedures using a larger sample mass will have less variance and procedures using a smaller mass will have more variance. It is possible to algebraically separate the analytical and inter-lab errors from the standard deviation by analyzing both small and large samples. This approach uses the product of the sample mass and the variance to express sample heterogeneity which can be applied to any sample mass.