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## **Application of Partial Least Squares Methods in Identifying integrated Geochemical Anomalies using stream sediment data in Northwestern Hunan, China**

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Geochemical data are compositional data. Different element variables have multiple correlations, and the “closure” of compositional data causes null correlations, so the impact of “closure” has to be solved before identifying the composite anomalies. In this study, the lead-zinc deposit occurring in the 3-4 submembers of Qingxudong formation, is obviously controlled by strata. The major elements association is extracted based on statistical regularities of geochemical feature in ore bearing layer.

As different element variables have multiple correlations, and the “closure” of compositional data causes null correlations, so the impact of “closure” has to be solved before identifying the composite anomalies. In this study, three main forms of log-ratio transformation have been applied to explore the effects of the data closure problem. The result with ilr transformation shows conspicuous central tendency, and the mean value tends to be more like zero.

For comparison purposes, three dimension reduction methods (PCA, FA, PLS) are applied in the study. The results show that the major elements association extracted by PLS matches the geochemical features of study area better. This elements association extracted by PCA and FA can't be dealt with geological interpretation easily.

In the study area, anomaly distribution matches location of faults and ore deposits largely. To be specific, ore deposits usually correspond to the areas with high positive anomaly value, and faults are often located around the border of positive and negative anomaly. The results can reflect geochemical features of lead-zinc deposit in study area mostly. It is much more convenient for explanation and metallogenic prognosis.

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