

Mapping of anomalies in continuous and discrete field models of stream sediment geochemical data

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From stream sediment geochemical data, continuous and discrete field models of geochemical landscapes can be obtained, respectively, by interpolating the point data and by attributing the point data to their sample catchment basins [1]. A study was conducted to (a) compare anomalies mapped from continuous and discrete field models of stream sediment geochemical landscapes and (a) examine which empirical frequency distributions – those of original point data or those of grid cell values in models of stream sediment geochemical landscapes – are more useful in mapping of anomalies in such geochemical landscapes. Anomalies were mapped by using the mean+2SDEV [2], median+2MAD [3] and concentration-area (C-A) fractal [4] methods of defining threshold values in a geochemical data set.

The results of the study, in the Aroroy epithermal-Au district (Philippines), show that for mapping of anomalies in either continuous or discrete field models of stream sediment geochemical landscapes, the C-A fractal method performs best, followed by the median+2MAD method and then by the mean+2SDEV method. Anomalies mapped in discrete field models, compared to those mapped in continuous field models, of stream sediment geochemical landscapes mostly have stronger positive spatial associations with known epithermal-Au occurrences in the study area. Mapping of anomalies in continuous or discrete field models of stream sediment geochemical landscapes via either the median+2MAD or mean+2SDEV method must be based on analysis of empirical frequency distributions of the original point data. Empirical frequency distributions of either the original point data or the grid cell values in continuous or discrete field models of stream sediment geochemical landscapes are similarly useful in the C-A fractal method.

[1] Carranza (2008) *Geochemical Anomaly & Mineral Prospectivity Mapping in GIS*. Amsterdam: Elsevier. [2] Hawkes & Webb (1962) *Geochemistry in Mineral Exploration*. New York: Harper. [3] Reimann *et al.* (2005) *Sci. Total Env.* **346**, 1–16. [4] Cheng *et al.* (1994) *J. Geoch. Explor.* **51**, 109–130

Photochemical reactions of mercuric sulfide nanoparticles

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Nanometer-sized mercuric sulfide particles were used to investigate photochemical promotion of particle dissolution and reaction to form methylmercury in aqueous solutions of varying composition. Irradiation with light ≥ 280 nm enhanced dissolution compared to dark controls in solutions containing an acetic acid buffer or natural organic matter (NOM). Total dissolved mercury concentrations were approximately doubled following irradiation for 7 hours compared to dark controls. Results of methylmercury concentration measurements also showed increases following irradiation. These results may indicate that dissolved mercuric ions released by dissolution are relatively easily methylated in the presence of the organic acids which act as the methyl donors. The molecular weight and polydispersity properties of the NOM samples were also monitored. The molecular size decreased after 7 hours photoirradiation, which could be due to photodegradation or adsorption of higher molecular weight NOM fractions. In addition to the effects of organic acids, results showed the dissolution and methylation are pH-dependent. The dissolution of mercury became appreciable at pH values greater than 6 and increased with increasing pH. The production of total mercury increased when 10 mg C/L NOM was introduced in the pH buffered solutions. Overall, the results indicate photochemically enhanced production of methylmercury may be significant at lower pH values, while thermal dissolution and methylation routes predominate under higher pH conditions.