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Examining the relationship between mercury and organic matter in lake sediments along a latitudinal transect in subarctic Canada

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The accumulation of Hg in aquatic environments at both high and low latitudes can be controlled by organic matter through algal scavenging, thus complicating the interpretation of historical Hg profiles in lake sediments1,2,3. However, other recent studies suggest that algal scavenging is not important in governing Hg flux to sediments4, in some cases because of dilution by inorganic materials5. This study examines relationships between Hg and organic matter (OM) in over 100 lakes located between 60.5 and 65.4 °N and crossing the latitudinal tree-line in subarctic Canada. The latitudinal gradient approach in our study offers an opportunity to better understand climate and environmental controls on OM accumulation and its role in influencing Hg deposition in subarctic lacustrine environments. We used Rock Eval 6 pyrolysis to determine total organic carbon (TOC%), S1 (soluble OM consisting of degradable lipids and algal pigments), S2 (OM derived from highly aliphatic biomacromolecule structure of algal cell walls), and S3 (OM dominated by carbohydrates, lignins, and plant materials). Total Hg in sediments was measured using thermal decomposition, amalgamation, and atomic absorption spectrophotometry. In these lake sediments, S2 composes the majority of TOC (Pearson's r = 0.978, $p<0.01$) and is negatively correlated with latitude (r = -0.475, $p<0.01$). S1 and TOC are also negatively correlated with latitude (r = -0.237 and -0.452, respectively, $p<0.01$). These associations are interpreted to reflect less autochthonous OM production and proportionally higher allochthonous OM input to more northern lakes (oxygen index vs. latitude r = 0.371, $p<0.01$). Similar to previous studies1,2,3 Mercury displays a significant positive association with S1 (r = 0.556, $p<0.01$), S2 (r = 0.518, $p<0.01$), and TOC (r = 0.504, $p<0.01$),supporting the hypothesis that OM influences Hg accumulation in subarctic lake sediments.

References

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