

Exploring complex relationships among fish tissue mercury concentrations, drivers of trophic status, and watershed characteristics in Maine lakes

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Abstract

Lake ecosystems are highly sensitive to airborne mercury (Hg) pollution because watershed and in-lake methylation processes increase its bioavailability. Hg bioaccumulation to toxic levels higher in the food chain has resulted in fish consumption advisories throughout the US. In the northeastern U.S., an inverse relationship between lake productivity and Hg levels in freshwater fish has been observed [1] and attributed to biodilution [2]. Our group has previously shown that lake sediment aluminum (Al) partly controls lake productivity through its control of phosphorus (P) availability [3]. Therefore, we propose that Al likely influences Hg fish bioaccumulation.

Watershed mobility of both Al and Hg is controlled by vegetation, soils, hydrology, and wetlands. Aluminum mobilization is favored by low pH and high dissolved organic carbon (DOC). Lake DOC is primarily controlled by the same landscape attributes [4], factors strongly influenced by human modification of landcover. In-lake degradation of Al-DOC complexes by UV radiation results in precipitation of aluminum hydroxide which renders P biologically unavailable. Using existing Maine lake/watershed data (spatial, chemical and biological), we seek to better identify relationships among watershed attributes, lake chemistry and trophic state to build a predictive model to identify lakes that are susceptible to high fish Hg burden. Despite a decrease in atmospheric deposition of Hg over the past three decades, the accumulated legacy and continued leaching of Hg in our watersheds will influence Hg concentrations in fish for some time as will any hydrological shifts due to climate change.

- [1] Chen *et al.* (2005) *Ecotoxicology* **14**, 135–147.
[2] Pickhardt *et al.* (2007) *PNAS* **104**, 7477–7482.
[3] Kopáček *et al.* (2000) *Limnol. Oceanogr.* **45**, 212–225.
[4] Canham *et al.* (2004) *Ecological Applications* **14**, 839–854.

Quartz-vein wolframite ore and granitoid magmatism: Spatial and genetic connection

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This problem was solved by the example of rare-metal deposits related with granites in Eastern Transbaikalia, with which different types of wolframite mineralization is associated: dissemination (up to ore-productive) in granites and greisens, pegmatoid bodies and quartz veins in massive and in far area of its (from 0, 5 to 3 km). Spokoinoje W-deposit is considered as a model object. Methodological basis were isotope-geochemical (Rb-Sr, Sm-Nd) researches and study of mineral-forming environment in quartz. The main results are as follows: (1) On the basis of studying of two isotope systems, it is found, that age of formation of all types of ore mineralization within the granite massive is corresponds to the interval - 139, 8±1, 3Ma, by age of mother massive granites - 144, 5±1, 4Ma. This interval may corresponds to the duration of transition from magmatic to hydrothermal stage of Spokoinoje ore-magmatic system formation; (2) The established differences in isotope characteristics of Sr and Nd between the Spokoinoje granites ($\epsilon_{Nd}(144) = -3, 4$, IR (Sr)=0, 70658±28) and wolframites within massive ($\epsilon_{Nd}(140)$ up -1, 9 to -1, 8, IR (Sr) = 0, 710839±46) indicates participation of depleted component by the formation of ore material; (3) Estimation of W concentration in the melt of Spokoinoje massive on the basis of study of melt inclusions in quartz showed extremely low solubility of wolframite: $\log K_{sp}$ varying from -6, 5 to -6, 7 mole²/kg² (from 8, 8 up to 3, 7 ppm W in melt); (4) Formation of quartz-wolframite-cassiterite veins of far area (144, 0±2, 1Ma) is happening simultaneously with the formation of Spokoinoje massive (144, 5±1, 4Ma), which suggests their formation at different stages of the hydrothermal system.

Obtained results, including considerable time gap between granite massive forming and wolframite crystallization on the one hand and extremely low solubility of wolframite in melt on the other, unconditionally show hydrothermal-metasomatic (?) nature of wolframite.

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