Constraining mercury oxidation using wet deposition

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We combine results from the GEOS-Chem mercury model with wet deposition data from the U.S. Mercury Deposition Network (MDN) to identify how wet deposition can be used to constrain the oxidation pathway of mercury. We compare GEOS-Chem wet deposition results from two simulations with either bromine compounds or OH and O3 as dominant oxidants. We find that the simulated difference between wet deposition using these alternative oxidation mechanisms has a seasonal variation, notably in the Western U.S. While measured mercury deposition correlates strongly with precipitation in the Eastern U.S., especially in the Southeast, this correlation is not as strong (or nonexistent) in the Pacific and Western regions. We compare the simulated seasonal pattern with MDN data to identify locations most sensitive to differences in oxidation mechanism. We then compare simulated Hg (II) concentrations and wet deposition with auxiliary data from selected sites (daily precipitation and air quality data such as O3 concentration) to clarify potential chemical mechanisms and source influence, including marine boundary layer influences.

Carbon isotope composition of CO_2 from fluid inclusions in quartz

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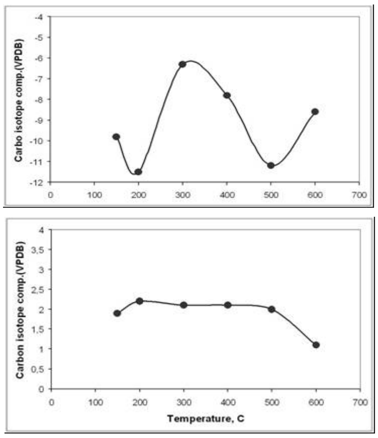
The main component of fluids in hydrothermal oreformation is CO_2 generally, that fixed by fluid inclusions in quartz. However, the source of CO_2 that determined by $\delta^{13}C$ values is mostly unknown. The factors affected the resulting carbon isotope composition in case of thermal decrepitation may be: a) thermochemical reactions in the system $CO_2 + H_2O + CH_4 + C$ result in isotope exchange between C-containing constituent of the system, presented in a sample; b) decomposition of solid-phase carbonates starting from more than 450°C with the release of CO_2. Experimentation with carbon isotope analysis from inclusions in quartz of different gold-ore deposits allowed to determine the limits within definiteness of geological interpretation of obtained $\delta^{13}C$ values can be attained: 1) selection of quartz sample from veins, that are below 'boiling' level [1]; 2) absence of carbonate phases in inclusions; 3) chromatographic analysis of gaseous constituent in inclusion with futher selection of the quartz samples in which CO_2 is prevalent; 4) measuring of CO_2 using the system [2] within strictly defined temperature interval. $\delta^{13}C$ values of different temperature stages are mostly 'discordant' (fig. 1a) and the determening of CO_2 source is impossible in most cases. But $\delta^{13}C$ values may point to source of CO_2 in case of 'concordant' (or quasi) $\delta^{13}C$ distribution (fig. 1b) against temperature.



1a

1b

Figure 1: Distribution of $\delta^{13}C$ values against temperature.

[1] Wilkinson (2001) *Lithos* **55**, 229–272. [2] Semenova *et al.* (2009) *Geochim.Cosmochim. Acta* **73**, is.1.P.A1193.