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# Carbon isotope fractionation of fluid during tungsten ore formation

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Isotope composition of carbon of carbon dioxide in fluids in quartz was lead for two wolframite greisen mains: Spokoinoe (Russia) and Akchtau (Kazahstan). Carbon on both main is present only in fluid inclusions. Carbonates and graphite are absent. Carbon dioxide is the predominate form of carbon in fluid. Carbon dioxide was extracted form quartz by thermal evacuation. $\delta^{13}$C (PDB) for initial granites is determined -5.6 $\pm$ 1.5 ‰ for Spokoinoe and –6$\pm$2‰ for Akchatau. These values follow the usual interval for miasmatic rocks. The deep level of ore veins has the $\delta^{13}$C values close for initial granites. Carbon dioxide from quartz-muscovite metasomatites with the maximum ore deposition is enriched by $^{12}$C and $\delta^{13}$C is determined from –24.4‰ for Akchatau and 16.5$\pm$1‰ for Spokoinoe mains. Upper parts of massive have no any isotope anomalies and its composition is close for unaltered granites. So, the light carbon isotope composition in ore metasomatites can't be explained by mixing of different sources. Because of the low maintenance of methane in comparison with the maintenance of carbon dioxide the isotope effect at oxidation of methane could not be caught.

The important feature of both ore mains is heterogenization and boiling of ore-forming fluids. Only liquid phase was trapped in fluid inclusion during quartz crystallization. So, the isotope composition characterizes only dissolved carbon dioxide. The evolution of isotope composition can be explained by a Rayleigh-type isotope distillation model along fluid heterogenization and boiling. The gas phase with the high carbon dioxide concentration is separated from a liquid and gas flow is filtrated by other way. Liquid phase react with the granites forming metasomatites. The result of isotope fractionation thermodynamic calculation show good agreement with isotope composition

of ore bodies and explains the wolframite precipitation. Condensation of the gas phase in upper parts of massive produces the carbon dioxide solution with the initial isotope composition. This mechanism of carbon isotope fractionation can be applied for other hydrothermal systems.