

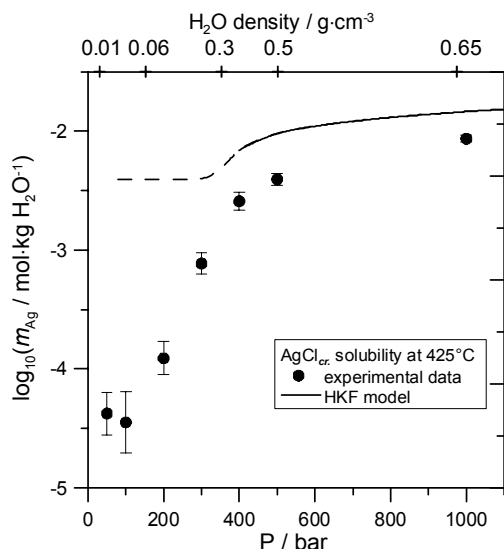
Solubility of chlorargyrite AgCl_{cr} in low density aqueous fluid at 400 - 425°C and 50 - 1000 bar

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The goal of this study is to develop an approach to thermodynamic description of neutral aqueous complexes in a wide range of fluid density. For this purpose chlorargyrite solubility has been measured in water as a function of solvent density.

Experiments were carried out in pure water using titanite alloy VT8 autoclaves at temperatures 400 and 425°C and pressure range of 50-1000 bar. The density of solvent thus changes within the limits of 0.015-0.7 g/cm³. Solubility of AgCl was determined by means of loss-weight and atomic adsorption methods. The results of experiment are shown in the figure as a filled symbols. It can be seen that AgCl solubility decreases sharply with lowering pressure in comparison to the HKF model (solid line in the figure).



Thermodynamic description of the experimental data is based on the new equation of state of Akinfiyev & Diamond (2003) for neutral aqueous species.

Acknowledgements

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Reference

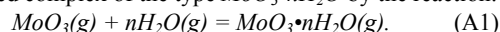
Akinfiyev N.N. and Diamond L.W. (2003) *Geochim. Cosmochim. Acta* **67**, 613-627.

Molybdenum solubility and speciation in water vapor at elevated temperatures and pressures

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Given that hydrothermal systems responsible for the formation of porphyry *Mo* deposits are commonly vapor-dominated, it is reasonable to ask if vapor could be the agent of *Mo* transport. As a first step in addressing this question, we have experimentally investigated the solubility of MoO_3 in dry water vapor at 300, 320, and 360°C and 39 to 163 bars. Results of these experiments show that the solubility of MoO_3 is between 1 and 25 ppm, which is 19-20 orders of magnitude higher than in the water-free system. Molybdenum solubility increases with increasing $f\text{H}_2\text{O}$, indicating that *Mo* forms a hydrated complex of the type $\text{MoO}_3 \cdot n\text{H}_2\text{O}$ by the reaction:



The hydration number, n , is 2.3 at 300°C, 2.9 at 320°C, and 3.2 at 360°C and the corresponding values of log K are 17.5, 15.1, and 12.0. Calculations based on these data predict that the solubility of *Mo* in water vapor is ~0.06 ppm at conditions typical for the formation of a porphyry *Mo* deposit. This would be sufficient to form an economic deposit within the lifetime of typical hydrothermal systems. However, the high salinity of porphyry *Mo* systems, and evidence that *Mo* forms stable gaseous chloride species in water-free systems, suggest that the *Mo* solubility in water vapor may be enhanced by the formation of hydrated chloride species. This conclusion is strengthened by the fact that the fugacities of MoO_2Cl_2 , [1] MoCl_4 , [2] and MoCl_6 [3] in the water-free system are many log units higher than that of MoO_3 (e.g., at 300°C, the log fugacities are 2.79, 3.11, and 0.92 bars, respectively, whereas MoO_3 has a log fugacity of -28.76).

The hypothesis that *Mo* forms stable gaseous hydrated chloride complexes will be investigated experimentally in the system *Mo-Cl-H₂O* at temperatures from 300 to 600°C, at both undersaturated and saturated water vapor pressure. The latter experiments will be used to determine the partition coefficient for *Mo* between liquid and vapor, in order to evaluate the relative importance these phases in the transport of *Mo* in magmatic-hydrothermal systems.

References

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