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Condensation temperatures of trace elements during Moon formation

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The Moon is characterized like many other planetary objects by a depletion in volatile elements. Remarkably, this depletion is more pronounced than that of the Earth and this observation was used as an argument for a giant impact for generating the Moon. However, the conditions of volatile loss are not fully understood. Thermodynamic models for the volatility of major elements of the protolunar disk have been proposed [1-3] but the case of trace elements is less well studied. In this study, we have modeled the chemical equilibrium between vapor and condensed phase during the Moon forming event and determined the condensation temperatures for trace elements of geochemical interest, using a wide range of temperature and pressure conditions.

Assuming a given T and P of vapor-liquid separation, it is possible to determine the composition of lunar condensates and our results show that it is possible to reproduce the chemical composition the bulk Silicate Moon using a relatively large range of pressures, given the wide uncertainties in the lunar compositions reported in the literature. If the vapor-liquid separation takes place over a range of P-T conditions (rather than a discrete value) then more complex trace element patterns can be obtained.

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