**CONTROL ID:** 2258359

**TITLE:** The devolatilization of stellar material that produces rocky planets is more accurately described by non-equilibrium partial sublimation rather than equilibrium partial condensation: implications for water content

**ABSTRACT BODY:**

**Abstract Body:** Elemental "50% condensation temperatures" have been used for decades in planetary science to represent the relative volatility of elements. These temperatures are based on taking a hot gas of solar composition and cooling it, with all elements and compounds in chemical equilibrium with each other. Although condensation temperatures are useful as a first approximation, they do not reflect the dominant physical mechanisms responsible for the devolatilization that leads to the formation of rocky planets. Stars begin to form with protoplanetary accretion disks in the densest and coldest (~ 5-30 K) cores of molecular clouds. As the star and midplane of the accretion disk heat up, the cold condensed and clumped material begins to sublimate and fractionate. Because of the clumping and the heating of previously cold material, the devolatilization that leads to rocky planet formation is produced by non-equilibrium partial sublimation, not equilibrium partial condensation. The difference between the temperatures when an element is 50% ("partially") sublimated from a non-equilibrium clump, and 50% condensed at equilibrium is particularly large for the dominant elements carbon and oxygen. Using the elementatl abundance differences between the Sun and the Earth and plotting them as a function of how refractory or volatile an element is, we make new higher estimates of the temperatures that should be used for carbon and oxygen to parametrize the devolatilization of stellar material in protoplanetary disks to produce rocky planets. These modifications have important implications for the C/O ratio that controls redox state and the main chemical composition of a planet, and the amount of H2O on a planet.

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**PRESENTATION TYPE:** Oral