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Mercury's early silicate atmosphere

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We combined some of the existent chemical and thermodynamical equilibrium models of high-temperature silicate surface constituents, namely from Fegley and Cameron (1987), and Lieshout et al. (2014), to model the early atmosphere of the Mercury proto-planet. We compute the equilibria in a melt, between the melt and its equilibrium vapor, and in the gas phase. We calculate the temperature-dependent pressure and composition of vapor in equilibrium with the molten silicate lava using a range of surface temperatures. Finally, we derive the atmospheric mass loss for possible Mercury proto-planets. We present the results for the derived mineralogical average surface composition of Mercury presented by Wurz et al. (2010). We predict the evaporation and sublimation loss of the molten silicate lava and give estimates of the column densities and exobase altitude of the primordial hermean atmosphere. Given the evaporation and sublimation loss rates and Mercury's age, we estimate the present exosphere conditions and compare with available observations.