

## **Atmospheric blowoff and melting during the giant impact stage of planet formation**

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Mantle noble gas data record evidence for multiple partial mantle magma oceans and atmospheric loss episodes on the growing Earth. Based on a broad suite of giant impact simulations, we develop scaling laws for blowoff of the atmosphere and an ocean. In addition, we consider the early time energy budget to estimate the volume of mantle melted by a giant impact. For the specific impact energies typical of terrestrial planet formation, partial atmospheric blowoff is common when an ocean is present, but ocean loss is rare. Atmospheric blowoff without an ocean requires impact energies on the high end expected during planet formation. Because the giant stage is stochastic, different sequences of giant impacts lead to differences in the volatile content of the final planet.