The Origin of Earth's non-chondritic composition?

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It is commonly assumed that the Earth's composition is chondritic. Chondrites, as primitive undifferentiated meteorites, with compositions that correspond very closely to that of the solar photosphere, make an excellent reference for the bulk mass of the Solar System, out of which the planets formed. Measurements of rare earth elements, particularly $^{142}Nd/^{144}Nd$, however, suggest that the Earth's composition is not chondritic. One model to explain this is that there is a hidden reservoir at the base of the mantle, in which the missing material has been hidden since < 30Myr after the formation of Earth. A second hypothesis assumes the Earth is in fact non-chondritic and that it accreted out of a non-chondritic region of a heterogeneous protoplanetary nebula. We investigate a third scenario in which a non-chondritic Earth formed from the selective accretion of differentiated bodies. In order to investigate this collisional model we use a combination of an efficient N-body code to model the runaway and oligarchic phase of planet formation and a sophisticated planetesimal collisional model that takes into account many different collision outcomes including hit-and-run, partial accretion, erosion, super-catastrophic disruption and perfect merging. By considering collisions between differentiated bodies, we are able to track the core-mantle composition of terrestrial planets as they form. This provides important insights into the possibility of forming an Earth with non-chondritic composition and constrains the collisional history of such a planet. We form a range of terrestrial mass planets with different compositions. These provide important predictions for observations of earth-like exo-planets and their radius-mass distribution.