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Tomographic, kinematic and gravitational evidence for a slab under Greenland and its potential links to Arctic magmatism.

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Seismic tomography and recent satellite gravity data reveal regions of anomalous structure within Earth's present-day mantle. On scales of some tens to hundreds of kilometers in wavelength, individual subducted slabs and mantle plumes can be resolved. When linked with global plate reconstructions and models of mantle convection, subducted slabs of lithosphere can be related to distinct periods of ocean basin closure. Here we explore the origins for a distinct fast seismic feature under present-day Greenland that is apparent across several P and S-wave tomography models. The sub-rounded seismic anomaly of interest is distinct from the more westerly "Farallon" slab, and is located in the mid mantle between $\sim$1000-1600 km depth. We include a discussion of mantle sinking rates, showing that taking 1600 km slab base depth and applying sinking rate of 1.2 cm/yr implies a subduction age of $\sim$133 Ma. We supplement the tomographic evidence for this slab with independent, satellite-derived vertical gravity gradients. Preliminary analysis of the gravity reveals a possible mantle anomaly in the SW Greenland region, complementary in spatial extent to that inferred from tomography. Considering absolute and relative plate reference frames, we suggest that palaeo-Arctic subduction related to the opening of the Amerasia Basin in the Jurassic, may account for this mantle feature. We finally investigate potential geochemical links of this slab feature with high arctic magmatism in the Cretaceous, showing that a time-dependent consideration of surface kinematics and mantle dynamics may reveal new insights into the geodynamic evolution of the Arctic.