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Plume-induced sinking of the intracontinental lithosphereas a fundamentally new mechanism of subduction initiation.

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Although many different mechanisms for subduction initiation have been proposed, few of them are viable in terms of agreement with observations and reproducibility in numerical experiments. In particular, it has recently been demonstrated that intra-oceanic subduction triggered by an upwelling mantle plume could contribute greatly to the onset and functioning of plate tectonics in the early Earth and, to a lesser extent, in the modern Earth. In contrast, the onset of intracontinental subduction is still underestimated. Here we review 1) observations demonstrating the upwelling of hot mantle material flanked by sinking proto-slabs of the continental mantle lithosphere, and 2) previously published and new numerical models of plume-induced subduction initiation. Numerical modelling shows that under the condition of a sufficiently thick (> 100 km) continental plate, incipient down thrusting at the level of the lowermost lithospheric mantle can be triggered by plume anomalies with moderate temperatures and without significant strain and/or melt-induced weakening of the overlying rocks. This finding is in contrast to the requirements for plume-induced subduction initiation in oceanic or thin continental lithosphere. Consequently, plume-lithosphere interactions in the continental interior of Paleozoic-Proterozoic (Archean) platforms are the least demanding (and therefore potentially very common) mechanism for triggering subduction-like foundering in Phanerozoic Earth. Our findings are supported by a growing body of new geophysical data collected in a variety of intracontinental settings. A better understanding of the role of intracontinental mantle downthrusting and foundering in global plate tectonics and, in particular, in triggering "classic" oceanic-continental subduction will benefit from further detailed follow-up studies.