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The role of a sharp cratonic keel edge for lithospheric delamination and rapid orogenic plateau uplift, Canadian Cordillera

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The interior of the Canadian Cordillera is part of an exhumed fossil plateau located in a back-arc tectonic setting. In this study, we compare new analysis of teleseismic Rayleigh-wave tomography with published thermochronology data to investigate lithospheric structure and exhumation history in this region, where the western edge of the North American cratonic mantle keel records the highest known upper-mantle lateral velocity gradient. We show that the craton edge is marked by a remarkably abrupt change in lithospheric thickness, from > 200 km to < 50 km, coincident with a step in surface heat flow. This sharp plate edge delineates the eastern limit of a fossil orogenic plateau that experienced rapid uplift and exhumation (10 to 15 km) during the mid to late Eocene. Our tomographic images show evidence for a sinking high-velocity block in the sub-Cordilleran mantle, at depths > 165 km, which we interpret as foundering lithospheric mantle; we propose that delamination of this block was triggered by edge-driven convection and led to rapid uplift, voluminous magmatism and transition from compressional to extensional regime. Similar processes may have resulted in removal of the lithospheric keel beneath the North China craton and regional uplift of the Altiplano.