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Combining geophysical and petrological estimates of the thermal structure of southern Tibet

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The thermal structure of the Tibetan plateau remains largely unknown. Numerous avenues, both geophysical and petrological, provide fragmentary pressure/temperature information, both at the present, and on the evolution of the thermal structure over the recent past. However, these individual constraints have proven hard to reconcile with each other. This study presents a series of models for the simple underthrusting of India beneath southern Tibet that are capable of matching all available constraints on its thermal structure, both at the present day and since the Miocene. Three consistent features to such models emerge: (i) present day geophysical observations require the presence of relatively cold underthrust Indian lithosphere beneath southern Tibet; (ii) geochemical constraints require the removal of Indian mantle from beneath southern Tibet at some point during the early Miocene, although the mechanism of this removal, and whether it includes the removal of any crustal material is not constrained by our models; and (iii) the combination of the southern extent of Miocene mantle-derived magmatism and the present-day geophysical structure and earthquake distribution of southern Tibet require that the time-averaged rate of underthrusting of India relative to central Tibet since the middle Miocene has been faster than it is at present.