# The inverted Barrovian metamorphic sequences and fluid-present melting in the Arun area, eastern Nepal

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The metamorphic pressure-temperature (P–T) field gradient and fluid-present melting across the Main Central Thrust (MCT) zone in the Arun area have been investigated. The MCT shear zone bounded by the MCT and lower MCT marks the boundary of the overlying high-grade High Himalaya Crystalline Sequence (HHCS) from the underlying low-grade Lesser Himalaya Sequence (LHS). The location of the MCT is identified by low celadonite content in muscovite from schists and low pargasite content in amphibole composition from amphibolites just above the MCT. Kyanite gneisses of the lower HHCS include kyanite- and tourmaline-bearing leucosomes formed by fluid-present melting associated with the MCT activity, and monazite and zircon U–Pb ages revealed that the MCT in the Arun area was mainly active during ca. 20–14 Ma. The metamorphic rocks regionally preserve inverted Barrovian sequence (i.e. intermediate P/T type metamorphism) without high-pressure metamorphism. Metamorphic grade increases upwards from 670–730 ˚C and 6.9–9.1 kbar in the MCT zone and lower HHCS to 725–835 ˚C and 8.6–11.1 kbar in the middle HHCS. Orthoamphibole gneisses in the middle HHCS yield prograde P–T path from 640–680 ˚C and 8 kbar to 760–835 ˚C and 10–11 kbar with intermediate P/T gradient, accompanied by crustal thickening. The isobaric field gradients near the MCT in this area could represent syn-metamorphic thrusting as a cause for inverted Barrovian metamorphic sequences, which are contrast to the high field pressure gradients near the MCT observed in the other transects in eastern Nepal. In addition, there is no age gap in the K–Ar muscovite ages across the MCT, and they show similar ages (ca. 13–7 Ma) in the hanging wall and footwall of the MCT. These results suggest that the inverted Barrovian sequences were exhumed during 13–7 Ma by lower MCT in the south.