

## **Constraints on crustal growth and evolution by multiple detrital mineral records from large rivers**

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Detrital minerals from rivers draining exposed crust over extensive areas provide representative components which are optimal subjects for understanding the composition and evolution of the continental crust. It is of appeal to look into multiple minerals with distinct host-rock preferences, growth conditions, closure temperatures and physical and chemical resistances. In this study, we carry out an integrated investigation of detrital minerals including zircon (U–Pb–Lu–Hf–O isotope), monazite (U–Th–Pb–Sm–Nd isotope), rutile (U–Pb isotope and trace element), titanite (U–Pb–Sm–Nd isotope) and apatite (U–Pb–Sm–Nd isotope). Samples from two large rivers within the North China Craton (NCC) have been studied; Yongding River (YDR) in the central part and Luan River (LR) in the northern part. Distinct from the zircon and monazite records, the old populations of detrital rutiles and apatites cluster at ca. 1.76 Ga, which might be attributed to the effect of the Paleoproterozoic high grade metamorphism trans the NCC. The model ages of zircons, monazites and apatites from YDR and zircons from LR are consistent with the Sm–Nd isotope compositions of the representative bulk rock, corresponding to the major crustal growth episod during Neoproterozoic in the NCC. However, the monazites of the LR trend to have younger Nd model ages, implying contributions of juvenile components. Due to the decouple of Nd model ages of monazite and bulk rock in the drainage area, we suggest these Phanerozoic monazites are exotic and possibly related to the Central Asian Orogen Belt (CAOB) to the north of the NCC. The detrital rutiles with Paleozoic ages also indicate contributions from the CAOB. Our combined data set of multiple detrital minerals presents a better constrains on the evolution of the continental crust in the catchment.