

Age constraints on late Mesozoic lithospheric extension and origin of felsic volcanism in the Songliao basin, NE China

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Late Mesozoic lithospheric extension in NE Asia resulted in the development of a large extensional province and widespread formation of volcano-sedimentary basins. Songliao is the biggest basin in that region, situated between the Siberian and Sino-Korean (North China) cratons. The Songliao basin contains voluminous volcanic rocks as a major part of the basin fill. Volcanic successions form a significant, mostly concealed part of the late Mesozoic magmatic province in NE China.

Here we report zircon U-Pb ages and geochemical data for felsic volcanic rocks from the Songliao basin. Zircon populations of two types of rhyolites with distinct I- and A-type affinities, analyzed by laser ablation ICP-MS, yielded similar U-Pb ages of 114 ± 2 Ma and 113 ± 2 Ma, respectively. Whole-rock Nd and zircon Hf isotope data of the felsic rocks indicate an origin from newly formed crustal protoliths. The I-type rhyolites show geochemical signatures of subduction related underplated mafic rocks, whereas the A-type rhyolites have higher heavy rare earth element (HREE) and high field strength element (HFSE) concentrations and lower Ba/Nd ratios that are interpreted as evidence for melting of I-type felsic lower crustal sources in an intra-plate tectonic environment. Typical geochemical compositions of A-type rhyolites indicate anorthite-rich plagioclase as a residual magmatic phase and imply melting at shallow crustal levels. The comparable A-type felsic rocks in the Hailar and Songliao basins of northeastern China, were generated during a period of maximum lithospheric extension around 120 Ma and 110 Ma, respectively. This thinning process progressed from west to east was probably related to the retreat of the Paleo-Pacific trench.