

Mesozoic–Cenozoic thermal evolution of SE China in response to flat-slab subduction at the proto-Western Pacific margin

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The flat-slab subduction model has been proposed to explain the complex Mesozoic–Cenozoic geotectonic record of SE China as part of the Western Pacific margin. Here we investigate the post-250 Ma thermal history of the SE China to evaluate the model. Our multi-chronological approach includes zircon U/Pb geochronology, ⁴⁰Ar/³⁹Ar dating of K-feldspar and biotite, (U-Th)/He dating of zircon and apatite, and fission-track dating of apatite from basement/sedimentary rocks, as well as vitrinite reflectance analysis of coal seams. Zircon U/Pb dating revealed Early Silurian and Late Jurassic crystallization ages for the Fuxi (ca. 438 Ma) and Liyuan (ca. 162 Ma) granites, respectively. Syn-/pre-depositional single-grain zircon (U-Th)/He ages from Lower Jurassic sandstones record a Middle Triassic exhumational cooling, interpreted to reflect the Indosinian Orogeny, possibly caused by a flat-slab subduction event. Late Jurassic biotite ⁴⁰Ar/³⁹Ar age (ca. 156 Ma) obtained from the Late Triassic Mengdong granite, together with maximum vitrinite reflectance values of 1.690%–2.336% measured from a Lower Jurassic carbonized coal sample, document a thermal maximum in the Late Jurassic, likely related to the prior regional magmatism arising from delamination of the subducting Paleo-Pacific plate. K-feldspar ⁴⁰Ar/³⁹Ar plateau age from the Fuxi granite (ca. 125 Ma), and zircon (U-Th)/He mean ages (152–115 Ma) record a protracted cooling through the K-feldspar Ar and the zircon He partial retention zones during the Cretaceous. The Cretaceous cooling is in accord with the prediction of regional uplift and erosion in response to foundering of the flat-slab and consequent lithospheric rebound. The rapid cooling during the Paleocene–Eocene, recorded by apatite fission-track central ages (72–39 Ma) and apatite (U-Th)/He mean ages (38–33 Ma), is interpreted to reflect Cenozoic rifting in the leadup to the opening of the South China Sea.