

Latest Carboniferous-earliest Permian subduction-related volcanism in the northwestern Lesser Xing'an Range: Implications for the tectonic evolution of Northeast China

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Paleozoic tectonic nature of the Northeast China region, either continental blocks or orogenic belts, has always been a hot-debated issue. In recent years, Northeast China, located in the eastern section of the Central Asian Orogenic Belt, is widely regarded as a collage of several independent microcontinental massifs through a series of collisions in the Paleozoic, and the northwestern Lesser Xing'an Range records the early Late Carboniferous collision between the Xing'an and Songnen-Zhangguangcai Range massifs, which was along the Heihe-Neijiang suture. Consequently, it is widely accepted that the Late Carboniferous-Early Permian magmatism along the Heihe-Neijiang suture zone has always been interpreted to be the result of a post-orogenic crustal extension. However, we have newly identified latest Carboniferous-earliest Permian (307~290 Ma) intermediate-basic and acidic volcanic rocks in the northwestern Lesser Xing'an Range, NE China, whose petrological and geochemical signatures support a subduction-related active continental margin setting.

The intermediate-basic volcanic rocks comprise a suite of calc-alkaline basaltic andesite, basaltic trachyandesite, andesite, and minor subalkaline basalt, with average composition of $\text{SiO}_2 = 55.09$ wt.%, enrichment in LILEs, and depletion in Nb and Ta, which is typical of subduction-related magmatic rocks. The acidic volcanic rocks are dominated by high-silica rhyolite (71.83-79.23 wt.% SiO_2 , pronounced negative Eu anomalies: $\delta\text{Eu} = 0.14-0.56$) and subordinate dacite. Together with their zircon $\varepsilon_{\text{Hf}}(t)$ values (+6.20 to +14.39), we conclude that the magmas were derived by the partial melting of juvenile crustal material with a contribution from a depleted lithospheric mantle in an active continental margin setting related to the northwards subduction of the Paleo-Asian oceanic plate beneath the Siberian paleo-plate. Combined regional geological data with the fact that these subduction-related rocks occur across the Heihe-Neijiang suture zone, it is inferred that a Carboniferous island arc, as a result of the western Baolidao arc extending northeastwards, probably exists under the northern Songliao Basin, and that an island arc-continent collision only occurred in the early Late Carboniferous and oceanic subduction lasted at least until the early Permian in the northwestern Lesser Xing'an Range, NE China. This work is supported by NSFC (41802068), CPSIBRF (J1907) and NKRDPC (2017YFC0601301).