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Early Cretaceous Tectonic Evolution of the Lingshan Island in Shandong, Eastern China

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Abstract: Based on previous studies, we carried out systematically work on the Cretaceous sediments and volcanic lavas as well as granitic rocks from the Lingshan Island and adjacent region aimed to constrain accurately formation ages of the sediments, volcanic lavas and accompanying granite in adjacent regions and deduce petrogenetic setting. Detailed field and analytical work were conducted on the Cretaceous sediments on Lingshan Island, several key conclusions are concluded as below: (i) The detrital zircon U-Pb analyses demonstrate that the Fajiaying Formation and the clastic rocks from the bottom of the Bamudi Formation were deposited in the late periods of Early Cretaceous, showing the synchronous depositional ages within the uncertainties, 127±3 Ma and 128±4 Ma, respectively. (ii) Moreover, two sets of clastic rocks have the same age spectra and similar Hf isotopic compositions, indicating that the sandstone or mudstone characterized by soft sedimentary deformations and pebbly sandstone have the similar sedimentary provenance, which was very single and mainly derived from the Jiaobeiterrane akin to the north China craton attributes. (iii) Comparison with the Jiaolai basin, the detrital zircons of the Laiyang Group in Lingshan Island show different age spectra. We argue that the sedimentary rocks from Lingshan Island might be deposited in a solo basin controlled by the fault different from the Jiaolai basin during the Early Cretaceous. On the other hand, new insights from the volcanic lavas and granite were summarized as follow in study region: (i) Zircon SHRIMP II and LA-MC-ICP-MS U-Pb dating resulting reveal that the rhyolite and andesitic rocks were formed at 126~128 Ma and 129~131 Ma, respectively. (ii) Zircon Hf-O isotopes and Neoproterozoic inherited zircons together suggest that the rhyolite was derived from partial melting of Yangtze crustal material, while the andesitic assemblages were derived from partial melting of enriched lithosphere and subsequently experienced two-stage petrogenetic processes. (iii) Zircon U-Pb dating demonstrates that the granite was emplaced at 119 Ma and sourced from partial melting of Paleoarchean crustal material in the Caochang village. During the evolutionary process, the enriched mantle material also participated in the formation of granite. During Early Cretaceous, the study region and adjacent regions experienced large-scale lithosphere delamination and thinning which result in asthenosphere upwelling inducing partial melting of lower crust and generating granitic magma. Subsequently, granitic magma emplaced and crystallized at ~10 km underground; meanwhile, it belonged to typical faulted-basin sedimentation and suffered from strong volcanism and earthquake which led to large-scale slump and soft sedimentary deformations for the non-diagenetic sediments on Lingshan Island. In the Late Cretaceous, Jiaonan region experienced quick tectonic uplift, and ~10 km crustal material was eroded and denudated. The granite pluton, emplaced in a deep setting ~10 km underground, was exhumed to continental surface (e.g. Mts. Dazhu, Laoshao). Compared with granite pluton, the sediments and volcanic breccia deposited on the continental surface, and did not experienced strong tectonic denudation. Integrated with regional tectonic uplifting differences, we infer that there is a hidden regional fault located between Lingshan Island and Jiaonan region. Also, this hidden fault was typical basin-controlling fault during early periods, and subsequently played a key role in constraining regional uplifting and denudation.

Key words: Sulu orogenic belt, Lingshan Island, Cretaceous, sand-mudstone, volcanic breccia and lavas, petrogenesis

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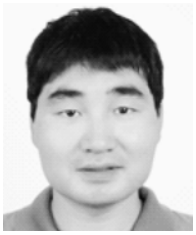

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