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Sedimentary provenance of the Hengyang and Mayang basins, SE China, and implications for the Mesozoic topographic change in South China Craton: Evidence from detrital zircon geochronology

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A B S T R A C T

Detrital zircon U–Pb data from sedimentary rocks in the Hengyang and Mayang basins, SE China reveal a change in basin provenance during or after Early Cretaceous. The results imply a provenance of the sediment from the North China Craton and Dabie Orogen for the Upper Triassic to Middle Jurassic sandstones and from the Indosinian granitic plutons in the South China Craton for the Lower Cretaceous sandstones. The 90–120 Ma age group in the Upper Cretaceous sandstones in the Hengyang Basin is correlated with Cretaceous volcanism along the southeastern margin of South China, suggesting a coastal mountain belt have existed during the Late Cretaceous. The sediment provenance of the basins and topographic evolution revealed by the geochronological data in this study are consistent with a Mesozoic tectonic setting from Early Mesozoic intra-continental compression through late Mesozoic Pacific Plate subduction in SE China.

1. Introduction

The Mesozoic and Cenozoic basins and granitoids in southeastern China depict a complex basin-range pattern similar to the present-day Basin and Range Province in western North America (Li, 2000; Shu et al., 2004; Li and Li, 2007) (Fig. 1). The tectonic history of South China is hence marked by a prolonged period of shortening during the Mesozoic that became progressively less intense and eventually reverted to crustal extension during the Jurassic to early Cenozoic (Liu et al., 2003; Shu et al., 2004). An active continental-margin model, with the subduction of a paleo-Pacific plate beneath the South China Craton, is often used to account for the extensive magmatic zone in southeastern China during the Mesozoic (e.g. Charvet et al., 1994; Lapierre et al., 1997; Sewell and Campbell, 1997; Zhou and Li, 2000; Li and Li, 2007). While this active-to-passive margin transition could account for the development of the Mesozoic granitoids and Cenozoic sedimentary basins in South China, the ages of the basins and the topographic evolution during this transition remain poorly studied. Two unresolved questions are particularly critical for the understanding of the paleogeographic evolution of the region during this compression–extension transition. The first question pertains to the provenance of the basin sediment and did the provenance shift with time. Secondly, whether there was a plateau or coastal mountain range in eastern China associated with the subduction of the paleo-Pacific plate during the Mesozoic has been the subject of an intense debate (Chen, 1997; Zhang et al., 2001; Chen et al., 2003). The presence of such a mountain range system in eastern China would certainly have major implications on the paleoclimatic condition and sedimentary environment. An integrated basin and structural analysis could provide an effective means of reconstructing the paleogeographic evolution of the region and shed lights on these two questions.

The collision between the North and South China blocks occurred in a diachronous manner from east to west since Early Mesozoic (Zhao and Coe, 1987; Yin and Nie, 1993; Okay et al., 1993; Faure et al., 1996; Liu et al., 2003; Katsube et al., 2009). A total of about 4.0×10^6 km^3 was estimated to have been eroded from the suture zone during the Early Mesozoic (Okay et al., 1993; Li et al., 1999a, 2000, 2002a). It is important to determine where such a great volume of sediment was eventually deposited and if the extensive denudation of the suture zone constituted the source for the basin sediment in the South China Craton. The Hengyang and Mayang basins in the South China Craton have preserved a relatively complete sedimentary record useful for studying the basin provenance and topographic evolution. In this paper, detrital zircon U–Pb age data from sedimentary rocks in the Hengyang and Mayang basins are presented in an attempt to (1) determine the

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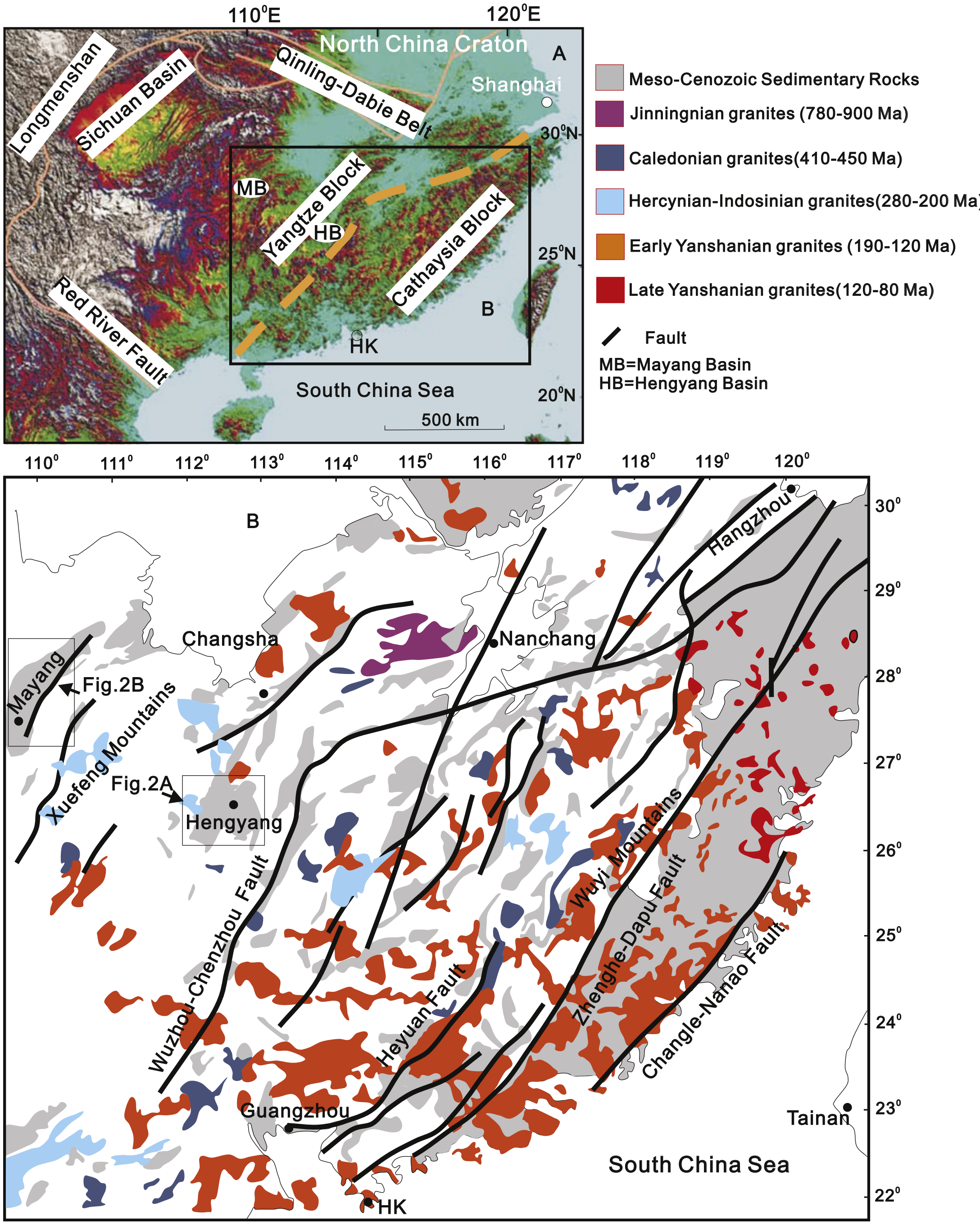

Fig. 1. A-Digital topography and tectonic sketch of the South China Craton (modified after Li and Li, 2007). HB-Hengyang Basin; MB-Mayang Basin. B-Simplified geological map showing the distribution of Meso-Cenozoic basins and magmatism rocks in southeast China (Modified after Shu et al., 2004). HK-Hong Kong.

origin of the detritus in the basins and (2) reconstruct the topographic features of the South China Craton.

2. Regional geology

The South China Craton comprises the Yangtze Block in the north and Cathaysia Block in the south (Fig. 1A), each with distinctive crustal ages and tectonic histories (HNGBMR, 1988; Ren, 1991; JXGBMR, 1988; Duan et al., 2011; Li et al., 2011; Wong et al., 2011). The basement of the Yangtze Block consists of Archean rocks (Ames et al., 1996; Qiu et al., 2000) while that of the Cathaysian Block dominantly Paleo-Mesoproterozoicsome Late Achaean components (~2.5 Ga; JXGBMR, 1988; Chen and Jahn, 1998). The collision of the two blocks resulted in the 0.9–1.3 Ga Sibao Orogeny, which coincides with the worldwide Grenville event (Li et al., 2002b; Rino et al., 2008; Santosh et al., 2009). Large-scale Neoproterozoic rifting (0.7–0.8 Ga) began within the South China Craton soon after Yangtze–Cathaysia amalgamation (Li et al., 1999b; Sewell et al., 2000; Wang et al., 2009). The Caledonian South China Fold Belt within the Cathaysia Block is characterized by 420–450 Ma folding and the intrusion of 400–440 Ma S-type granitoids (Li, 1998; Chen and Jahn, 1998; Wang et al., 2007a). The Late Paleozoic to Early Triassic is represented by a thick sequence of shallow marine to terrestrial sequence deposited in a stable tectonic setting in South China Craton (Zhao and Coe, 1987).