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# U-Pb ages of detrital zircons in Lower Cretaceous non-marine successions of the Gyeongsang Basin, Northeast Asia: Implications for sediment provenance

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ABSTRACT

The Cretaceous Gyeongsang Basin is the largest non-marine Mesozoic sedimentary basin of the Korean Peninsula. The Lower Cretaceous successions of the Gyeongsang Basin are coevally correlated to those of the Cretaceous Gunsan Basin in the Yellow Sea which is located far to the west of the Gyeongsang Basin. This study presents U-Pb ages of detrital zircons to evaluate the sediment provenances of the Gyeongsang Basin. The detrital zircon ages clearly show the different distributions between the northern (Uiseong area) and southern (Jinju area) areas of the Gyeongsang Basin. The detrital zircons of the northern area have an age cluster in the Jurassic or Triassic, whereas the detrital zircons of the southern area show a wide range of ages from early Cretaceous to Neoarchean. In the Gunsan Basin, detrital zircons from a core also yield ages ranging from early Cretaceous to Neoarchean. The age distribution from the Gunsan Basin is similar to those of the southern Gyeongsang Basin, except for the absence of Jurassic detrital zircons. The petrographic modal analysis of sandstones in the Gyeongsang Basin suggests a mixed provenance. This study indicates that possible sediment provenances of the Gyeongsang Basin were shared with those of the Gunsan Basin. We suggest that the sediment provenance of the northern Gyeongsang Basin was adjacent basement highs, whereas sediments to the southern Gyeongsang Basin were probably derived from relatively distant source areas that possibly were located in the vicinity of the Gunsan Basin during the early Cretaceous (ca. 113 Ma).



## 1. Introduction

The early Cretaceous is an important period in the understanding of the Northeast Asian tectonic framework because large sedimentary basins were formed by the destruction of the North China Craton and crustal thinning at that time (Zhai et al., 2007a; Charles et al., 2011a, 2011b; Zhang et al., 2012; Daoudene et al., 2013).

Provenance studies of sedimentary basins have been widely applied to reconstruction of paleogeography and paleotectonics (Dickinson and Suczek, 1979; Dickinson, 1988; Cawood and Nemchin, 2000; Cawood et al., 2012). Sediment provenance of the Cretaceous Gyeongsang Basin, the largest Mesozoic sedimentary basin in the Korean Peninsula, has been investigated using petrographic modal analysis and geochemistry (Lee and Lee, 2000, 2003; Lee and Lim, 2008; Y. I. Lee et al., 2010; Lee et al., 2015). Detrital zircon geochronology has also been carried out in the Gyeongsang Basin (T.-H. Lee et al., 2010; Y. I. Lee et al., 2010; Lee et al., 2014). U-Pb data for detrital zircon ages have been used to constrain the maximum depositional age of the basin (Y. I. Lee et al., 2010; Lee et al., 2014). The sediment provenance of the Lower Cretaceous sediments was constrained to the adjacent regions of the Gyeongsang Basin, such as the Yeongnam Massif or the Ogcheon Belt (Chang, 1975; Koh, 1986). The sediments were eroded and transported basinward owing to unroofing of plutonic and metamorphic rocks (Chang, 1975; Choi, 1986a).

In this study, we will examine the spatial and temporal age distribution of detrital zircons in the Lower Cretaceous successions of the Gyeongsang and Gunsan basins in Northeast Asia. Main objectives of this study are to describe detrital zircon ages between two basins, and to discuss the possible sediment provenance and paleogeography between the Korean Peninsula and Yellow Sea.

## 2. Geological setting

Mesozoic sedimentary basins are widespread along the continental margin of East Asia, and the Gyeongsang Basin is the largest Cretaceous sedimentary basin in the Korean Peninsula (Fig. 1). The Korean Peninsula experienced late Jurassic contractional deformation, called the Daebo orogeny (Cluzel, 1992). The Korean Peninsula was

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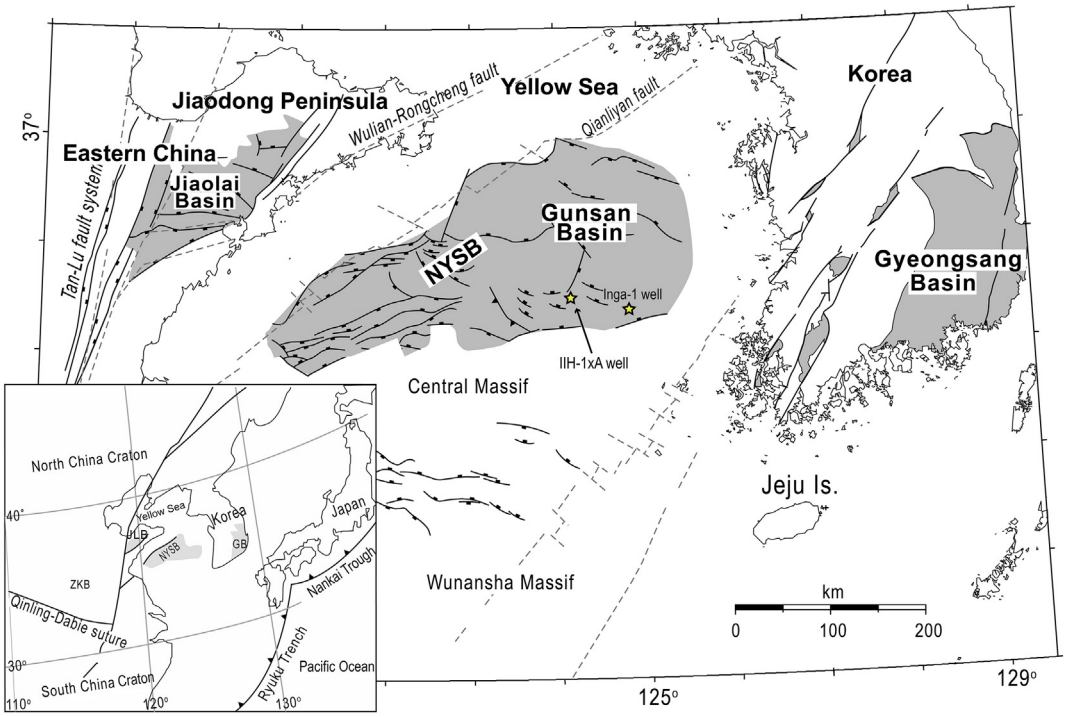


**Fig. 1.** Regional geologic structures and early Cretaceous sedimentary basins around the Yellow Sea (modified from Zhang et al., 1989; Shinn et al., 2010). The inset map shows the location of Northeast Asia (modified from Allen et al., 1997; Shinn et al., 2010). GB, Gyeongsang Basin; NYSB, Northern Yellow Sea Basin; JLB, Jiaolai Basin.

subsequently under post-orogenic condition during the early Cretaceous (Lee et al., 2011; S. W. Kim et al., 2012). At that time, the tectonics of eastern Asia was affected by strike-slip movement due to oblique subduction of the Izanagi plate (i.e., paleo-Pacific plate) or amalgamation of the Sino-Korean Block (i.e., North China Craton), and back-arc extension due to roll-back of the Izanagi plate (Chough et al., 2000; Ryu et al., 2006; Hwang et al., 2008; Chough and Sohn, 2010; Lee et al., 2011).

The Gyeongsang Basin formed in the early Cretaceous after the Daebo orogeny (Chang, 1975; Cluzel, 1992). The youngest detrital

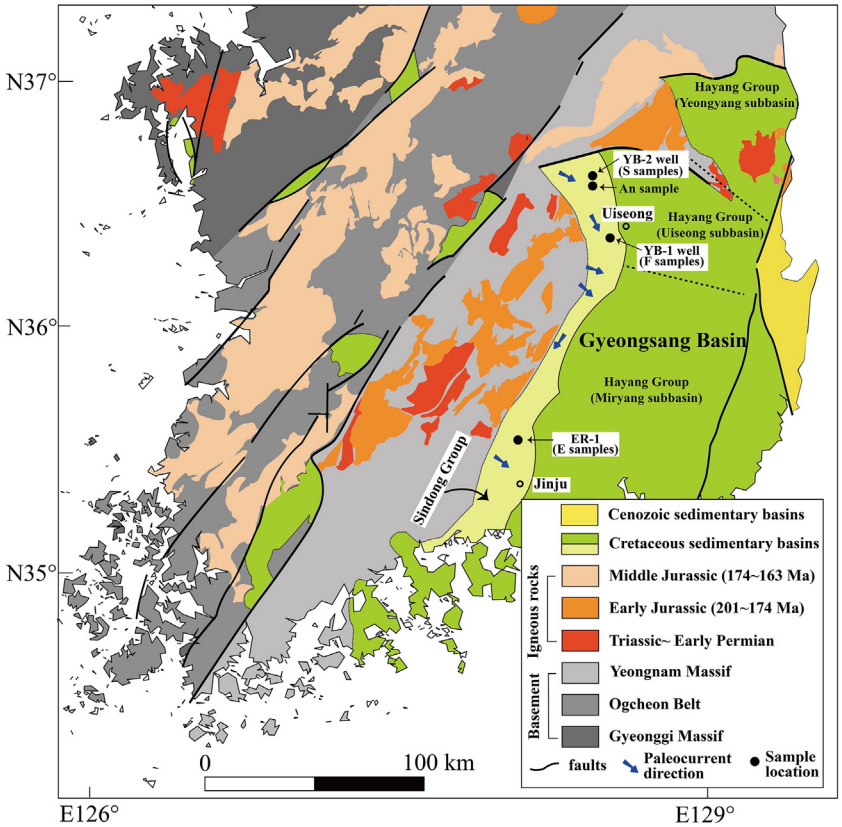


**Fig. 2.** General geological map of the southern Korean Peninsula (modified from Cheong and Kim, 2012). The paleocurrent data were compiled by Chough and Sohn (2010).