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Seismic stratigraphic reconstruction of Plio-Quaternary depositional sequences on the continental shelf of Korea Strait



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ABSTRACT

The Korea Strait is a seaway connecting the East Sea with the East China Sea. The Plio-Quaternary stratigraphy and sedimentation on the Korea Strait shelf was studied using a dense network of high-resolution, single-channel seismic reflection profiles. The shelf sequences above the acoustic basement consist of seven depositional sequences separated by erosional unconformities corresponding to falls in sea level. Individual sequences are characterized by well-stratified and complex sigmoid-oblique prograding reflection configurations, reflecting a history of upbuilding and outbuilding in response to repetitive transgressive and regressive events driven by sea level changes. During the regression to lowstand of sea level, lowstand prograding wedges were formed seaward along the present shelf margin, whereas during the highstand of sea level, as in the present condition, highstand deposits were deposited in the inner shelf along the coast. However, as the subsequent regression began, the inner-shelf highstand deposits were severely eroded out and/or formed a condensed section. Volumetrically, the forced regressive and lowstand systems tracts are the most important components of the Korea Strait. Consequently, the Plio-Quaternary sequence in this area consists of a succession of stacked progradational lowstand wedges, mainly formed during the regression and lowstand of sea level.

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1. Introduction

The development of shelf sequences is primarily controlled by the magnitude and rate of relative sea level changes, in turn determined by the interaction between eustasy, tectonism, and sediment supply (e.g., Posamentier et al., 1988; Vail et al., 1991). Such shelf sequences in relation to sea level cyclicity can be interpreted based on the sequence stratigraphic concept (e.g., Vail, 1987; Posamentier et al., 1988; Van Wagoner et al., 1988). Although the sequence stratigraphic concept was developed to account for the sequence corresponding to the sea level cycle of 2.0–1.0 Ma (third-order cycle), it has recently been shown to be a useful tool for the

interpretation of high-frequency cyclothem (fourth- or fifth-order cyclicity) sequences (e.g., Mitchum and Van Wagoner, 1991). Since the successful test for the Quaternary sequence in the Gulf of Mexico (Boyd et al., 1989), the application to Quaternary sequences, through analysis of high-resolution seismic profiles integrated with sediment data, has become common (e.g., Tesson et al., 1990, 2000; Lykousis, 1991; Ediger et al., 1993; Bellotti et al., 1994; Chiocci, 1994; Ercilla et al., 1994; Hernandez-Molina et al., 1994; Okyar et al., 1994; Saito, 1994; Trincardi et al., 1994; Gensous and Tesson, 1996; Morton and Suter, 1996; Somoza et al., 1997; Tortora, 1996; Yoo et al., 2002; Lobo et al., 2004; Zecchin et al., 2008; Lobo and Ridente, 2014). These tools were found to allow identification of depositional sequences, as well as delineation of the external and internal geometry of individual seismic units. Such information sheds light on the depositional history and growth patterns of sedimentary deposits on the shelf and slope. The increasing high-resolution knowledge of late Quaternary stratigraphy, and its relationship to sea level changes, has led to the emergence of data that have an

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important bearing on idealized stratigraphic models and concepts (Sydow and Roberts, 1994; Chiocci, 2000; Kolla et al., 2000; Trincardi and Correggiari, 2000). Recently, Lobo and Ridente (2014) reviewed Quaternary cyclical deposition pattern related to high-amplitude sea-level oscillations which are driven by Milankovitch cycles on modern continental shelves worldwide. Moreover, the new paradigm for the sequence stratigraphy has been emphasized and reviewed by Ridente (2017). Here, the construction of a comprehensive model of sequence stratigraphy, controlled by a combination of relative sea-level cycles and sedimentary dynamics, was suggested.

The Korea Strait is a narrow continental shelf located between the southeastern tip of the Korean Peninsula and Tsushima Island, and is an important seaway through which the warm Tsushima Current flows into the East Sea (Fig. 1). Various aspects of the late Quaternary sedimentation in the Korea Strait have been addressed previously by several authors (Park and Yoo, 1988; Suk, 1989; Min,

1994; Park et al., 1999; Lee and Chung, 2000; Lee et al., 2005; Yoo et al., 2014a, 2014b). These studies indicated that the study area is a principal depocenter of the terrigenous sediments derived from the southeastern part of Korea in the Plio-Quaternary. They also document that sea level fluctuations associated with the locally high sediment discharge by the Nakdong and Seomjin rivers have played a major role in the development of the Quaternary sequences on the shelf. Moreover, a paleophysiography was identified showing narrow pathway, connecting the East China Sea and the East Sea during the Last Glacial Maximum (Fig. 2; Park and Choi, 1986; Park and Yoo, 1988; Yoo et al., 2016). Yoo and Park (1997), based on high-resolution seismic profiles associated with sediment data, showed the existence of prograding wedges on the outer shelf in the Korea Strait. Yoo et al. (2003) also suggested that these shelf margin wedges could be regarded as a “shelf-perched lowstand wedge system” closely related to alternating episodes of successive regression and transgression during the late Pleistocene. Yoo and

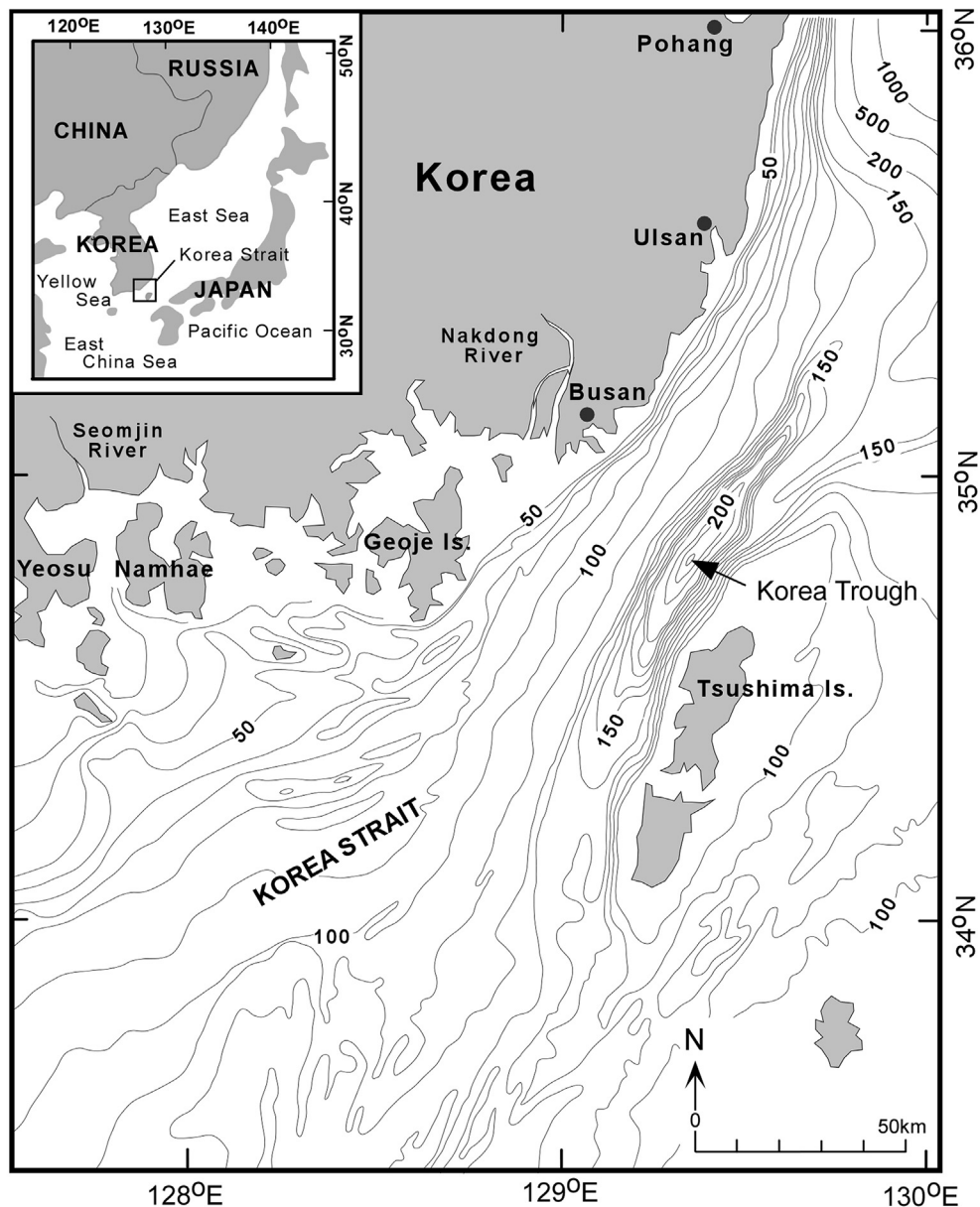


Fig. 1. Detailed bathymetry of the Korea Strait and adjacent area. Insert shows the location of the study area (Contour intervals are 10 m).

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