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Editorial: Understanding the marginal seas of northeast asia for tectonics and submarine geohazards

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Editorial on the Research Topic
Understanding the marginal seas of northeast asia for tectonics and submarine geohazards

The past three decades have brought large steps forward in our understanding of the tectonics and submarine geohazards of the marginal seas of Northeast Asia. This improved understanding has been accompanied by a major increase in the number of geophysical experiments and data, which have shed light on this topic. Given the rise in urbanization and population growth, assessing the risk of submarine geohazards is increasingly important; therefore, this is the ideal time to present the latest observations, models, applications, data syntheses, and advances. This Research Topic comprises eleven papers covering multiple aspects of the tectonics and submarine geohazards of Northeast Asia. Many articles in this Research Topic present integrated studies linking multiple geophysical datasets and techniques to advance innovative ideas and models.

Zhang and Luan investigated variations of the crustal thickness, heat flow, fault patterns, and petrology to unravel the tectonic evolution of the Okinawa Trough. Their study shows that the northern, central, and southern sections of the Okinawa Trough are in an early back-arc extensional setting, a transition between back-arc rifting and oceanic spreading, and an early seafloor spreading setting, respectively.

Xu et al. analyzed the data from the third phase of the China Array to reveal details of the crustal thickness, V_p/V_s ratio, and polarization direction beneath the Trans-

North China Orogen (TNCO). Their results reveal lateral variations in crustal structure, which are correlated with the Bouguer anomaly. They further propose that the crustal deformation of the TNCO could be a consequence of the counterclockwise rotation of the Ordos block.

Li et al. studied the fault system in the southern Liaodong Bay sub-basin by analyzing 3-D seismic reflection data. Their results reveal the geometry of the fault system and of the stratigraphic units controlled by the fault system, as well as the complex evolutionary history of the area. They applied their results to better understand hydrocarbon accumulation in the study area.

Kim et al. confirmed a close spatial relationship between the rift bounding fault and earthquake epicenters in the South Korea Plateau (SKP) in the East Sea (Japan Sea). The faults in the SKP were reactivated in the mid-Miocene and have continued moving with a strike-slip sense. Kim et al. estimated the maximum expected magnitude and return period of earthquakes at the SKP using a statistical approach.

Liu et al. produced high-resolution P-wave velocity models of the eastern North China Craton (NCC) and the Yangtze Craton (YZC) using four active-source wide-angle onshore–offshore seismic surveys. They propose a five-stage model for the collision between the YZC and NCC based on these velocity models and regional gravity and magnetic anomalies.

Seismic and electromagnetic images by Deng et al. show low-velocity, high-conductivity anomalies associated with the volcanic plumbing system in northeast China. Their images suggest that these volcanoes are back-arc intraplate volcanos and that the genesis of their magma is closely linked to subduction of the western Pacific slab into the mantle transition zone and the water released during this process. They conclude that more extensive, higher-resolution geophysical images are required to reliably determine volcanogenic mechanisms in northeast China.

Wang et al. imaged the strong, complex lateral velocity variations and low velocities in the shallow sediment on the floor of the Yellow Sea using ocean bottom seismometers (OBS) and multicomponent Scholte-wave dispersion analysis. Uplift, active faults, and thrust nappe structures can be identified in their pseudo-2D shear-wave velocity profile of the shallow sediments.

Routine operations in seismic data processing including phase detection, phase picking, association, and determination of earthquake source parameters are time-consuming and labor-intensive. Wu et al. tackled this issue by building a deep learning-powered automatic workflow and applying it to an OBS array in the Challenger Deep. The automated workflow produced a high-resolution local earthquake catalog, which is essential for understanding the active faults in the study area. Although they applied the method to OBS data, it is also applicable to land-based seismic observations.

Yao et al. analyzed the geophysical characteristics of the southwestern margin of the South China Sea (SCS), including the thermal structure, 3D shear wave velocity, and gravity. Their results provide a framework for understanding the geological evolution and continental margin dynamics of the SCS.

Although there are clear historical records of tsunamis in Korea, the magnitude of the earthquakes recorded since the start of instrumental seismic observations is too low to produce such devastating tsunamis. Ha et al. revisited the historical tsunami record, compiled active fault maps for the area off the eastern coast of the Korean peninsula, and constructed tsunami scenarios. They then used numerical modeling to estimate runup heights in the proposed scenarios. Their results successfully hindcast the occurrence and effects of tsunamis in the local historical literature.

Lee et al. investigated the tectonostratigraphic evolution of the southwestern Ulleung Basin in the East Sea (Japan Sea) using multi-channel seismic reflection profiles and offshore wells. They divided the sedimentary succession of the Ulleung Basin into four sequences and proposed a four-stage tectonic model that includes back-arc opening, tectonic inversion, post inversion, and neotectonic stages.

Submarine landslides have attracted attention as a cause of large tsunamis. Pan et al. analyzed the potential for submarine landslides to trigger damaging tsunamis along the coast of Southern Central Vietnam (SCV). Their results show a tsunami with wave heights of 5 m may arrive at the closest coastline <30 min after a submarine landslide. This is a serious threat to communities along the coastlines of the SCS and sustained action is required to reduce the risk to life and property.

We hope the wide spectrum of geophysical data and applications presented here can motivate new research projects involving the deployment of new instruments on the seafloor, multichannel seismic profiles across borders, and the application of innovative techniques and multi-disciplinary approaches to tackling long-standing questions in the region. The guest editors are very grateful to the authors for their excellent contributions and to colleagues who provided timely, critical, and constructive reviews of the manuscripts. We also

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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