

Fault distribution in the Japan Sea

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This study is a part of "the Comprehensive evaluation of offshore fault information project" by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). The project composes three themes, 1) Collecting seismic survey data and building a database, 2) Data processing and analysis using unified methods, and interpreting faults utilizing the processed seismic sections, 3) Building fault models from the interpreting results and simulating strong motion and tsunami utilizing these models. Here, we present the interpretation of the fault distribution in the Japan Sea and re-processing to trace faults. Various research institutes have conducted seismic surveys over the decades in the Japan Sea. The dense seismic survey data has been collected and provided us an opportunity to observe seismic data from multiple surveys at the same time. This gave us a great advance to investigate and evaluate submarine active faults.

The past seismic survey data was re-processed using state-of-the-art data processing methods for obtaining high resolution seismic profiles. In particular, it is important to remove multiple reflections and we specially paid attention to apply the algorithm for demultiples. The revised seismic profiles defined clearly the geometry of subsurface structure, and provided us better understanding to determine fault system and shape. Since the fault models for simulation require parameters of length, strike and dip angles and depth, a velocity model for entire seismic data must be constructed to convert seismic section in depth unit. With the depth section we carry quality control of the interpretation results and evaluate their spatial distribution. Discussion includes demonstration of the fault interpretation on representative seismic sections from Tsushima-Kita Kyushu area to off northern tip of Hokkaido.

Normal faults which have developed during the opening of the Japan Sea in the Miocene and reverse faults which have developed after from the normal faults under inversion tectonic settings at compressive stress exist along Japan Sea coast. Those faults in the north eastern area especially reverse faults in the earthquake zone of the Nihonkai-Chubu earthquake extend at depth near the Moho. On the other, those reverse faults in landward are in large scale but extend at depth near Upper-Lower crust boundary. Lateral strike-slip faults are developed in the Sanin coast area, and fault-related-fold structures are observed. Those structures were developed under compressive stress field after the opening of the Japan Sea and following lateral stress field was much dominated to form lateral slip. In Kita Kyushu coast area, fault belts, which composes small strike-slip faults, develop forming echelon structure. As studies on 2005 Fukuoka earthquake suggest that those small individual faults could cause interrelated earthquakes, it is very essential to argue the possible occurrence pattern of interrelated earthquakes to build fault model.

Keywords: submarine fault, Japan Sea, seismic survey