

Crustal contraction of the Sado Ridge estimated from geologic structure, eastern margin of Japan Sea

*Yukinobu Okamura¹

1. Research Institute of Earthquake and Volcano Geology, National Institute of Advanced Industrial Science and Technology

The amount of crustal shortening in the Sado Ridge, eastern margin of Japan Sea, was estimated from geologic structure. Many reverse faults have developed in the Sado Ridge under the W-E compressional stress during the last 3.5 million years. The faults were Miocene normal faults that have reactivated by inversion tectonics. The about 70 km wide ridge extends to NNE for about 250 km from the Sado Island and consists of many reverse faults accompanying asymmetric anticlines of 10 to 20 km wide. Assuming that these anticlines are fault-related folds above reverse faults that cut entire upper crust, it is possible to estimate amount of crustal shortening from the area of anticline on seismic profile that is product of thickness of the upper crust and horizontal slip of the fault.

This study based on seismic profiles acquired by the Geological Survey of Japan from 1989 to 1991. They are single-channel data, but they have enough quality to identify geologic structure of several hundreds meters below seafloor. The direction of seismic survey lines is 290° sub-parallel to the direction of contraction of the eastern margin of Japan Sea, and interval of the lines is about 3 km.

The onset of the reverse faulting is widely recognized by an unconformity marked by the change of reflection pattern from parallel to divergent below and above of the unconformity, which indicate that the ridge was nearly flat before the reverse faulting and uplift of anticline changed depositional patterns. I determined the geometry of anticline from the unconformity horizon on the seismic profiles and the area of anticline was measured assuming the unconformity was flat before folding. Some anticlines were truncated at their summits and a few may be composed of basement which has no internal structure. I determined fold geometry of anticlines from structure of underlying and surrounding sediments. Fifty seismic lines were analyzed to estimate crustal shortening.

The Sado Ridge is composed of several sub-parallel chains of anticlines. Although the area of anticline varies along the chain, the sum of the areas of anticlines along the WNW trending seismic lines crossing the entire Sado Ridge shows smaller variation. The crustal shortening of the ridge was roughly estimated to be 2 km or less assuming that the thickness of the upper crust is 15 km. This analysis suggests that the direction of crustal shortening is more westerly directed than 290°. I also discuss the problems and significance of estimation of crustal shortening using geological structure.

Keywords: eastern margin of Japan Sea, crustal contraction, fault-related fold