Fault Distribution and Structural Characteristic in the Nansei Islands

*Rei Arai[1], Shimizu Shoshiro[1], Nobuaki Sato[1], Minako Katsuyama[1], Goro Ando[1], Narumi Takahashi[1], Shigeyoshi Tanaka[1], Nobutaka Oikawa[1], Yoshiyuki Kaneda[2]

1.Japan Agency of Marine-Earth Science and Technology, 2.Disaster Mitigation Research Center, Nagoya University

As a part of “the Comprehensive evaluation of offshore fault information project” by the Ministry of Education, Culture, Sports, Science and Technology, JAMSTEC has carried out collecting seismic reflection data from various institutes and private companies and reprocessing data to obtain high resolution seismic profiles by state-of-the-art data processing methods.
Interpretation of faults on a seismic survey profile is a simple work, but in order to map out the distribution of a fault, the spatial distribution of the fault must be assigned from subsurface structures interpreted on each seismic profile and geomorphologic features. The distribution of displacement along faults is frequently recognizable in the landscape, therefore it is a well-approved method to map out the location of active faults from the geomorphologic features. In this project, we utilize both the seismic profiles and high resolution bathymetric data. The seismic profiles enable us to determine the actual location of displacement of the fault in the subsurface, and the high resolution bathymetric map tells the extension and direction of the fault. This interpretation process led the result of a brief and advanced offshore fault mapping.
The Ryukyu Arc is located in the Eurasian plate and extends from Kyushu, Japan to the Taiwan collision zone. At the Ryukyu Trench, the Philippine Sea plate is subducting beneath the Eurasian plate, and the backarc basin called the Okinawa Trough is formed by crustal extension behind the subducting system.
In offshore of Yonaguni-jima, Iriomote-jima, and Ishigaki-jima, a forearc basin forms a flat terrace. The thickness of basin sediments increases westwards due to a normal fault striking at SE, and dipping NE. In the southeast offshore of Ishigaki-jima, a reverse fault striking at NNE, and dipping NW up-rifts the basin sediments and forms boundary of the west end of the basin. In the south offshore of Miyako-jima, there are several reverse faults striking at NE, and dipping NW develop and up-lift the basement exposing at the sea floor with thin sediments. In the south margin of the forearc basin, accretional wedges develops by thrust faults, and there is remarkable east-west trending steep slope continuously exists exposing the basin sediment layers on the slope face. This could happened if some lateral displacement due to the movement of the Philippine Sea plate had effected slope stability on the wedge, and then the mass sediment body had collapsed. In offshore from Miyako-jima to Kerama Gap, the forearc basin sediments distribute with relatively thin layer, and the entire basin and basement is uprifted by thrust faults. In offshore of Okinawa-jima, a gentle slope composed of thick sediment layers forms from the edge of island shelf towards the trench. There are three large step-like terraces developed along the trench with small to large scale trust faults.
The southern Ryukyu Arc consists of the edge of continental crust, and the terrace of the arc was eroded to naturally flat surface. Normal faults, which cut perpendicular to the axis of the arc, are developed such as Miyako Saddle and Kerama Gap, and these gaps play structural transmit zone in both the trench and the trough geology.
In the Okinawa Trough, there are hundreds of meter cliffs developed along west side of island arc with northeast-southwest trend. In the southern Okinawa Trough, widely knowns as the present trough’s growing stage, east-west trending rift valleys exist at the trough bottom, and the subsurface structure displays spreading system such as great number of normal faults developing

towards the axis of the valley. In the central Okinawa Trough, there are series of NE-NW normal faults, and the edge of the rotated block appears as ridges or small cliffs.
In this session, we will briefly report the structural interpretation on seismic profiles and discuss structural characteristic based on the fault distribution.

Keywords: offshore fault, seismic reflection survey, Ryukyu Arc, Okinawa Trough, Ryukyu Trench

