

Stratigraphy and structural reconstruction of the Goto Group in Narushima Island, Goto Islands, Nagasaki Prefecture

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Goto Islands is located western of Nagasaki Prefecture and consists of five islands though northeast to southwest trend. In Goto Islands, the middle Miocene Goto Group is well exposed and overlain unconformably by volcanoclastic rocks of the Nakadorijima Group in Nakadori-jima islands. We mainly focus to Naru-shima Island that contains stratigraphy of the Goto Group with less deformation. Naru-shima Island also has northwest-southeast trend narrow bays. This study did detail geologic mapping and identified stratigraphy and geological structures of the Goto Group in this island. This study also did U-Pb age dating of three samples at three islands to correlate stratigraphy and deformation of each island.

Sedimentary sequences in Naru-shima Island have NW strike in the middle to southern portion which shows gentle fold (0-20°). This fold changes to NW 70° dipping at northern most part. It may be identified NW dipping normal fault (F_1) preserved below this drug fold.

F_1 was cut by NW-SE trend faults (F_2). F_2 divides Narushima Island into 4 blocks (Nishiegami, Ura, Tomari and Yagami) and form wide brecciated sandstone zones (well exposed at 2 places in this island). The Ohokushi-Fault-Zone is well preserved more than 100 m wide cataclasite at northwest area. The Kochidomari-Fault-Zone is exposed at Kochidomari with more than 20-30 cm wide cataclasite. These F_2 faults were formed at topographically eroded portion and formed NW-SE trend bays of Naru-shima Island.

Stratigraphy in Naru-shima Island is divided three formations as follows: Suzunoura, Okoshima and Nokobiura Formations. The Suzunoura Formation (-250 m+) is characterized by alternating beds of pyroclastic rocks and tuffaceous sandstone. The pyroclastic rocks contain 1-3 cm elongated volcanic rubble oriented with their long axes parallel to bedding and show grading and sometimes show inverse grading. The tuffaceous sandstone contains 1-3 mm volcanic rubble. The Okoshima Formation (-850 m) is composed mainly alternating beds of sandstone and mudstone, and subdivided three members; Lower Member (100 m), Middle Member (550 m) and Upper Member (200 m). Sandstone in the Okoshima Formation exhibits planar and trough cross-bedding, climbing ripple and wave ripple. The Nokobiura Formation (-1700 m+) consists of thick sandstone and thin mudstone. Planar cross-bedding and wave ripple are found in sandstone of the Nokobiura Formation.

This study obtained new three U-Pb sedimentary age dates from SP1 at the middle portion of the Goto Group on Fukue-jima Island, SP2 at the Okoshima Formation on Naru-shima Island and SP3 at the lower portion of the Nakadorijima Group on Nakadori-jima Island. Zircon grains of SP1 were measured by SHRIMP at National Institute of Polar Research and of SP2 and SP3 were measured by LA-ICP-MS at National Museum of Nature and Science. SP1, SP2 and SP3 yielded upper limit of sedimentary age of 15.0 ± 0.3 Ma, 15.9 ± 1.2 Ma and 13.6 ± 0.8 Ma respectively. Therefore this study obtained upper limit of sedimentary age of 15.0 ± 0.3 Ma in the Goto Group.

In this study, we identified that total thickness of the Goto Group in Naru-shima Island was about 2800 m and was divided into three formations. Since sedimentary age of lower Goto Group was reported to be

17.5 Ma, it is thought that the Suzunoura Formation is sediment due to volcanic activity in the primary expansion phase of the Sea of Japan. The Okoshima Formation accumulated at the lacustrine environment at rift basin. The Nokobiura Formation was related to river system. After sedimentation of the Goto Group, NW dipping normal faults (F_1) is identified and is important evidence for opening phase of the Sea of Japan in south-western Japan. NW-SE faults (F_2) may be related to NE-SW extension event happened during about 8-6 Ma which coincides with the age of subsidence of the Hohi volcanic zone and Goto Nada strait and of Okinawa Trough rifting event.