

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

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The Goto Islands is located western of Nagasaki Prefecture and consists of five islands though southwest to northeast trend (Fig. 1). In all Goto Islands, the middle Miocene Goto Group is well exposed and overlain unconformably by volcanics of the Nakadorijima Group at Wakamatsujima and Nakadorijima islands (Fig. 1; Ueda, 1961; Kawahara, 1986). We mainly focus to Narushima Island. It contains stratigraphy from lower to upper of the Goto Group stratigraphy by less deformation than that of other Goto Islands (Yamamoto, 2006MS; Yasunaga, 2007MS; Hasegawa, 2008MS). Narushima Island also has a distinctive topography with north-south trend many bays. These topographic characteristics also may suggest some other tectonic evidences in Goto Islands. In this study, we make detail geologic map at Narushima Island and identify geological structures and stratigraphy of Narushima Island. Then we will try to correlate other stratigraphy and structural relationship at other Goto Islands.

Sedimentary sequences in Narushima Island strikes NW in the middle to southern portion very shallow and gentle folding (0-20°), however, the northern most part is formed by drag fold (F₁ fold) as quick bended from shallow dipping beds to 60° NW beds. Especially, F₁ fold is well preserved at Kajinohanebana on this island.

F₁ fold was cut by NW-SE trend faults (F₂ faults). F₂ faults divide Narushima Island into 4 blocks (Fig. 1) and form wide area of highly brecciated sandstone zones (well exposed at 2 places in this island). The Ohokushi-Fault (boundary of Kurosebana-Nishiegami and Ohokushi-Ura blocks) is well preserved more than 100 m wide cataclasite at northwest area (Fig. 2). The Kochidomari-Fault (boundary of Tomari-Kochidomari and Yagami-shioike blocks) is exposed at Kochidomari with more than 20-30 cm wide cataclasite. These faults were formed at topographically eroded portion and formed NW-SE trend bays and ridge topographic character of Narushima Island.

Stratigraphy in Narushima Island is divided 3 formations in ascending order, as follows: the Suzunoura Formation (~200 m thick) is characterized by alternating beds of pyroclastic rocks and tuffaceous sandstone. Pyroclastic rocks in the Suzunoura Formation contain 1-3 cm elongated lapilli oriented with their long axes parallel to bedding and show grading and sometimes show inverse grading. Tuffaceous sandstone sometimes contains 1-3 mm volcanic rubble. The Okoshima Formation (~600 m thick) is composed of debris flow deposits and alternating beds of sandstone and mudstone, and subdivided 3 members. The Lower Member (200 m thick) is characterized by debris flow deposits and mudstone-dominant alternating beds of sandstone and mudstone, the Middle Member (150 m thick) by sandstone-dominant alternating beds of sandstone and mudstone, the Upper Member (250 m thick) by mudstone-dominant alternating beds of sandstone and mudstone. Sandstone in the Okoshima Formation exhibits planar cross-bedding, trough cross-bedding, climbing ripple and wave ripple. The Nokobiura Formation (~1200 m + thickness) consists of thick sandstone and thin mudstone. Planar cross-bedding, trough cross-bedding and wave ripple are found in sandstone of the Nokobiura Formation. At Narushima Island, there is no pyroclastic sequence of the Nakadorijima Group.

This study revealed that total thickness of the Goto Group in Narushima Island was about 2000 m and was divided into 3 formations (Suzunoura, Okoshima, Nokobiura formations). Since sedimentary age of the Goto Group is reported 18-16 Ma, it is thought that the Suzunoura Formation is sediment due to volcanic activity in the expansion phase of the Sea of Japan. Then the basin formed by expansion became a lake and the Okoshima Formation accumulated. The lake was changed to rivers to delta environment of the Nokobiura Formation. After sedimentation of the Goto Group, NW direction drop-down F₁ fold is identified and is important evidence for 15 Ma opening south-western tip of the Sea of Japan. NW-SE F₂ faults related NE-SW extension event happened during about 8 Ma which coincides with the age of the Hohi volcanic events. F₂ faults might be related to this volcanic activity and related Northern Okinawa trough rifting event (Ito, 1998).

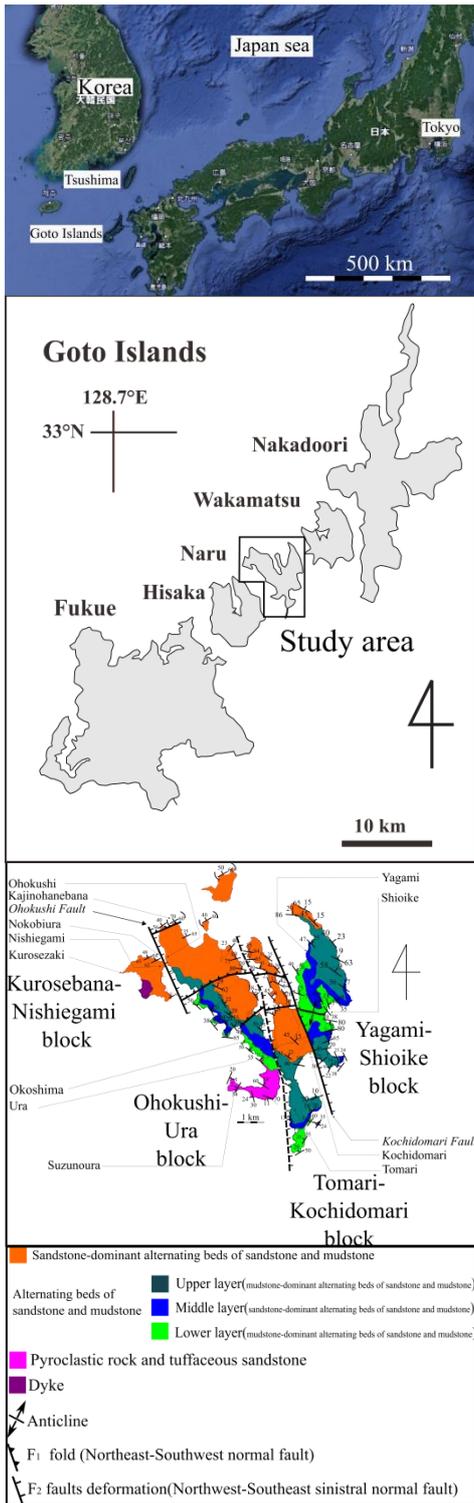


Figure 1. Location of Goto Islands and geological map of Narushima Island



Figure 2 Type 2 deformation at Ohokushi with about 100 m breccia zone.

References

- Hasegawa, T., Tectonic evolution of the western part of Goto Islands, Nagasaki Prefecture. MS Thesis, Univ. of Kyushu. 2008
- Itoh Y., Takemura K. and Kamata H., History of basin formation and tectonic evolution at the termination of a large transcurrent fault system: deformation mode of central Kyushu, Japan. *Tectonophysics*, 284, 135-150. 1998.
- Kawahara, K., Tsukahara, S., Tajima, T. and Kamogawa, N., The late Miocene volcanism in Nakadori-jima, Goto islands, Nagasaki prefecture, Japan. *Geol. Soc. Japan*, 24, 77-91. 1986.
- Ueda, Y., Study of the Goto Group, *Sci. Rep. Fac. Sci. Kyushu Univ., Geol.*, 5, 51-61. 1961.
- Yamamoto, A., Geotectonic history of Tamanoura region, Goto Islands. MS Thesis, Univ. of Kyushu. 2006
- Yasunaga, M., Lithostratigraphy of the Neogene Goto Group and finding of plant megafossils in Nakadori-jima and Wakamatsu-jima, central part of Goto Islands, Nagasaki Prefecture. MS Thesis, Univ. of Kyushu. 2007