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Tsunami sediment in the Okinawa Island

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The occurrence interval of mega-tsunamis in the south Ryukyu arc was estimated to 200-500 years from the ages of tsunami boulders (Nakata, Kawana 1994, Araoka et al., 2013). The source of 1771 Yaeyama tsunami (Meiwa tsunami), which was the latest mega-tsunami, is interpreted as the M8 class thrust-type earthquake in the Ryukyu trench from the numerical simulation of tsunami. However, past tsunamis have not been found in the central Ryukyu arc because the tsunami boulders were not detected in this area. No tsunami records were documented in the old literatures of central Ryukyu arc. We conducted a tsunami sediment survey in the Okinawa Island to investigate the history of large tsunami on the central Ryukyu Trench. We performed drilling survey from 4 to 15 March 2013 in the Okinawa Island in a collaboration with the coastal disaster prevention section of civil engineering and construction division, the Okinawa Prefectural Office. Survey sites were is Kijoka (Ogimi Village), Teima (Nago), Yaka (Kin Town), Yagi (Nakagusuku Village), Oyama (Ginowan). The sand layers, which have the possibility of tsunami sediments, were found at the cores samples of Teima and Yagi from visual observation. Then, we analyzed the sand layers and their overlying and underlying layers, and compared them with the sand layers. Teima-1 (elevation 4.5m, 0.4km from the coast) is located at the back marshes of the inner part of Oura Bay. We collected five samples at the depth between 1.85m to 1.25m from the surface ground. Yagi1-3 (elevation 2.8-3.1m, 0.1-0.2km from the coast) are located at the coastal lowlands along Nakagusuku. We collected 7 samples at the depths between 0.8m to 4.15m at Yagi-1, 4 samples at the depths between 1.35m to 2.05m at Yagi-2, and 1 sample at the depth of 1.95m at Yagi-3. Furthermore, we sampled modern coastal sands near the survey sites. First, the samples were charged with 10-fold diluted hydrogen peroxide solution after drying completely at the temperature of about 60 degrees. Then samples were washed by the water flow during sieving 63um. After that, the samples were divided to a particle size of five types for using sieve. Foraminifera analysis method was conducted the particle size of 1.00mm ˜0.5mm from sample collection. We picked the samples so as to contain over 150 individuals of foraminifera. Next we classified them to dominant species foraminifera and other species. In addition, we compared their foraminifera composition with those of modern coastal sand, and estimated the origin of the sediment. From the core samples of Teima-1, we detected 3 individuals of *Anomalinella* at the depths of 1.55 m and 1.65 m, and 2 individuals of *Calcarina Mayori* at the depth of 1.65 m. This suggests that the sediments at the depths of 1.55 m and 1.65 m were moved from out of the reef because these species live out of the reef. From the core samples of Yagi-1, we detected 2 individuals of *Anomalinella* at the depths of 3.75 m and 3.85 m, and 4 individuals of *Dendritina* and 3 individuals of *Operculina* at the depth of 3.75 m. Since these species live out of the reef, the sediments at the depths of 3.75 m and 3.85 m were moved from out of the reef. Next we detected 4 individuals of *Dendritina* and 4 individuals of *Operculina* at the depth of 1.85 m in the core sample of Yagi-2. As well, we detected 2 individuals of *Dendritina* at the depth of 2.05 m in the core sample of Yagi-2. These suggest that the sediments at the depth of 1.85 m and 2.05 m were moved from the out of the reef. Thus, we found that the species, which live in the out of reef, were included in the core samples of Teima and Yagi. A possible mechanisms to move the sediment from seafloor to land are ocean waves, storm surges, and tsunamis. However, since ocean waves and storm surge are attenuated by the reef, these could not move the sediments from out of the reef. The sediments which contain the species living out of the reef would have been moved by tsunamis.

Keywords: tsunami, tsunami sediment, foraminifera