Vertical crustal movement during the past 600 years in the Kikai Island, deduced from the height distribution and ages of coral microatolls

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The Kikai Island is known as a tectonically active region due to the MIS 5e coral terrace reaching over 200 m in altitude. Holocene marine terraces divided into four levels suggest that 1-2 m of uplift has intermittently occurred every 1500-2000 years (Sugihara et al., 2003). However, recently simulation results propose that the main factor of terrace formation is a combination of steady uplift and erosive action triggered by relatively small coseismic uplift (Shikakura, 2014). According to the geodetic observation, GNSS data shows uplifting at about 2 mm/year, but it is contradictory that the leveling survey results (comparison between Sep. 1997 and Apr. 2014) indicate subsiding at approximately 1 mm/year (Ito et al., 2015).

As described above, there are various views and observation results on the crustal vertical movement pattern of the Kikai Island. Therefore, we focused on coral microatoll which is a natural tide gauge and reconstructed the long-term crustal vertical deformation based on its distribution and age.

Since the microatoll formed by *Polites sp.*, grows on the basis of the low tide level, and records sea level change annually, it is good paleoshoreline indicator to reconstruct past crustal vertical deformation. We found a total of 25 living microatolls at three areas in the northern part, eastern part and southern part of the Kikai Island and one emerged microatoll. We obtained detailed cross-sections of five living micro-atolls and sliced samples of emerged microatoll to take a CT-scan image, and also obtained some samples for 14C age which were calibrated of marine reservoir effect based on data of Hirabayashi et al. (2017).

In the northern area (Onozu), the height of the top surface of all living microatolls was almost flat at -1.01 - 1.07 m (TP), and the maximum was 78.8 cm in radius. Emerged microatoll found in this area is 270 cm in radius. Its shape of the top surface is almost flat but the altitude is decreasing gently from the center (-0.80 m TP) to the edge (-0.87 m TP) and is 20 cm higher than the living microatolls. From the CT scan image, 237 lines of annual band can be counted in the range of 260 cm showing clearly growing in the horizontal direction. Therefore, the mean horizontal growth rate is estimated to 1.1 cm/year. It is consistent with 14C age data which shows AD 1305-1425 in the center and AD 1489-1650 in the margin. Based on the growth rate obtained from analysis of emerged microatoll, the age of growth of the living microatoll in this region can be estimated to about 72 years ago.

The largest one of the living microatolls confirmed in the eastern area (Kadon) has a radius of 145.6 cm and can be estimated to about 132 years ago, which is no contradiction to the 14C age of the center (AD 1680-1880). The shape of the top surface is roughly horizontal throughout the growth period, but the altitude is slightly uneven between -1.06 m (TP) and -1.20 m (TP).

Based on the above results, the relative sea level change of the Kikai Island slowly decreased by 7 + α cm within 300 years from the 14th to the 17th century, and rapidly fall by 20 - α cm at the 17th century or in the period until the 19th century. Also, since at least 137 years ago, the sea level is almost stable while fluctuating about 10 cm at the maximum. Although it is difficult to distinguish the crustal deformation and the eustatic sea level change, if it is regarded that all of the change was the tectonic influence, it can be denied the steady uplift at a constant rate for the past 600 years. The rapid sea level fall during the 17th century or until the 19th century may have been an intermittent coseismic uplift.

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