

Seismic history of the Ryukyus megathrust: Insights from coral microatolls

Key Words : Tectonics - Geodynamics

To complete the contributions of geodetic tools in the understanding of the megathrust behavior of the Ryukyu Trench, we chose to use coral microatolls. At the intermediate time scale in the Southern Ryukyus, the seismic potential is debated since GPS data reveal low seismic coupling, and few M8+ earthquakes, with uncertain origin, have been reported in the past 350 years. Using coral microatolls, we sought to reconstruct relative sea-level (RSL) changes, due to an interaction between climate and tectonic events over several thousand years.

Using satellite and drone imagery, we identified and investigated a total of 9 sites in Miyako, Ishigaki, Iriomote and Hateruma islands, where we sampled 4 fossils and 7 living coral of variable shape. We used U/Th dating to estimate the age of our fossil slices, and the age vary between 4711 and 2270 BP. We retrieved the RSL changes from our 11 samples which lead us to records over the last 230 years, and 320 years cumulated between 2270 BP and 4711 BP.

Living microatolls show slight submergence of around 0.7mm/yr for those past 150 years. Some local slow and sudden events can be observed for each sample, but only few of them can be related to each other between sampling sites or even islands.

The fossil microatolls from Nagura Bay in Ishigaki witnessed two sudden emergences: one of 28cm around 2273 BP and one of 29cm around 4290 BP.

The intake of the climatic component of the RSL, brought by satellite altimetry and local tide gauges data, lead to several interpretations. At local scale first, the microatolls confirm their use as natural tide gauge, as same short events are recorded by both instrument and corals. At larger scale, the use of satellite altimetry reveals an absolute sea-level rise of 3 mm/yr since 1992, meaning that the apparent 0.7mm/yr submergence of the microatoll records reflects a tectonic uplift of around 2mm/yr, probably for more than 250 years.

Those results call for a reassessment of the seismic hazard of the subduction zone.