Active tectonic uplift process of the Osado Mountains pressed up in Japan Sea, using paleoshoreline data and fault modeling

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The Sado ridge is aggregation of small ridges in Eastern Margin of the Japan Sea, and a part of it in southernmost had been raised above sea level. This ridge is Sado island, which has marine terraces formed in late Quaternary. These express one of earthquake segments of faults in the Eastern Margin of the Japan Sea. We have made a study on fault modeling estimated from altitude distribution which indicates quantity of upheaval,and an upheaval process of Osado which has marine terraces distributed widely. This study classified terrace surfaces developed in the Osado into Pleistocene-terrace I to VII and the Holocene-one L1 to L5: three are the terrace topography, and two are the one of the shoreline of emergence. The displacement pattern is verified with the measurement of the former shore line in the V, VI, L2, and L3. It can draw an arc-shaped equivalent upheaval line expanded eastward, and the values of four measured terraces at the central west coast of the Osado are large. The displacement pattern is same between the Pleistocene-terrace and Holocene-one; the south-eastward tilting accumulates at the Osado. The tilting in each surface is 5.9/1,000 in the V, 3.9/1,000 in VI, 0.25/1,000 in L2, and 0.19/1,000 in L3. A program to assist crustal deformation analysis (Okada, 1992; Naito and Yoshikawa, 1999) utilizes for the fault modeling. The eastward dip fault is estimated under the sea-surface at 10 km far out from the Sotoumifu coast. The parameters of this fault are 45 km in length, 19.9 km in width, 0 km in upper-most depth, 10.3 km in lower-most depth, 4.6 m in slip, and 31 degrees in dip. This fault may not be the Sotoumifu fault system on land, but may fit in well to the base of the oceanic ridge. The latest activity can be about 14th century. This is determined with the radiocarbon dating with the fossilized Pomatoleios kraussi adhered to the shoreline of L5 that may be the outcome of the latest earthquake event. The receding age of the V, and VII, and L1 to L5 is computed for the re-construction of the upheaval process. The Jomon transgression creates the L1; the receding age becomes 7 ka. The age of the receding of the L5 is 0.65 ka with the radiocarbon dating. The earthquakes have occurred 4 times for the 6,350 years between L1 and L5. The span to a next earthquake can put 1,600 years. The receding age of the rest terrace surfaces becomes 5.4ka in L2, 3.8 ka in L3, and 2.2 ka in L4.V suits for MIS 5e: the peak period for the last glacial stage. This is from the facts that the overlay of the K-Tz (95ka) revealed by the excavation of V, the tilting accumulation with L2, and the large development of the surface. The receding age becomes 125 ka. On the other hand, the tilting accumulation of L2 reveals that VI is for MIS 5a, and the age is 85 ka. The span to a next earthquake is 1,600 years. The upheaval during an inter-earthquake is 1mm/yr from a bench mark changing data of the Geological Survey Institute in Japan. The upheaval at an earthquake is 1 m. The terrace altitude estimated from the receding age is well adapted to the one of the Holocene-terrace at the Osado; the change may create this terrace. The accumulation of the changes at the earthquake and during inter-earthquakes, however, cannot explain the one of the Pleistocene-terrace. The consideration whether the outline of the Osado can be by the fault is also done. The characteristic of the Osado is the asymmetry of the East-westward slope; the slack in the east side, and the steep in the west side. The estimated fault, however, results the opposite topography against the actual one. The fault cannot be the origin of this topography; another upheaval process needs. Until now, the seismic survey reveals the possibility of the fault. This fault develops westward of the oceanic ridge carrying the Osado. The activity of this fault had created the outline before the activity ceased. After it, the fault put in this study may create marine terraces.