

Evaluating the magnitude of late Holocene mega-tsunamis on Ishigaki Island based on an analysis of molluscan assemblages

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Four ancient tsunami deposits have been identified on Ishigaki Island, Okinawa, Japan. Three tsunami deposits (T-I, T-II, and T-IV) are calcareous sand beds which have sharp erosional bases and normal graded structure, while one tsunami deposit (T-III) is buried tsunami boulders between tsunami deposits T-II and T-IV. The youngest tsunami deposit T-I, was caused by the AD 1771 Meiwa tsunami, which had a wave height of at least 10 m in the study area. The depositional ages of the three older tsunami deposits (T-II, T-III, and T-IV) are 790-610 cal. yrs BP, 1494-1258 cal. yrs BP and 2502-2287 to 1494-1258 cal. yrs BP, respectively. The elevations of the landward margins of sandy tsunami deposits T-I, T-II, and T-IV are up to 9, 6, and 8 m, respectively. This study examines the influence of the local topography, such as beach ridge and reef system, on the runup of these ancient tsunamis based on a comparison of molluscan assemblages in the tsunami deposits T-I, T-II, and T-IV and those found in recent beach deposits. The results show that the conditions in the reef system off the study area have remained largely unchanged since the occurrence of tsunami T-IV. Beach ridge during the occurrence of tsunami T-IV did not become well developed relative to those during the occurrence of tsunami T-I and T-II. These findings suggest that the magnitude of tsunami T-II were smaller than those of tsunamis T-I and T-IV, while the magnitude of tsunami T-IV did not reach that of tsunami T-I (AD 1771 Meiwa tsunami).

Keywords: large tsunami, Ishigaki Island, late Holocene, analysis of molluscan assemblages