Field Survey of tsunami deposits in Noda Village, Iwate prefecture

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Large tsunamis had frequently affected to the Sanriku coast according to historical and observation records (Utsu, 2004). It is essential to collect information of paleo-tsunami deposits for understanding nature of low frequency large tsunamis in the past. However, there are few reports of paleo-tsunami deposits along the Sanriku coast (Yagishita et al. 2001) nevertheless that the coastal region is broad. Thus, more geological data should be collected to better estimate timing, recurrence interval, and size of historical and pre-historic tsunamis along the Sanriku coast. Goto et al. (2014) performed preliminary survey at Noda Village of Iwate Prefecture in Northern Sanriku and reported several gravelly sand layers. They also reported presence of the AD 915 Towada-a tephra (To-a) and AD 946 Baegdusan- Tomakomai tephra (B-Tm) above the gravelly sand deposit. On Sendai and Ishinomaki plains (Sawai et al. 2007, 2008), Otsuchi Bay (Torii et al. 2007), and Koyadori in Miyako City (Ishimura and Miyauchi, 2015), the 869 Jogan tsunami deposit has been identified based on the stratigraphy that the To-a tephra layer was deposited just above the tsunami deposit. Noda Village locates far north from the area where the 869 Jogan tsunami deposit was reported. Therefore, if we can identify the 869 Jogan tsunami deposits in this area, it will be useful to constrain the tsunami source model. However, correlation of gravelly sand layers and identification of their tsunami origin should be further evaluated. Thus, we conducted detail field survey at Noda Village in order to correlate gravelly sand layers among each survey pits and to identify their origin.
We set a survey line and observed sediments with approximately 5 m to 10 m interval for the most parts. As a result, we found at least 4 gravelly sand layers and identified them as the event deposits based on sedimentary features (event layers I to IV in ascending order). We then correlated these deposits pit by pit to understand the continuity of each event deposit. We also used chronological data for correlation of event deposits because the survey area is an artificial terrace topography for agricultural work so that correlation by lithological observation only was sometimes difficult. Based on grain size analysis and numerical simulation of storm surge and wave, we evaluated the origin of the event layer III, which is deposited continuously and widespread area. The event layer III was formed by the sediments that were transported landward by strong current, because of rounded shape of particles, landward fining and thinning features, and upward fining trend. Our numerical modelling revealed that the landward extent of the event layer III could not be explained by the storm surge/wave even if we assume extremely large size. Based on these results, we identified the event layer III as tsunami deposits. Similarly, we identified all other event layers (I, II, and IV) as tsunami deposits because their landward extents are further than the inundation limit of extremely large storm surge/wave. In this way, the numerical simulation of storm surge and wave can be a useful method to distinguish tsunami deposits from storm deposits.
Our results imply that four large tsunamis had occurred during 1600 years from around 1100Cal BP to 2700Cal BP. Considering the landward extents of each tsunami deposit, local sizes of these tsunamis might have been large equivalent to the 2011 tsunami or the 1896 tsunami.

