Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)


HDS05-01 Room:203 Time:May 23 11:03-11:26

# Geological features of the tsunami -lessons learned from the 2011 Tohoku-oki event-

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Tsunami geology is one of the important approaches to understand the historical and pre-historic tsunami events. After the late 1980's, the tsunami deposits have been used to understand the recurrence interval of the large tsunamis at the high-risk area in the world. The Pacific coast of the Tohoku region of Japan is one such area and the 2011 Tohoku-oki event is considered as the probable recurrence of the AD869 Jogan tsunami event. The 2011 event was unfortunately revealed the usefulness of the tsunami deposits to better understand the low-frequency large tsunamis. On the other hand, not only the recurrence interval, scale of the historical and pre-historic tsunamis should also be clarified for the future risk assessment. As such, the distribution limit of the sandy tsunami deposits has been used as the minimum inundation limit of the tsunami. However, the sandy tsunami deposits did not cover entire the inundation area of the 2011 event and, in some places, the maximum extent of the sand deposits was about 60% of the inundation distance. In this way, the sedimentary features of the tsunami deposits are not directly linked to the size of the paleo-tsunamis. At Sendai Plain, more than 1,000 data of the tsunami deposits were corrected by the various research groups. Moreover, 5-m DEM data is available at this area. These high-resolution data as well as the numerical modeling of the tsunami inundation provide us rare opportunity to understand the relationship between the tsunami deposit and hydrodynamic properties. In addition to that, I also review the current understanding of the environmental effects of the sedimentation/erosion by the 2011 event at the Sendai Plain and the recovery process.

Keywords: tsunami, Tohoku, geology, tsunami deposit

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# Effects of the 3/11 Erthquake and Tsunami on the Coastal Marine Ecosystem and Recovery Process in Moune Bay, Kesennuma

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Kesennuma city, one of the most important fishing ports in northeastern Pacific coast of Japan (Sanriku district), was heavily devastated by the 3/11 tsunami attck. It has been getting famous in the world because it is the birth place of a grass-root social movement catch-phrased by ”The sea is longing for the forest” established in 1989. The leader, oyster culture fisherman, Mr.Shigeatsu Hatakeyama was elected as Asian representative of forest heroes by the United Nation for international year of 2011. Moune bay, a branched inlet of Ksennuma bay, is the real birth place of the movement which originally aimed to rebuild oyster and scallop culture once collapsed by highly deteriorated coastal environments due to rapid economic growth in 1970s and 1980s. Oyster and scallop culture in Moune area recovered with progress in the social movement, but it was completely destroyed again by the 3/11 tsunami. Under very serious situation of heavily damaged mrine and fisheries institutes located along the Sanriku district, the author proposed organising a volunteer investigation to assess the effects of the earthquake/tsunami on the coastal marine ecosystem and its recovery process. The first survey started in May 2011 and continued every two months under cooperation of NPO ”The sea is longing for the forest” and researchers. With advances in the investigation, the research team is expanding to be included more than 30 members of a large varaiety of experts and students came from all around Japan.

The most excited finding in this investigation is saltmarash and tidal flat reappeared in the innermost part of Moune bay which had been utilized as housing and agricultural land before the earthquake and tsunami attack, due to 70cm sinking of the ground. Many organisms like fish juveniles, shrimp, clams and seaweeds appeared, in particular asari clam juveniles

showed the most remaralable appearance. Some of them are growing so rapidly to produce their offsprings. Local people have been largely encouraged by reviving coastal marine ecosystem with many organisms, then decided to live again with the sea. However they have a very serious problem that local government decided to make concrete ”gigantic seawalls” along the Sanriku coast. If it wiil be realized, the coastal marine ecosystem would be highly damaged, resulting in seriously pessimistic future of caostal fisheries, aquaculture, and shightseeing idustries. We claim more comprehensive strategy and tactics for protecting earthquake/tsunami disasters including more sustainable ”green seawalls” which has been proposed by emeritus professor Akira Miyawaki. Based on the fidings from the Kesennuma-Moune investigation we could draw a future design in Moune area that reappeared wetland, recognized as a precious ”present” from the earthquake and tsunami, should be utilised for environmental education paraticularly for young generation and also a model researach target of reviving nature once destroyed by human being.

Keywords: coastal marine ecosystem, earthquake and tsunami, Moune Bay, oyster culture, saltmarash and tidalflat, the sea is longing for the forest

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# Suggestions for coastal zone reconstruction based on vulnerability data obtained from the 2011 Japan tsunami

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The 2011 Great East Japan tsunami caused various kind of damage in coastal zones. This paper presents an analysis of tsunami flow depth or height against human fatality and damage on building, fishery boat and pedestrian bridge. Suggestions for the reconstruction based on the analysis of results for each topic were proposed. Human fatality ratio of the 2011 Tohoku tsunami was compared with other historical tsunamis. Fatality ratio in Sendai Plain coast is as high as in Sanriku ria coast even though the tsunami height in the Sanriku coast is much higher. This shows importance of evacuation in reducing human loss by tsunami. For building, a higher damage probability exists on the ria coast due to higher flow velocity for a given inundation depth. It is clear that RC and steel buildings performed better than wood and masonry buildings. The performance of buildings with three or more stories is particularly significant. Buildings constructed after 1981 performed slightly better than buildings constructed between 1971 and 1981. It can concluded that damage is observed in fishery boat when tsunami height is greater than 2 m and totally damage when the height is greater than 5-10 m depending on coastal and boat types. Fishery boats that is larger than 5 tons show higher performance. Finally, pedestrian bridge will start to be damaged by tsunami if 1) the tsunami flow depth is higher (1.5 times) than the height of bridge or 2) if the location of pedestrian bridge relative from the shoreline is 1/10 of the maximum inundation in land.

Keywords: 2011 Japan tsunami, Fragility curves, Coastal reconstruction

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# Debris Management and Contamination in the aftermath of March 11, 2011; Impacts and Restoration. Miyagi Prefecture.

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The massive destruction by the tsunami along the coastline in March 2011created a gargantuan amount of debris. Between 15.5 million to 18 million tons resulted alone in Miyagi equaling 23 years of waste production by the entire Miyagi prefecture. 10.44 million tons (67%) before the end of 2012. An enormous financial and managerial challenge for the purpose required more than 1,000 employees to clean-up, gather and separate debris.

Once collected they were piled-up in to temporary storage separated in burnable materials (lumber and other organic materials), non-burnable (metals and household appliances) hazardous materials (asbestos, PCBs, gas cylinders, etc.) as well as damaged boats and cars. A second separation process included five holding blocks along the coastline in cities, towns and villages such as Kesennuma, Ishinomaki, Miyagi-Tobu, Sendai and Watari-Natori.

Wide spread contamination from chemicals and other materials in the soil, surface, ground as coastal waters from the accumulated debris most likely occurred through leached, storm and rain-run-off , which most likely impacted ecosystems and animals and plant species with different degrees.

Since no insulation measures were provided in many sites potential short, medium and long-term environmental impacts and the consequences may occur which may in turn likely affect the degree and quality of restoring some of the tsunami-affected areas if proper measures are not undertaken.

Keywords: debris, contamination, impact, restoration, coastal waters, soil and freshwater