

# The Diatom Assemblages as the Indicators for Huge Tsunami Sedimentations and Recover Processes of Environment at Kesenuma Bay, Tohoku, Japan

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Kesenuma Bay is located north of Sendai, Miyagi Prefecture, and is an enclosed bay along the Pacific Ocean. It was damaged by the Tsunami at 2011 East Japan Tsunami (March 11, 2011). About 1500 persons were killed and 10,000 houses were broken by the tsunami along the bay. The oil from the broken oil flowed into the bay, and fired for several days at the north part of the bay. The oil fire left the serious influences for the plankton flora, and took huge damage for the fishery production of the bay for several years.

The tsunami currents occurred huge scale of sedimentation and erosion within the bay. Dr. Tsuyoshi Haraguchi, Osaka City University, compared the detail measurements of the submarine topography of the bay between in 2010 (one year before the tsunami), 2011 (one month later the tsunami) and in 2013 (two years later the tsunami) and presumed the distributions of erosion and deposition areas in the bay by the tsunami current. The maximum sedimentation by the tsunami current reached more the 3m, at north and east part of the bay. He also took core samplings of the tsunami deposits where the sedimentary parts, and made clear that almost of the tsunami deposits were consisted of clay or silt materials. The sand material (the Tsunami Sand) distribution was very limited in the bay (the margin of the bay).

Diatom are clay or silt size (less than 100  $\mu\text{m}$ ), and we tried to trace the transportation processes by the tsunami of silt and clay materials using diatom assemblages in the sediments. The samples for diatom analysis in the Kesenuma Bay were as follows:

- (a) The surface deposits at 26 sites in the bay, taken in 2010 (one year before the tsunami), in 2012 (one year after the tsunami) and in 2014 (three years after the tsunami)
- (b) Three drilling cores at the tsunami deposits in the bay taken in 2013 (two years after the tsunami).
- (c) Three drilling cores at the Tsunami deposits at 1960 Chilli Tsunami (1960 Valdivia Earthquake Tsunami) taken 2009, two years before the 2011 Tsunami.

At the tsunami currents in 2011, a lot of inland deposits along the coasts flowed into the bay by the back current of the tsunami. The ratio of the freshwater diatom assemblages in the bay surface deposits increased about 50%, and it presumed the strong sedimentation of freshwater materials from inland coasts by the tsunami.

The 1960 Chilli Tsunami (1960 Valdivia Earthquake Tsunami) had long-period waves (about 100 minutes interval). The waves looked gently moved on the surface, but the strong erosion and sedimentation processes were occurred at the submarine floor of the bay.

The fluctuations of “go” and “back” currents of tsunami were kept as the laminated structures in the core deposits in the bay clearly. Diatom assemblages also fluctuated according to the laminated

structures. Ratio of off shore marine diatoms increased at the “go” stages, and freshwater diatoms from inlands increased at the “back” stages.

Keywords: Diatom Assemblages, 1960 Valdivia Earthquake, 2011 Earthquake off the Pacific Coast of Tohoku, Kesenunuma Bay, Submarine Topography