Event deposit and Holocene environmental change preserved in coastal marsh in Osatsu, Toba, central Japan part 2

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Tsunami caused by large earthquakes in the sea surges to the land with sediments from sea beds and shore area. In coastal lowlands, various matters were deposited by tsunami. These deposits caused by tsunami are called tsunami deposits. Recently, many studies about tsunami deposits have been carried out. However, it is difficult to distinguish pre-historic tsunami deposits from deposits caused by other events (e.g. high tide). Thus, there is no established method for identifying tsunami deposits.

The purpose of this study is to identify tsunami deposits on the basis of facies, grain size analysis, fossil foraminifera, magnetostratigraphy and magnetic susceptibility in the coastal marsh deposits intercalated with several event deposits that may be correlated with tsunami deposits. Especially, I focused on bathymetric distributions of recent foraminifera.

Ten sediment cores were sampled by Geo-slicer from three areas of coastal marsh in Osatsu, Toba City, Mie Prefecture. On the basis of 14C dating, Mitamura et al. (2001) concluded that the sediments in these cores were deposited during the last 7000 years. Facies of these cores are similar between three areas. The sediments consist mainly of silt with organic materials interbedded with more than ten thin sand layers.

Eleven layers in these sands show good horizontal continuity. These 11 sand layers were correlated between the cores on the basis of facies, stratigraphy, magnetostratigraphy and magnetic susceptibility, and were numbered from OS-1 to OS-12. Many of these sand layers show evidence of erosion at their base, and are recognized as sudden change of sedimentary facies in fine sediments. These results show that these 11 sand layers are event deposits provided by some event to coastal marsh. In addition, these 11 sand layers can be divided into two types that are with fossil foraminifera or not. In this study, there are fossil foraminifera in five sand layers out of 11 sand layers. Event deposits with fossil foraminifera have evidence of erosion at their base, including plant fragments and mud crusts with depositional grading in some part. These lithology is similar to characteristics of tsunami deposits.

Fossil foraminifera occurred from four event deposits (OS-2, 6, 8 and 9). Identifications of fossil foraminiferal species were carried out in each event deposits with foraminifera of one core. Concentration of fossil foraminifera has some variety, while number of species have few variety. Many of foraminifera species in this study are common at the water depth of 0-50m. However, foraminifera species that are common at the water depth of 50-100m occur in all event deposits with fossil foraminifera. In only one event deposits with fossil foraminifera, foraminifera species that are common at the water depth of 100-150m occur.

As events that provide sediments from sea to coastal area, there are storm and tsunami. General differences between storm and tsunami were as follows. Storm was caused by windstorm and rise in the sea surface by the change of atmospheric pressure. On the other hand, tsunami was caused by the movement of water mass by displacement of sea floor. These characteristics indicate that storm cannot provide foraminifera living at the water depth of more than 50m to the study area. This results show that event deposits with foraminifera were formed by tsunamis. Tsunamis surged to the study area with sediments with foraminifera in sea beds.

Concerning the identification of tsunami deposits, conclusion of this study was carried out on the basis of several methods including foraminifera analysis. It was shown that identification of tsunami deposits and its ages before historical periods is possible by these methods.