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Possible onshore-dominated source of tsunami deposits of the 2011 Tohoku tsunami: a case study from northern Fukushima
Possible onshore-dominated source of tsunami deposits of the 2011 Tohoku tsunami: a case study from northern Fukushima

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We surveyed the tsunami deposits of 2011 Tohoku tsunami at Matsukawaura and Yunuki, two lowlands in northern Fukushima. The presence of a lagoon at Matsukawaura and river at Yunuki makes these locations are the best location to study the source of tsunami deposits. Matsukawaura is a flat area, and it was a paddy field before inundated by tsunami. At Matsukawaura we surveyed and sampled every 200 m along 2 km transect. Our first point is just behind the lagoon. The inundation distance was around 3.8 km, and our last point was about 300 m before inundation limit. The tsunami height was around 9 m. The tsunami deposits here composed of sand and mud layers. The mud is black and along the transect the mud is distributed in the upper part of the tsunami deposits; however it is sometimes intercalated between the sand. The thickness of the mud is from 1 to 10 cm, and the thickness of the sand is from 3 to 10 cm. Sometimes, within the sand, rip-up clasts are present.

Yunuki is a flat (1.5 x 5 km2) valley located around 7 km south of Matsukawaura. The inundation distance was about 4.5 km, with tsunami height about 10 m. At Yunuki, we surveyed the tsunami deposits along 4.1 km transect (longitudinal transect). We also surveyed the tsunami deposits crossing the river (transversal transect). Total 26 points for longitudinal transect and 11 points for transversal points were observed and sampled. In general the tsunami deposits are composed of sand layer covered by mud. The sand sometimes laminated. This laminated sand deposited above the massive or graded bedding sand.

To understand the main source of these tsunami deposits, we perform foraminifera and mineral composition analysis of beach, dune, lagoon, and tsunami deposits. Examples of foraminifera found within the tsunami deposits are genus of Elphidium, Haynesina, Rotalia. Some species of Elphidium, Haynesina are typical of lagoon spesies.

Based on the percentages of foraminifera, shell fragments and mineral composition, the possible main source for tsunami deposits at Matsukawaura were dune (30%) and lagoon (35%), meanwhile at Yunuki the possible main source was the dune (70%). This novelty result is very important because we always thinking that tsunami deposits mostly sourced from offshore area, and now we understand that tsunami deposits can also mostly sourced from onshore area.

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