

## Mega-dunes formed by the 2011 Tohoku-Oki tsunami at the Kesenuma Bay, Japan

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The 2011 off the Pacific coast of Tohoku Earthquake was one of the largest events in the history of Japan. The huge tsunami (the 2011 Tohoku-Oki tsunami) inundated a large coastal area of northeastern Japan, causing widespread devastation. Twenty days after the tsunami, we analyzed the impact of the tsunami on the sea bottom of the Kesenuma inner bay using side-scan sonar and a depth sounder to explore the damage and bathymetric change in the harbor. Herein we present the first direct evidence that the sea bottom sediments of around 10-15 m were reworked by the tsunami to thickness of a few meters, and that large dunes were formed by the tsunami. Considering that the sea wave influence is as weak as it is inside the inner bay, the potential exists that even meter-thick sandy or silty paleo-tsunami deposits are preserved in shallow sea bottoms with large bedforms. This finding will be a steppingstone to future geological studies of tsunami effects in shallow sea regions.

Keywords: 2011 Tohoku-Oki tsunami, Kesenuma Bay, Mega-dune