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Depositional processes of the 2011 Tohoku-Oki earthquake- and tsunami-induced event deposits offshore of Sanriku, Japan

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Deep-sea turbidite is occasionally used as a tool of submarine paleoseismology. To use deep-sea turbidite as a paleoseismological tool, it is important to understand what kind of phenomena has occurred and what kind of event deposits has been formed by the earthquakes. The 2011 off the Pacific Coast of Tohoku (Tohoku-oki) earthquake and tsunami was the most destructive geohazard in the North Japan. To understand the influence of the earthquake and tsunami on the sea floor environments and to characterize the event deposits related to the earthquake and tsunami, we examined the undisturbed surface sediment samples from off Sanriku to Sendai collected at July to August, 2011 around 4.5 months after the 2011 Tohoku-oki earthquake. The results indicated that influence of the 2011 Tohoku-oki earthquake and its following tsunamis were widely recognized at sea floor from outer shelf to lower trench slope off Sanriku. Composition of the event deposits indicated multiple sources of the event deposits reflecting that the sea floor disturbance occurred at wide areas. Two types of sedimentary structures were recognized in the event deposits. Type 1 event deposit is further subdivided into two subtypes. Type 1-1 event deposits having the fine-grained turbidite sequence with a sharp erosional basal contact suggested the relatively long-distance transport of the sediment particles by turbidity currents, whereas relatively short-distance transport by sediment resuspension and settling near the original site for Type 1-2 and Type 2 event deposits composing of homogeneous muddy sediment above a sharp surface but without basal coarse-grained layer. Radioactivity measurement suggested that surface sediment remobilization was a major factor producing the event deposits. Amount of resuspended sediments and submarine topography might control the transport distance. Wide distribution of the event deposits in space and water depth reflected the large magnitude of the earthquake and its following tsunamis.