

Geochemical characteristics of paleo-tsunami deposits using multiple classification analysis

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Cataloguing and assessing tsunami records are important for long-term tsunami prediction and for tsunami-hazard mapping. However, like on a number of other tsunami-susceptible coastlines, historical records of tsunamis are too short to develop a predictive chronology of events. Understanding the geochemical characteristics of tsunami sediments is significant for revealing the mechanisms of tsunami inundation. Principal component analysis (PCA) can be used to extract geochemical features of tsunami sediments. It is one of the most pervasive multivariate analysis techniques which can be used for extracting the hidden structure and pattern from high-dimensional data in various fields of natural and social sciences. We conducted field surveys in February and March 2016 in Wakabayashi, Sendai City. The sedimentary sequence contained a disturbed sandy soil at the top, overlying a mixed layer with the To-a and Jogan tsunami deposit, as well as characteristic sand layers at about 50 cm, 103-113 cm and about 140 cm depth. The core was analyzed using an ITRAX X-ray fluorescence core scanner, which provides high resolution semi-quantitative elemental data, as well as photographic and radiographic images. Major elements (Si, K and Ca etc) showed high counts at 100~110 cm depth, while the distribution of minor and trace elements (Zn, Cr and Zr etc) was more variable. The Mo ratio (Mo_{coh}/Mo_{inc}) which is an indicator of organic content was, as expected, lower in sandy layers than in the peat. The PCA was performed using normalized counts of 17 major elements and minor/trace elements. The PAC was showed geochemical characteristics of tsunami deposits in a comprehensive fashion. The above 3 factors, such as PC1, PC2 and PC3 can explain the processes that contribute to the chemical variations. These results and the other geological evidences can be useful for understanding the mechanism of the tsunami indentation.

Keywords: tsunami deposits, multiple classification analysis, geochemical characteristics