Geophysical Research Abstracts
Vol. 19, EGU2017-17211, 2017
EGU General Assembly 2017

Effects of heavy metal pollution on foraminifers in the Marmara Sea (Balıkesir-Canakkale-Tekirdag, Turkey)

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ABSTRACT
This study aims to investigate the effects of heavy metal pollution on Holocene foraminiferal assemblages in the sediments of Marmara Sea (Balikesir-Canakkale-Tekirdag, Turkey). For this purpose four drilling samples, one from Bandirma (Balikesir/Turkey), two from Erdek Bay (Erdek-Bandirma/Turkey) and one from Tekirdag (Turkey) have been taken. Additionally core samples taken from 43 different locations in the Western Marmara Sea also have been examined. Foraminiferal assemblages were identified and changes in heavy metal concentrations were determined (spatially) in the vertical direction by means of drilling samples; in the vertical direction for geochronology and in the horizontal direction by the areal distribution of the core samples. In this research an average value defined as Pollution Index (PI) was used for the first time in order to summarize the results of geochemical analyses. Within the scope of this method, the pollution index value is obtained by dividing the sum of average value ratios of heavy metal measurement values by the number of measurements. It was observed that the number of individuals and species decreased where the heavy metal measured values (MV) were higher than the pollution index and increased where the heavy metal values were lower than the pollution index when obtained index value was correlated separately with the numbers of foraminifer individuals and species. It was also observed that foraminifera were completely absent in some locations where PI was less than MV. Morphological changes were observed in three foraminifer species, Elphidium crispum, Massilina secans, and Ammonia compacta, in the core samples taken in areas where industrial wastes are discharged into the southern parts of the Marmara Sea. At some locations, between Misakca-Denizkent, and Erdek-Balikesir, Turkey, where the heavy metal density was high it haven't been any foraminifer species were achieved. The pollution index (PI) value measured in this area was higher than the critical value, indicating that heavy metal concentrations affect the habitats of foraminifera.