

Dating of marine sediments for historical trends of the heavy metal concentrations in the Candarlı Gulf of Turkey

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Introduction: Candarlı Gulf (38°57'37''-38°43'44''N and 26°44'58''-27°04'23''E) is a semi-enclosed bay in the eastern Aegean Sea which has extensively surrounded with residential, industrial and agricultural areas. In particular, Aliaga city which is south of Candarlı Gulf on the Aegean Coastline of Turkey, includes many heavy industries such as Turkish Petroleum Refinery Petrochemical Holding Company, shipbreaking facilities, phosphate fertilizer plant, paper factory, iron and steel plants and thermal power plants based on natural gas. Additionally, Bakırçay River is a highly contaminated stream passing through the most heavily industrialized area. As a result, the rapid urbanization and industrialization in the region since the 1970s has resulted a significant environmental impact on the aquatic environment. Therefore, ²¹⁰Pb and ¹³⁷Cs dating methods were applied to marine sediments in order to establish a geochronology for historical trends of the heavy metal concentrations in the Candarlı Gulf of Turkey.

Methods: Candarlı Gulf has placed between 38°57'37'' and 38°43'44'' N geographic latitudes and 26°44'58'' and 27°04'23'' E geographic longitudes in the Aegean Sea. The sampling via a gravity corer have been performed by Koca Piri Reis research vessel from Dokuz Eylul University, the Institute of Marine Sciences and Technology. Sediment cores were collected systematically at 20 stations in the Candarlı Gulf during August 2014 (Fig.1). The cores were sliced at 1-cm intervals for

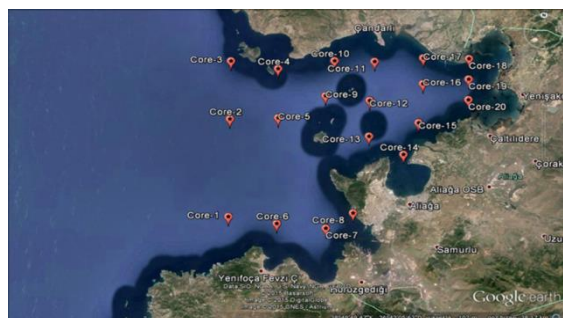


Fig. 1: Location of the sediment cores further analyses. Sediment subsamples were dried at 40-60 °C to constant weight, and water content was

determined. The dried samples were powdered in a ball-mill for geochemical and radionuclide analysis. In this study, the quantitative determination of the ²¹⁰Pb and ¹³⁷Cs was carried out by HPGe gamma spectrometry.

Results: The sedimentation rates obtained from ²¹⁰Pb dating were appeared in the range of 0,2 - 2,5 cm.yr⁻¹. There is not a significant discrepancy between CRS and CIC Models [1-3] and give the almost same results. Furthermore, the validity of the proposed methodology is confirmed by ¹³⁷Cs chronology. The established chronology indicated that sediments mainly started to receive anthropogenic inputs of heavy metals, since the 1980s.

Discussion: The dated sediment cores were used to sedimentary record of historical heavy metal contamination of the Candarlı Gulf. According to the established chronology showed clearly that the increase in the concentrations of the As, Cd, Hg, Zn and Pb in the recent sediments were caused by human- induced changes. The combination of trace metal analysis, Pb isotopic composition and ²¹⁰Pb and ¹³⁷Cs dating as well as statistical data in the sediments provide vital information on the long-term accumulation of metals in the Candarlı Gulf.

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