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Radioisotopes in sedimentary study of the Black Sea and Caspian Sea

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Natural archives, such as lake or marine sediment, are widely used in erosion/sedimentation, water quality, climate change and eutrophication study alongside with the retrospective reanalysis of contaminants fluxes (trace metals, organic pollutants or radionuclides). In order to "read" information stored in sediment sequences a chronostatigraphic method have been developed and used since 1950s which is based upon variation of activity of ^{210}Pb over the sediment profile, natural radioisotope of Uranium decay series with half-life 22 years, and hence valid for the last 100–150 years of recent sedimentation history. The ^{210}Pb chronology is prone to be validated by other time-markers, such as artificial radionuclides globally dispersed after the nuclear weapons tests of 1960s or major accidents on NPP (the Chernobyl accident of 1986 or latest on the Fukushima Daiichi in 2011). In the last decade an intensive study using sediment cores collected from shelf and deep-sea areas in the Black Sea and the Caspian Sea have been undertaken within the framework of a number of international research projects organized by IAEA and UNOPS-GEF and devoted to environmental problems of this enclosed, and therefore sensitive to environmental impact, marine systems. Elaborative analysis of the experimental data and sediment age calculation have been done by application of CRS and CIC dating models to unsupported ^{210}Pb activity over the sediment profile. Measured in sediment ^{137}Cs and ^{241}Am clearly showed well resolved Bomb test and Chernobyl fallout peaks and were used as markers in order to corroborate radiometrically determined age of sediment. Geochronological reconstruction of the fallout radionuclides inventory, fluxes and accumulation rate in the sediment of the Black Sea and Caspian Sea by application of combined radiometric dating technique proved to be very consistent with the historical data of atmospheric fallout observations of that artificial radionuclides recorded worldwide since nuclear era onset in early 1950s. Another finding of the initially radioactivity related to project was suitability of unmixed sediment cores recovered from the deep anoxic floor and continental slope of the Black Sea to be used for proxy reconstruction of the late Holocene climate variability in the region. This well preserved sediment are characteristic in finely laminated coccolith ooze (Unit I – approximate age 2000 years) overlaying above rich in organic matter sapropels of Unit II. Variations in accumulation rates of biogenic carbonate sediment fraction of Unit I were found to be satisfactory correlate with changes in winter SST anomaly calibrated in recent radiometricaly dated topmost sediment. Further development and rectification of the proposed interdisciplinary method is in progress.