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Effect of Mediterranean Inflow on Redox Conditions of the Istanbul Strait Outlet Area of the Black Sea

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The İstanbul Strait (Bosphorus) outlet area of the Black Sea (ISBS) includes the shelf and upper slope areas north of the Strait that is the only connection of the anoxic Black Sea basin with the world ocean. This area is characterized by the Mediterranean inflow that is responsible for the ventilation and sluggish deep circulation the anoxic Black Sea basin. The oxic-anoxic boundary (chemocline) is presently at 100-150 m depth, but may have varied in the past as result of the changes in the amounts of the Mediterranean inflow of riverine water input and global sea level.

We have carried out geophysical subbottom profiling and sediment coring along depth transects from -75 m to -307 m on the shelf and upper slope areas onboard RVs Arar and MS Merian for the EC FP7 Hypox project. The cores were analyzed for physical properties using Geotek Multi-Sensor Core Logger (MSCL), elemental analysis by Itrax XRF Core Scanner, and total organic (TOC) and inorganic (TIC) contents by Shimadzu TOC analyzer, and dated by AMS C-14 analysis. Cores located in the oxic zone above -125 m are green gray to gray mud without any distinct lamination whereas the cores in the anoxic zone are laminated and banded dark gray to black mud. Cores below -190 m show the presence of the dark green to gray Sapropel and dark gray to black Coccolith units. The anoxia development started after the latest connection with Mediterranean waters at 9.4 ka BP. The anoxic/oxic boundary is detectable by Mn, S and Fe anomalies in the cores at -150 m, which is tentatively dated 6.8 ka BP. The effect of Mediterranean waters on the seafloor can be followed down to -307 m (depth limit of the transects) by high Mn counts on the XRF scanner profiles. Such Mn anomalies in upper slope cores, unassociated with Fe and S anomalies, are probably formed by deposition of Mn (II) from the water column, and represent green to gray green mud intervals rich in benthic bivalve and foraminifera populations above -160 m. In adition to Mn anomalies the transition from oxic to anoxic conditions are shown by changes in mud colour from gray green through gray and dark gray to black. Most cores contain a 1-2 mm thick brown oxic mud at their top, suggesting the microbially mediated anaerobic reduction of nitrate coupled with the bacterial oxidation of Mn (II) and Fe (II) oxides. MSCL results show the increased delivery of sediments to the shelf and upper slope areas in the last few hundred years as a result of human impact.