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Rapid sapropel accumulation on the upper continental slope of the NE Black Sea during the past century: a response to the global warming?

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A semi-liquid black sapropelic mud layer, 26 - 75 cm thick, was recovered at the coretops from the upper continental slope off the Arkhipo-Osipovka village, NE Black Sea. The organic-rich coarsely laminated (gray/black) or massive (black) mud overlies denser gray shelly mud in a canyon thalweg at water depths 230 - 250 m. Similar semi-liquid sapropelic mud was recovered just behind the shelf break, at water depths of 110 to 140 m, off the town of Gelendzhik. In a mini-core of this sapropelic mud, the technogenic 137Cs activity record fixed a sharp peak at 5 cm likely marking the Chernobyl incident at 1986. The mini-core was retrieved in 2000, 14 years after the Chernobyl catastrophe. Therefore, the sediment above accumulated with a rate of 3.8 mm per year. Further below, another wider 37Cs maximum at 8 – 12 cm possibly corresponds to the atmospheric nuclear bomb tests which culminated about 1963. Therefore, the sediment between 5 and 10 cm accumulated with a rate of 2.7 cm/yr. Additional samples collected from the same area in 2010 are in process now and we expect that new measurements will precise the age estimates, but even the existing data suggest extremely high sedimentation rates indicating that the sapropelic mud layer has accumulated in the past century.

We assume that such a rapidly accumulated recent deposit was formed due to periodical organic-rich suspended matter washing from the high-energy shelf edge to the low-energy upper slope environment, where it settled as an unstable sediment body. The organic-rich near-bottom nepheloid layer is created over the outer shelf likely by seasonal or multi-annual phytoplankton blooms related to intensified water mixing in the hydrological frontal zone. The increase in frontal zone intensity that led to enhanced productivity might result from reorganization of the hydrological regime over the continental margin at the beginning of 20th century warming. We interpret the sharp contact between the relatively dense greenish gray shelly mud below and the semi-liquid black sapropelic mud above, in cores from the canyon thalweg, as a result of slow downslope mudflow (or creep) over an erosion surface. If so, erosion in canyon upstreams during the Korsunian (i.e. Little Ice Age) cold regressive phase of the Black Sea was replaced by a calm bottom water environment favorable for fine-grained mud accumulation at the beginning of warming, whereas the hydrodynamic activity and productivity increased over the shelf edge simultaneously.