The role of sediments in regulating the Earth‘s climate

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Introduction: Sediments are a great indicator of past environmental conditions. Changes in the many aspects of the environment also produce changes in the sediments, such as shifts in their composition, isotope ratios, and sedimentation rates. If the sediments were deposited in an undisturbed environment, they could be used to interpret the changes that led to the current conditions. If used along with the sediment dating, the pace of these changes could be determined.

Methods: The sediment cores were collected from the Black Sea in the vicinity of Varna, Bulgaria (Fig.1) and from the Adriatic Sea in the vicinity of Budva, Montenegro (Fig.2). The cores were collected using a pressure or a gravitational multi-corer. The cores were cut immediately aboard the ship into centimeter intervals. Some cores were transferred to the different labs undisturbed. The cores were dated and selected intervals were subject to the total carbon, organic carbon, and inorganic carbon analysis.

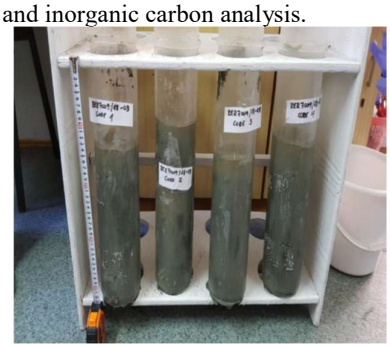

Figure 1. Four sediment cores retrieved at the station 7009-18-03, Black Sea, Varna, Bulgaria at 22 m water depth on 26th September 2018 by using pressure multi-corer. The cores have been subjected to radionuclides, trace elements, dating and organic, and inorganic matter analysis by the participants of the IAEA RER7009 and RER7015 projects.

Since the ratio of carbon stable isotopes ($\delta^{13}C$) and oxygen stable isotopes ($\delta^{18}O$) of the organic matter and inorganic carbon can also change depending on the climate conditions, further isotope analysis is planned.

Discussion: The anthropogenic CO_2 emissions have already caused a huge increase in atmospheric carbon concentrations. Many natural environments help the reduction of the atmospheric carbon concentrations by sequestration. It is a well-known fact that seas have a major role in sequestering carbon. It is estimated that oceans act as a sink for about one quarter of the anthropogenic CO_2 emitted in the last 20 years at a mean rate of about 2.0–2.5 Pg C yr^{1} [1].

Figure 2. Core RER7009-19-01-02 is one of the 5 cores taken on 8th October 2019 at 123 m water depth in front of Budva, Montenegro by using a gravitational corer. The cores have been subjected to various analyses (see Fig.1).

Most of the research is focused on the interaction between the atmospheric carbon and the surface of the sea or the terrestrial environments (such as farmlands and wetlands), but the interaction between the dissolved carbon in the sea and their bottom sediments is scarcely investigated. Since the seas are forced to sequester more and more carbon [1], the increase in the sediment precipitation rate and carbon concentrations should be also visible in the precipitated sediments.

By measuring the sedimentation rate and changes in the carbon concentrations throughout the sediment core, it should be possible to perceive their increase with the decrease of depth and age. Thus, a calculation of the carbon sequestration in the sediments would be attainable as well as the inorganic and organic carbon contributions.

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References:

[1] Landschützer et al. (2014) Recent variability of the global ocean carbon sink. Global Biogeochem. Cycles, 28/19, 927–949. doi:10.1002/2014GB004853