Geophysical Research Abstracts,
Vol. 11, EGU2009-5301-2, 2009
EGU General Assembly 2009

Sublacustrine river valley in the shelf zone of the Black Sea parallel to the Bulgarian coast

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The considered sublacustrine river valley is situated in the shelf zone of the Black Sea. It runs in parallel to the Bulgarian coast, was formed in the time period of the Younger Dryas (Preisinger et al., 2005), and features an inclination of about 0.5 m/km. An about 200 km long sediment wall separates the approximately 10 km broad river valley from the outside shelf zone. This wall was generated during the Older Dryas until the beginning of the Younger Dryas. Its shape was formed by transportation of water and sediment from the Strait of Kerch by a circulating rim current in the Black Sea and water as well as sediment flow of the Danube in direction to the Bosporus.

New investigations of the sediments of this river valley were performed by utilizing a Sediment Echo Sounder (SES 2000). This Echo Sounder is a parametric sub-bottom profiler enabling a high resolution sub-bottom analyses. It is capable of penetrating sea beds up to more than 50 m of water depth. The received echo data are real-time processed. The signal amplitudes are valuated in context to a logarithmic scale and graphically visualized by means of a colorized echogram utilizing false colours ranging from red for a high to blue representing a low signal (W.-D. Heinitz et al., 1998). The highest signal (red) is given by the acoustic impedance of the boundary between sea water and river sediment. The echograms of the river valley depict spatially isolated (red) high-signal peaks, which are periodically repeated in vertical direction between the sediment surface and the bottom of the valley. The number of these high-signal parts increase with an increasing valley depth. Studying of the distribution of these peaks allows to draw conclusions regarding the content and composition of the sediment. This prediction of the sediment composition obtained by means of the SES 2000 was successfully verified by analyzing a gravity core taken near Nos Maslen (at 44 m water depth) with a particular focus on the water content. The first 36 cm of the core exhibited the highest water content of 40%. A similar result was found by utilizing quantitative analyses on the basis of framboidal greigites (Fe3S4) in sulfat-reducing bacteria, which show a minimum in this part.

The results achieved by our SES-based sediment analysis method enable an insight into the evolution of the sublacustrine river valley. For example, they revealed that the sediment layers are asymmetrically deposited regarding the vertical centre of the river's cross section. This effect can be attributed to Baer-Babinet's law, which is, in this particular case, a direct consequence of the Coriolis forces acting on the counterclockwise flowing rim current near the coast line of the Bulgarian Black Sea (Einstein, 1926).
Another important result of our analysis is the localization of different periods which took place since the entrance of water from the Marmara Sea over the Bosporus 9.300 years ago. They are identified by different water and greigites contents and last 352 $\pm$ 16 years.

References:
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