Geophysical Research Abstracts
Vol. 18, EGU2016-649, 2016
EGU General Assembly 2016

Late Glacial to Holocene evolution and sea-level history of Gulf of Gemlik, Sea of Marmara, Turkey

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The Gulf of Gemlik is an E-W elongated trans-tensional basin with a maximum depth of 113 m, located on the middle strand of the North Anatolian Fault (NAF) in the south eastern part of the Sea of Marmara (SoM). While during the Holocene the sea level in the Gulf of Gemlik changed in tandem with the water level changes in the SoM, it may have been different in the late glacial when the Sea of Marmara was lacustrine. Beside the tectonic activity related to the NAFZ, eustatic sea level changes would have controlled the basin evolution and consequent sedimentary history during the different paleocanographic phases of the SoM. Considering the limited studies on the late glacial-Holocene stratigraph of the Gulf of Gemlik, this study aims to investigate the depositional units and their environments with respect to different allogenic and autogenic controls. For these purposes, we analyzed over 300 2 – 7 kHz bandwidth high-resolution gridded seismic sub-bottom CHIRP profiles together with 70 kHz high resolution multibeam bathymetry with backscatter data.

Four seismic stratigraphic units were defined and correlated with chronstratigraphic units in five piston cores covering the last 15.8 ka BP according to radiocarbon ages (^{14}C). The depth-scale accuracy of chronostratigraphic units in cores is of key importance for the precise calculation of sedimentation rates. Correlation between the seismic profiles and cores were made by matching Multi-Sensor Core-Logger (MSCL) data and seismic reflection coefficients and amplitudes for different stratigraphic units. The impedance data derived from the logger were used to generate a synthetic seismogram. We used an approach to display, estimate, and correct the depth-scale discrepancies due to oversampling affecting the upper part of sedimentary series during piston coring. The method is based on the resynchronization of synthetic seismograms computed from high-quality physical property logs to the corresponding CHIRP profiles. Each sequence boundary represented by different reflection coefficient and various amplitude values were mapped for the whole gulf area from the pseudo-3D seismic data. Isopach and isochron maps were generated using 2-D cubic B-spline interpolation method to reconstruct basin evolution models through late glacial to Holocene. Each map shows various depositional period with respect to water level changes that has been controlled by sea level fluctuations in the SoM.

The seismic units labeled as Unit S1-S4 from top to bottom display different seismic facies and geometries. Unit S1 is a transgressive marine mud drape younger than 10.6 ka BP, which lacustrine sediments, Unit S2 is a parallel bedded mud drape in the basin and progradational clinoforms on the shelf edge. It is dated between 13.9-10.6 ka BP, Unit S3 is characterized by erosional gullies and a clinoform architecture indicating a deltaic system dated between 15.8-13.9 ka BP. Unit S4 represents mounded sediments that are truncated by erosional gullies and dated $>$15.8 ka BP.

Key words: Gulf of Gemlik, Seismic Stratigraphy, Numerical Modelling, Late Pleistocene to Holocene