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Pressure coring at gas hydrate-bearing sites in the eastern Black Sea off Georgia

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Shallow marine sediments host large amounts of gas hydrate-bound methane, which is a climate relevant gas and an energy resource. However, current estimates of gas hydrate volumes vary strongly due to (1) an insufficient number of locations being sampled and (2) the difficulties in directly quantifying the gas as a result of decompression during core recovery. Studies in the Eastern Black Sea for the first time provide in situ gas hydrate volumes in the shallow sediments of this major anoxic basin. They result from gas volume measurements and high-resolution chlorinity analysis on pressurized sediment cores from the Dynamic Autoclave Piston Corer (DAPC) and from on discrete gas hydrate samples. The nature of the gas hydrate structure differs between Batumi Mound (>99.7% methane; structure I) and Pechori Mound (>97.6% methane; at least partly structure II) where oil is present. The total methane concentration in the sediment below the zone of anaerobic methane oxidation (AOM zone) reached > 1 mol/kg porewater at both sampling sites, Pechori Mound and Batumi Mound. This results in maximum gas hydrate volumes of about 30% of pore space over the length of the core below the AOM zone. These are the highest gas hydrate volumes that were measured with the DAPC so far. In comparison to direct gas volume measurements, methane volumes modelled from chlorinity data at Batumi Mound are smaller by roughly 20%, possibly due to unresolved brine inclusions in the gas hydrates. The chlorinity data further constrain the vertical distribution of gas hydrates in core BS351 (Batumi Mound), showing high volumes to appear below 60 cm. The observed gas hydrate contents are only comparable to those found in shallow sediments of Southern Hydrate Ridge, which hosts the seep site with the highest gas hydrate

volumes known so far.