SEISMIC CHARACTERISATION OF GAS-RICH NEAR SURFACE SEDIMENTS IN THE ARKONA BASIN, BALTIC SEA

Mathys Mieke[1], Olaf Thießen[2], Friedrich Theilen[2] and Mark Schmidt[2]

[1] Renard Centre of Marine Geology, Department of Geology and Soil Science, University of Ghent, Krijgslaan 281, S8, B-9000 Gent, Belgium
E-mail: mieke.mathys@ugent.be

[2] Institute of Geosciences, Christian Albrechts University
Olshausenstrasse 40, D-24098 Kiel, Germany

The Arkona Basin, situated in the SW Baltic Sea, is characterised by shallow gas-rich sediments with different levels of saturation and has been subject of only a limited number of studies on shallow gas phenomena. Recently however, interest in this area increased. In the framework of the German Geotechnology Program 'Gashydrates' the Arkona Basin was chosen as a natural laboratory for testing new technologies for seismic and geochemical investigations of gas-rich sediments (Landerer, pers. comm.; Mathys, 2003; Thießen *et al.*, 2003).

The upper fine-grained muddy sediments of the Arkona Basin are rich in organic matter and provide an ideal environment for the formation of biogenic methane by anaerobic bacterial carbonate reduction (Thießen *et al.*, 2003). When methane concentration exceeds saturation levels in the pore water free gas bubbles will form. Free gas is known to have a dramatic effect on the geoacoustic properties of the seabed. Bubbles, even in small quantities, cause considerably reduced compressional (P-) wave velocities, increased P-wave attenuation, and increased sound scattering (Anderson and Hampton, 1980). 'Acoustic turbidity' is the most frequently cited evidence used to infer the presence of sub-seafloor gas from geoacoustic or seismic records.

This study deals with the expression of gas bubbles on seismic reflection profiles in two distinct frequency ranges, *i.e.* boomer (800-2600Hz) and echo sounder (38kHz) profiles, acquired during three ship cruises in the central part of the Arkona Basin. A velocity dispersion could be observed between the boomer and echo-sounder profiles in free gas containing zones. Also, acoustic turbidity zones observed on boomer profiles are differently expressed on echo-sounder sections. These differences led to the conclusion that seismic parameters become strongly frequency dependent due to the presence of gas bubbles.

References

Anderson A.L. and L.D. Hampton. 1980. Acoustics of gas-bearing sediments. I: Background & II: Measurements and models. J. Acoust. Soc. Am. 67(6):1865-1903.

Mathys M. 2003. Seismic characterisation and sedimentological investigation of gas-rich near surface sediments in Arkona Basin (Baltic Sea). Unpublished M.Sc. thesis. Corelab, Research and Technology Centre, Christian Albrechts University, Kiel, Germany.

Thießen O., M. Mathys, Y. Qian, G. Klein, M. Schmidt and F. Theilen. 2003. Geochemical and geophysical properties of gas-rich sediment in the Arkona Basin (Baltic Sea). Poster abstract for EGS-AGU-EUG Joint Assembly 2003, Nice, France.