Geophysical Research Abstracts
Vol. 19, EGU2017-14292, 2017
EGU General Assembly 2017

Understanding the paleo environment in the Danish North Sea using 2D and 3D seismic analyses

Lasse K. Prins, Ole R. Clausen, and Katrine J. Andresen
Aarhus University, Department of Geoscience, Aarhus, Denmark (lasse.k.prins@geo.au.dk)

This study presents the first detailed and integrated mapping of buried Quaternary valleys, river systems and iceberg scourings from the Danish North Sea region. The mapped features coincide spatially but have very different characteristics and incision levels which allow us to constrain their relative timing and differentiate their environment of formation (subglacial, proglacial and marine). The results of the study bring new critical information regarding the paleoenvironment of the North Sea Basin during the latest Quaternary deglaciation period and our analysis provide a well-tested workflow for utilizing 2D and 3D seismic data in relation to paleogeographical reconstructions.

Our analysis is based on interpretation of conventional 3D seismic and high-resolution sparker data from the Southern Danish Central Graben. The project forms part of the portfolio for the 'Danish Hydrocarbon Research and Technology Centre' and aims at building a high-resolution 3D geological-geotechnical model of the shallow subsurface by using geophysical data combined with geological and geotechnical data from shallow borings. One of the objectives is to map potential geohazards for offshore installations such as buried valleys and constrain their geotechnical properties.

The central North Sea is known to have been covered by glaciers several times during the Quaternary with climate changing between arctic and boreal. Marine conditions periodically prevailed and large river systems mainly from central Europe dominated during periods of subaerial exposure. Hence, many buried erosional incisions, primarily tunnel valleys but also river systems, can be observed within the upper 200-400 meters of the Quaternary succession throughout the central North Sea region. A high-resolution mapping of the infill of the tunnel valleys and river systems have however not previously been presented.

Our analysis shows that within the study area at least four generations of tunnel valley formation and river system incisions can be mapped. The tunnel valleys have a strong NE-SW orientation and are typically characterized by an irregular base. The fluvial river systems which are the youngest, are smaller, typically with an anastomosing appearance. They generally have an NW-SE strike perpendicular to the older tunnel valleys. Clear sedimentary structures can be recognized on the high-resolution 2D seismic data indicating a complex history of cut and fill.

In general, the study area displays a very heterogenic sedimentation pattern with varying valley types and significant lateral variations within the same valleys revealing a subtle interplay between incision and infilling. In some areas we furthermore see a distinct control of the river system morphology by deeper salt structures adding to the complexity of controlling factors for the rivers and tunnel valleys in the study area.

The results of the study provide valuable information on the evolution of the Quaternary ice-sheets and drainage patterns and hence exemplify the use of seismic data for Quaternary paleo-environmental studies. With the good control on the distribution and infill of buried valleys and river systems, the study furthermore provides the first constrain to a detailed 3D model of different litho-facies based on seismic facies analysis combined with information from shallow borings.