



## Mapping the North Sea base-Quaternary: using 3D seismic to fill a gap in the geological record

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The identification and mapping of the base-Quaternary boundary in the central parts of the North Sea is problematic due to the change from an unconformable transition between Pliocene and Pleistocene deltaic deposits in the southern North Sea to a conformable one further north (Sejrup et al 1991; Gatliff et al 1994). The best estimates of the transition use seismic reflection data to identify a 'crenulated reflector' (Buckley 2012), or rely on correlating sparse biostratigraphy (Cameron et al 1987). Recent integration of biostratigraphy, pollen analysis, paleomagnetism and amino acid analysis in the Dutch and Danish sectors (Rasmussen et al 2005; Kuhlmann et al 2006) allows greater confidence in the correlation to a regional 3D seismic dataset and show that the base-Quaternary can be mapped across the entire basin.

The base-Quaternary has been mapped using the PGS MegaSurvey dataset from wells in the Danish Sector along the initially unconformable horizon and down the delta front into the more conformable basin giving a high degree of confidence in the horizon pick. The mapped horizon is presented here alongside the difference between this new interpretation and the previously interpreted base-Quaternary (Buckley 2012). The revised base-Quaternary surface reaches a depth of 1248 ms TWT or approximately 1120 m (assuming average velocity of 1800 m/s) showing an elongate basin shape that follows the underlying structure of the Central Graben. The difference between the revised base-Quaternary and the traditional base-Quaternary reaches a maximum of over 600 ms TWT or approximately 540 m in the south-west with over 300 ms TWT or approximately 270 m at the Josephine well (56°36.11'N, 2°27.09'E) in the centre of the basin.

Mapping this new base-Quaternary allows for the interpretation of the paleo-environment during the earliest Quaternary. Seismic attribute analysis indicates a deep water basin with sediment deposition from multiple deltas and redistribution by deep water currents. This has strong implications for both the Quaternary climate archive and petroleum systems in the North Sea.

Key Words: base-Quaternary; chronostratigraphy; seismic interpretation; paleoenvironments

### References

- Buckley, F.A., (2012) 'An Early Pleistocene grounded ice sheet in the Central North Sea' From: Huuse, M., Redfern, J., Le Heron, D.P., Dixon, R.J., Moscardiello, A., Craig, J. (eds) 'Glaciogenic reservoirs and Hydrocarbon Systems' *Geological Society, London, Special Publications*, **368**
- Cameron, T.D.J., Stoker, M.S., Long, D., (1987) 'The history of Quaternary sedimentation in the UK sector of the North Sea Basin' *Journal of the Geological Society*, **144**, 43-58
- Gatliff, R.W, Richards, P.C, Smith, K, Graham, C.C, McCormac, M, Smith, N.J.P, Long, D, Cameron, T.D.J, Evans, D, Stevenson, A.G, Bulat, J, Ritchie, J.D, (1994) '*United Kingdom offshore regional report: the geology of the central North Sea.*' London: HMSO for the British Geological Survey
- Kuhlmann, G., Langereis C.G., Munsterman, D., van Leeuwen, R.-J., Verreussel, R., Meulenkamp, J.E., Wong, Th.E., 2006 'Integrated chronostratigraphy of the Pliocene-Pleistocene interval and its relation to the regional stratigraphical stages in the Southern North Sea region' *Netherlands Journal of Geosciences* **85**(1), 29-45
- Rasmussen, E.A., Vejbæk O.V., Bidstrup, T., Piasecki, S., Dybkjær, K., 2005 'Late Cenozoic depositional history of the Danish North Sea Basin: implications for the petroleum systems in the Kraka, Halfdan, Siri and Nini fields', *Petroleum Geology Conference series* **6**, 1347-1358
- Sejrup, H.P., Aareseth, I., Hafliðason, H., 1991 'The Quaternary succession in the northern North Sea' *Marine Geology* **101** 103-111