

Preservation potential of the Last Interglacial lower Rhine delta relative to the Holocene Rhine-Meuse delta

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1. Introduction

In order to improve our insights in the sequence stratigraphic and architectural development of lower deltaic hydrocarbon reservoirs we study the Last Interglacial Rhine delta (MIS-5), and compare it to its well investigated counterpart, the Holocene (MIS-1) Rhine-Meuse delta (Berendsen & Stouthamer, 2000). The Last Interglacial record has experienced a full glacial-interglacial cycle of sea-level and climate change in a subsiding tectonic setting, and arguably is in a more relevant state of preservation when the delta is to be used as a reservoir analogue.

For both deltas a large amount of sedimentary and chronological control is available from borehole-databases of Utrecht University and Geological Survey of the Netherlands – TNO. The dataset for the Last Interglacial is composed of undisturbed continuous cores, cone penetration tests, gamma well logs, as well as offshore and onshore seismics. 3D geological models aided to architecturally characterize the near-coastal deposits. Optically Stimulated Luminescence dating, palaeomagnetism, U/Th dating and biostratigraphy were used for age determination.

Here we compare the sedimentary architecture of both deltas and discuss the preservation potential of deltaic sediments dating from the Last Interglacial.

2. Interglacial sedimentary setting

The Last Interglacial lower Rhine delta occupies and buries a relative wide ice-marginal valley, inherited from the deglaciation stages of the penultimate glacial (MIS-6), incised in and flanked by Middle Pleistocene fluvial deposits with a till-sheet cap (Peeters *et al.*, 2013). The Last Interglacial deltaic sediments are primarily flood basin fines of the Rhine and occur over the full width of the palaeo-valley. These fresh-water sequence shows a gradual change into estuarine conditions towards its top. A shallow- marine sequence, deposited during the *Eemian* transgression and sea-level high-stand, forms the upper part of the Last Interglacial sequence. These Last Interglacial deposits are erosionally truncated and buried by Rhine (and local) sediments of Weichselian Pleniglacial age and Late Glacial eolian sediments. The sedimentary sequence is capped by Holocene age lagoonal and fluvio-deltaic deposits.

3. Preservation

One way to add to a better understanding and predictability is to focus on (non)preservation of the lower delta in transgressive and high stand settings (Peeters *exp.* 2014).

The Weichselian Rhine strongly eroded parts of the Last Interglacial sequence but left it nearly intact at the valley sides. An analysis of the preserved versus eroded sequence shows that of the Last Interglacial Rhine delta only the lower transgressive estuarine and delta deposits have been preserved, the latter being equivalent to the Holocene estuarine deposits and basal peats. The major difference between both deltas is the (near) lack of Last Interglacial high stand sediments.

The one-million-dollar-question is of course whether these high stand deposits are eroded or never have been deposited, and whether we understand why and can use it predictively.

4. Final remarks

A detailed comparison of the Last Interglacial and Holocene Rhine deltas illustrates the preservation potential of a delta during a full glacial-interglacial cycle. Our comparison helps to better understand and reconstruct older deltas and hence the stratigraphic architecture of hydrocarbon reservoirs.

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References

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