Facies distribution and preservation potential in near-coastal deltaic settings

Comparison and translation of process relationships and deposit characteristics obtained in a Holocene delta to an Eemian setting in The Netherlands

Preservation potential	Sedimentology	Eemian	Sequence stratigraphy

Introduction

Recently, Utrecht University, Statoil, Deltares and TNO started a new PhD-research project to sedimentologically and architecturally characterize near-coastal deltaic settings of different age and to translate process relationships and deposit characteristics of sub-recent analogues to hydrocarbon reservoirs. The near-coastal area is defined as the area that is influenced by both coastal and fluvial processes.

Objectives

The objectives of our project are: (1) sedimentological and architectural characterisation of Holocene (10-0 kyr BP; Fig 1a) and Eemian (130-115 kyr BP; Fig. 1b) deposits that were originally formed in near-coastal areas, (2) determination of preservation potential of Eemian deposits relative to Holocene deposits, (3) comparison and translation of process relationships and deposit characteristics obtained in a Holocene delta to an Eemian near-coastal setting, and (4) determination of sequence stratigraphic and reservoir modelling implications.

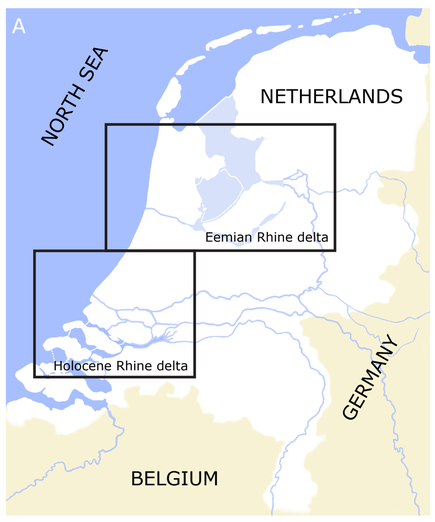
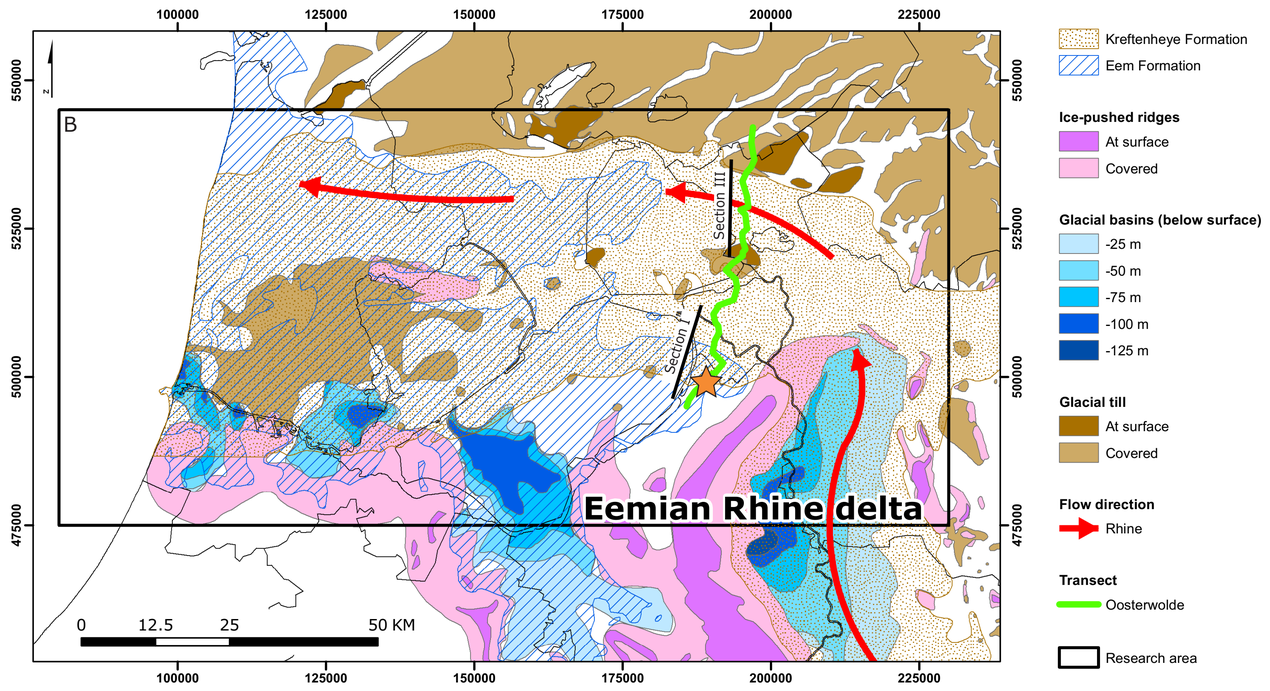


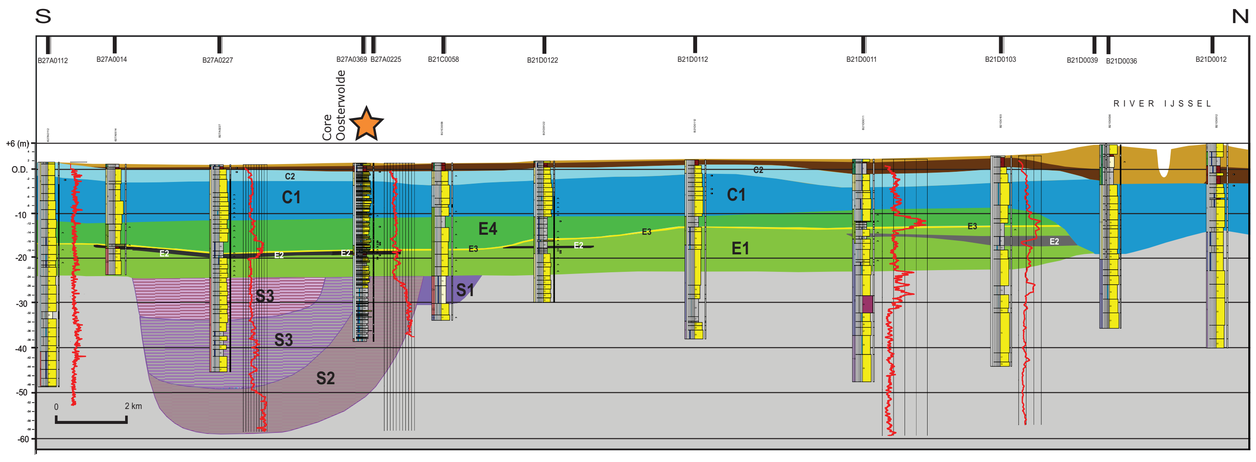
Figure 1a. Research areas in The Netherlands.

Figure 1b. Eemian Rhine delta research area.



Naar: De Bosatlas van Ondergronds Nederland, 2009; Digitaal Geologisch Model, TNO

Oosterwolde transect section I



Oosterwolde transect section III

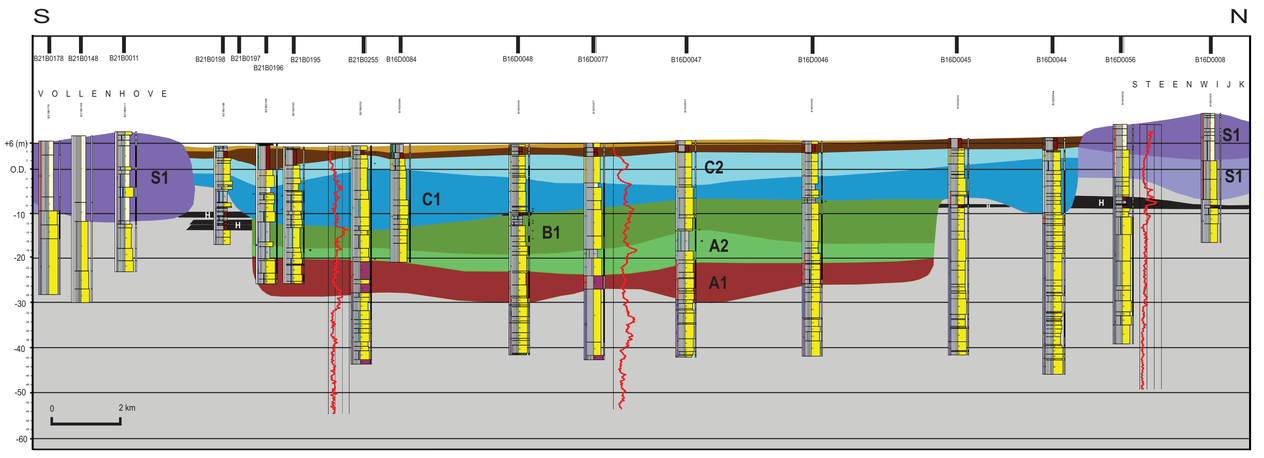


Figure 2. Geological transect with sedimentary units of the Eemian near-coastal area in The Netherlands.

Section I shows a zone with fluvial-marine interaction that was under direct influence of Eemian sea-level fluctuations. Eemian shell lag deposits and peat can be seen in photographs of continuous core Oosterwolde (Fig. 3), showing the sedimentary deposition history in detail.

Section III shows a fluvial sedimentary succession with a major Rhine imprint, represented in the borehole logs, resulting in different sedimentologically and architecturally properties.

SEDIMENTARY UNITS

Section I & III	Section I		Section III	
Younger Holocene deposits	E4 Eemian marine upper sand body	S3 Late Saalian delta sand	B1 Eemian - Early Glacial fluvial deposits	A1 Late Saalian braided river deposits
Holocene basal peat	E3 Eemian marine shell lag	S3 Late Saalian laminated clay and delta sand	A2 Eemian fluvial deposits	S1 Saalian till deposits
C2 Late Glacial - Early Holocene	E2 Eemian peat	S2 Glacio-lacustrine clay	H Holsteinian peat (MIS 11)	S1 other glacial deposits
C1 Pleniglacial	E1 Eemian fluvial lower sand body	Older Pleistocene deposits		

Torres, 2010

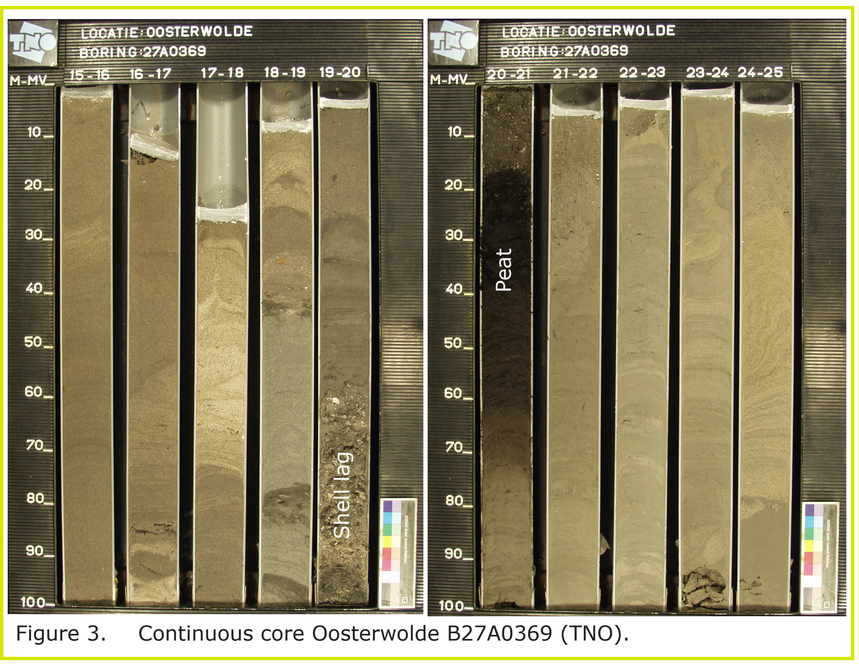


Figure 3. Continuous core Oosterwolde B27A0369 (TNO).

Approach

We will use the huge datasets available at Utrecht University and TNO and new continuous cores, well logs, seismic sections and 3D geological models to sedimentologically and architecturally characterize the near-coastal deposits. The translation of process relationships and deposit characteristics of the Holocene to the Eemian near-coastal setting will be established by using facies distribution, quantitative architectural parameters and the sequence stratigraphic framework. The second part of the project addresses facies response to allogenic and autogenic processes.
For age determination Optically Stimulated Luminescence dating, U/Th dating, pollen-chronology and tephrochronology will be used.

Ultimate goal

The use of process relationships and facies distribution of Holocene deposits in near-coastal settings for the interpretation of Eemian deposits will now be investigated and tested with field data. This will result in a better understanding of the interaction between coastal and fluvial processes and their effect on facies distribution, geometries and preservation potential in near-coastal areas, greatly contributing to the prediction of architecture and facies distribution in hydrocarbon reservoirs. New conceptual and sequence stratigraphic models concerning the allogenic and autogenic interaction and forcings will be developed.

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