

Paleogene Arctic Wide Source Rocks: A Semi-Quantitative Appraisal*

By

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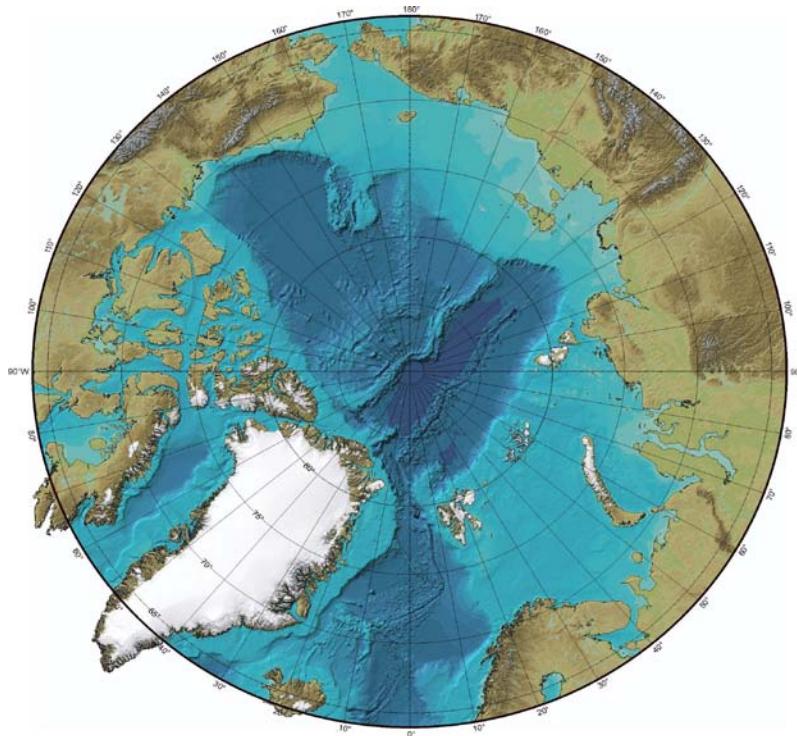
Abstract

With the recently recovered organic-rich sediments of early Tertiary age from the Lomonosov Ridge by the Integrated Ocean Drilling Program (IODP) Leg 302, first direct source rock data are now attainable for the central basins of the Arctic Ocean. Results of seismic interpretations and published sedimentological and organic geochemical data from Leg 302 provided the framework for the first quantitative assessment of source rock quality and distribution of the Palaeogene sediments in the central Arctic Ocean. In addition, a simple burial history and thermal modelling were performed to evaluate if hydrocarbon generation is likely to occur in these early Tertiary sediments.

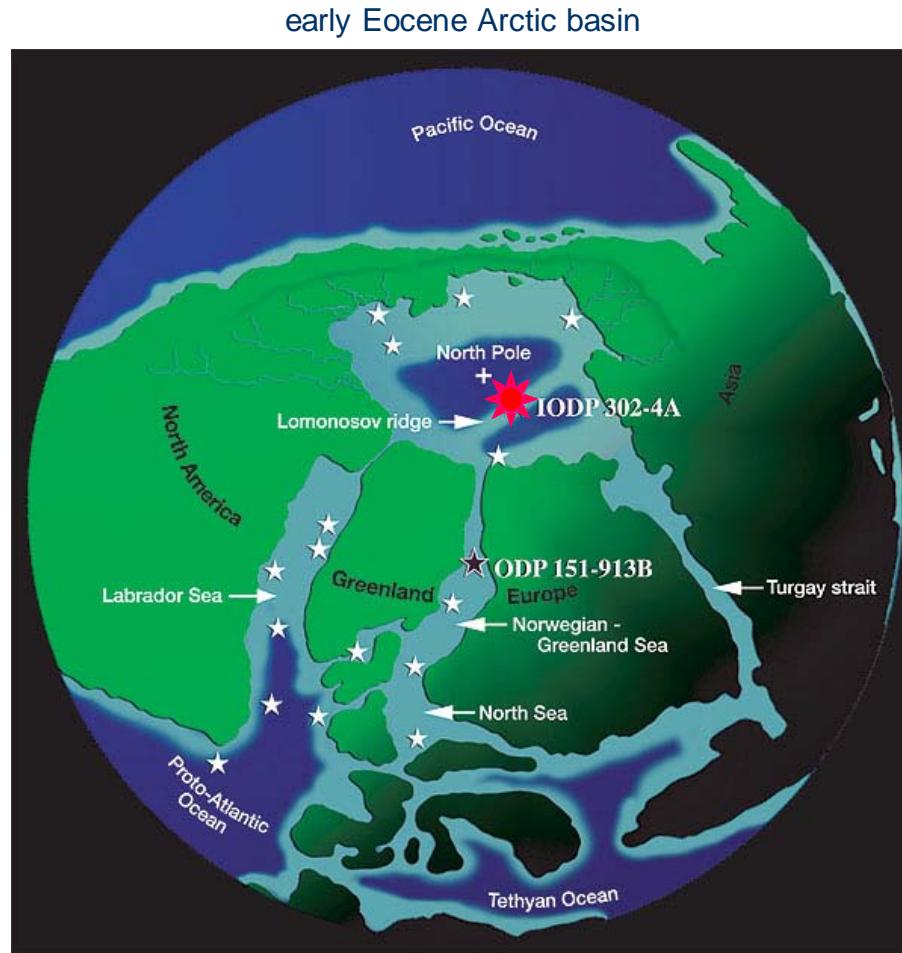
The modelling results can be summarized as follows: An approximately 100-m-thick early to middle Eocene sedimentary sequence of good to very good source rock is suggested to occur along a 75 km long transect across the Lomonosov Ridge. In-situ generation of hydrocarbons is rather unlikely as overburden (~200-250 m) and thermal maturity are too low. Burial history and thermal modelling revealed that an additional overburden of at least 1000 m is necessary to start generation in this area. However, source rock modelling results show the possibility for good source rock potential in lateral equivalents in the adjacent Amundsen Basin. Simulated organic carbon contents of 1.5 - 5 %, coupled with an overburden of ~1000 - 1200 m and heat flow anomalies due to the vicinity to the Gakkel Ridge spreading centre, indicate that necessary conditions for hydrocarbon expulsion are already reached and point to viability of a potential petroleum system. Our results support the hypothetical deposition of a good potential hydrocarbon source rock across the entire Arctic Basin and adjacent margins during the Early Tertiary.

Palaeogene Arctic wide source rocks: A semi-quantitative appraisal

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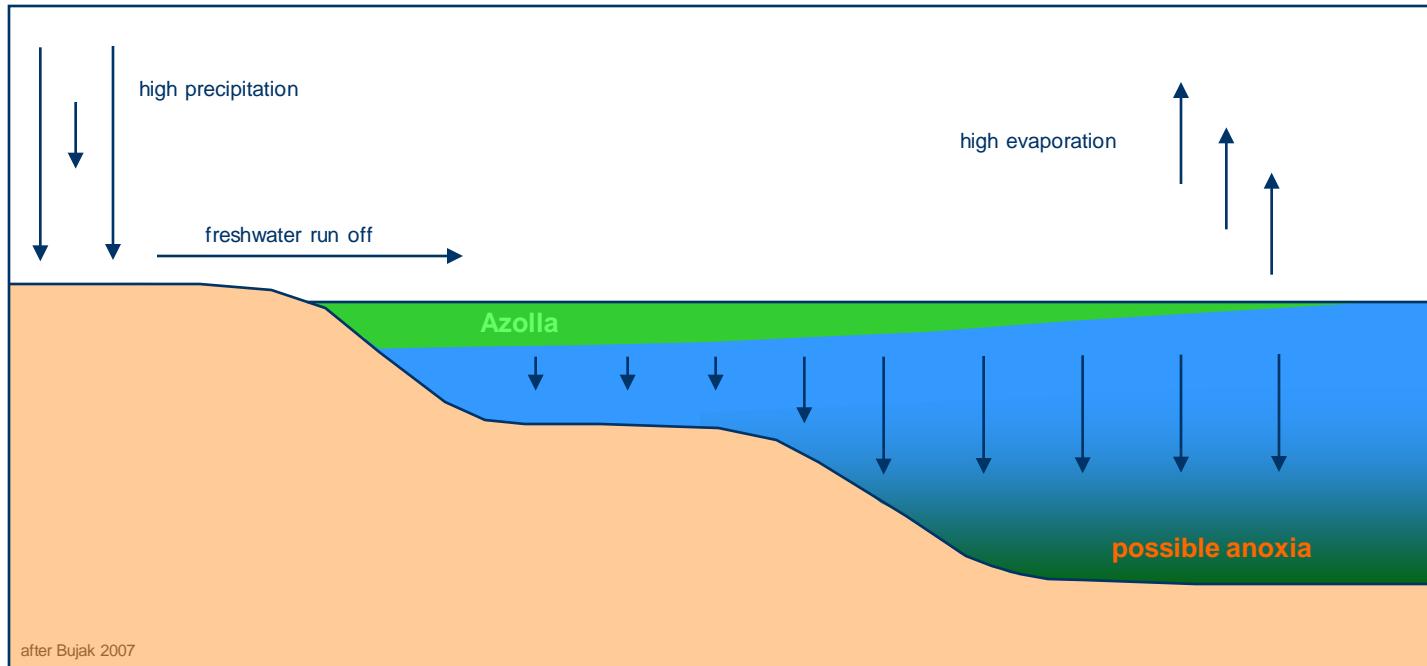
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Brinkhuis et al. 2006

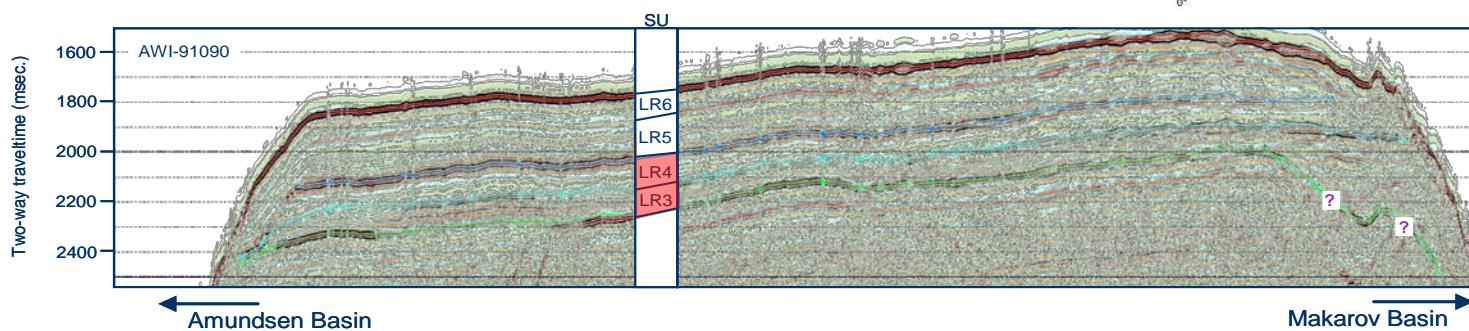
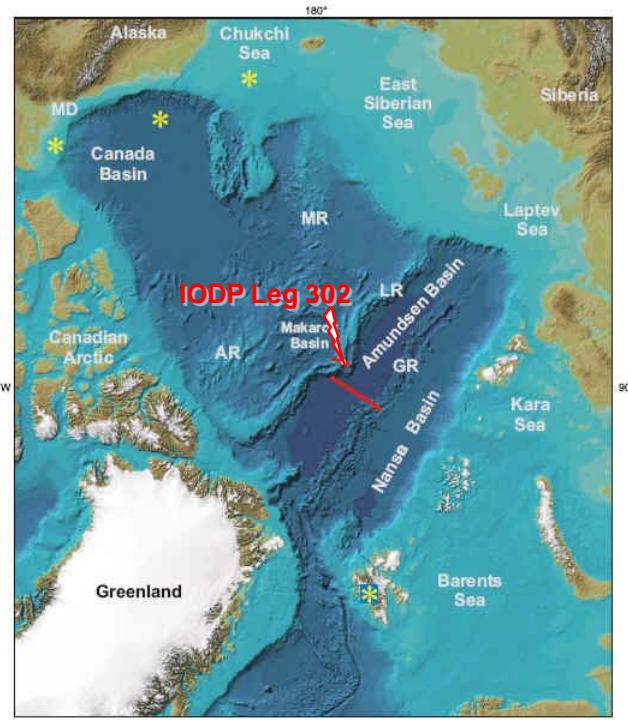


Palaеogene Arctic wide source rocks: A semi-quantitative appraisal



Palaeogene Arctic wide source rocks: A semi-quantitative appraisal

- Recovery of Eocene organic rich sediments
- Paleocene/Eocene Thermal Maximum (*PETM*, ca. 55 Ma)
- Freshwater fern *Azolla* (*Azolla Event* ca. 48.6 Ma)

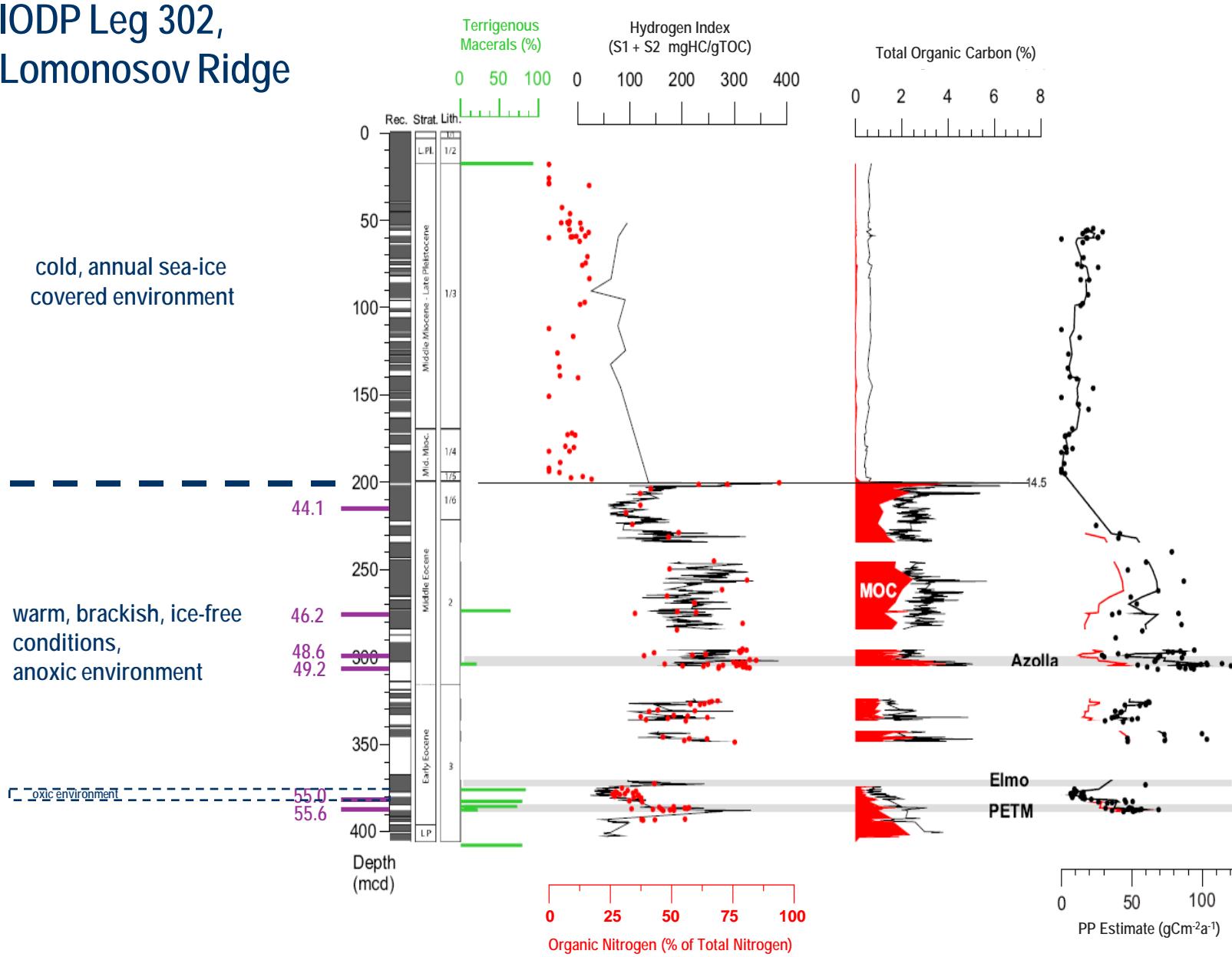


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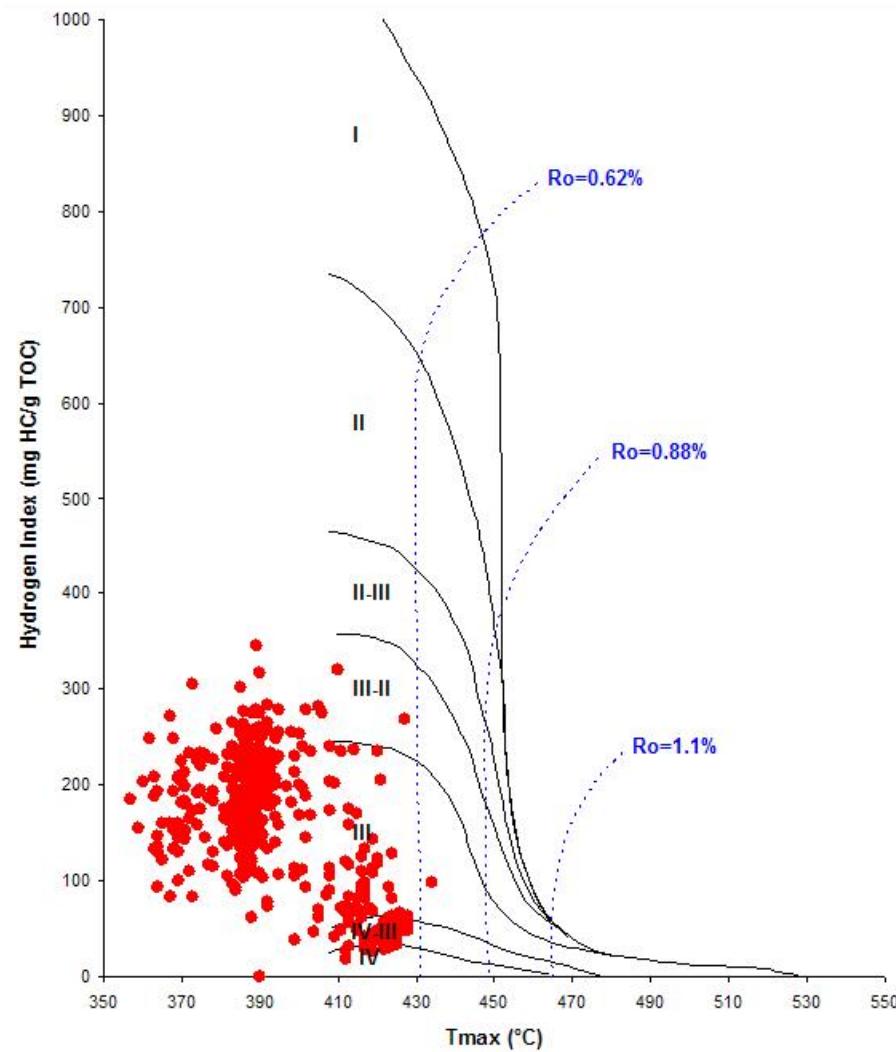
- Application of new proxy data for input in the source rock modelling
- Improvement of the understanding of the major processes and the Palaeogene depositional environment, testing of different conceptual scenarios
- Quantitative assessment of the source rock potential in an area stretching over the Lomonosov Ridge into the adjacent Amundsen Basin

IODP Leg 302, Lomonosov Ridge

cold, annual sea-ice
covered environment

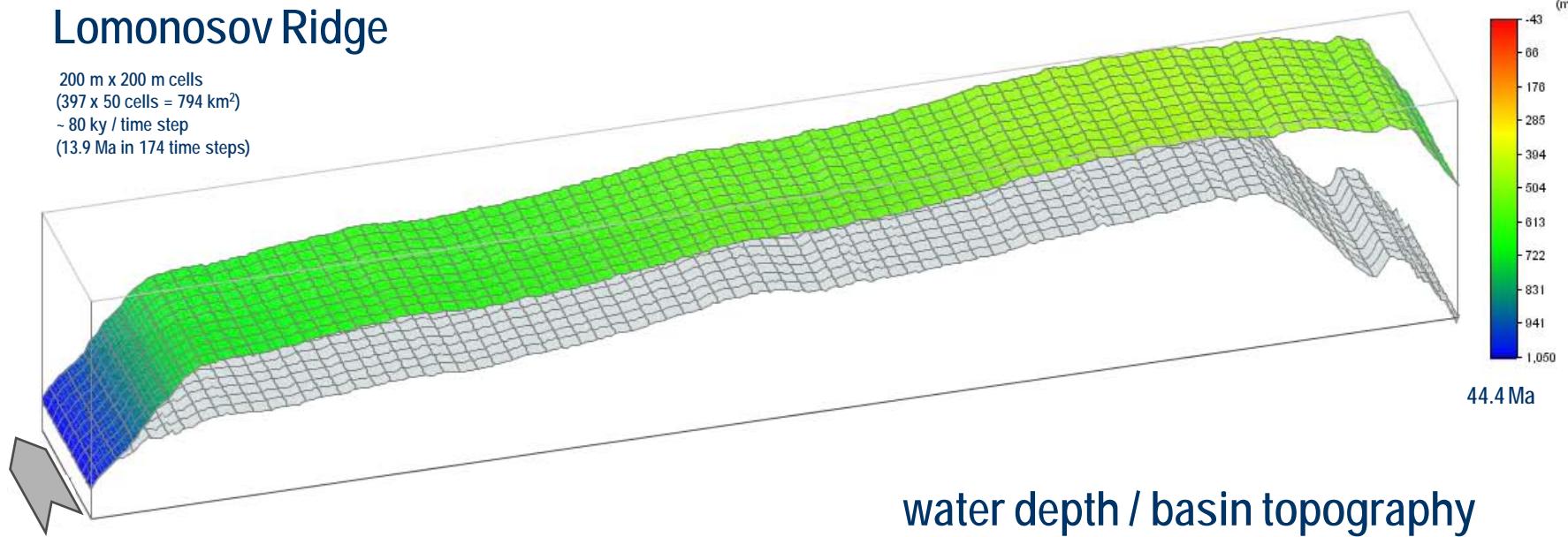


IODP Leg 302, Lomonosov Ridge

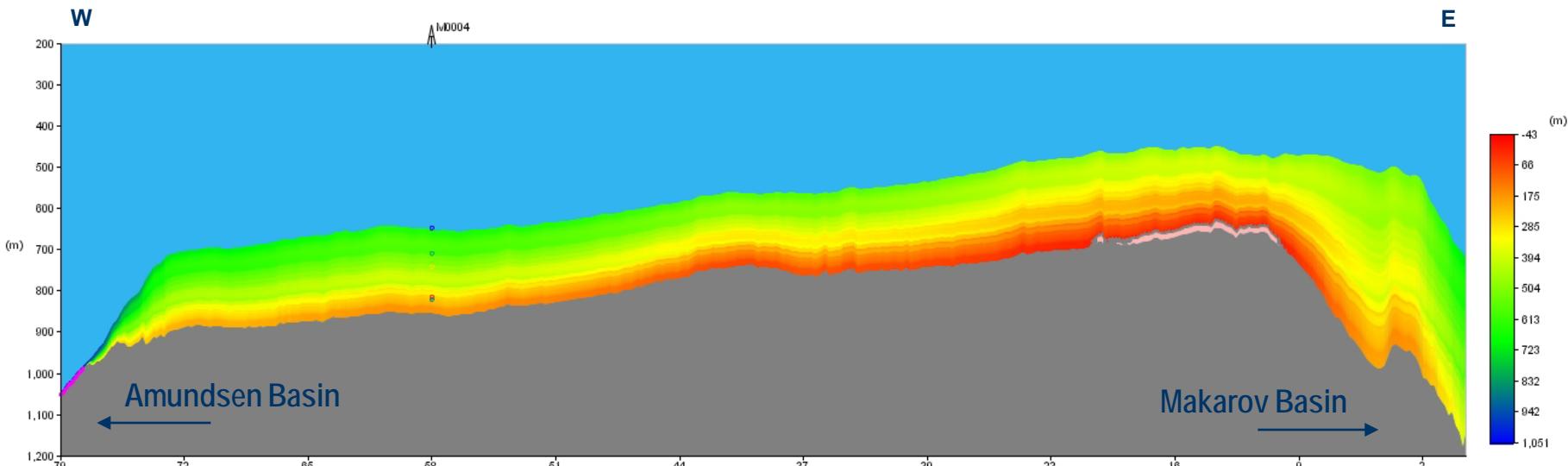


Source rock modelling of the central Arctic Ocean Lomonosov Ridge

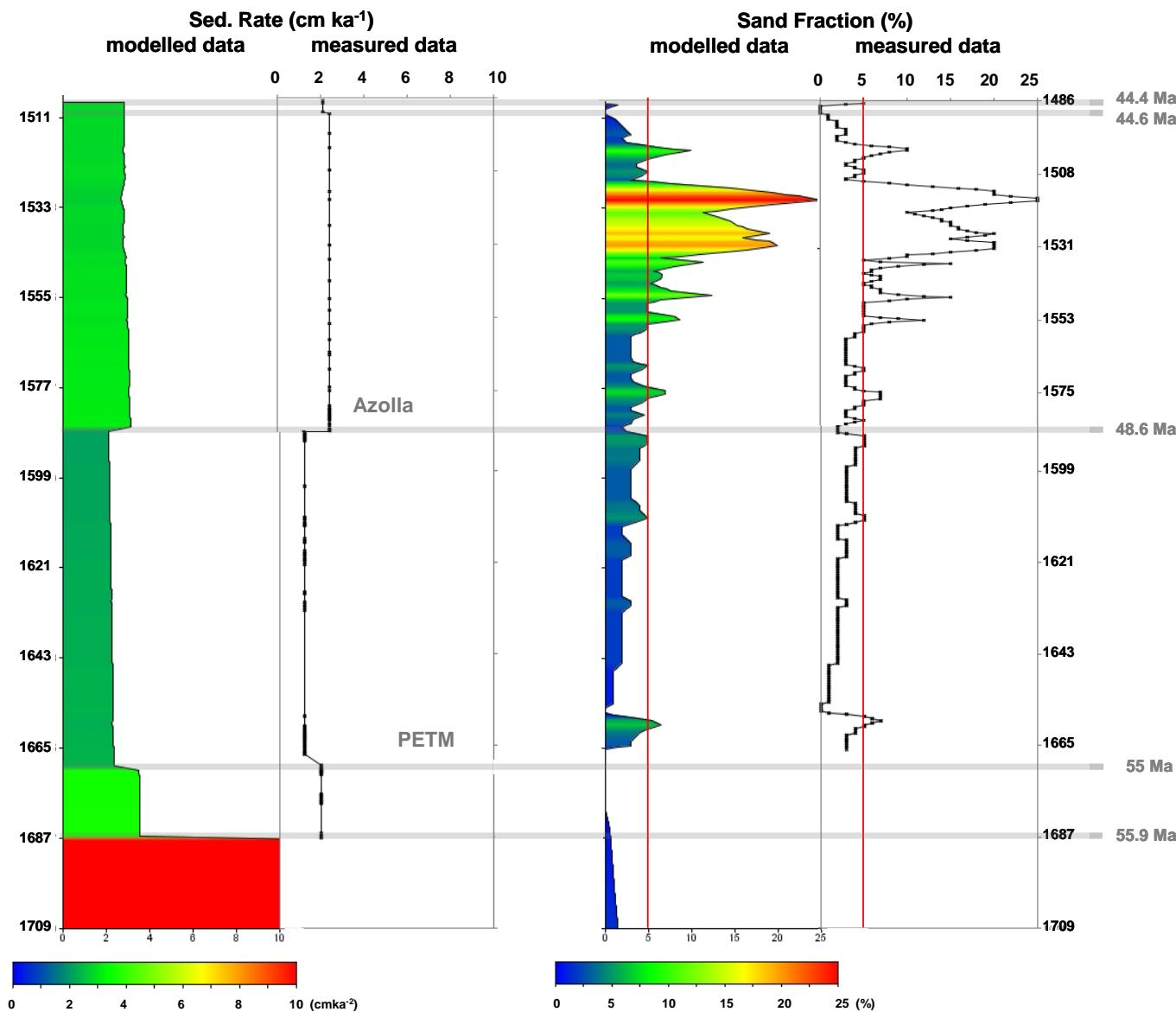
200 m x 200 m cells
(397 x 50 cells = 794 km²)
~ 80 ky / time step
(13.9 Ma in 174 time steps)



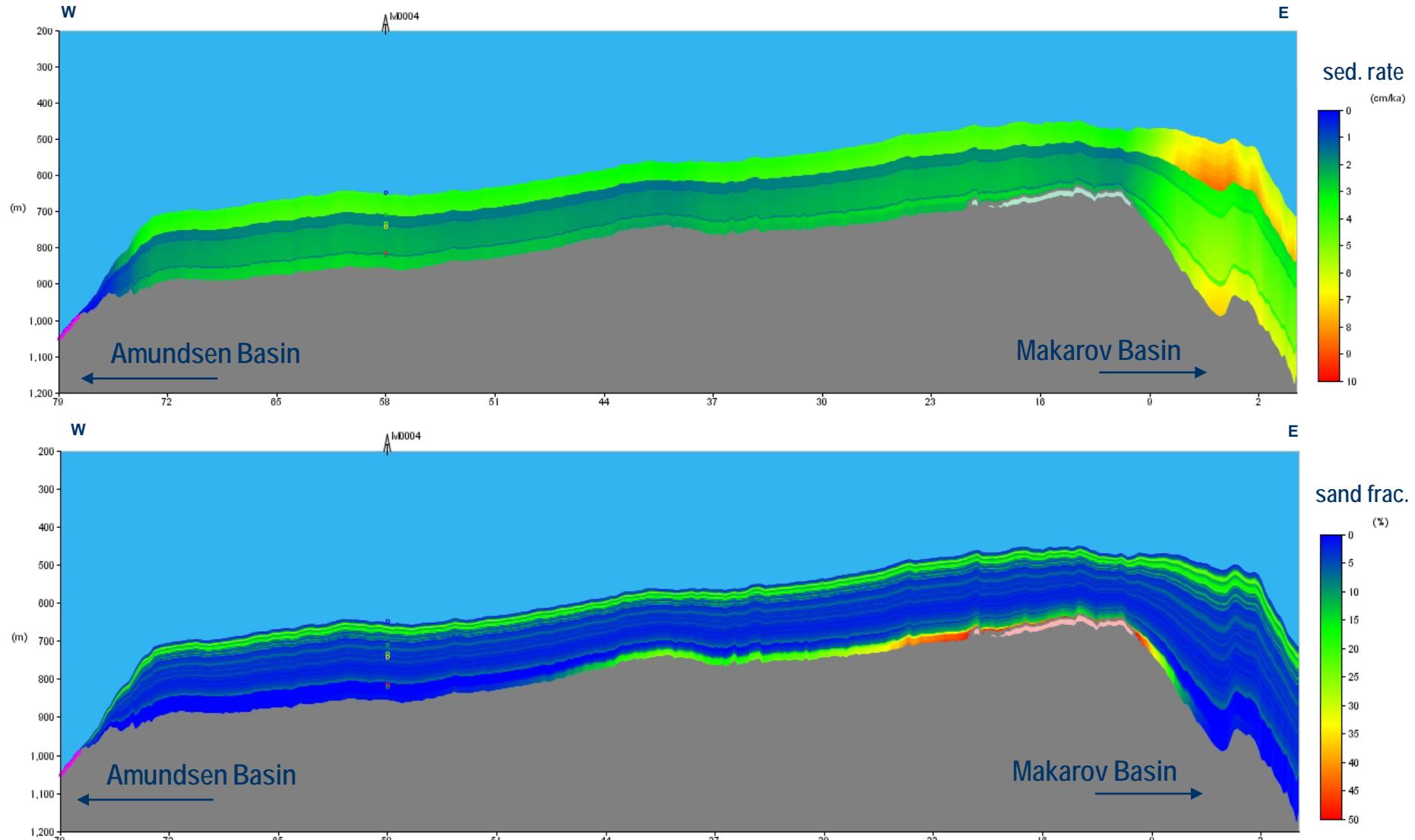
water depth / basin topography



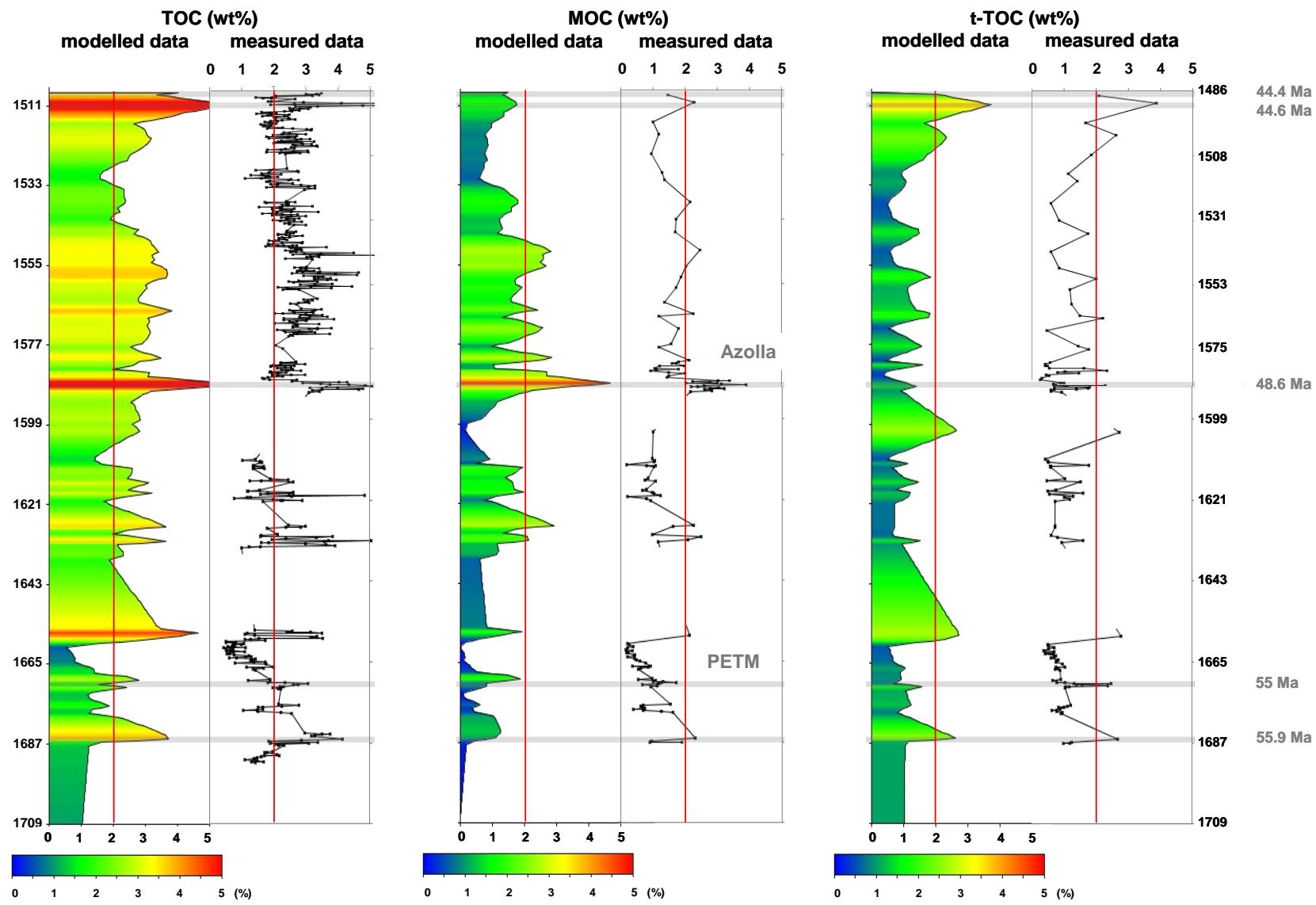
IODP Leg 302, Lomonosov Ridge



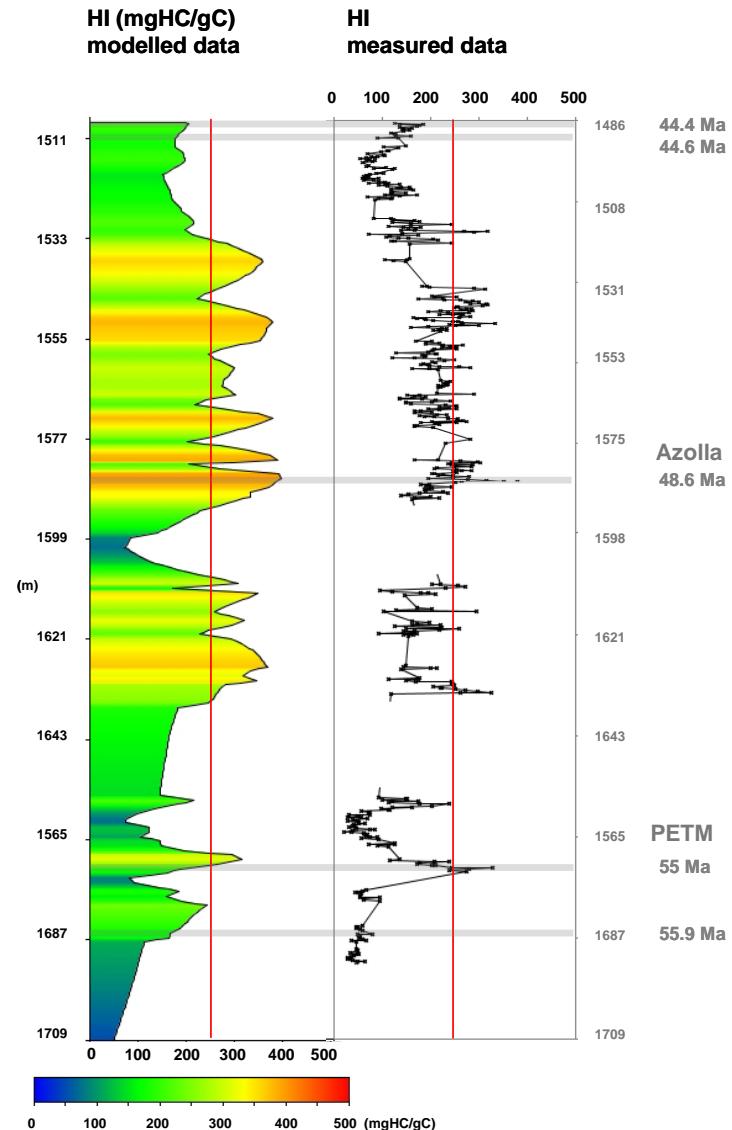
Source rock modelling of the central Arctic Ocean, Lomonosov Ridge



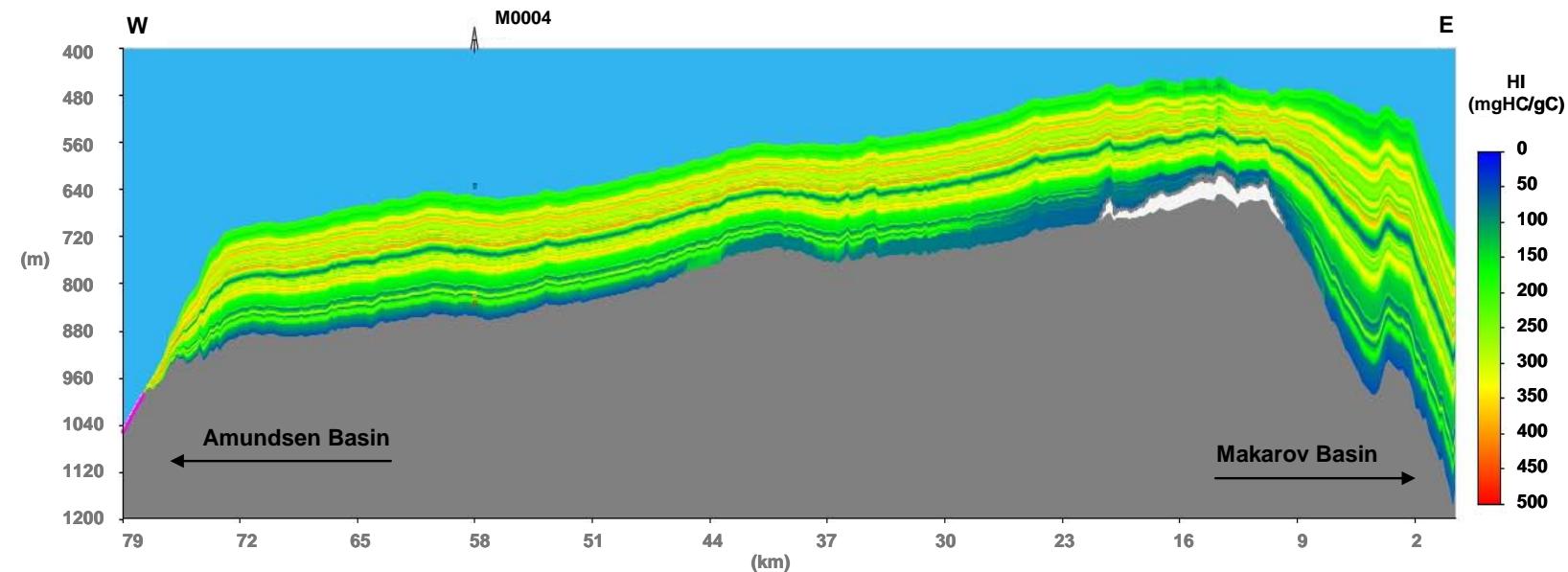
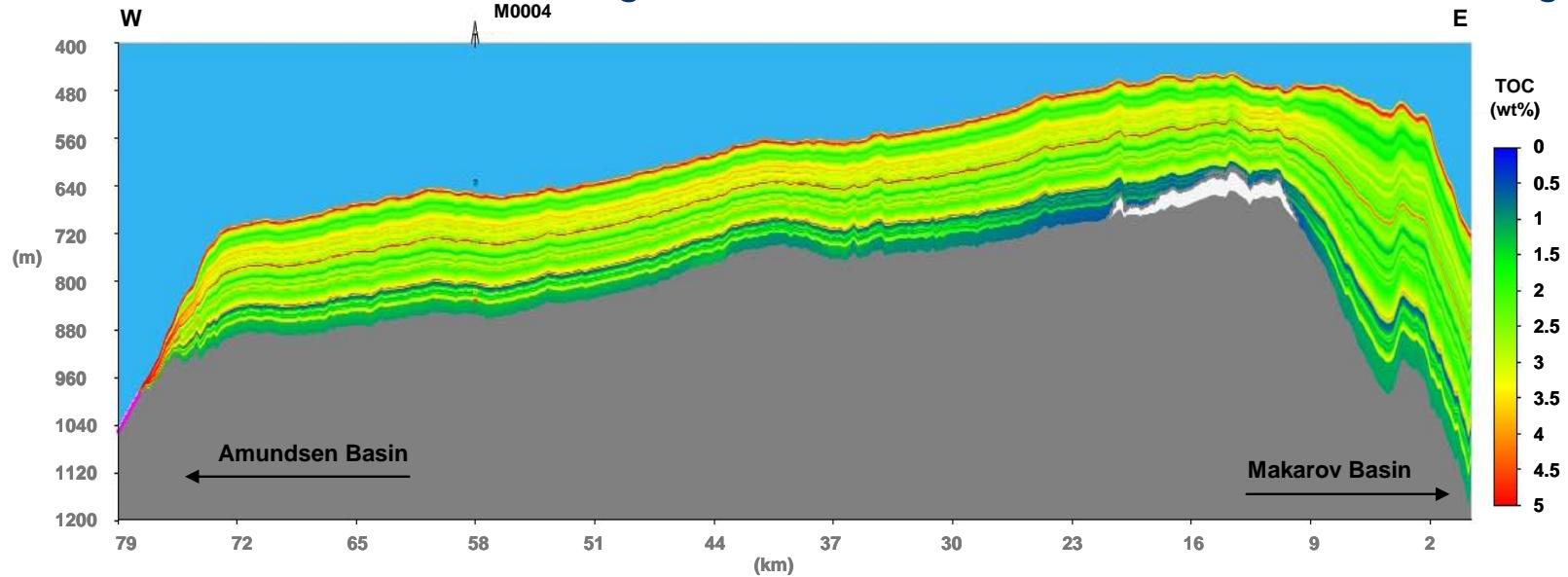
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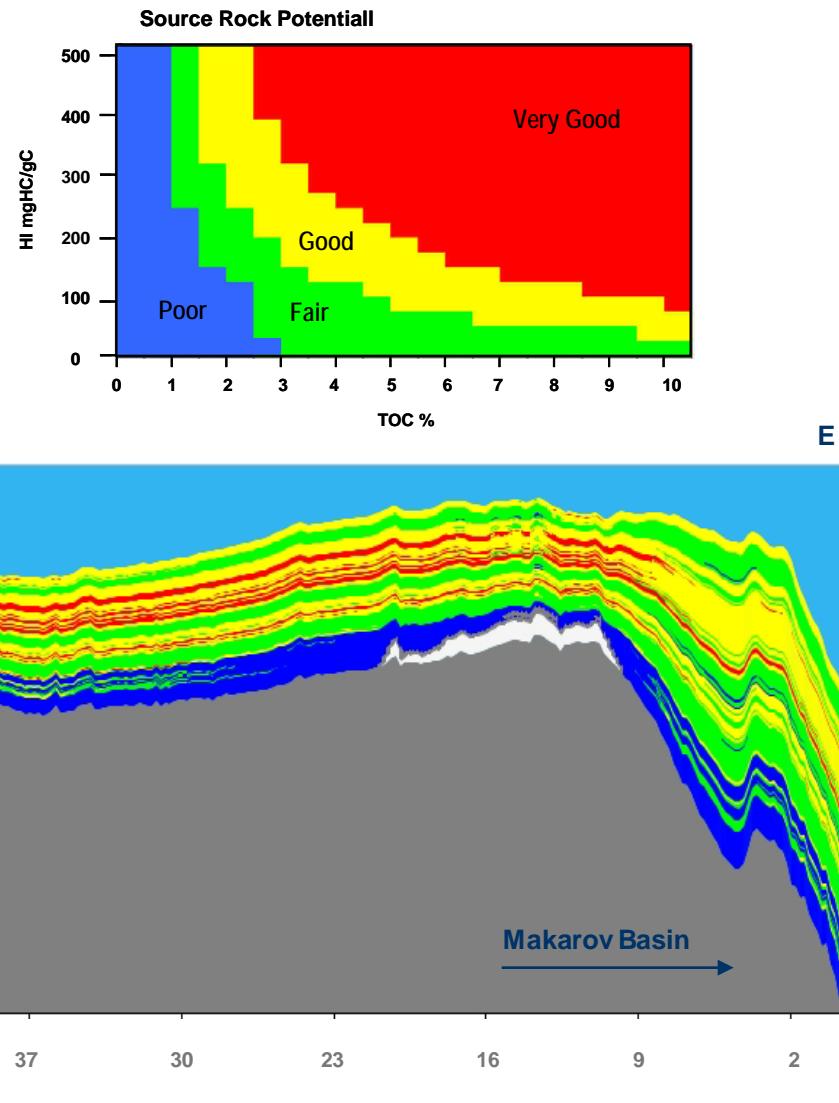
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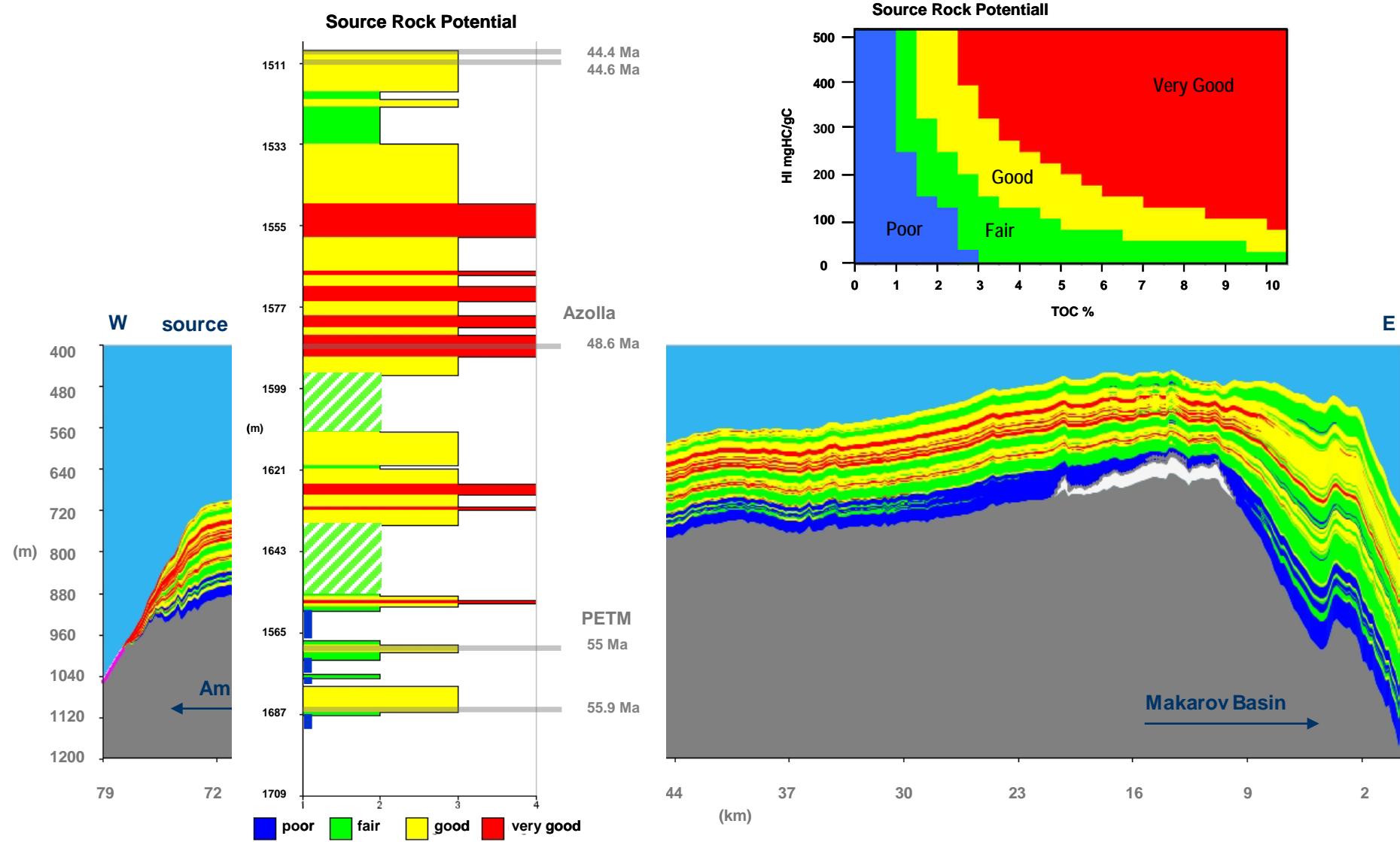
Source rock modelling of the central Arctic Ocean, Lomonosov Ridge



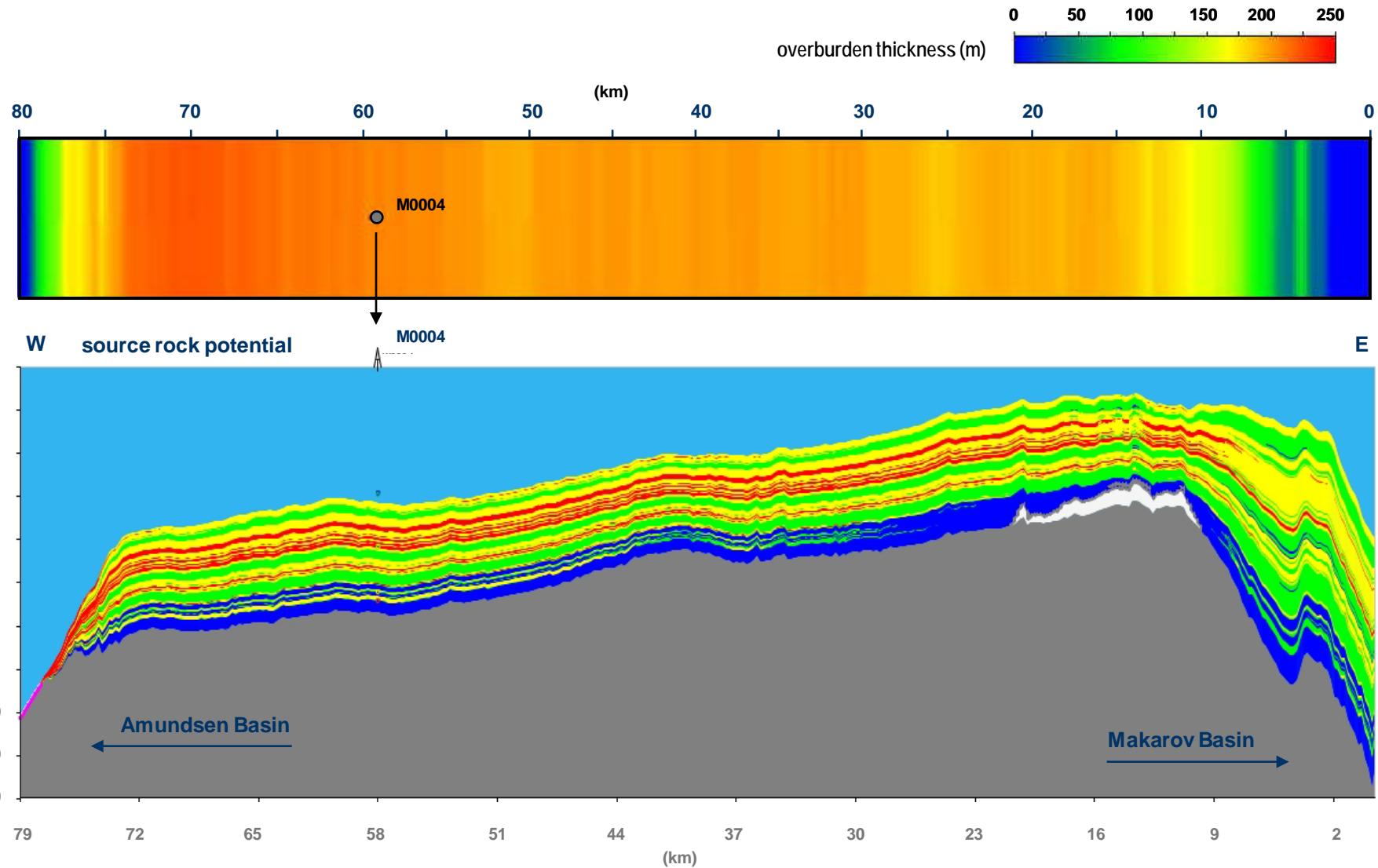
Source rock modelling of the central Arctic Ocean, Lomonosov Ridge



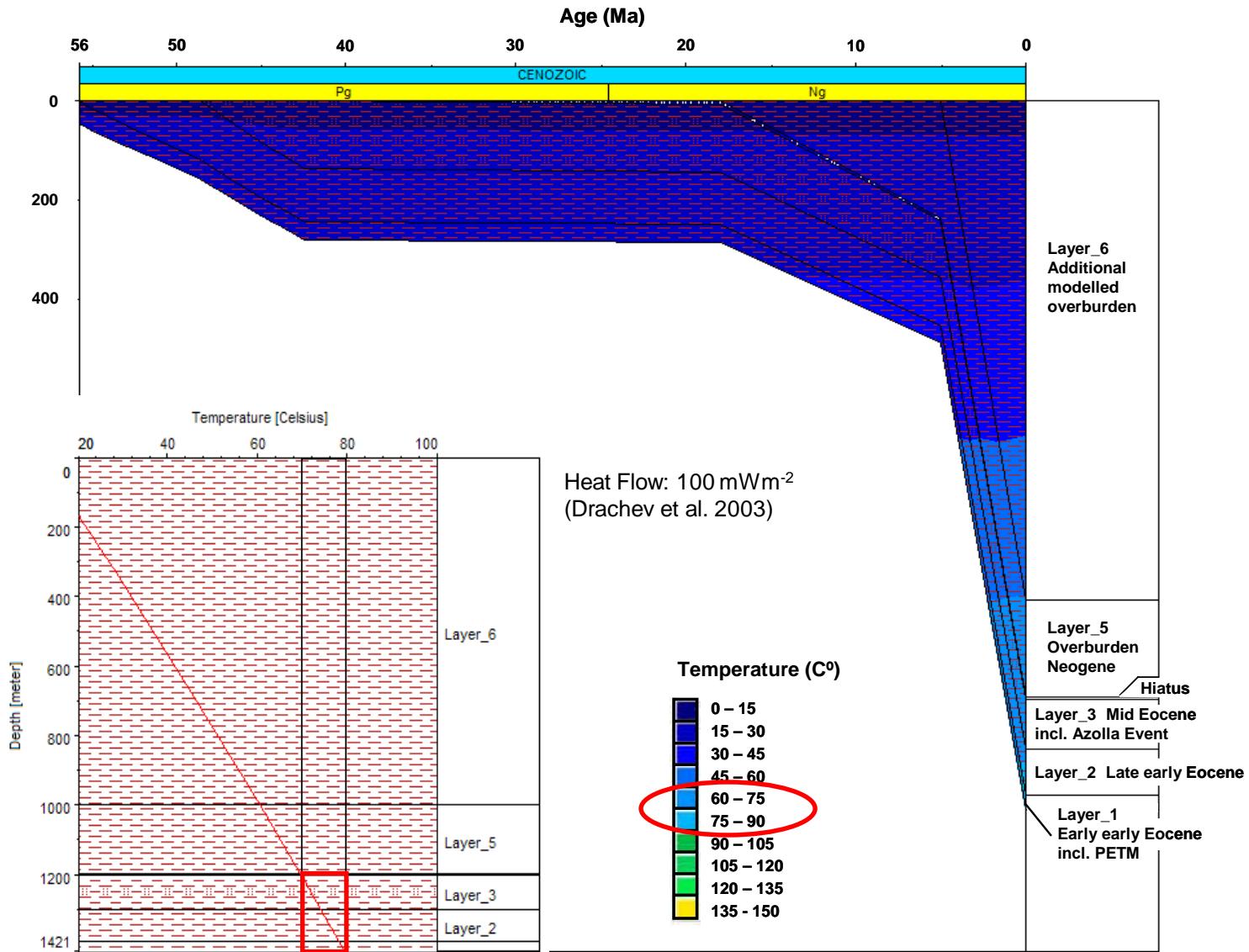
Source rock modelling of the central Arctic Ocean, Lomonosov Ridge



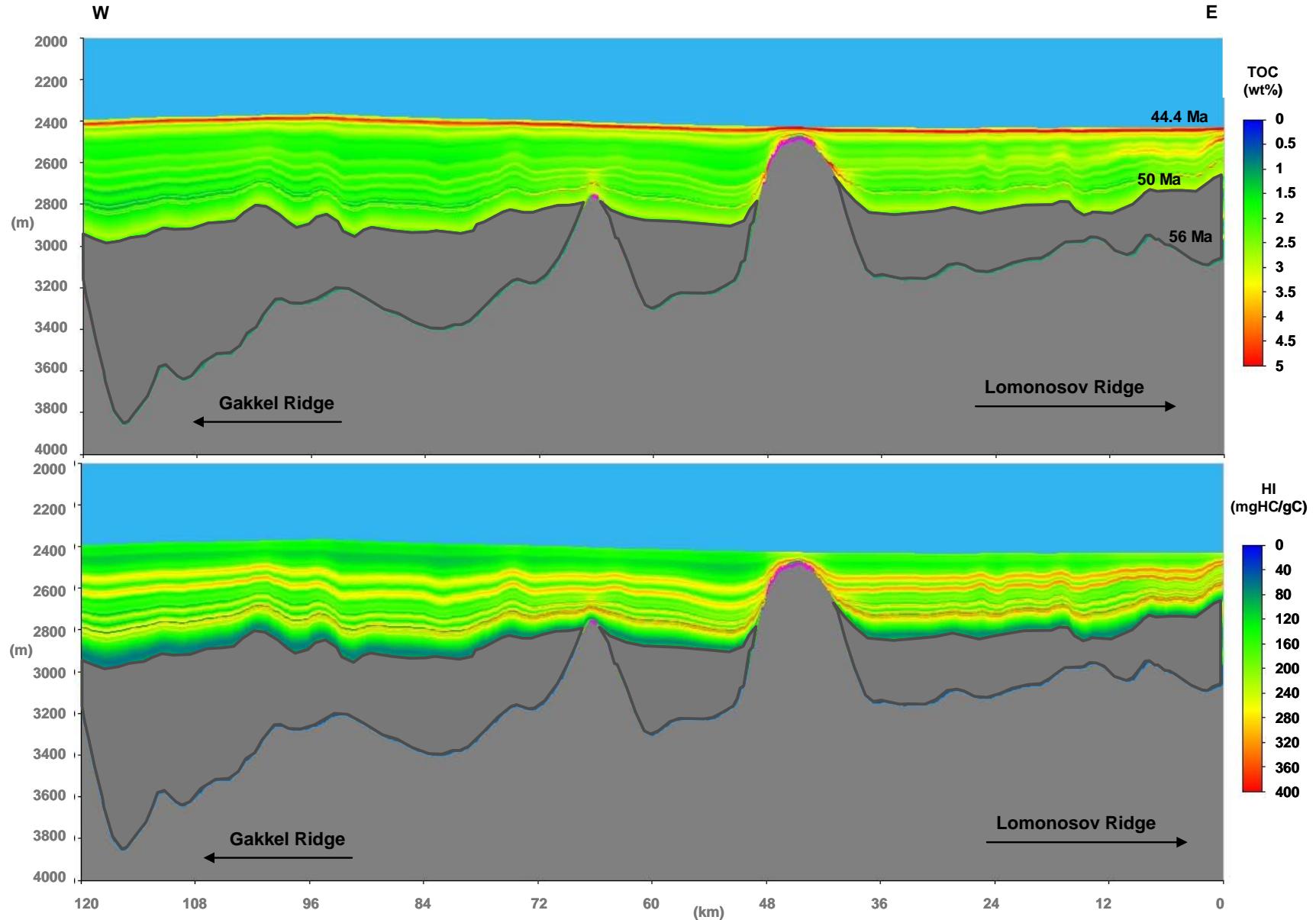
Source rock modelling of the central Arctic Ocean, Lomonosov Ridge



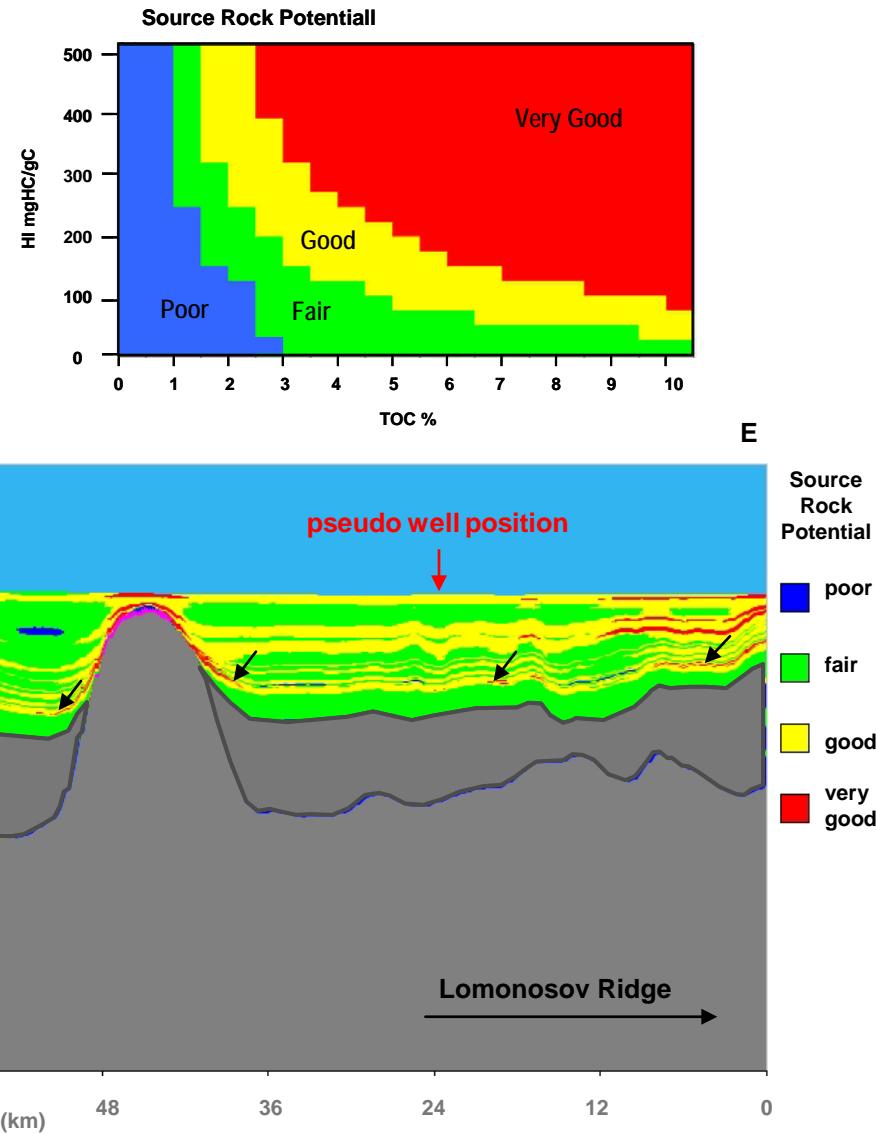
Source rock modelling of the central Arctic Ocean, Lomonosov Ridge



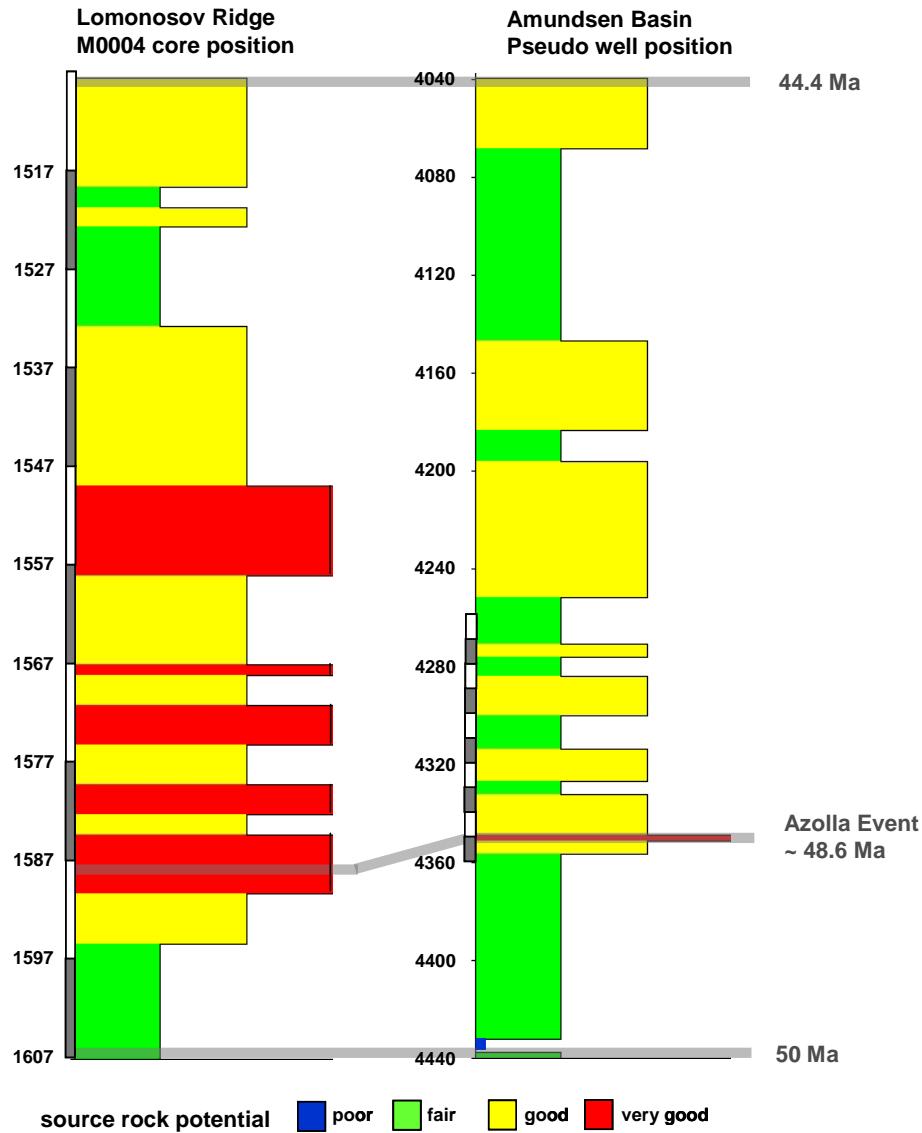
Source rock modelling of the central Arctic Ocean, Amundsen Basin



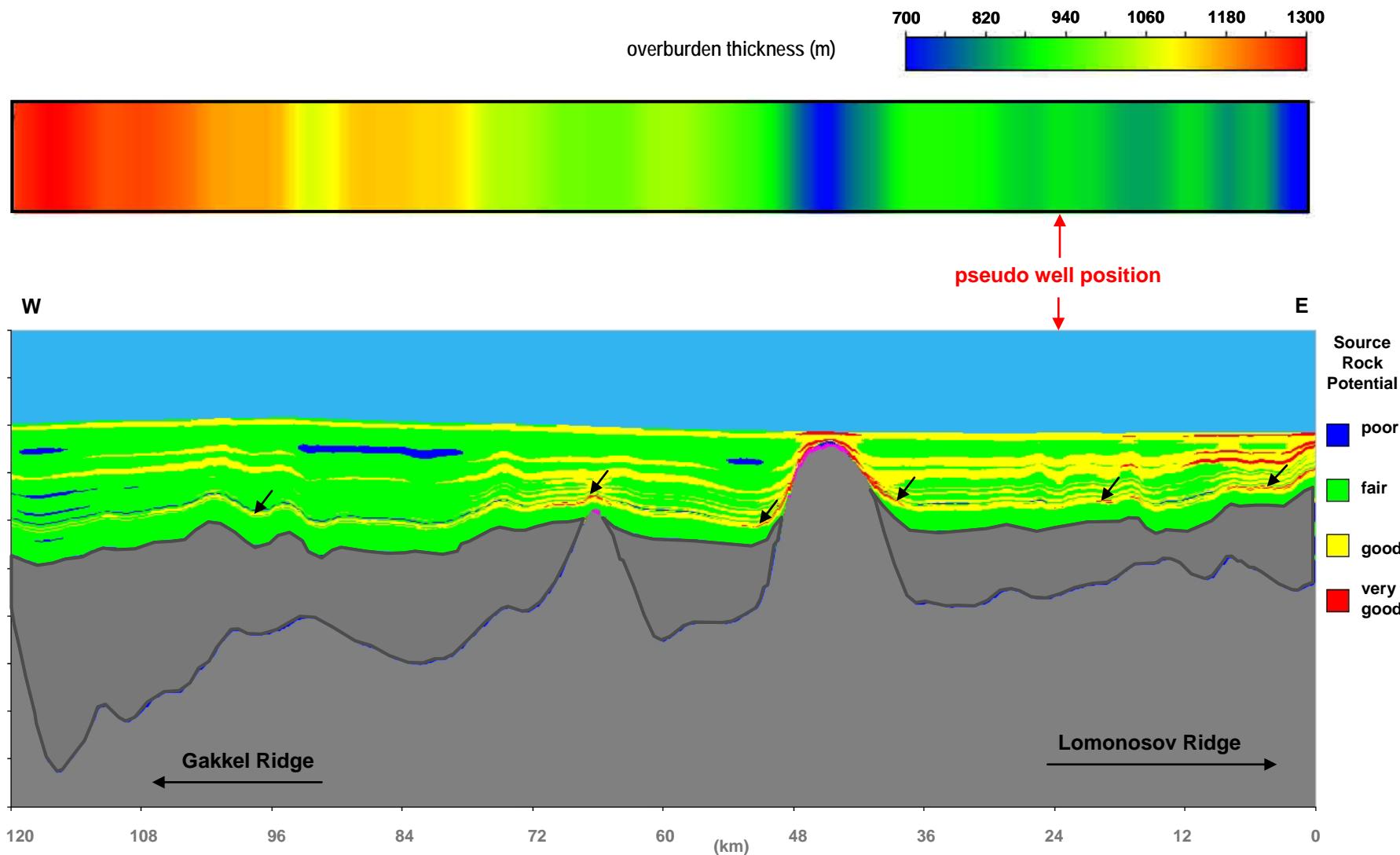
Source rock modelling of the central Arctic Ocean, Amundsen Basin



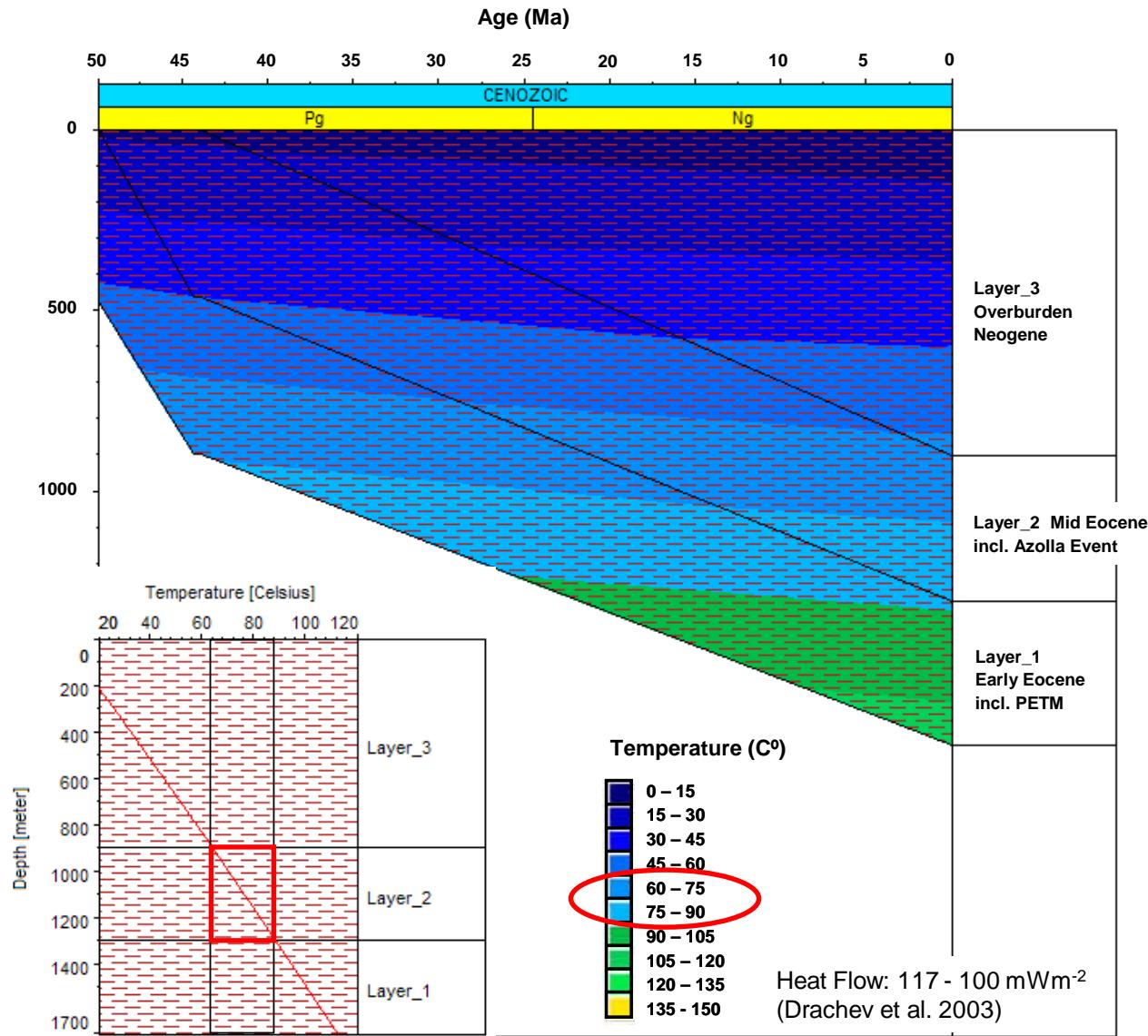
Source rock modelling of the central Arctic Ocean, Amundsen Basin



Source rock modelling of the central Arctic Ocean, Amundsen Basin

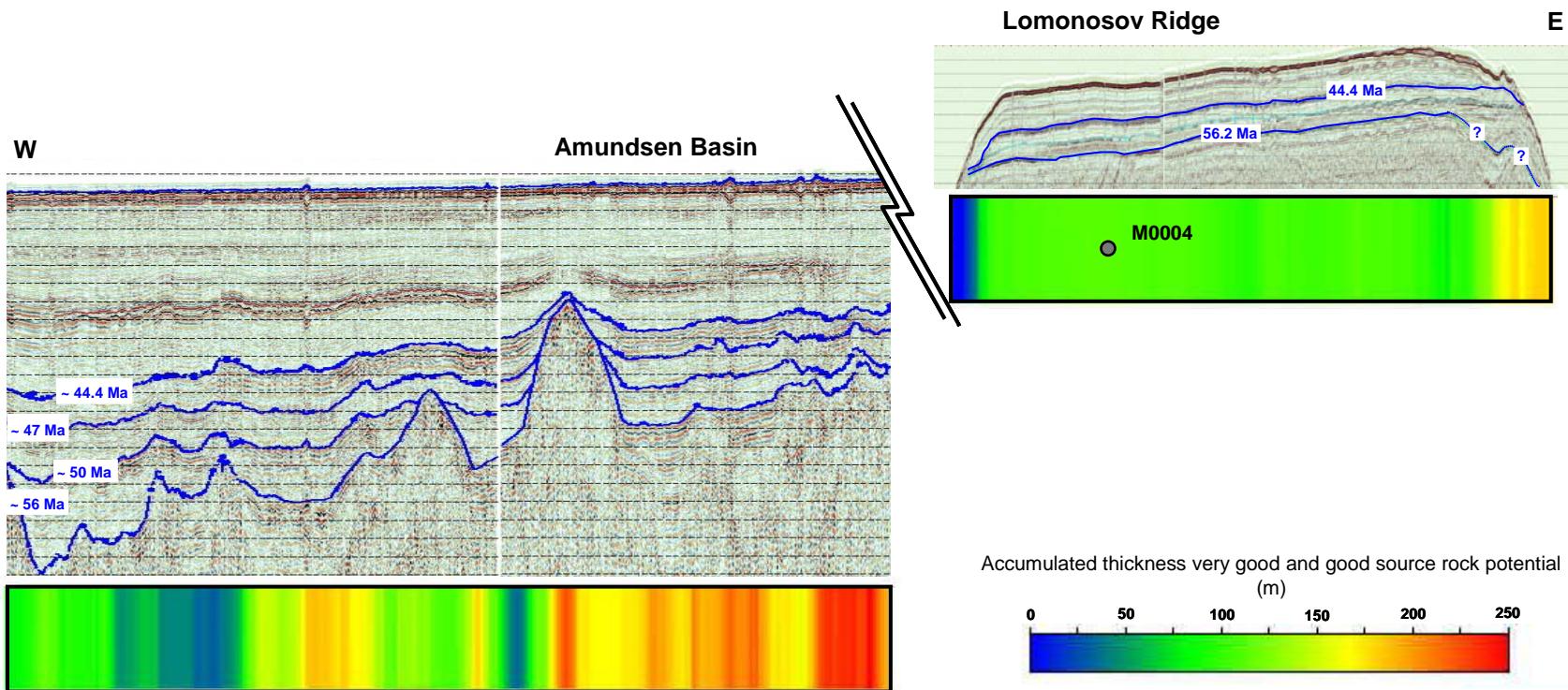


Source rock modelling of the central Arctic Ocean, Amundsen Basin



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Accumulated thickness very good and good source rock potential



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Conclusions

- Potential good and very good source rocks at the Lomonosov Ridge and in the Amundsen Basin during Eocene times
- Effective source rocks in the Amundsen Basin

