The Ordovician Glaciation in Saudi Arabia — Exploration Challenges Part 1. Geology (Outcrop, Subsurface, Analogues)*

Andrea Moscariello[1], Pieter Spaak[2], Alain Jourdan[3], and Abdul-Hameed Azzouni[3]

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See Part 2 - Search and Discovery article #50176, Khalil, A., G. Pike, P. Van Mastrigt, and J. Smale, The Ordovician Glaciation in Saudi Arabia – Exploration Challenges, Part 2: Geophysics.

[1]Reservoir Geology, Horizon Energy Partners, The Hague, Netherlands (a.moscariello@horizon-ep.com)
[2]Exploration New Ventures, SHELL E&P, Rijswijk, Netherlands
[3]Evaluation, SRAK, Al Khobar, Saudi Arabia

Abstract

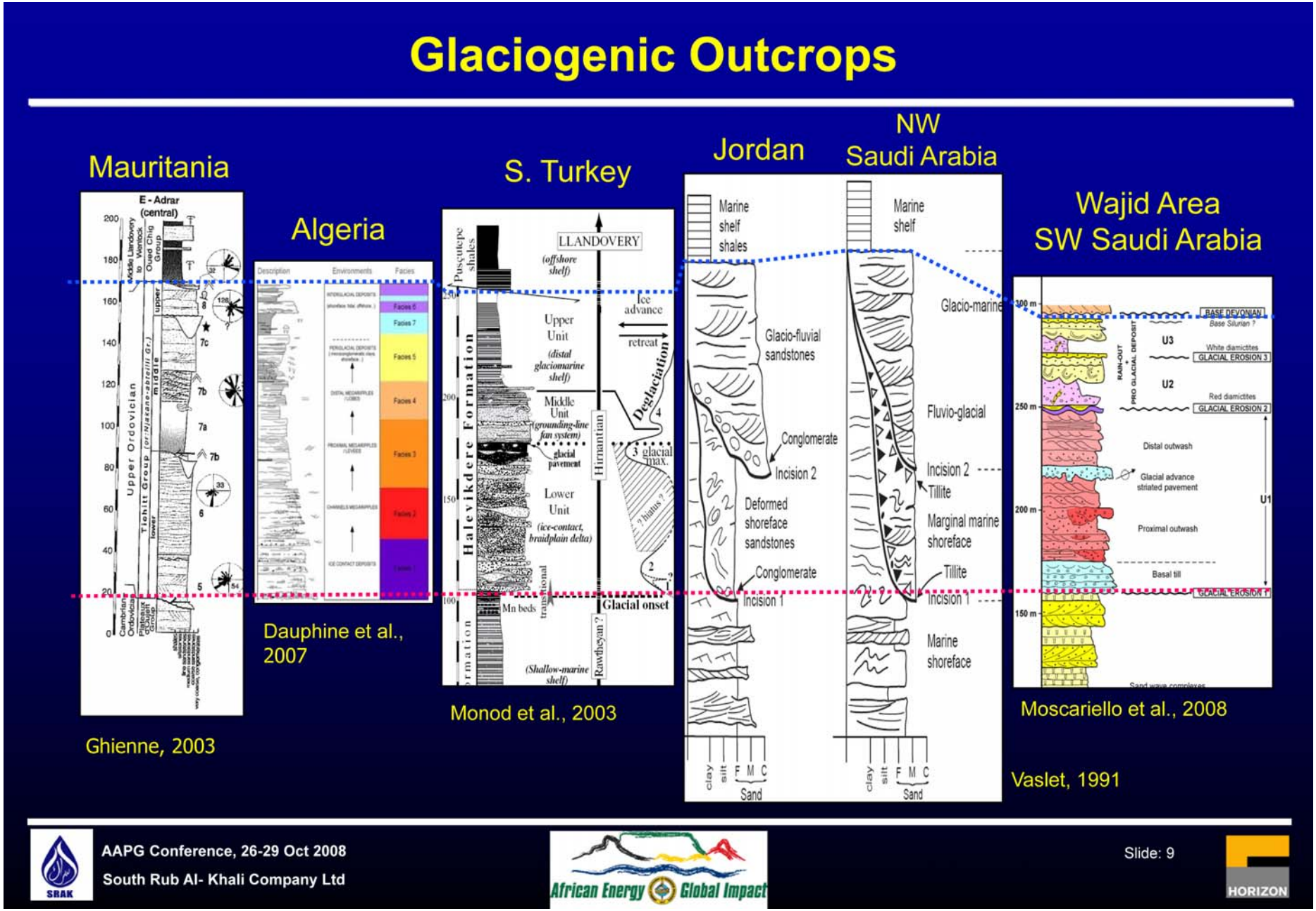
The South Rub Al-Khali Company Limited (SRAK) is an incorporated Joint Venture formed on 17th December 2003 by Shell Saudi Ventures Limited (40% share), Saudi Arabian Oil Company (30% share) and Total Ventures Saudi Arabia (30% share) in order to explore for non-associated gas in the South Rub ‘al Khali Basin in the Kingdom of Saudi Arabia.

After an extensive seismic campaign, exploration drilling is now ongoing with Late Ordovician peri-glacial sandstones forming a primary reservoir target. The lack of pre-existing Ordovician penetrations forms a major exploration challenge. This paper focuses on the palaeogeographic understanding of this play based on outcrop, well data and present-day glacial analogues. This approach provides the context for a more detailed seismic evaluation of the play, which is presented in a companion paper.

The sedimentological study of the Ordovician succession offers new insights into the nature, variability and areal distribution of the glaciogenic Sarah/Zarqa Formations in the South Rub al Khali Basin. Subsurface data can be correlated with the stratigraphically equivalent Sanamah Member of the Wajid Sandstone Formation in outcrop, some 500 Km west of the well penetrations. This highlights the vertical and lateral heterogeneity due to the interplay of sediment accumulation and erosion caused by successive ice-sheet advance and retreat.

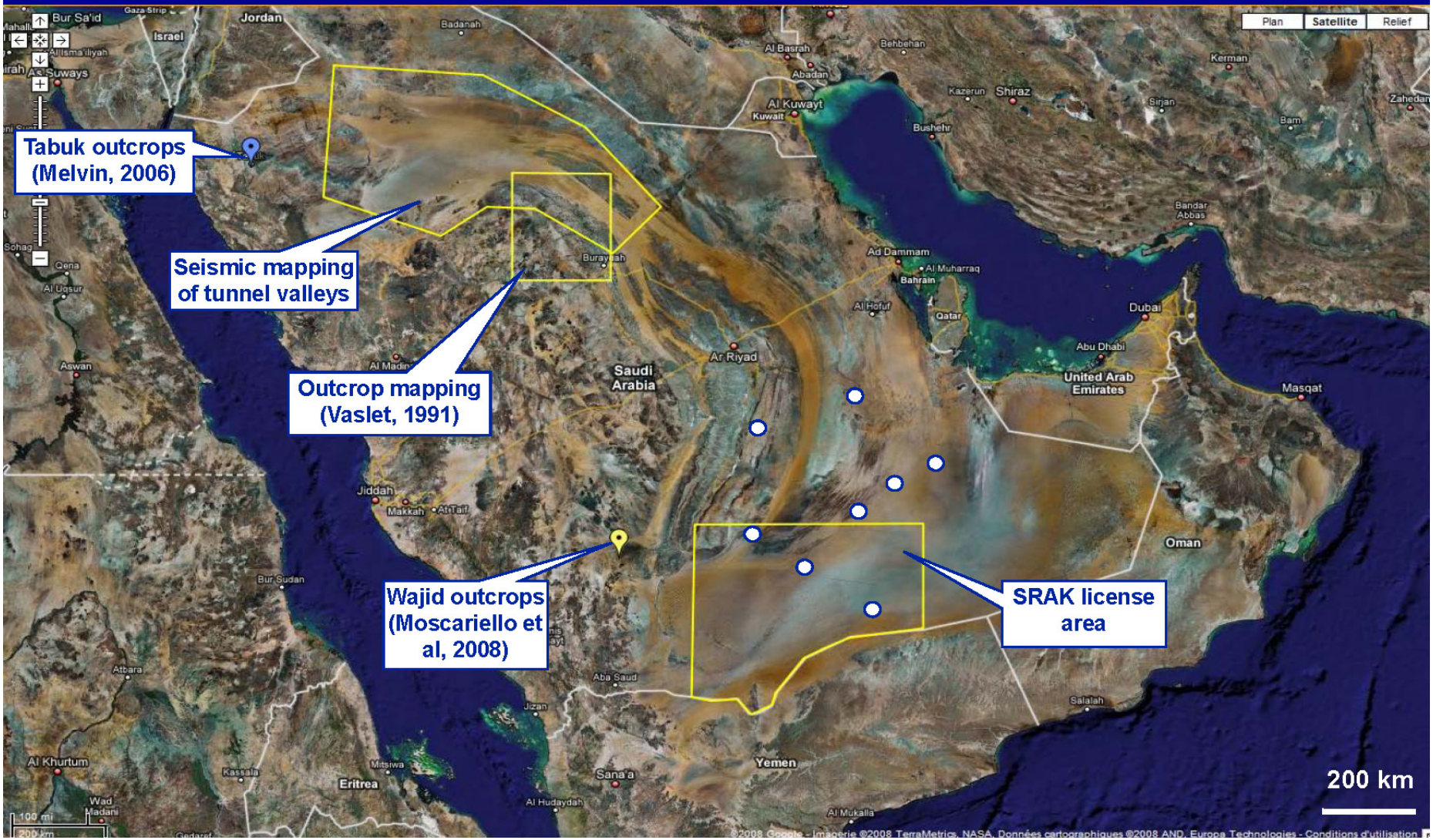
The reconstruction of this complex stratigraphy and of the regional distribution of the Late Ordovician succession is further aided by the study of recently deglaciated areas, e.g. in the area previously occupied by the Pleistocene ice-sheet in NW Europe where a network of glacial tunnel valleys and associated proglacial deposits is being investigated as an analogue for the Ordovician glaciation of SW Saudi Arabia.

Selected Figures



Slide 9: Glaciogenic Outcrops.

Available data: Outcrops & Seismic



Slide 10: Available data: Outcrops & Seismic.

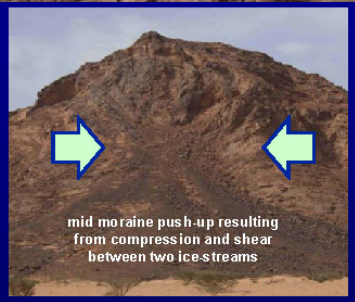
Sedimentary Facies of Glaciogenic Deposits

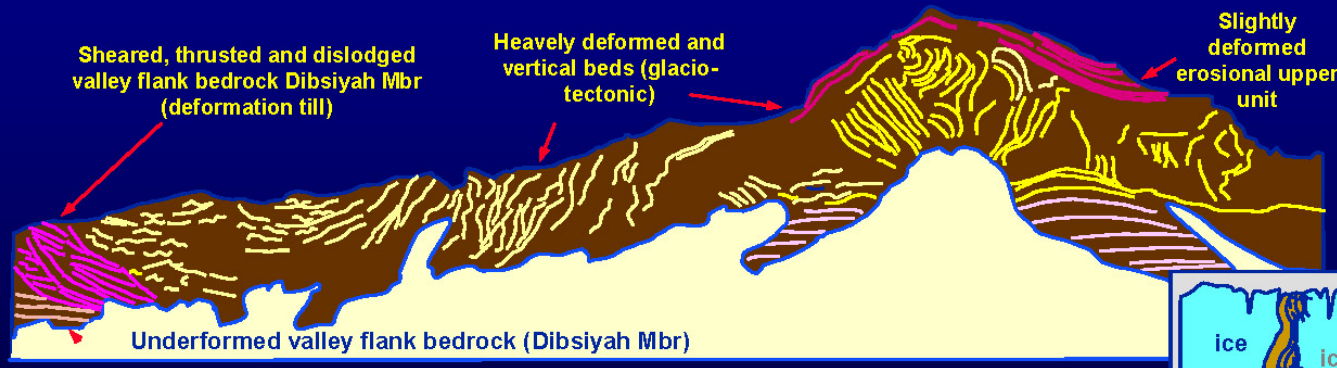
Diamicton can be interpreted as :

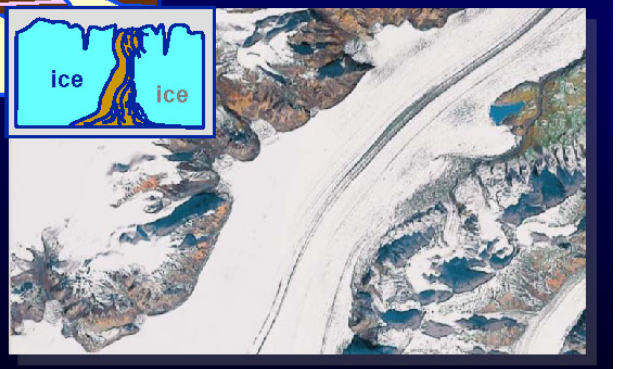
Deformation till,
Basal till,
Melt till (lateral moraine ridge),
Rain out till with drop stones.

Slide 13: Sedimentary Facies of Glaciogenic Deposits.

Glacial Valley Internal Architecture







Complex internal architecture of glacial valleys from the valley flanks to the axial position

Interaction of multiple, neighbouring ice streams.

The pushed-up, 'mushroom' structure, topographically higher than the rest of the valley infill deposits, is interpreted as the result of transpression associated with the formation of a mid moraine.

Slide 18: Glacial Valley Internal Architecture.

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