Depositional Environment and Facies Architecture of the Lower to Middle Ordovician Carbonate Ramp Succession, Öland, Southern Sweden*

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Search and Discovery Article #30381 (2014)**
Posted November 10, 2014

*Adapted from poster presentation given at AAPG International Conference & Exhibition, Istanbul, Turkey, September 14-17, 2014
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Abstract

The Lower- to Middle Ordovician carbonates of Öland, southern Sweden, exhibit outcrops of up to 12 m thickness and rest conformably on Cambrian black shales of the Alum Formation. Representing a passive margin setting on the west to southwestern part of Baltica micro-plate, yet approached from two sides by advancing continents through the Upper Ordovician, these carbonates were most likely formed in a temperate climate in about 45° to 60° paleo-latitude on the southern hemisphere. However, even though their fossil content is well known since Linné described some extinct species in the 18th century, their sedimentology has largely been left untouched. The scope of this contribution is therefore to clarify some basic aspects of this potential but mostly unexplored petroleum system that stretches through larger parts of the Baltic Sea in the subsurface.

For this study, six localities were sampled comprising the entire length of the island of Öland. All rocks throughout the succession consist of wacke- to packstones containing mostly bioclasts. Well-recognizable grains constitute echinoderms, brachiopods, bryozoans, recrystallized bioclasts, and trilobites, in decreasing abundance. All of these skeletal grains make up between 10 and 45% of these Ordovician rocks. The Lower to Middle Ordovician succession as a whole records a slight coarsening-upward sequence trend.

This Ordovician succession is interpreted to represent the central to lower part of an extensive homoclinal carbonate ramp system facing both Iapetus Ocean and Tornquist Sea: the wackestones represent the distal sediments, whereas the packstones reflect deposition in the central portion of this ramp. The slight coarsening trend observed throughout the studied interval is interpreted to reflect a lowering of overall sea level. This is in contrast to worldwide trends: most of the Lower Ordovician does reflect a highstand, and at the onset of the Middle Ordovician, there should be a drop of sea level, both of which is not recorded in the Swedish Ordovician succession. It is therefore speculated that also tectonics and not only eustasy control base level changes on Baltica during the Lower to Middle Ordovician.
Throughout Öland, the succession shows open and minus-cement porosities of between 4-5%. These carbonates are directly overlying one of the most prominent source rocks of Scandinavia with up to 18% Total Organic Carbon (TOC) content, and overlain by Silurian shales in the subsurface. Therefore, these carbonate units have a high potential for petroleum exploration, especially in the Baltic Sea.
DEPOSITIONAL ENVIRONMENT AND FACIES ARCHITECTURE OF THE LOWER TO MIDDLE ORDOVICIAN CARBONATE RAMP SUCCESION, ÖLÅN, SOUTHERN SWEDEN

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INTRODUCTION & GOALS

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ACKNOWLEDGEMENT

REFERENCES

The Ordovician carbonate succession in Öland has previously been studied in detail for the purpose of reservoir characterization and petroleum exploration. This study focuses on the lower to middle Ordovician carbonate succession (Wiley et al., 2004; Sørensen et al., 2009). The Late Ordovician marine carbonate succession of Öland consists of a hinge zone extension of the Svecofennian carbonate platform, comprising limestones and dolomites. The study aims to understand the depositional environment and the carbonate facies architecture of the Lower to Middle Ordovician carbonate succession in Öland. The study area is located on the southeast coast of Öland, Sweden. The succession is characterized by a series of transgressive-regressive cycles, indicating a sea-level rise and fall. The study provides insights into the depositional processes, sedimentary facies, and the evolution of the carbonate platform. The study also highlights the potential for petroleum exploration in the area.

ACKNOWLEDGEMENT

I would like to express my very great appreciation to Dr. Jordi Barbat, Dr. John Riddle, and Dr. George Caudill for their contribution. My special thanks are extended to Turkish Petroleum Corporation (TP) for supporting the research trip to Sweden and inviting me to publish this paper. I thank the members of the carbonate research group at Colorado State University for discussions and making this group such a lovely place to work in.

REFERENCES