ACADIA UNIVERSITY CARBONATE SEDIMENTOLOGY FIELD SCHOOL, BERMUDA SUMMARY REPORT

Submitted to:

Offshore Energy Research Association of Nova Scotia (OERA)

to fulfill the requirements of the Student Research Travel Program

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INTRODUCTION

We wish to thank OERA for travel support to participate in the Acadia Bermuda Field Course. The purpose of the course is to become proficient in the application of lecture-based concepts to studying the accumulation and alteration of limestone. The field-based, observation-driven component of the course allows for a better interpretation of what is expressed in the rock record, in regards to depositional environment and post-depositional diagenetic processes. The course highlights the processes controlling the development of carbonate source and reservoir rocks using hands on field experience alongside lab exercises and lectures. Acadia University is the sole institution in Atlantic Canada to provide this unique and valuable opportunity.

TRIP DETAILS & BACKGROUND INFORMATION

The series of small oceanic islands that make up Bermuda are formed of lithified carbonate eolianite dunes that sit upon a volcanic pedestal. Warm oligotrophic waters brought east by the Gulf Stream surround the islands, creating a nutrient-poor environment that favours the growth of diverse communities of carbonate-producing organisms. These carbonate reef communities are modern analogues for ancient oil-producing limestones. The six formations that comprise the exposed stratigraphy of Bermuda are composed predominantly of carbonate eolianite dunes separated by soil horizons; a stacking relationship which is interpreted to reflect cyclic changes in glacio-eustatic sea level.

Periods in the field allowed for the description and interpretation of both eolianites and carbonate sediment from modern environments. Lithofacies analysis assisted in the delineation and identification of rocky intertidal, beach, sea grass meadow, and lagoonal environments. Snorkeling in various environments surrounding the islands allowed us to observe these facies being produced in “real time” through sedimentary and biologic processes.

Lab exercises focused on the use of a binocular microscope to examine sediment samples taken from modern environments in the field. This provided information on the types of carbonate-producing organisms that contribute to the sediment. Further exploration of the factors controlling the accumulation of certain carbonate facies was undertaken through projects focused on specific environments that had been observed.

These data were also used to understand the role of diagenetic potential in the development of carbonate petroleum systems. Field visits to modern caves highlighted how water and mineral controlled alteration affect reservoir quality.

BENEFITS OF TRAVEL

Knowledge acquired is critical to understanding the sedimentology and diagenesis of our M.Sc. theses rocks. By conducting field observations in Bermuda, as well as laboratory work describing carbonate sediments, we were able to link sediment in distinct depositional environments directly with a lasting fingerprint in the rock record. This will provide better constraints on environmental factors, such as water depth, nutrient and sediment load, and pH, while trying to reconstruct paleo environments throughout our theses. As interpreting depositional environments correctly is key to finding potential hydrocarbon reservoirs, this experience is also instrumental to our goal of pursuing a career in the petroleum industry,

and being able to link modern processes with those which happened previously but are of interest in petroleum exploration.

OUTCOMES OF TRAVEL

This travel grant allowed us to study several key factors of carbonate sedimentology and diagenetic process, which are crucial in a multitude of disciplines, such as paleoclimate modelling, invertebrate evolutionary studies, and petroleum exploration. This trip also provided an opportunity for a direct comparison of Carboniferous limestones found in Nova Scotia with Pleistocene limestones and modern sediments found in Bermuda. We were also able to apply modern techniques to the study of potential hydrocarbon reservoirs, such as seismic reflection studies and wireline logs. This was an excellent applied field portion for the previously taken lecture class, Carbonate Sedimentology, GEOL 3323.

SIGNIFICANCE TO NOVA SCOTIA

This course provides a comparison of a modern marine environment (Marine) with a historical one (Windsor Group, Nova Scotia). Many factors are applied in order to interpret changing conditions, such as glacio-eustatic sea level, sediment load, and latitude. This unique combination of field observation paired with environmental interpretation is also key to understanding potential hydrocarbon reservoirs found in offshore Nova Scotia. These skills will aid in describing lithofacies throughout the completion of our theses, and potentially while working in the petroleum industry in Nova Scotia.

EXPENSE REPORT

Please see attached claim forms and receipts. The Bermuda Institute of Ocean Sciences has kindly converted their invoices into CAD for your convenience. Each invoice includes the cost of food, accommodation, access to lab and lecture space, and dive boat time.

ACKNOWLEDGEMENTS

We wish to thank OERA for providing the opportunity to conduct this research. The travel grants received allowed for travel to an ideal destination for studying carbonate sedimentology and diagenesis, as well as accommodations at a world class facility and logistical support needed in order to make the most of field time. We would also like to thank Dr. Peir Pufahl for his enthusiastic teaching and guidance while conducting this course, and the staff at BIOS who helped with local background knowledge.