<u>Lithological Analysis of the Saskatchewan Tyndall Stone from the Upper Ordovician in the Red River Formation</u>

Michael Raiwet

Abstract

The Ordovician period displays a remarkable environment in Saskatchewan vastly different from today. A shallow marine setting that was busy with marine life from a wide spectrum of fauna. The Tyndall stone deposits of the Red River formation display this environment particularly well. By carefully examining the Tyndall stone, in several different locations and under different circumstances, it is possible to get a better understanding and just how exciting this environment would have been. Examples of oxidization, fossils and anhydrate provide insight into the other characteristics that were in motion at this time. Periods with oxidation and anhydrate episodes in particular, tell a story of sub-aerial exposure during periods when the shallow ocean was not deep enough to cover specific regions of the Tyndall stone. Examples like this, bring an inference that although the Ordovician was an ever changing climate that would have at times been very unsuitable for the shallow marine fauna typically seen in Tyndall stone fossils.

Introduction

The Tyndall stone found in Saskatchewan and Manitoba in the Red River formation is a valuable resource for many enterprises, particularly the construction and the oil and gas industries. A better understanding of Tyndall stone and the environment in which it formed may provide insight to our Earth's early history for not just educational purposes, but economic purposes as well. The information in this report was collected using these methods: a guided tour through the Royal Saskatchewan Museum, hands on analysis of three cores at the Subsurface Geological Laboratory and statistical fossil data from the Saskatchewan Disease Control Laboratory.

Geological Setting

The geological core that has been studied for this report was recovered from the 36-51-8W2 (NTS-63-E-06) well site. Its geographical coordinates are +53° 27' 11.97", -103° 4' 13.46". A map of this location can be found on Figure 1.1, attached to the end of this report. It will be valuable to be cognizant that the depth of this core reaches a maximum of over 325 metres and covers approximately 65 metres within the core.

Background

Tyndall stone can be more precisely known by its lithological name as a dolomitized bioturbated fossiliferous limestone. It was deposited and lithified around 450 million years ago in the Ordovician. During this time, most of Saskatchewan would have been a shallow sea environment. Tyndall stone is well known for its large volume of fossils. Fossil members include: nautiloids, corals, stromatoporoids, bryozoans, crinoids, trilobites, brachiopods, gastropods, bivalves and more. "The wide range of fossil organisms, combined with paleomagnetic information, indicate that this area of Manitoba (and Saskatchewan) was a relatively warm, inland sea that just south of the Ordovician paleoequator," (Coniglio, 1999). Cogniglio goes on to suggest the "warm, shallow waters of the Bahamas Banks" as a reasonable modern day analogue of the environment that would have been at work forming the Tyndall stone of the Red River formation.

Findings

Unfortunately, the small portion of Tyndall stone observed from the Saskatchewan Disease Control Laboratory at the University of Regina did not display a significant amount of fossils. In all, and excluding the trace fossils, the sample of Tyndall stone used for the report only displayed four fossils, one of which could not be positively identified. It is important to note that while other slabs of the building were not carefully examined for this study, numerous examples of tabulate corals and brachiopods could be clearly observed. Due to time constraints and a consideration that not all the slabs could realistically demonstrate the amount of Ordovician fossils for a thorough analysis, it was decided that using our original control provided a more accurate portrayal of Tyndall stone.

A belemnite can be seen in figure 2.3 and a rugose coral in figure 2.4. Figure 2.4 features a Grewingkia rugose coral vertical section showing septa (Paterson, 2006). Paterson describes these corals as solitary explaining, " Individuals were separate and grew in the shape of a slightly curved cone rather like a cow's horn, hence the common name Horn Coral." Belemnites, which belong to the cephalopod family, are thought to have gone extinct sometime near the end of the Cretaceous (Eyden, 2003). Both rugose coral and tabulate coral went extinct during the end Permian mass extinction. Although not photographed, a rugose coral fossil was also discovered at approximately 300.1 metres in the core sample.

The 36-51-8W2 core shows a similar environment to that from the walls of the Saskatchewan Disease Control Laboratory. However, there are some notable differences. Throughout the core significant amounts of anhydrate can be seen (figure 2.1). From approximately 264.9 to 268.1 metres, the limestone has a distinguishing shade of red. This is caused be oxidation and marks periods of sub-aerial exposure. It is below this point where the anhydrate in its most significant concentrations. Oxidation returns from 273.3 to ~281 metres, once again suggesting sub-aerial exposure. Below this oxidized section, the limestone remains consistent up until it becomes sand stone at about 313.4 metres.

Conclusions

Saskatchewan during the Ordovician was an environment not unlike the Bahamas Banks, only on a much larger scale. A tropical shallow sea climate such as this would have been a very habitable setting for a wide range of marine life, including the two fossils discussed in this paper, belemnites and rugosa coral. To further demonstrate Saskatchewan once occurred as a shallow sea, evidence from the core lab shows two examples of periods when the sea did not cover the landscape and some areas would subjected to sub-aerial exposure causing oxidation.

Acknowledgements

This report and its author owe a great deal of gratitude the Royal Saskatchewan Museum, the Subsurface Geological Laboratory and the Saskatchewan Disease Control Laboratory. All of which, are located in Regina, Saskatchewan. Without the access they provided, much of the research acquired to formulate this report may have not been possible. Appreciation is also owed to Austin Guillemin for kindly supplying several photographs from the previously mentioned locations to be used inside this report.

Citations

Wat On Earth. “Manitoba’s Tyndall Stone” *whaton.uwaterloo.ca.* Coniglio, Mario. 1999. Web. April 6, 2013.

< http://www.whaton.uwaterloo.ca/waton/s9911.html >

Doug Paterson’s Main Page. “Fossils of the Tyndall Stone” *dfp.mediacooks.com*. Paterson, Dr. Douglas. 2006. Web. April 6, 2013.

< http://dfp.mediacooks.com/fossils >

Tonmo “Belemnites: A Quick Look” *tonmo.com*. Eyden, Phil. September 14, 2003. Web. April 6, 2013.

< http://www.tonmo.com/science/public/belemnites.php >

Maps

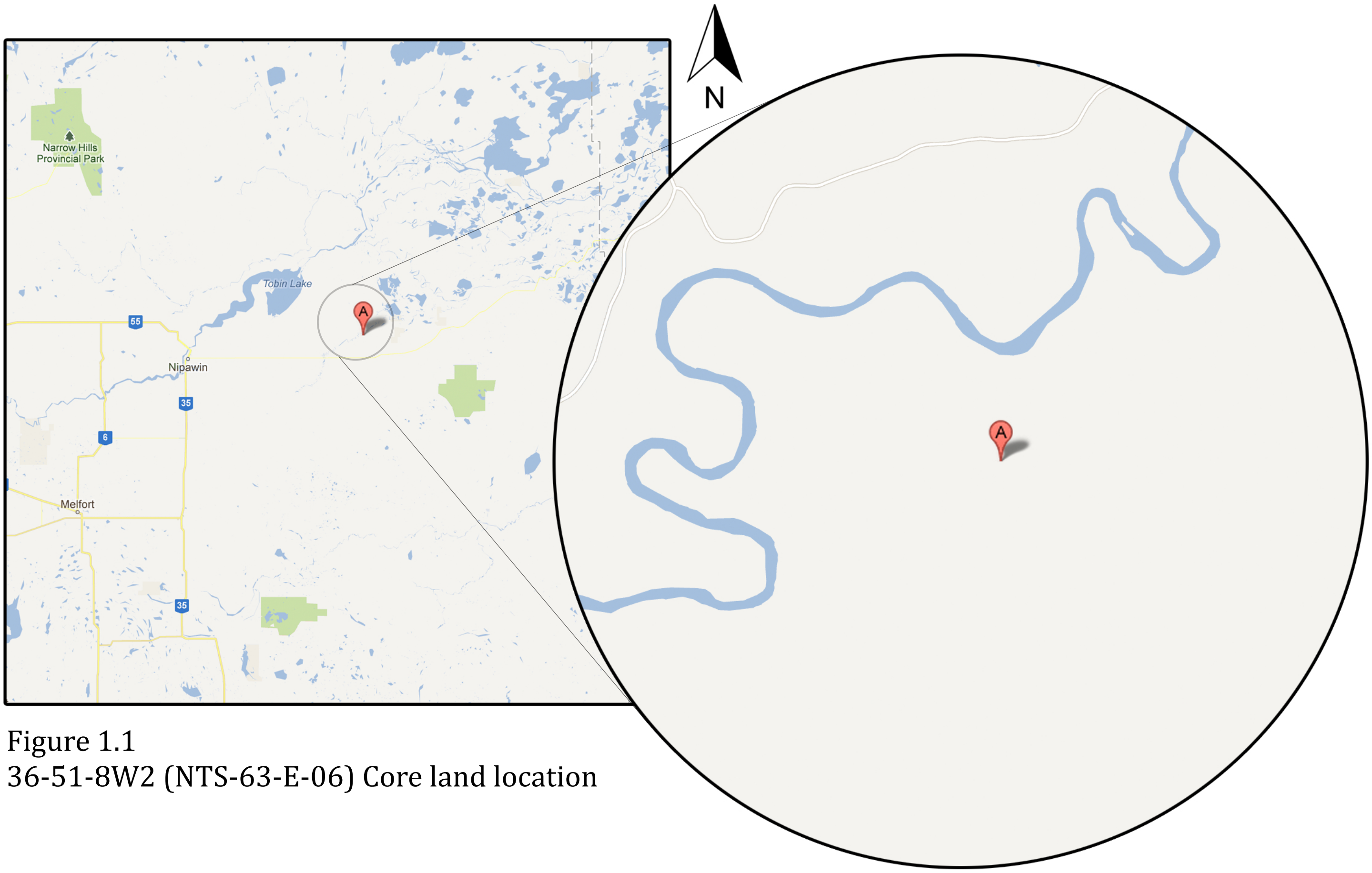

Figure 1.1
36-51-8W2 (NTS-63-E-06) Core land location

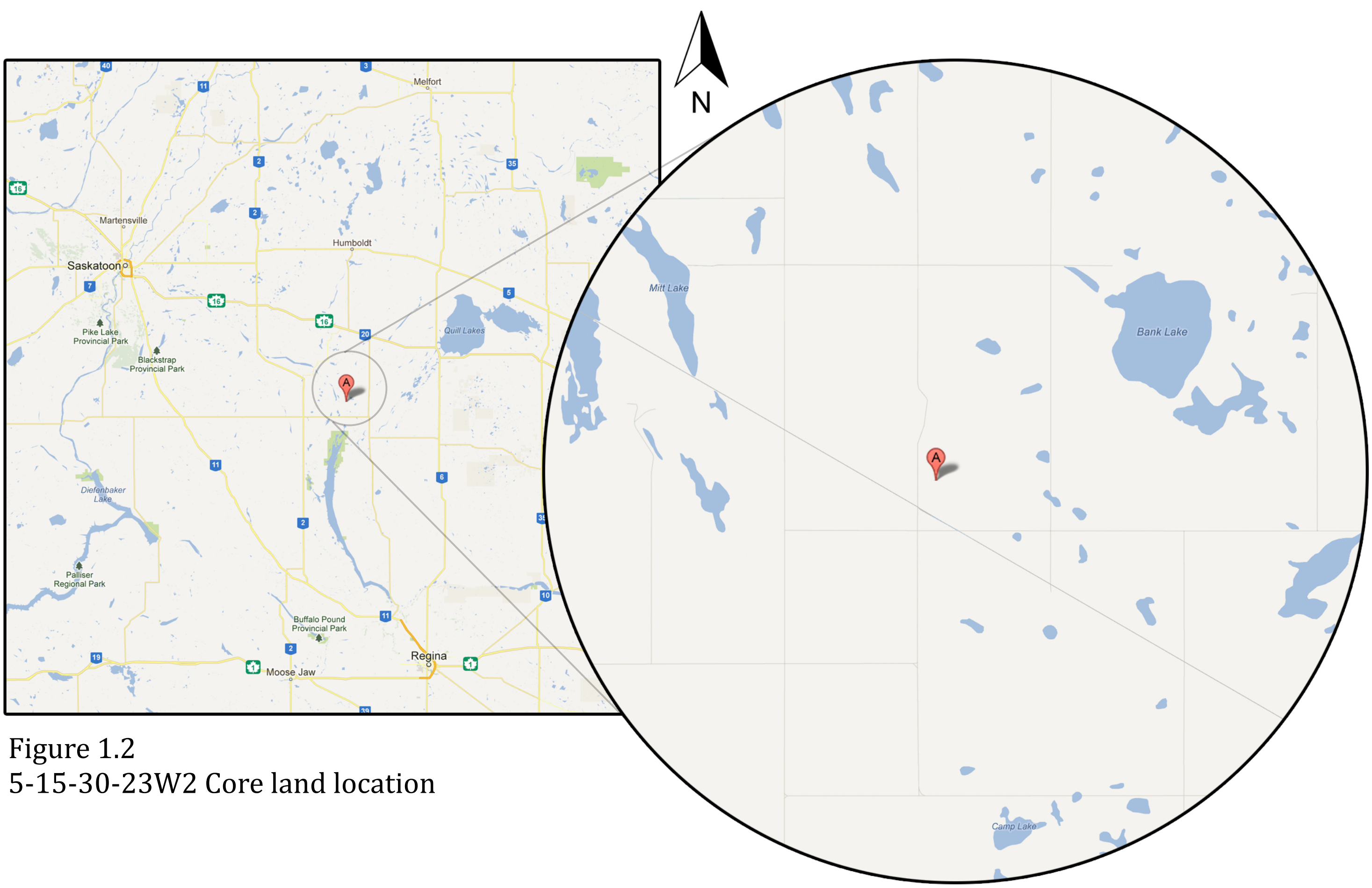

Figure 1.2
5-15-30-23W2 Core land location

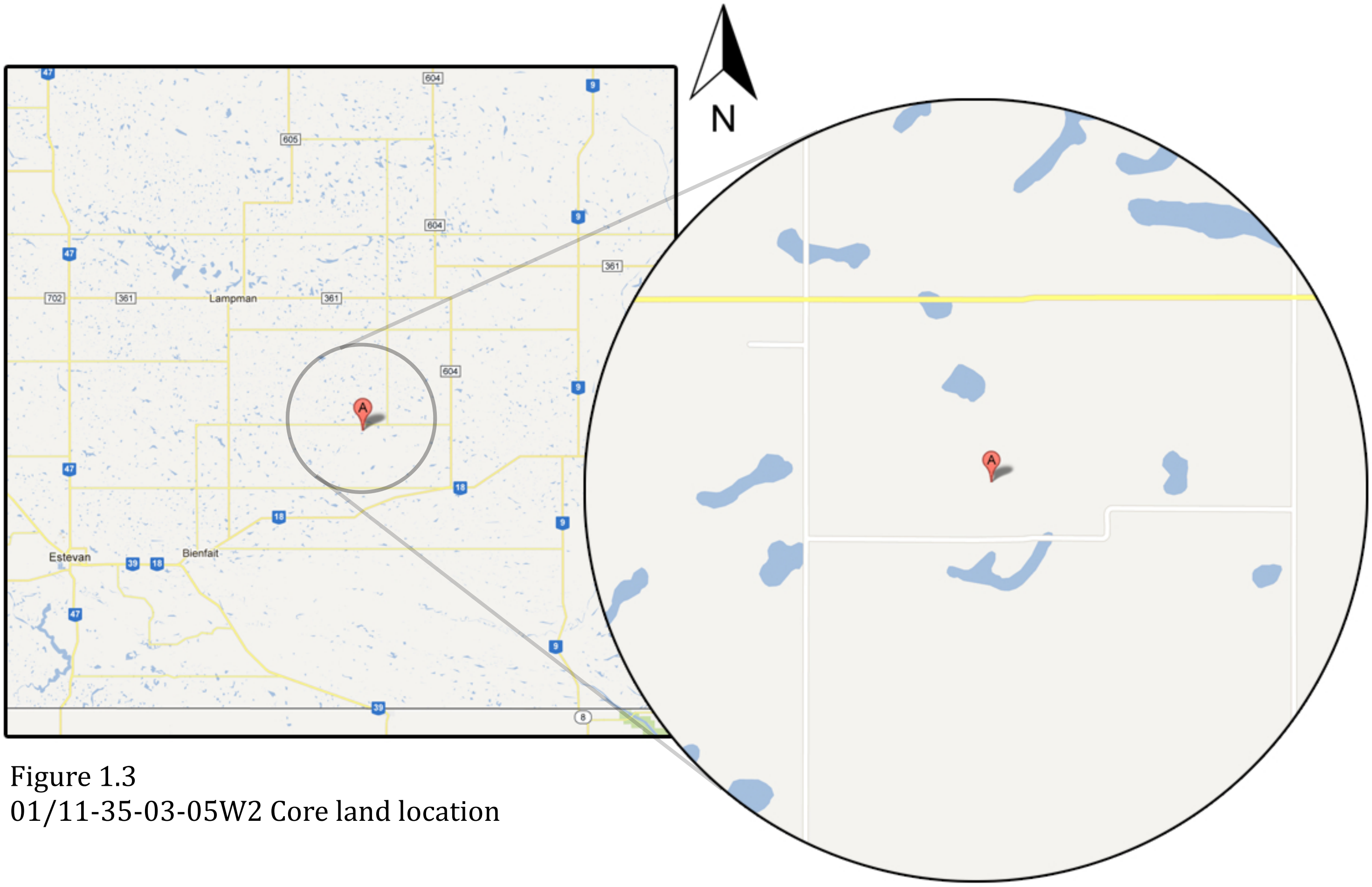

Figure 1.3
01/11-35-03-05W2 Core land location

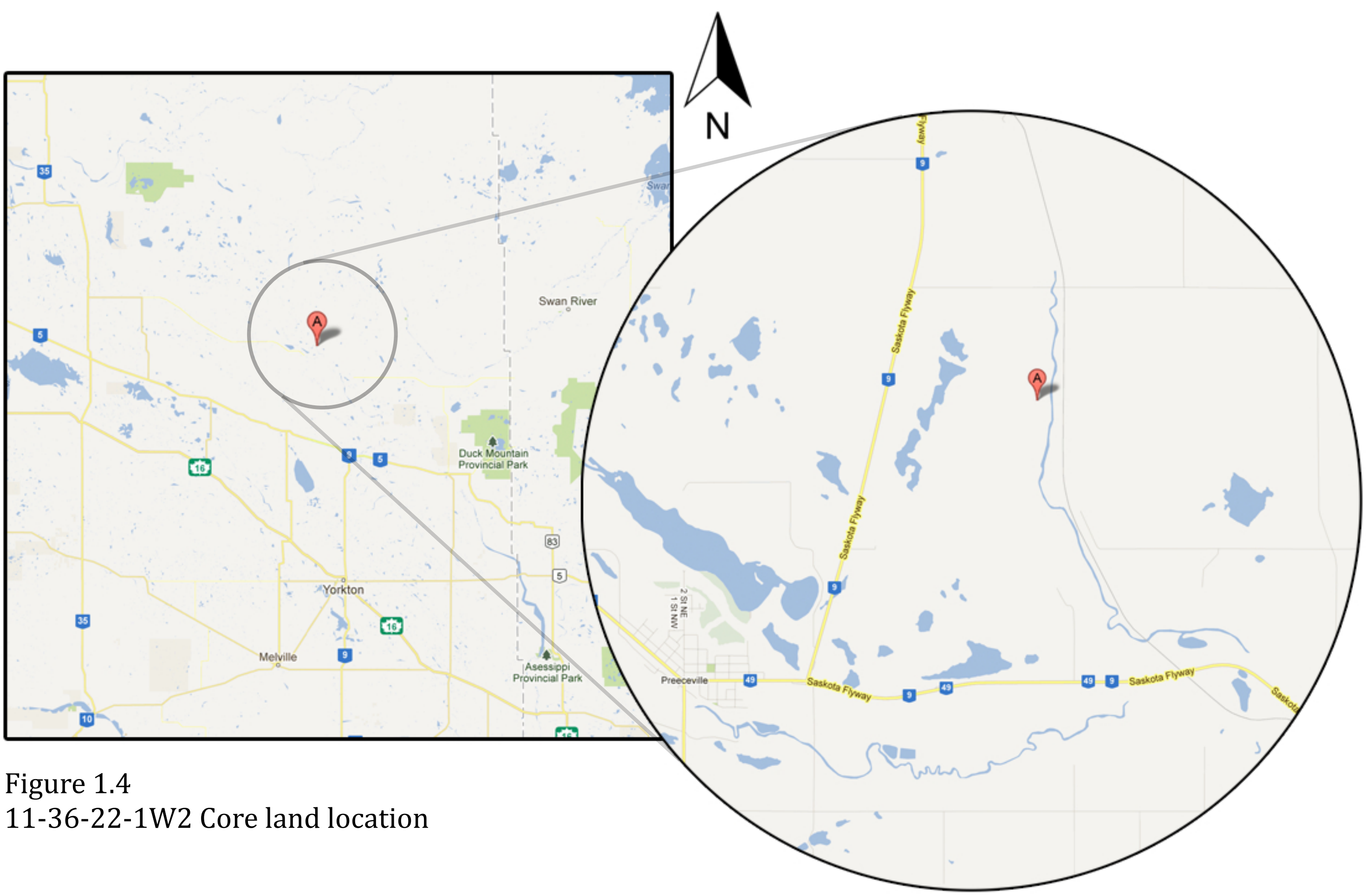

Figure 1.4
11-36-22-1W2 Core land location

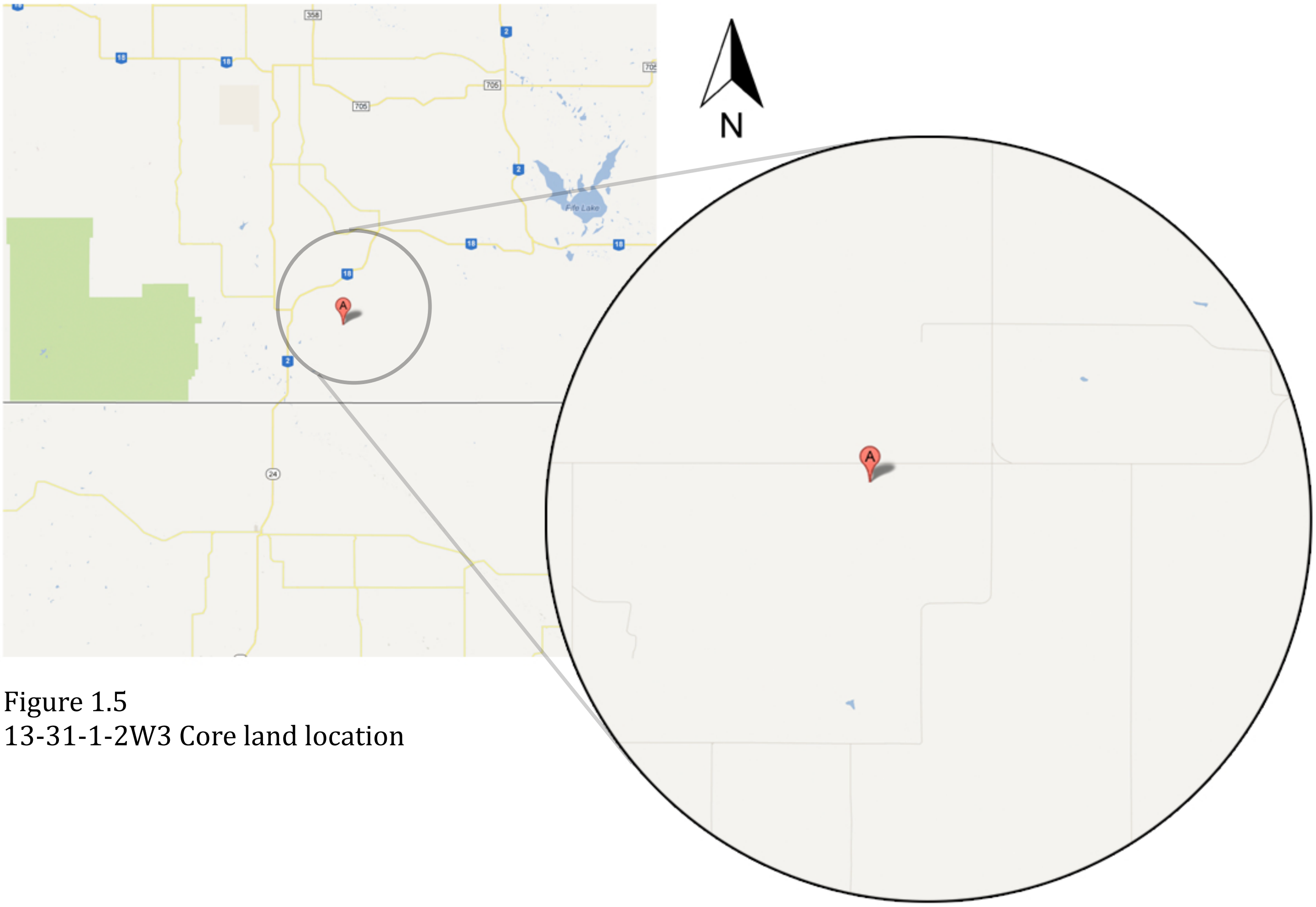

Figure 1.5
13-31-1-2W3 Core land location

Photographs

Figure 2.1

Figure 2.2

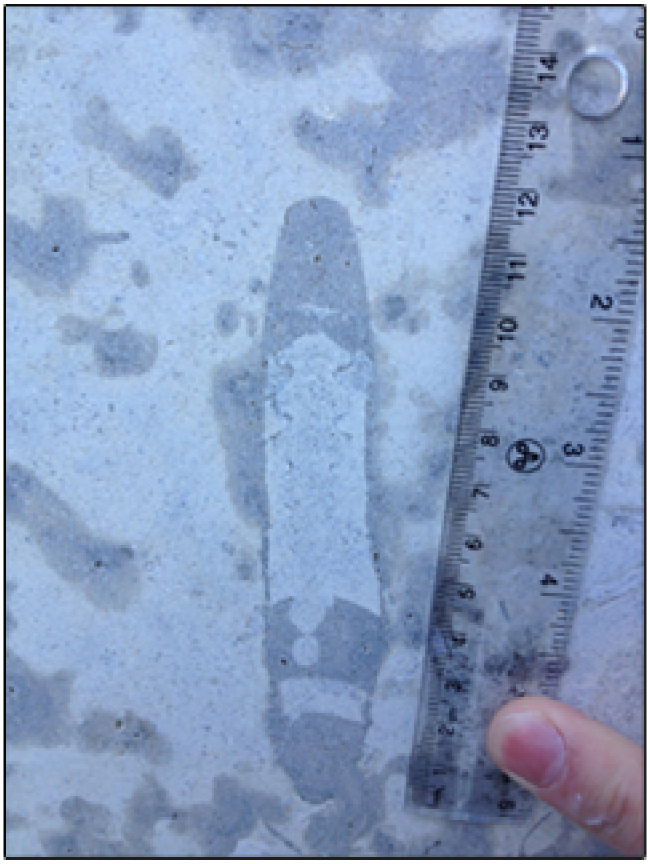

Figure 2.3

Belemnite fossil from the Saskatchewan Disease Control Laboratory. Photo credit: Austin Guilemin

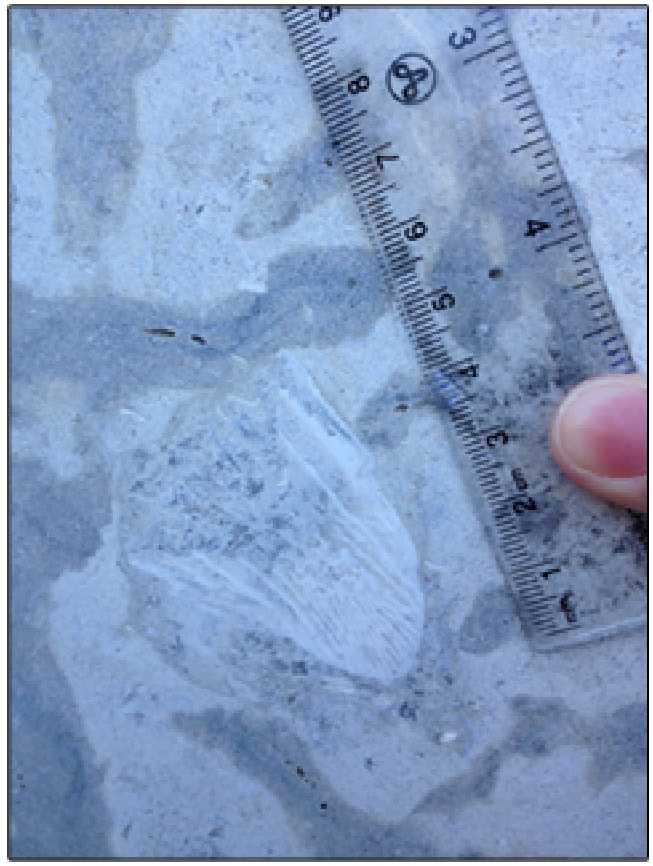

Figure 2.4

Rugose coral from the Saskatchewan Disease Control Laboratory. Photo credit: Austin Guilemin

Figure 2.5

31-51-8W2 core displaying oxidized dolomitized limestone that had been sub-aerially exposed at ~266 m. This sample displays a significant amount of anhydrate.