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A Study of Jurassic Paleoenvironment and Paleoclimate in the Western Canadian Sedimentary Basin Using Foraminiferal Assemblages

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Introduction

Correct age dating and detailed analysis of paleoenvironments and climatic influences are key in understanding the depositional history of a region throughout time. In many cases, foraminiferal assemblages tend to be more specific in their stratigraphic range and more abundant in sample. Therefore, alongside biostratigraphy developed from ammonites and bivalves, foraminiferal assemblages can provide a better understanding of a basin's history. This is especially important in a basin such as the Western Canadian Sedimentary Basin (WCSB) since depositional conditions and age have a strong control on hydrocarbon potential. Jurassic stratigraphy in the WCSB is problematic since unconformities and facies changes complicate lithostratigraphy and biostratigraphy. Analyzing taxonomy of foraminiferal samples from various locations across Alberta, including the Shaunavon Formation, Rierdon Formation, Husky Formation, and Fernie Formation, specifically the Grey Beds, Green Beds and Passage Beds, leads to a more accurate interpretation of the paleoclimatic influences on the basin during the Jurassic. The objective of this study is to evaluate the dominant and subdominant foraminiferal genera as well as examine abundance of agglutinants compared to calcareous tests for each formation to determine more accurate ages and paleoenvironment conditions during the Jurassic in the WCSB. Included in this is a focused study on the evolution of the reticulate test ornamentation in foraminifera from the Oxfordian Green Beds of the Fernie Formation and its indication of paleoclimatic influences acting on the basin.

Method

Foraminifera-bearing samples from various locations across Alberta within the Shaunavon, Rierdon, Husky and Fernie Formations were examined using a stereoscopic microscope and scanning electron microscope. Taxanomic evaluation of each specimen allowed them to be sorted into genera and catagorized based on their quantity. Abundant specimens were present more than 40 times per sample, frequent specimens were present 20 to 40 times per sample, common specimens were present 10 to 20 times per sample and rare specimens were those that were found fewer than 10 times per sample. The ages of the identified specimens were then compared with the accepted age of the formations to create a biostratigraphic chart.

Examples

Plates 1 and 2:

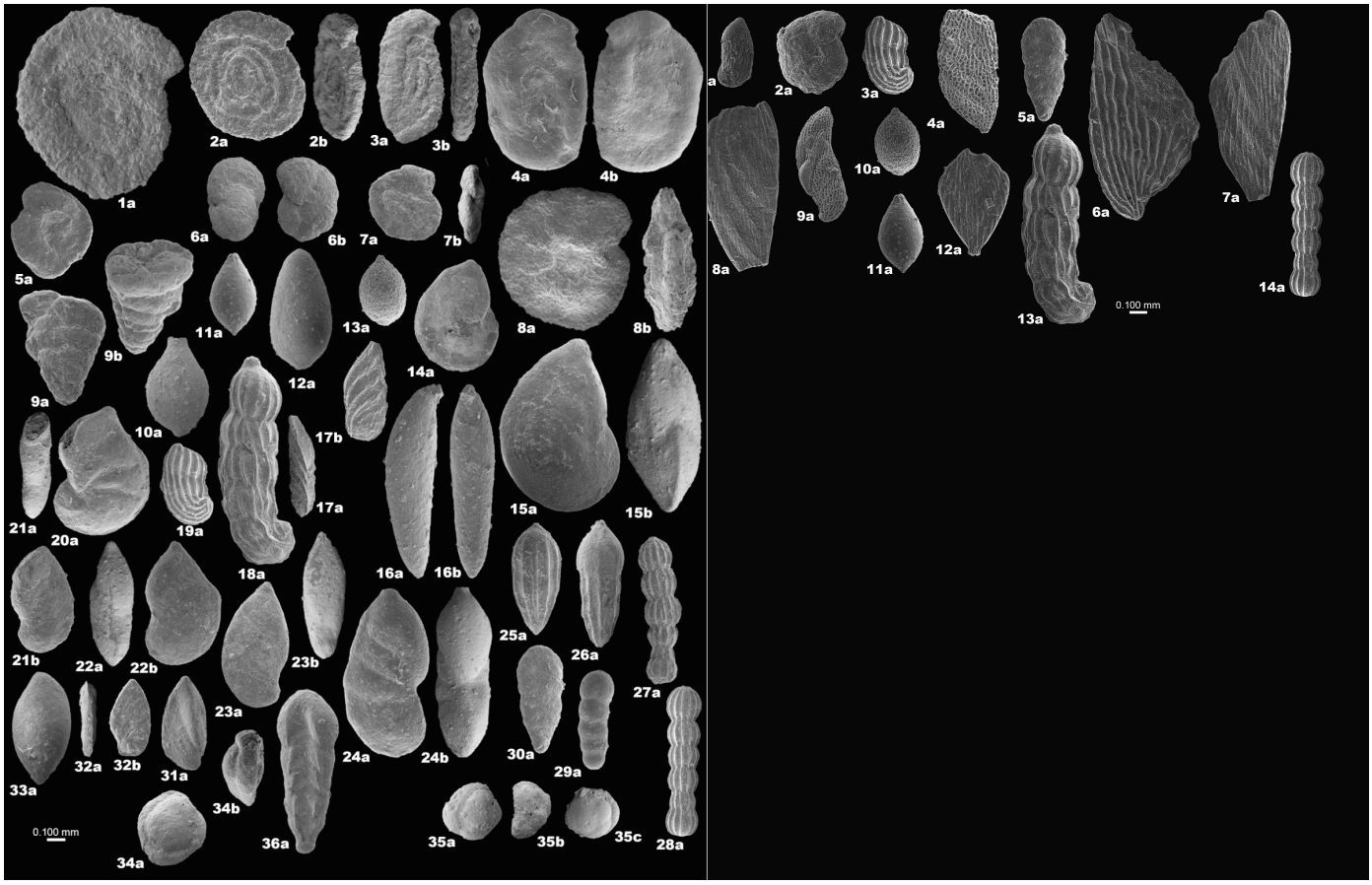

Plate 1 (left). Green Beds 1- 2. *Ammodiscus cheradospirus* Loeblich and Tappan 1950, 3-5. *Glomospira variabilis* Kubler and Zwingli 1870, 6. *Haplophragmoides* cf. *mirandus* (Dain 1972) n. sp., 7. *Haplophragmoides canui* Cushman 1930, 8. *Haplophragmoides* cf. *goodenoughensis* Chamney 1969 n. sp., 9. *Eomarsonella paraconica* Levina 1972, 10-12. *Ramulina* n. sp., 13. *Globulina* n. sp., 14-15. *Lenticulina audax* Loeblich and Tappan 1950, 16. *Astacolus aphrastus* Loeblich and Tappan 1950, 17. *Astacolus sibirensis* Kosyreva in Dain 1972, 18-19. *Marginulinopsis phragmites* Loeblich and Tappan 1950, 20-24. *Vaginulinopsis eritheles* Loeblich and Tappan 1950, 25-26. *Nodosaria daedala* Loeblich and Tappan 1950, 27-28. *Nodosaria orthostoecha* Loeblich and Tappan 1950, 29. *Lingulina tumida* Loeblich and Tappan 1950, 30. *Lingulina lordosa* Loeblich and Tappan, 31. *Saracenaria dixoni* Georgescu and Braun 2013, 32. *Planularia lidigrigia* Kosyreva in Dain 1972, 33. *Paleopolymorphina elactoides* Loeblich and Tappan 1950, 34-35. *Ceratobulimina poliarica* Dain 1972, 36. *Geinitzinita praenodulosa* Dain 1972

Plate 2 (right). Addition specimens from Jurassic formations of the WCSB showing well developed test wall structure, including specimens (4 and 9) displaying reticulate wall structures.

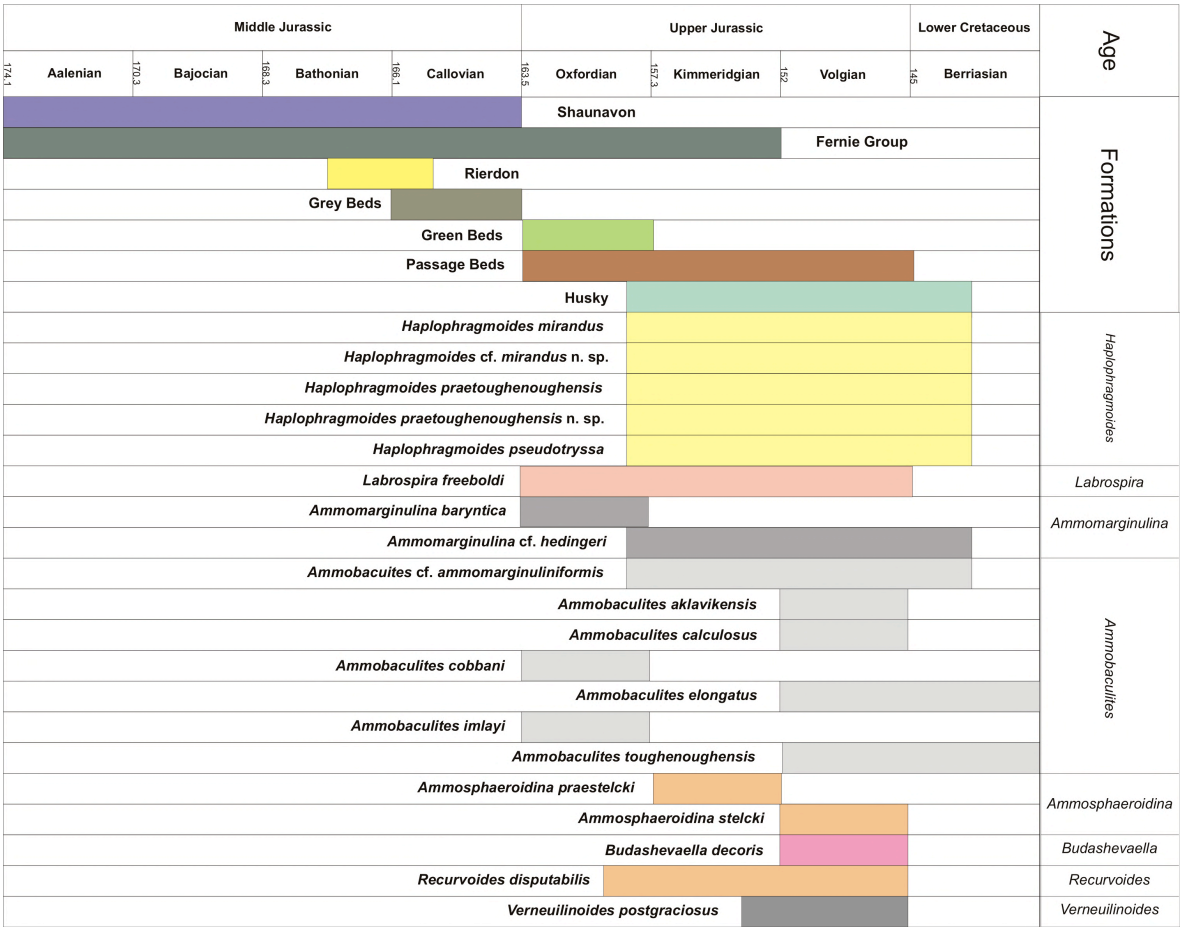

Chart 1: Biostratigraphic chart showing the ages of each formation and the age distribution of representative species identified in this study.

Conclusions

For certain foraminiferal species, the biostratigraphic chart confirms the accepted ages of the formations involved in this project. However, where the ages of specimens and their containing units did not correlate, it is evident that either the species and/or unit were not well defined. There are many foraminiferal species whose age range is broad and, because of this, are not effective index species. Emphasis was therefore placed on those species whose age is more restricted. Foraminiferal samples collected from the Passage Beds in the Fernie Formation and samples from the Husky Formation all correlated perfectly. Samples from the Shaunavon Formation, Rierdon Formation, Fernie Grey Beds and Fernie Green Beds all contained species that did not correlate with the accepted ages of their locations. Additional research into resolving the identification and dating of these species is necessary.

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