Notice of the Final Oral Examination
for the Degree of Master of Science
of
SEAN GAZDEWICH
BSc (Carleton University, 2018)

“Authigenic Carbonate Burial and Its Impact on the
Global Carbon Cycle: A Case Study from Late Devonian Strata
of the Western Canada Sedimentary Basin”

School of Earth and Ocean Sciences

Thursday, June 18, 2020
1:00 P.M.
Remote Defence

Supervisory Committee:
Dr. Jon Husson, School of Earth and Ocean Sciences, University of Victoria (Supervisor)
Dr. Laurence Coogan, School of Earth and Ocean Sciences, UVic (Member)
Dr. Chris Barnes, School of Earth and Ocean Sciences, UVic (Member)

External Examiner:
Dr. Chris Holmden, Geological Sciences, University of Saskatchewan

Chair of Oral Examination:
Dr. Margo Matwychuk, Department of Anthropology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract

It has been hypothesized that authigenic carbonate minerals, formed within the pore spaces of marine siliciclastic formations during early diagenesis, may have had a substantial influence on the global carbon cycle, particularly in times of low oxygen in Earth history. According to this idea, alkalinity is generated via anaerobic organic matter degradation, resulting in carbonate oversaturation and the precipitation of depleted $\delta^{13}C$ carbonate cements. If a substantial amount of isotopically depleted carbonate were being sequestered in this authigenic sink, this would have the effect of driving $\delta^{13}C$ DIC to more enriched values without significant organic carbon burial – a signal which would be recorded in marine carbonates. Research presented herein tests this hypothesis from newly acquired lithostratigraphic and chemostratigraphic data of Late Devonian limestone and black shale formations preserved within the Western Canada Sedimentary Basin. The Late Devonian includes a Paleozoic mass-extinction event, and is characterized by pervasive ocean anoxia and a crash in carbonate depositional systems. As such, it is thought to represent an ideal time for the emergence of an active authigenic carbonate sink. Results show that both basinal shale formations and platform carbonates record a $\delta^{13}C$ signal that is within the expected range of Devonian seawater, signifying that precipitated authigenic carbonate was not depleted enough to influence the isotopic composition of DIC. It was observed, however, that evaporitic depositional settings can host markedly depleted carbonate sediment, potentially caused by local water column organic matter recycling. If such restricted marginal-marine environments were globally pervasive, such as during global sea-level lows, it is plausible that the carbon isotope mass balance would be affected.