# The Biostratigraphy and Evolution of a Pennsylvanian-Permian Carbonate Ramp, East-central British Columbia

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## 1. Introduction

A carbonate succession in east-central British Columbia in the Sukunka-Kakwa area is characterized by oolitic and bioclastic shoals, shallow ramp and restricted inner ramp deposits. These carbonate deposits are interstratified with several conglomerates that are interpreted to represent erosion linked with tectonic activity (Henderson et al., 2010). This study uses biostratigraphy to constrain the timing of climatic and tectonic events documented by this carbonate succession. The detailed carbonate petrology of this succession shows faunal and rock fabric changes that provide a window into the changing depositional environments during the Pennsylvanian-Permian along the north-western margin of Pangea. The most representative section in the study area is Fellers Creek, which provides an example of the major units found in east-central British Columbia.

## 2. Background and Geologic Setting

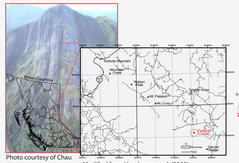


Photo courtesy of Chau (2009)

Modified from Henderson et al. (2010)

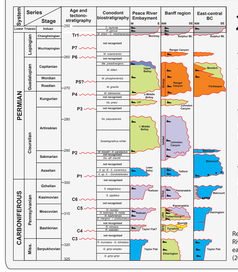
The study area is located in east-central British Columbia

Fellers Creek is the focus of this study and highlighted in red on the location map

The strata at Fellers Creek was deposited adjacent (west) to the Peace River Embayment (PRE)




Modified from Henderson et al. (2002)




### 2.1. Stratigraphy

The Permian Fantasque Formation is equivalent to the Upper Beloy from the PRE

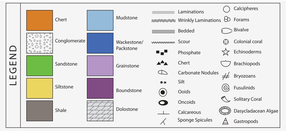
The Permian portion of the Belcourt Formation is equivalent to the subsurface Lower Belloy Formation in the PRE

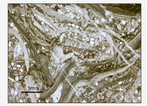
The Pennsylvanian portion of the Belcourt Formation is equivalent to the subsurface Ksituan in the PRE

Regional stratigraphy showing correlative units from the Peace River Embayment, the Banff Region, and the study area in east-central British Columbia. Modified from Henderson et al. (2010).

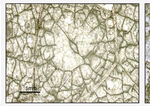
## 3. Paleoclimate

### 3.1. Sedimentology: Carbonate Associations

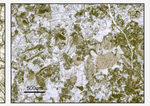


79.4 m Brachiopod Packstone

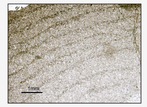


66 m: Coral Boundstone

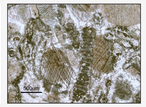


56.1 m: Bryozoan-Echinoderm Grainstone

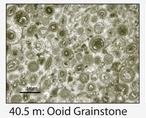
55.5 m: Bryozoan-Echinoderm Grainstone



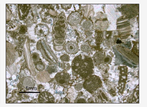
54.7 m: Wrinkly-Laminated Dolostone



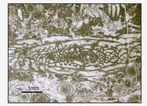
45.1m: Algal-Echinoderm Grainstone



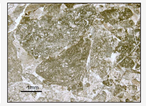
40.5 m: Ooid Grainstone



39.3 m: Bioclastic Grainstone

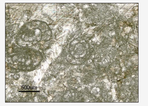


38.2 m: Ooid Grainstone

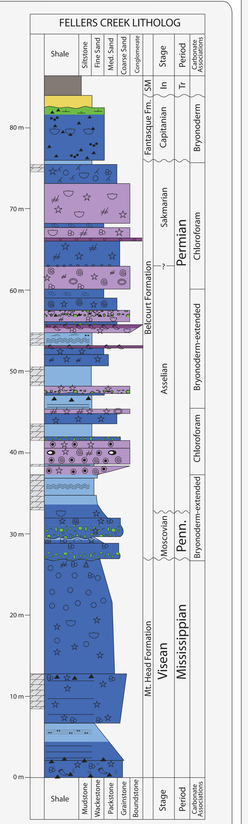


31.9 m: Conglomerate

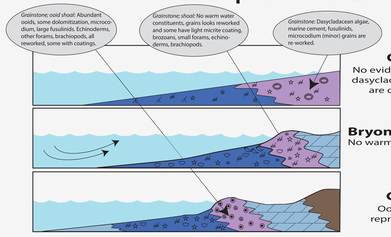
27 m: Basal Belcourt Conglomerate



12.5 m: Visean Endothyrid packstone




### 3.2. Depositional Environment



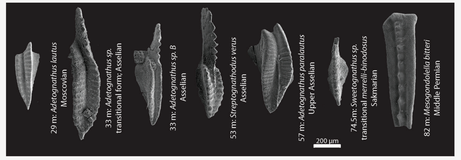

**Sakmarian Chloroforam Ramp**
No evidence for back ramp deposits, but dasycladacean algae and marine cement are clear warm water constituents

**Asselian Bryonoderm-extended Shoal**
No warm water constituents. Possible zone of upwelling

**Asselian Chloroforam Shoal**
Ooids, large fusulinids and algae representing a warm water carbonate association

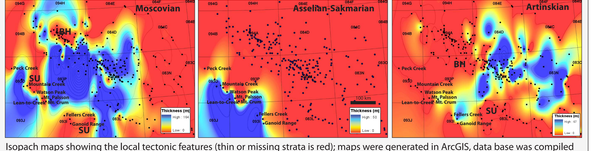
## 4. Tectonic History

### 4.1. Biostratigraphic Constraint



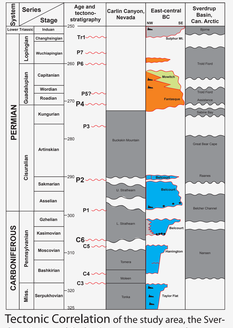

- Conodonts are the primary tool used for contraining the timing of tectonic events.
- Fusulinid and Endothyrid forams were also used; at 30 m, *Pseudostafella sp.* combined with *A. lautus* helped contrain age to Moscovian.
- A colonial rugose coral at 66 m gave an age of Early to Mid Sakmarian; *Protowentzelella kunthi (*see photo under section 3; Pers. Comm. W. Bamber, 2010*).*

### 4.2. Preliminary Paleo-geography

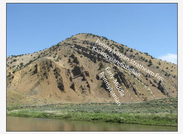



Isopach maps showing the local tectonic features (thin or missing strata is red); maps were generated in ArcGIS, data base was compiled from student theses: P. Chung, K. Fossenier, L. Dunn and J. Ing. SU= Sukunka Uplift, BH= Beatton High.

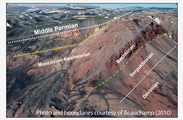
### 4.3. Correlation Along the Western Margin of Pangea




Tectonic Correlation of the study area, the Sverdrup Basin and Carlin Canyon area in Nevada. Tectonic sequences and stratigraphy modified from Snyder et al. (2002) and Henderson et al. (2010).



C6 unconformity (Sub-late Pennsylvanian) seen in outcrop at Carlin Canyon




Sub-Middle Permian unconformity (Melvillian disturbance) seen in outcrop in the Canadian Arctic. Equivalent to the P4 unconformity.


Paleogeography of North America during the early Permian. The three tectonically correlated deposits are indicated with stars and include the Sverdrup Basin, farthest north, the study area in the middle, and Nevada in the south. Blakey (2009).

## 5. Conclusions

- This study constrains the timing of paleoclimatic and tectonic events that affected the depositional environment at Fellers Creek.
- The timing of tectonic events recorded at Fellers Creek correlates with those described by Snyder et al. (2002) from Nevada.
- This study correlates to a shift in ocean circulation first recognized in the Canadian Arctic for the Sakmarian along the northwest margin of Pangea.
- A better understanding of these carbonate ramp deposits will further constrain the hydrocarbon bearing facies. The Pennsylvanian portion of the Belcourt Formation is equivalent to the Ksituan member, an important gas play. The Permian portion of Belcourt Formation is equivalent to the Lower Belloy and the Fantasque is equivalent to the Upper Belloy; both units are known hydrocarbon targets in the subsurface (Dunn, 2003).

### 5.1. Future Work

- These paleo-reconstructions will become more complete with the addition of data from all of the outcrops within the study area.
- Additional field data at new outcrops will help to further complete the paleogeographic reconstruction in this area.

## Acknowledgements

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