Characterizing Maritime Reservoirs for Geological Carbon Storage

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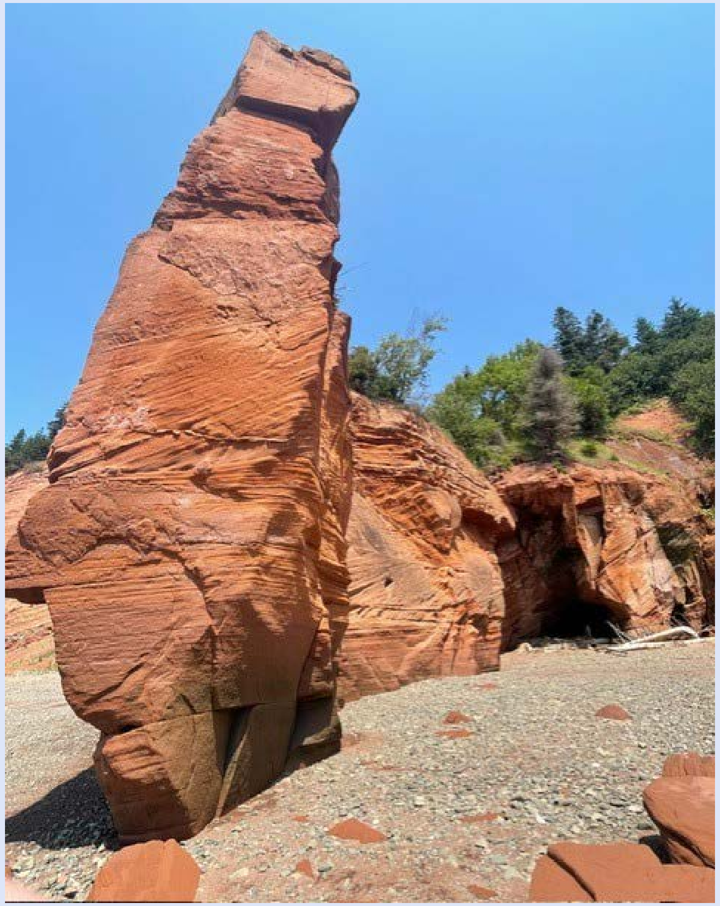
Contents



Project Overview

Scope of Work

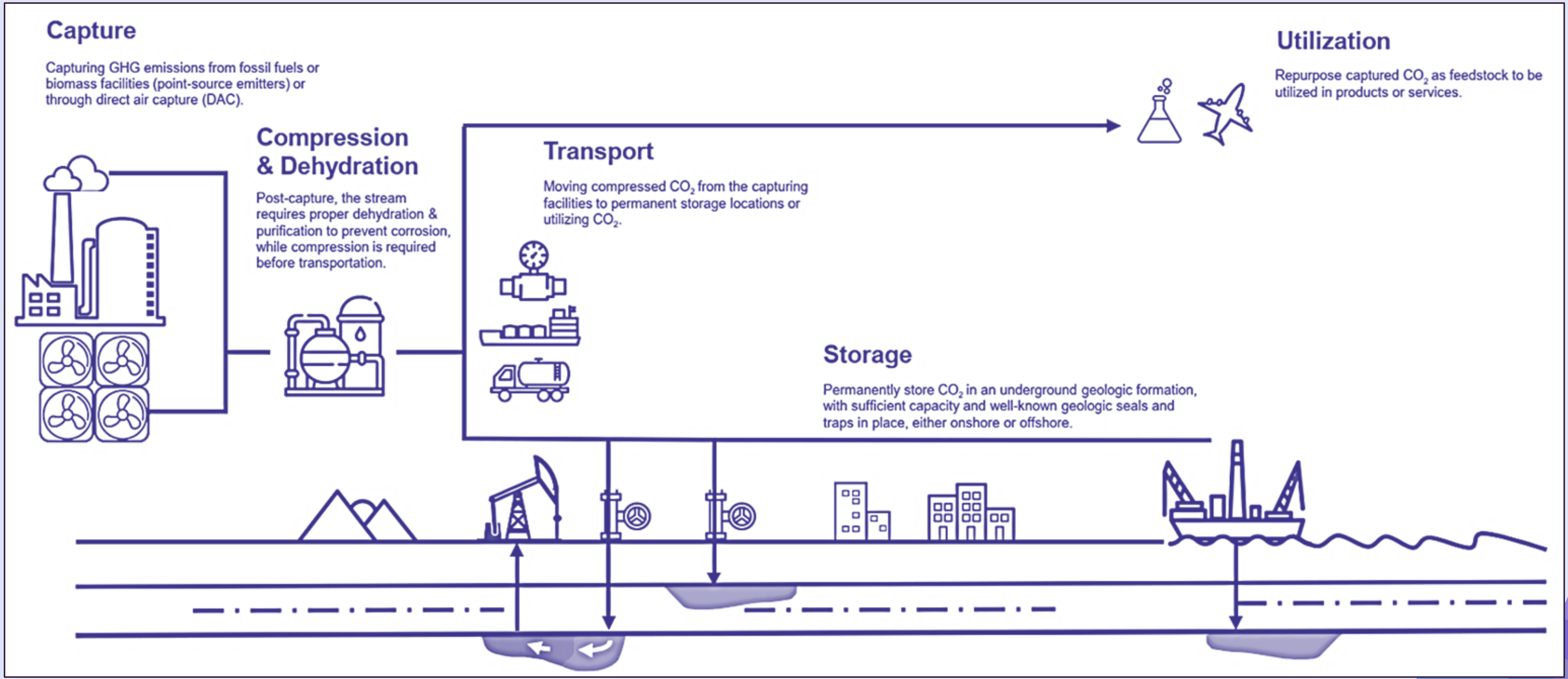
Evaluation of Carbon Storage Potential in Atlantic Canada

Along with researchers from Memorial University, University of New Brunswick, University of Waterloo, this project takes a multi-disciplinary and multi-scale approach to evaluating carbon storage potential in Paleozoic and Mesozoic strata in Atlantic Canada.

Project Objectives

- Reservoir facies macro-characterization of clastic and carbonate reservoirs onshore and offshore NS and NB through wellbore, outcrop, and outcrop analogue analysis.
    - Defining 3D reservoir facies, net-to-gross, and connectivity at the sub-seismic scale.
    - Applying lithofacies analysis from the outcrop to the subsurface.
    - Defining geobody and architectural elements for reservoir modelling.
- Reservoir facies micro-characterization of siliciclastic reservoirs through core and outcrop data including petrographic analysis.
    - Micro-scale reservoir composition and properties of representative reservoir porosity and permeability of clastic and carbonate facies.
- Static and dynamic fluid flow modelling of representative storage reservoirs in NS and NB.

Carbon Capture & Storage



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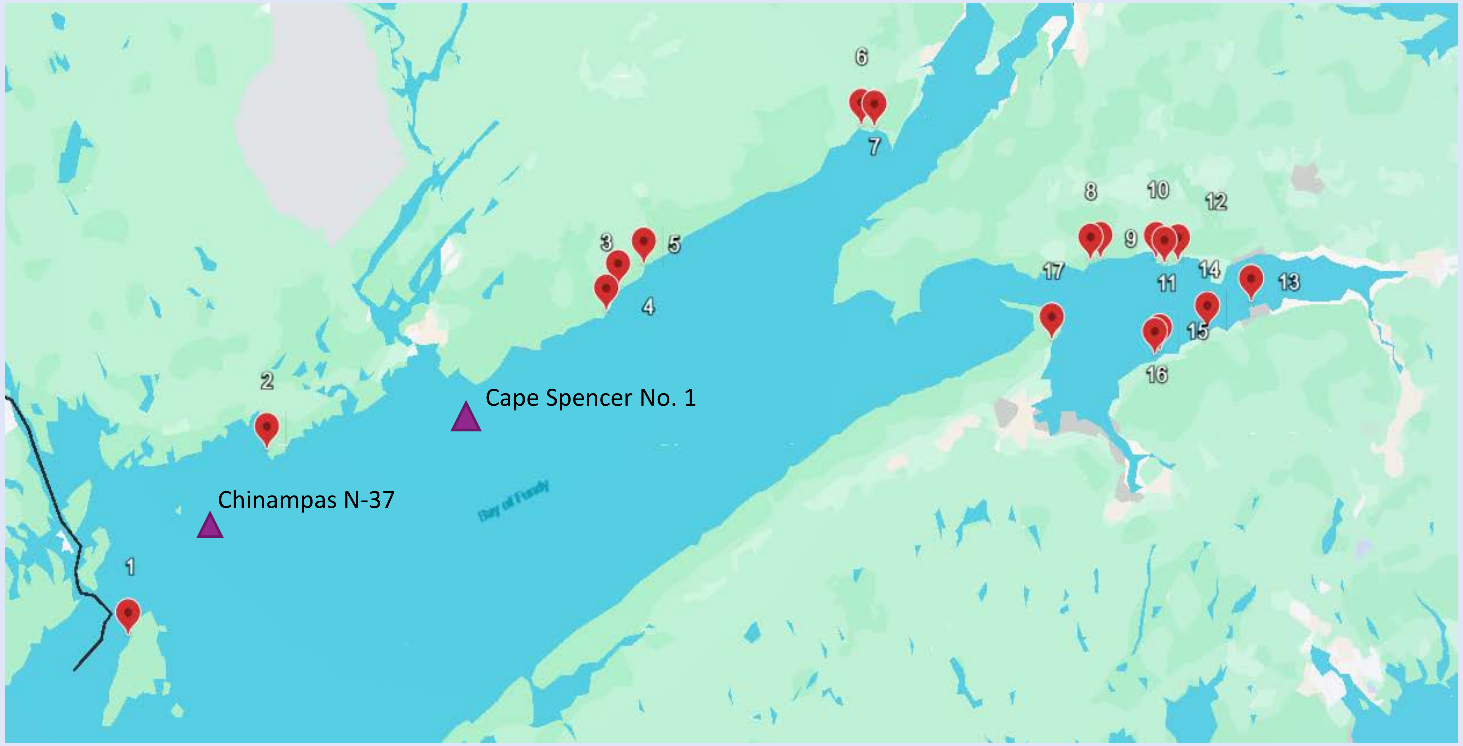
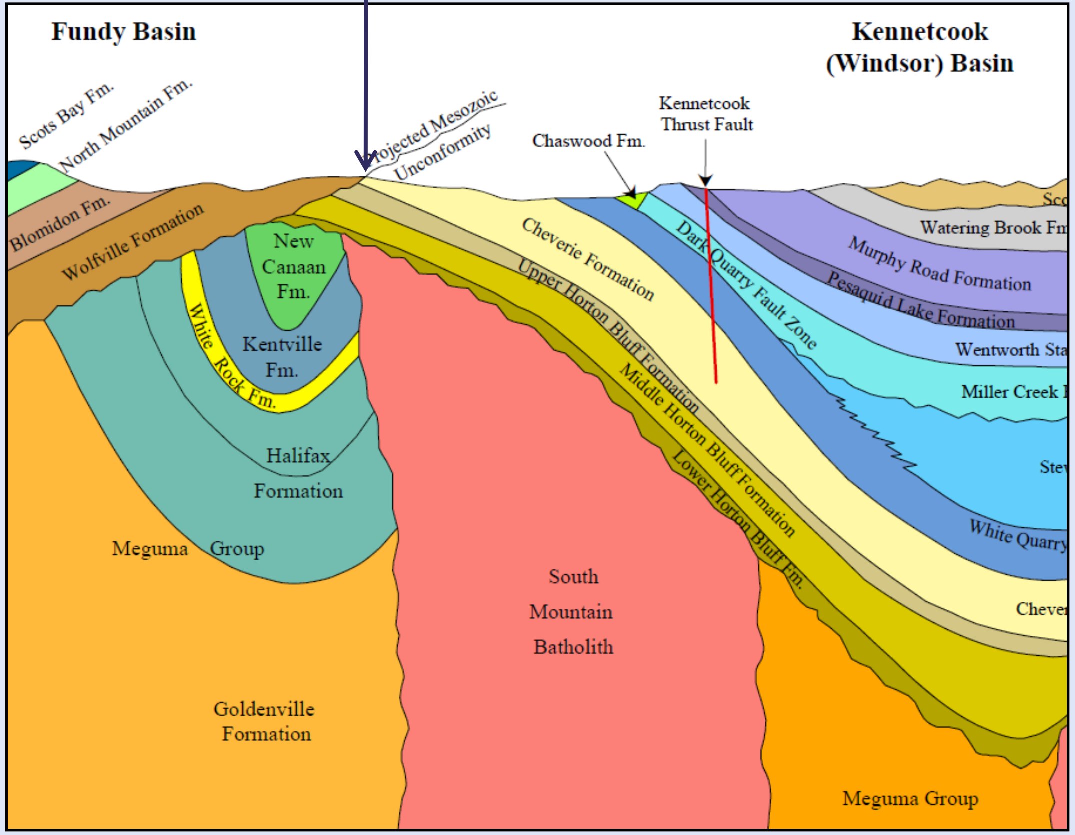
Study Area – Bay of Fundy Mesozoic Strata

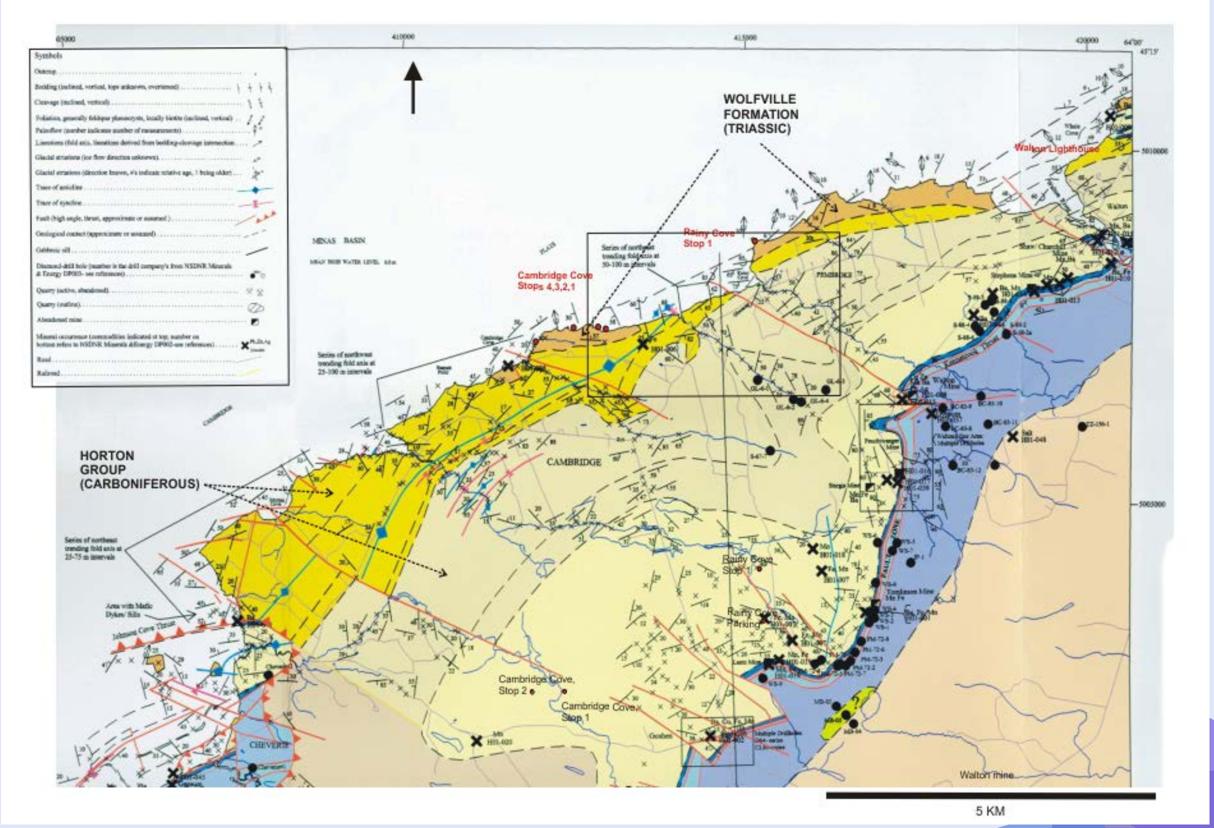


1 – Grand Manan Island
2 – Lepreau Point
3 – Browns Beach
4 – Saint Martins Sea Caves
5 – Melvins Beach
6 – Dennis Beach
7 – Waterside Beach
8 – Wasson Bluff
9 – McKay Head
10 – McCoy Brook
11 – Red Head
12 – Five Islands
13 – Burntcoat Head
14 – Tennycape
15 – Ivan's Point
16 – Rainy Cove
17 – Blomidon

Geological Setting

Rainy Cove Study Area





NSDNR, 2009

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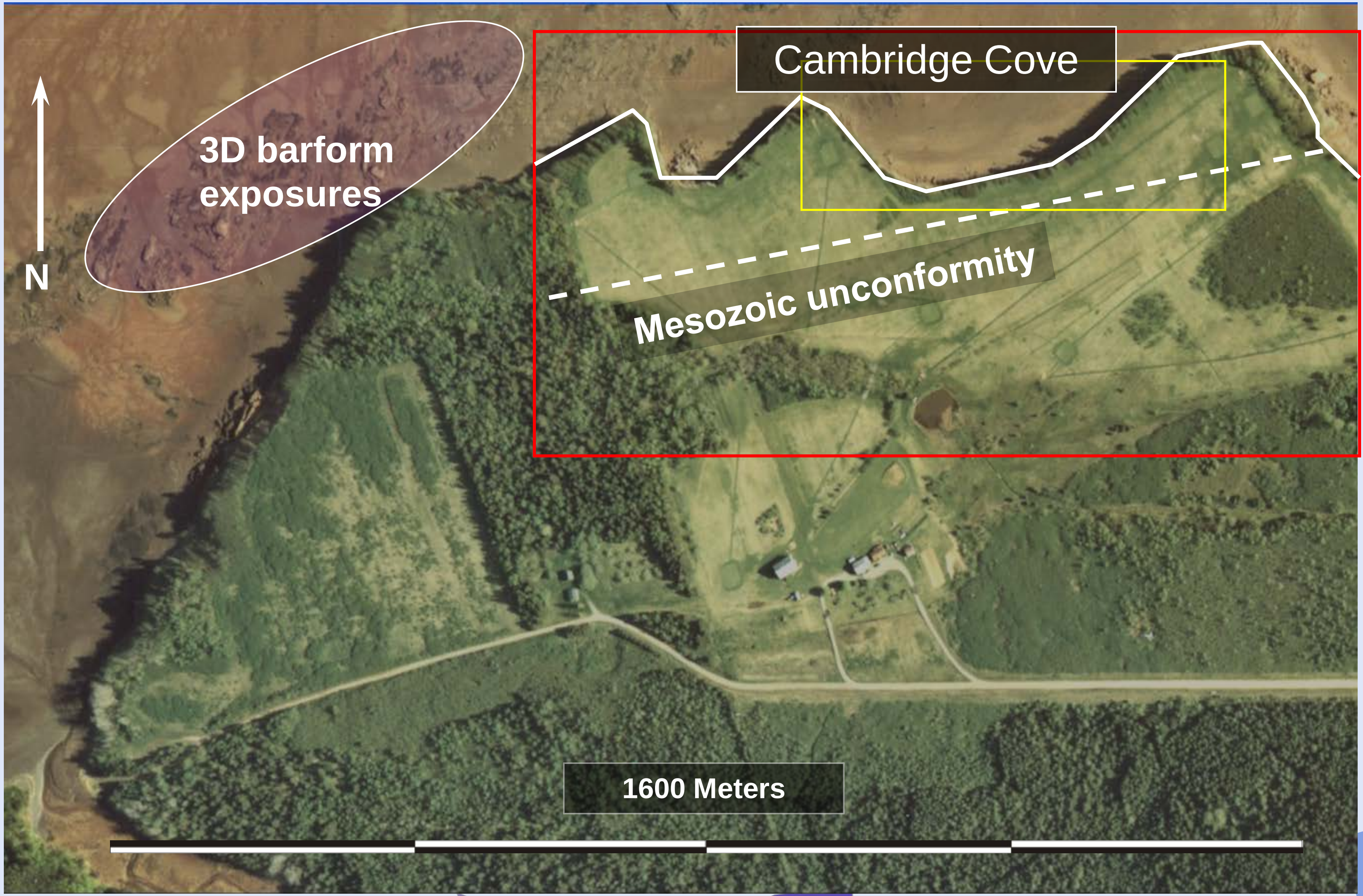
Study Area



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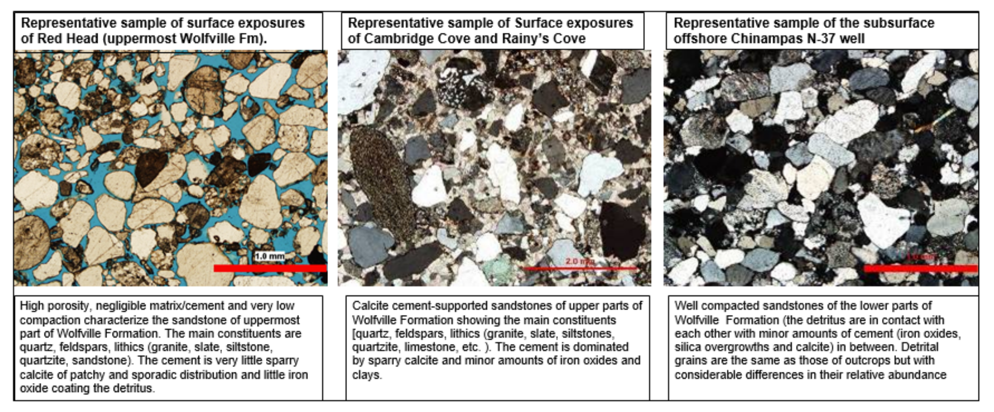
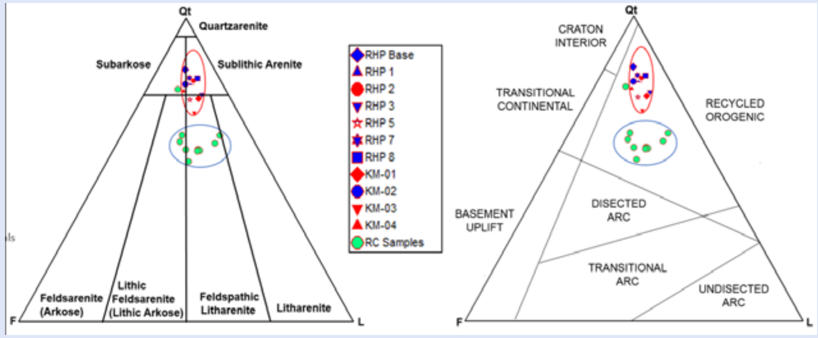
Existing Research

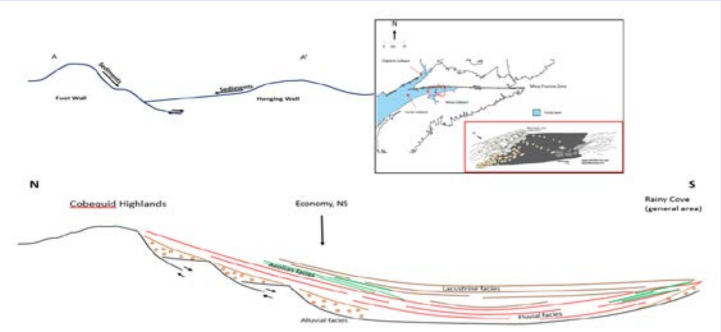
Existing Knowledge Base

Existing Research

Work has already been completed at various study locations for this project, including macro and micro characterizations in Mesozoic analogs in the Bay of Fundy.







Current Research

Methodology and Status

Equipment

GR-135 Scintillometer

Handheld XRF

Georadis

DJI Mavic Mini Drone

TinyPerm 3 Permeameter

Measurements

Scintillometer and Georadis measurements of some of the samples collected this summer.

Sample #	Georadis #	K (ppm)	U (ppm)	Th (ppm)	Dose (nSv)	Dose Rate (nSv/hr)	Location	Date	Sample N	TOT(PPM)	K(PPM)	U(PPM)	Th(PPM)	TOT(CPM)	K(CPM)
200	12	1.38+/-0.04	<3.0	<8.0	2	24	Waterside	2025-07-02	No. 29	14.4	3.7	3.8	1	544	119
201	13	1.28+/-0.04	<3.0	<8.0	1.9	23	Waterside	2025-07-02	No. 30	14.6	3.2	5.2	0.9	563	109
202	20	1.27+/-0.04	<3.0	<8.0	1.9	23	Waterside	2025-07-02	No. 31	9.2	2.3	1.2	2.1	352	72
203	21	1.42+/-0.04	<3.0	<8.0	1.9	23	Waterside	2025-07-02	No. 32	14.1	3.4	7.4	2.3	540	126
204	22	1.43+/-0.04	<3.0	<8.0	1.9	23	Waterside	2025-07-02	No. 33	16.2	4.7	4.7	6.8	624	155
205	23	1.57+/-0.04	<3.0	<8.0	2	24	Waterside	2025-07-03	No. 34	16.6	4.6	4.9	1.2	639	148
206	24	1.49+/-0.05	<3.0	<8.0	2.1	25	Waterside	2025-07-03	No. 35	10.7	2.5	3.5	2.1	411	86
207	25	1.30+/-0.04	<3.0	<8.0	1.9	23	Waterside	2025-07-03	No. 36	18.1	4.8	7.4	1	695	163
208	26	1.63+/-0.04	<3.0	<8.0	2.1	25	Waterside	2025-07-03	No. 37	8.2	2.5	1.7	0.8	314	77
209	27	1.46+/-0.04	<3.0	<8.0	2	24	Waterside	2025-07-03	No. 38	12.6	3.6	3	6.5	483	119
210	28	1.58+/-0.04	<3.0	<8.0	2	24	Waterside	2025-07-03	No. 39	14.7	3.9	4.7	5.2	567	132
211	29	1.47+/-0.04	<3.0	<8.0	1.9	23	Waterside	2025-07-03	No. 40	12.7	2.8	1.4	11.9	490	95
212	30	1.58+/-0.04	<3.0	<8.0	2	24	Waterside	2025-07-03	No. 49	12.1	2.5	5.9	3.5	465	46
213	31	1.53+/-0.05	<3.0	<8.0	2	24	Lepreau P	2025-07-04	No. 53	13.5	3	4	2.2	517	101
214	32	1.41+/-0.04	<3.0	<8.0	1.9	23	Lepreau P	2025-07-04	No.54	10.3	2.8	2.9	0.8	396	90
215	33	1.67+/-0.05	<3.0	<8.0	2.2	26	Lepreau P	2025-07-04	No. 55	10.6	3.2	2.4	3.7	408	104
216	34	1.57+/-0.04	<3.0	<8.0	2.1	25	Lepreau P	2025-07-04	No.56	19	4	6	8	732	143
217	35	1.42+/-0.04	<3.0	<8.0	1.9	23	Browns Be	2025-07-05	No. 58	11.8	1.9	2.5	8.9	454	70
218	36	1.36+/-0.04	<3.0	<8.0	2	23	Browns Be	2025-07-05	No. 59	11.7	2.8	5.4	2.2	450	102
219	37	1.60+/-0.04	<3.0	<8.0	2	24	Browns Be	2025-07-05	No. 60	9.8	2.1	2.7	0.6	379	69
220	38	1.59+/-0.04	<3.0	<8.0	2	24	Browns Be	2025-07-05	No. 61	11.2	2.3	4.7	4.8	430	89
221	39	1.44+/-0.04	<3.0	<8.0	2	23	Browns Be	2025-07-05	No. 62	12.1	2.5	3.6	4.9	466	90
222	40	1.28+/-0.04	<3.0	<8.0	1.9	23	Browns Be	2025-07-05	No. 63	11	2.3	0.9	11.8	424	79
223	41	1.51+/-0.04	<3.0	<8.0	1.9	23	Browns Be	2025-07-05	No. 64	12.1	2.9	3.3	6.4	464	100
224	42	1.64+/-0.04	<3.0	<8.0	2	24	Browns Be	2025-07-05	No. 65	11.7	2.9	3.9	2.2	430	98
225	43	1.42+/-0.04	<3.0	<8.0	2	24	Browns Be	2025-07-05	No. 66	11.7	2.8	2.4	7.8	499	95
226	14	1.42+/-0.04	<3.0	<8.0	2	24	Browns Be	2025-07-05	No. 67	11.2	2.2	4	3.4	432	79
227	15	1.36+/-0.04	<3.0	<8.0	1.9	23	Melvins B	2025-07-06	No. 72	11.5	2.4	3.2	10.4	442	89
228	16	1.45+/-0.04	<3.0	<8.0	1.7	23	Melvins B	2025-07-06	No. 73	15.8	3.6	5	9.3	608	128
229	17	1.34+/-0.04	<3.0	<8.0	1.9	23	Melvins B	2025-07-06	No. 74	11.3	2.1	5.6	7.5	435	87
230	18	1.54+/-0.04	<3.0	<8.0	2.1	25	Melvins B	2025-07-06	No. 75	11.5	2.2	4.1	7.6	444	85
231	19	1.40+/-0.04	<3.0	<8.0	2	23	Melvins B	2025-07-06	No. 76	10.9	1.2	8.5	4.5	421	72
232	48	1.51+/10.04	<3.0	<8.0	2	24	Rainy Cov	2025-07-17	No. 99	11.4	2.6	1.3	11.9	439	90
233	49	1.37+/-0.04	<3.0	<8.0	2	24	Rainy Cov	2025-07-17	No. 100	9.5	2.9	1.3	7.3	367	94
234	50	1.53+/-0.04	<3.0	<8.0	2.1	25	Rainy Cov	2025-07-17	No. 101	8.8	1.9	1.6	6.4	334	64
235	51	1.51+/-0.04	<3.0	<8.0	2	24	Rainy Cov	2025-07-17	No. 102	7.8	1.8	0.1	6.2	301	56
236	52	1.34+/-0.04	<3.0	<8.0	1.9	23	Rainy Cov	2025-07-17	No. 103	10.8	2.1	2	6.2	414	72
237	53	1.59+/-0.04	<3.0	<8.0	2	25	Rainy Cov	2025-07-17	No. 104	9.7	2.5	0.4	9.1	372	80
238	54	1.48+/-0.04	<3.0	<8.0	2	24	Rainy Cov	2025-07-17	No. 105	9.1	2.8	0.9	3.5	350	86
239	47	1.51+/-0.04	<3.0	<8.0	2	25	Rainy Cov	2025-07-17	No. 106	9.3	2.7	0.5	3.6	358	80
240	44	1.63+/-0.04	<3.0	<8.0	2.1	25	Ivans Poin	2025-07-17	No. 107	6.3	1.5	o	6.1	241	43
241	45	1.45+/-0.04	<3.0	<8.0	1.9	23	Ivans Poin	2025-07-17	No. 108	6.7	1.5	2.6	0.5	250	53
242	46	1.39+/-0.04	<3.0	<8.0	1.9	23	Ivans Poin	2025-07-17	No. 109	10.6	3.1	1.1	6.5	408	97
							Ivans Poin	2025-07-17	No. 110	6.6	2.1	2.2	3.4	253	71
300	55	1.59+/-0.04	<3.0	<8.0	2.1	25	Burntcoat	2025-07-18	No. 111	10.6	2.7	0	10.6	407	82
301	56	1.58+/-0.04	<3.0	<8.0	2.1	25	Burntcoat	2025-07-18	No. 112	11.4	1.8	1.1	11.7	437	67
302	57	1.60+/-0.04	<3.0	<8.0	2	25	Burntcoat	2025-07-18	No. 113	13	3.9	3.8	2.4	499	124
303	58	1.60+/-0.04	<3.0	<8.0	2.2	26	Burntcoat	2025-07-18	No. 114	13.9	3.3	5.4	9.2	534	122
304	59	1.88+/-0.05	<3.0	<8.0	2.3	27	Burntcoat	2025-07-18	No. 115	11.8	2.7	3.8	7.7	456	97
305	60	1.77+/-0.04	<3.0	<8.0	2.2	27	Burntcoat	2025-07-18	No. 116	10.9	2.2	1.1	9	421	75
306	61	1.50+/-0.04	<3.0	<8.0	2.1	25	Burntcoat	2025-07-18	No. 117	9.5	2.4	3.7	3.5	366	86
307	62	1.54+/-0.04	<3.0	<8.0	2.1	25	Burntcoat	2025-07-18	No. 118	12.4	2.7	0.9	13.3	475	92
308	63	1.63+/-0.04	<3.0	<8.0	2.1	26	Burntcoat	2025-07-18	No. 119	10	1.7	3.5	4.7	384	64
309	64	1.55+/-0.04	<3.0	<8.0	2.1	25	Burntcoat	2025-07-18	No. 120	10.9	3.1	2.3	5	421	89
310	65	1.50+/-0.04	<3.0	<8.0	2.1	25	Blomidon	2025-07-19	No. 121	16.4	2.8	4.4	105	630	106
							Blomidon	2025-07-19	No. 122	16.7	4	3.5	12.2	643	137
400	66	1.72+/-0.05	<3.0	<8.0	2.3	28	Blomidon	2025-07-19	No. 123	13.1	3.3	4.5	6.5	502	110
401	67	1.64+/-0.04	<3.0	<8.0	2.1	26	Blomidon	2025-07-19	No. 124	10	1.7	3.1	4.7	384	63
402	68	1.47+/-0.04	<3.0	<8.0	2.1	25	Blomidon	2025-07-19	No. 125	11.2	2.9	3.7	5	429	100
403	69	1.62+/-0.04	<3.0	<8.0	2	24	Blomidon	2025-07-19	No. 126	9.7	1.9	4.1	2	373	71
404	70	1.59+/-0.04	<3.0	<8.0	2.1	25	Blomidon	2025-07-19	No. 127	9.8	2.3	2.9	4.8	377	79

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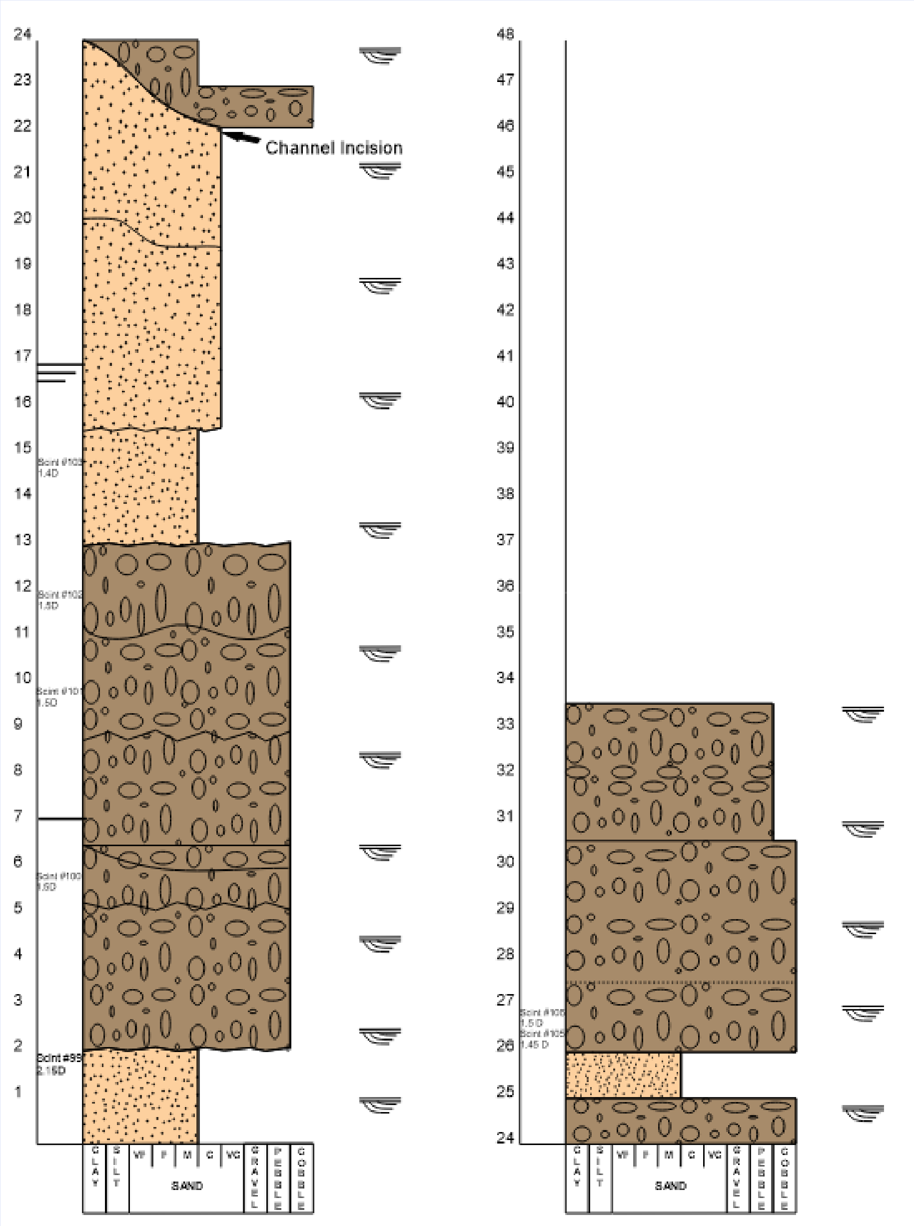
Rainy Cove



Rainy Cove

- The Triassic Wolfville Formation overlays the Carboniferous Horton Group by an angular unconformity. the Wolfville Formation at Rainy Cove comprises of conglomerate and sandstone and is interpreted as a braided river depositional environment.
- Channel incisions and an intra-Triassic unconformity may lead to migration pathways for fluids. Calcite cement (38%) causes porosity to decrease in representative samples from Rainy Cove.

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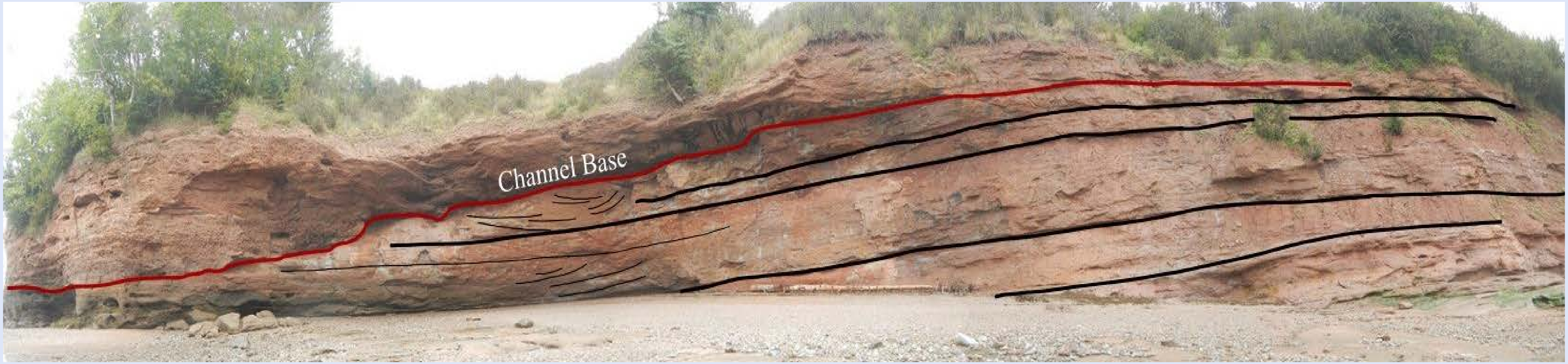
Architectural Elements



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Lithofacies

Clast supported conglomerates are comprised of poorly sorted, well rounded to sub angular clasts (45-90%), ranging in size from 1cm up to 20 cm.

Matrix supported conglomerates are comprised of poorly sorted, well rounded to sub angular clast (25-45%), ranging in size from 1cm up to 20 cm

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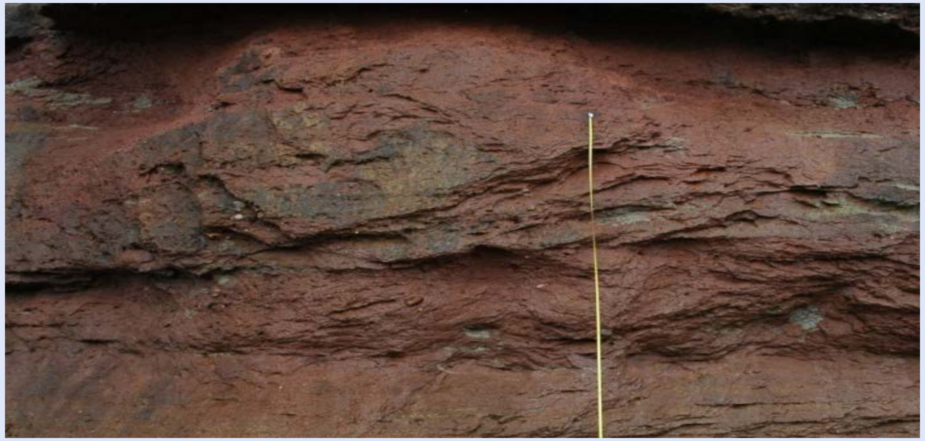
Lithofacies

Red sandstone containing quartz, feldspars, and metasediment grains. Grains were fine to coarse grained in size, rounded to sub angular, and very well sorted.



Paleosols; consist of thin horizons of carbonate bearing sediments found at the top of the laterally extensive sandstone beds.

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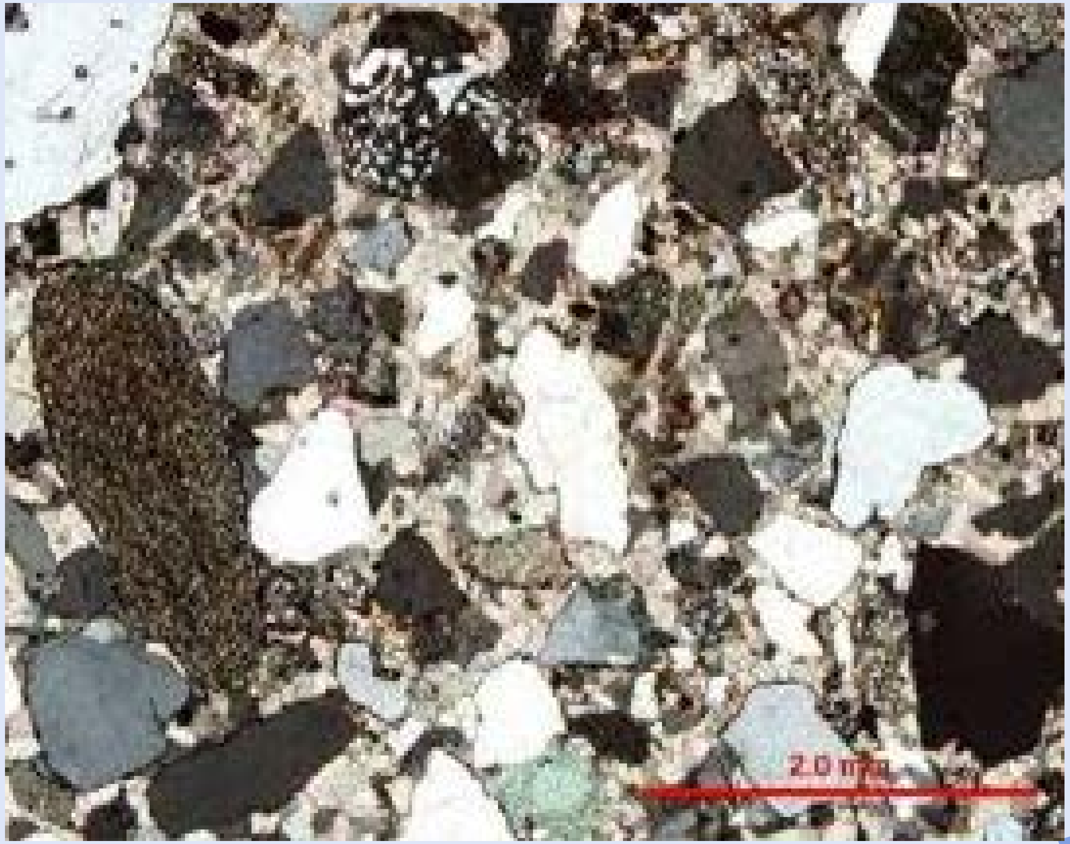
Micro Characterization

Representative sample of surface exposures of Cambridge Cove and Rainy Cove

- Samples collected from Rainy Cove show a calcite cement in the sandstones and conglomerate with minor amounts of clay and iron oxide cement.
- The ratio of cement to total counts is 38%. The average grain size ranges between 0.1-2.2mm (very fine sand to very coarse sand).



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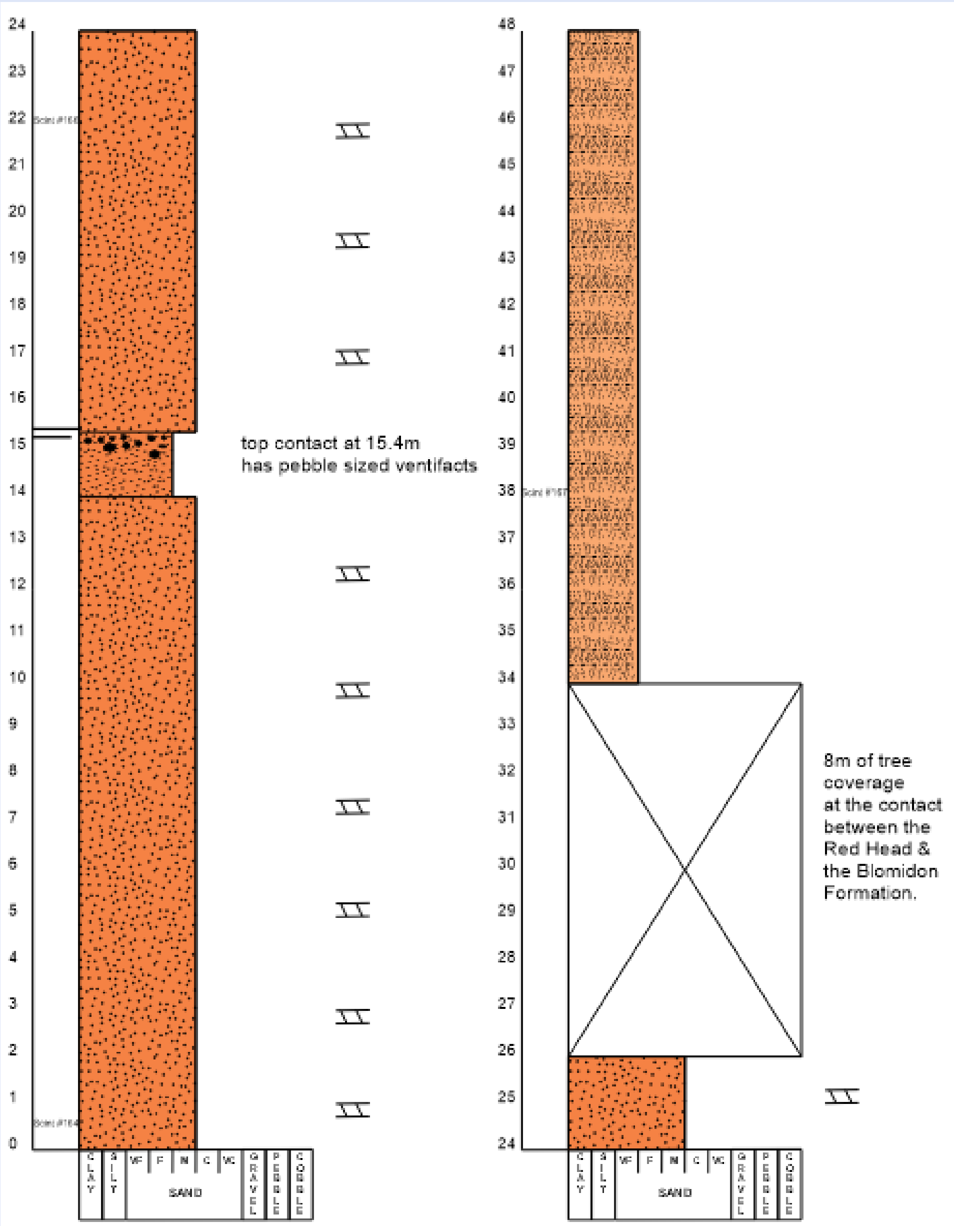
Red Head



Red Head

- Red Head is interpreted as a eolian sandstone and is the uppermost portion of the Wolfville Formation at the Five Islands section.
- The sandstone has good permeability and porosity (23%) due to excellent wind sorting. The variation of dune strata both laterally and vertically produces heterogeneity which could create baffles and barriers to fluid flow in the subsurface. The sandstone has negligible cementation.

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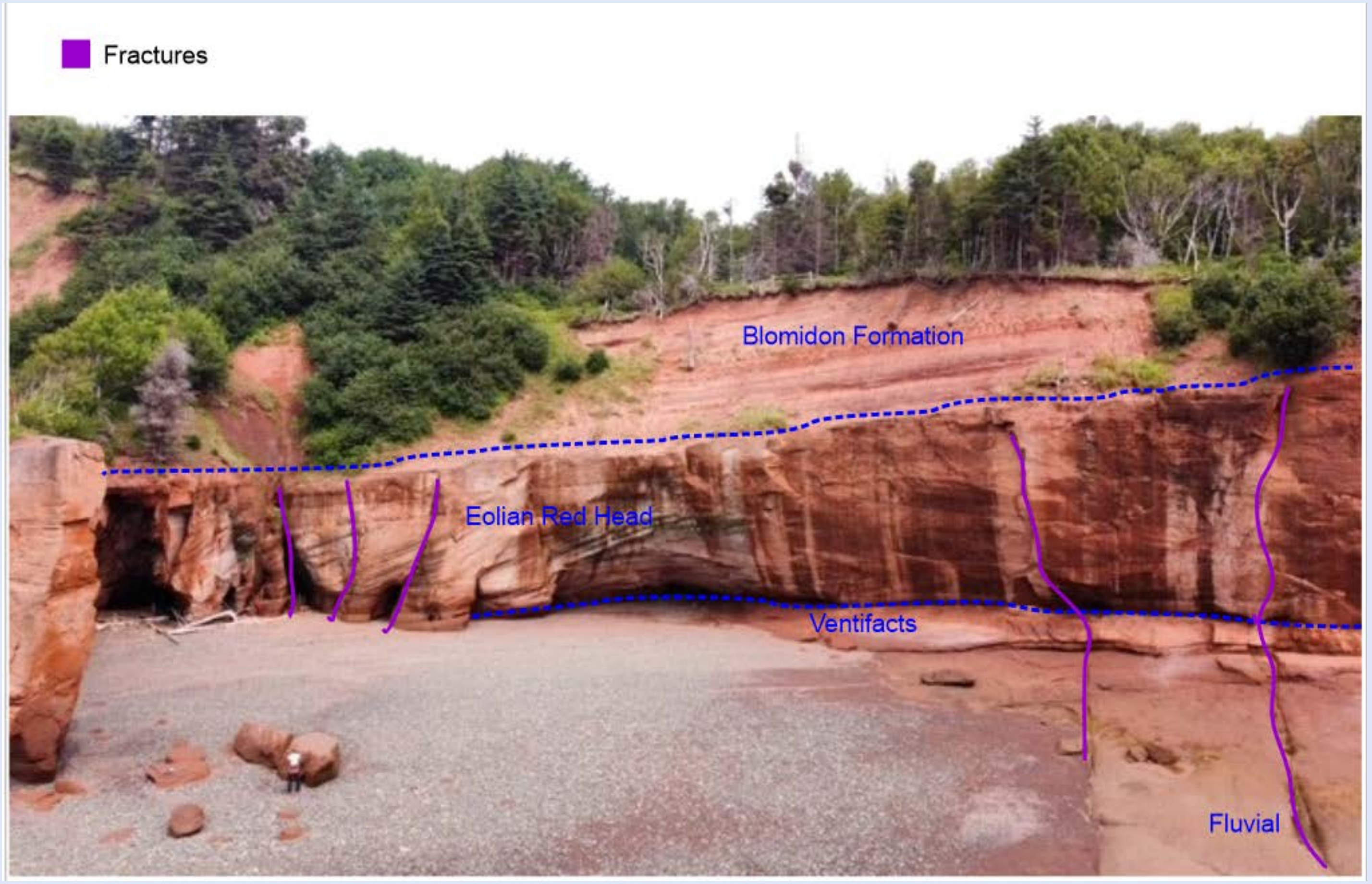
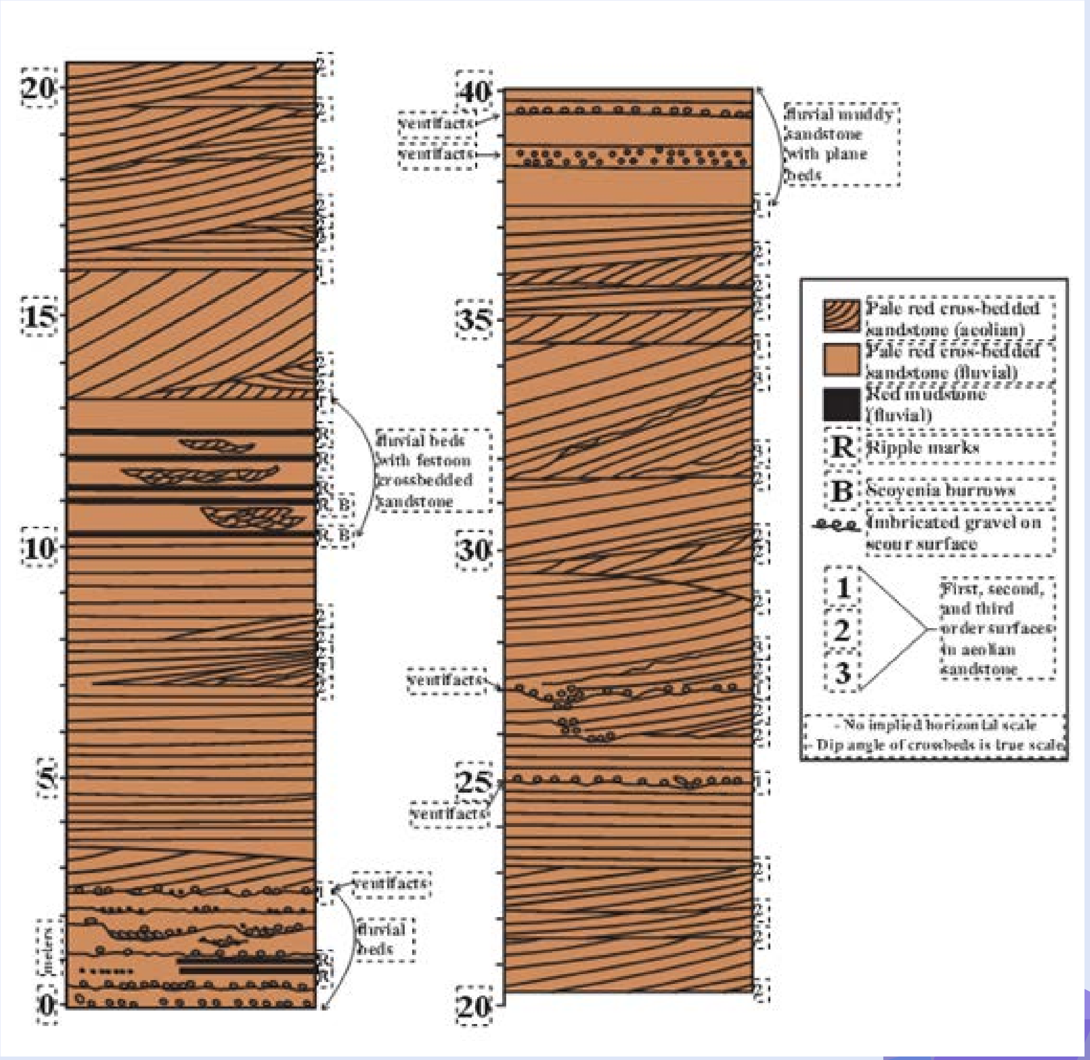
Architectural Elements



Lithofacies

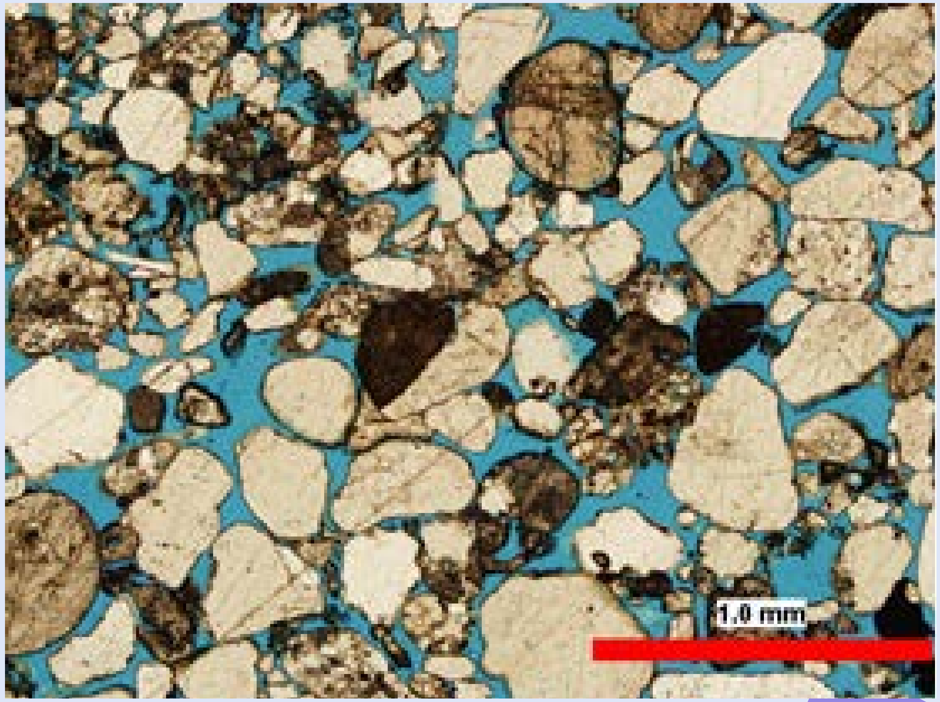
- Red Head has three different lithologies which can be separated into eolian and fluvial depositional environments.
- Hgh angle cross-bedded sandstones(1) are interpreted as the eolian lithofacies.
- Sandstone with ripple marks(2) and the red mudstone(3) are interpreted as fluvial lithofacies.



Micro Characterization

- Samples collected from Red Head show negligible cementation (3%) and very low compaction, the cement that is present is a calcite cement. Grain sizes range between 0.1-0.3mm (very fine sand to medium sand).
- We understand that in the subsurface there could be different diagenesis affecting the porosities and permeabilities measured at the surface.

Representative sample of surface exposures of Red Head (uppermost Wolfville Fm)



Y. Kettanah

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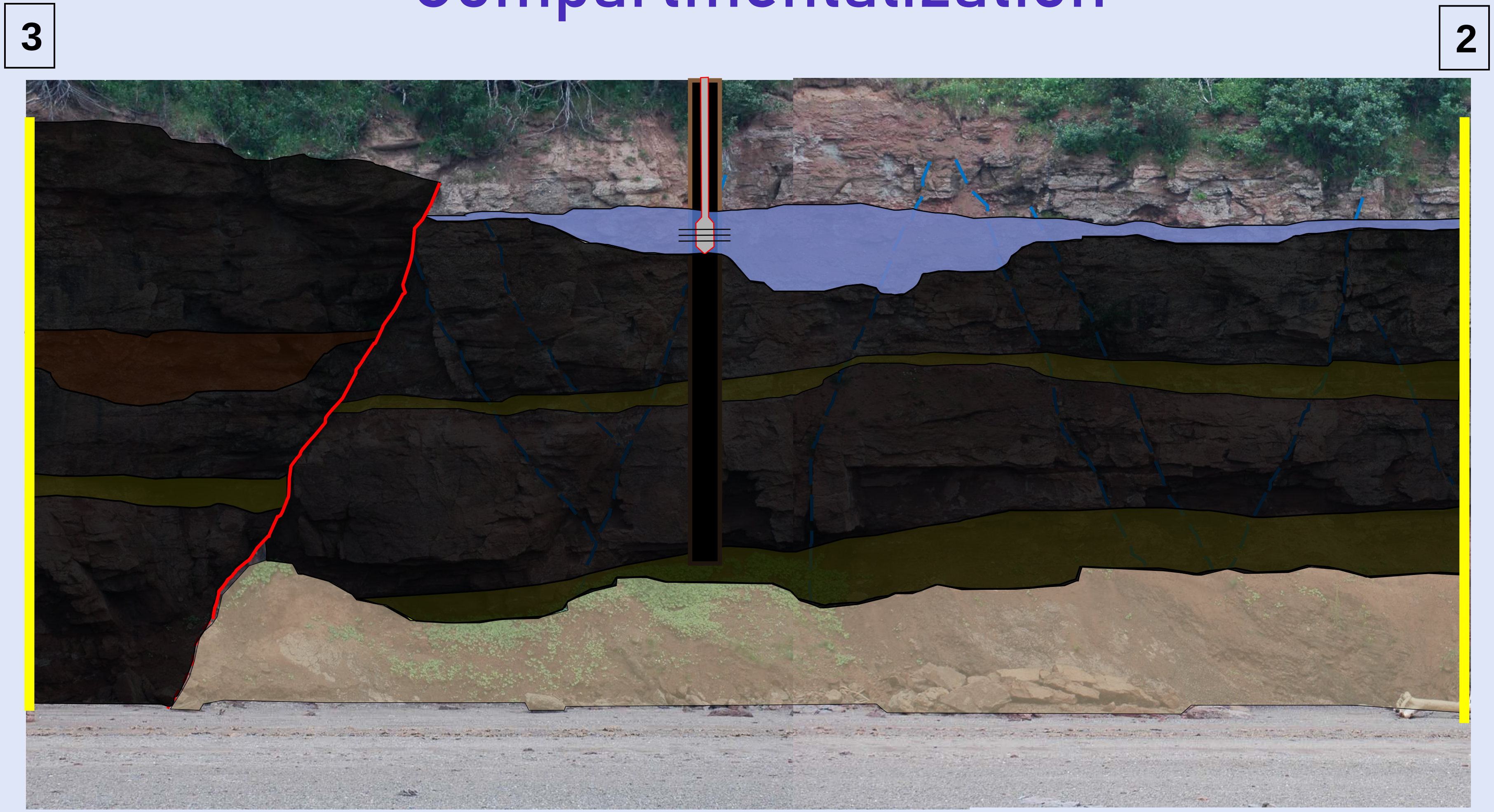
Project Future

What's Next

Next Steps

- Complete work on the Fundy Basin, including a report on field work and data compilation including detailed stratigraphic logs, lithofacies descriptions, interpretation of depositional environments, scintillometer data, XRF results, permeameter measurements, and sample logs.
- Sending selected samples off to have thin sections created, and sending remaining samples for SCAL analysis with project partners.
- Petrographic analysis of core and thin sections, working on micro-characterization.
- Developing static and dynamic models by incorporating wellbore, outcrop, outcrop analogue, and seismic data – modelling storage capacity and fluid flow.

Structural & Stratigraphic Compartmentalization



- Major Faults
- Minor Faults & Joints
- Carboniferous Rocks

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