Authors: Cotton, M, Neville, L.A, Ghostkeeper, D, Gladue, D., Auger, J, Foster, M, Lorentz, B, Kelly, S, Patterson, R.T

An Integration of Science and Indigenous Knowledge to Reconstruct Natural Environmental Background

(February 2020)

AGAT Laboratories

ENVIROVERSE

SOLSTICE Environmental Management

Background:

Lubicon Lake Band (LLB) members have hunted and gathered medicines for generations .....

The applications and methods of the LLB's hunting and gathering practices are kept for proprietary reasons

Joseph Auger (Consultation Manager) is the gate keeper for the knowledge holders

Recent experience pairing the LLB knowledge with western science will help bridge the gap between the knowledge holders, by identifying and tracking the medicines and game in the area of the LLB

Benefits to having the knowledge kept between the two disciplines of Traditional and Western documents is the key to passing down this knowledge to younger generations

LUBICON LAKE BAND #453

LLB team: myself Darrell Ghostkeeper, Loretta Laboucan, Joseph Auger, Dawn Seeseequon, Michael Calliou in the early beginnings, and Dwight Gladue our TEK Holder, and Troy Laboucan

Sometimes, in order for a certain medicine to grow back, another sub-species must grow in that area – this is important when thinking about reclamation

Engagement of the Elders along with the youth plays an important role, encouraging youth to further their education in the field of research

We strategized our work with the Elders in our community as well as trappers in the area of Little Buffalo

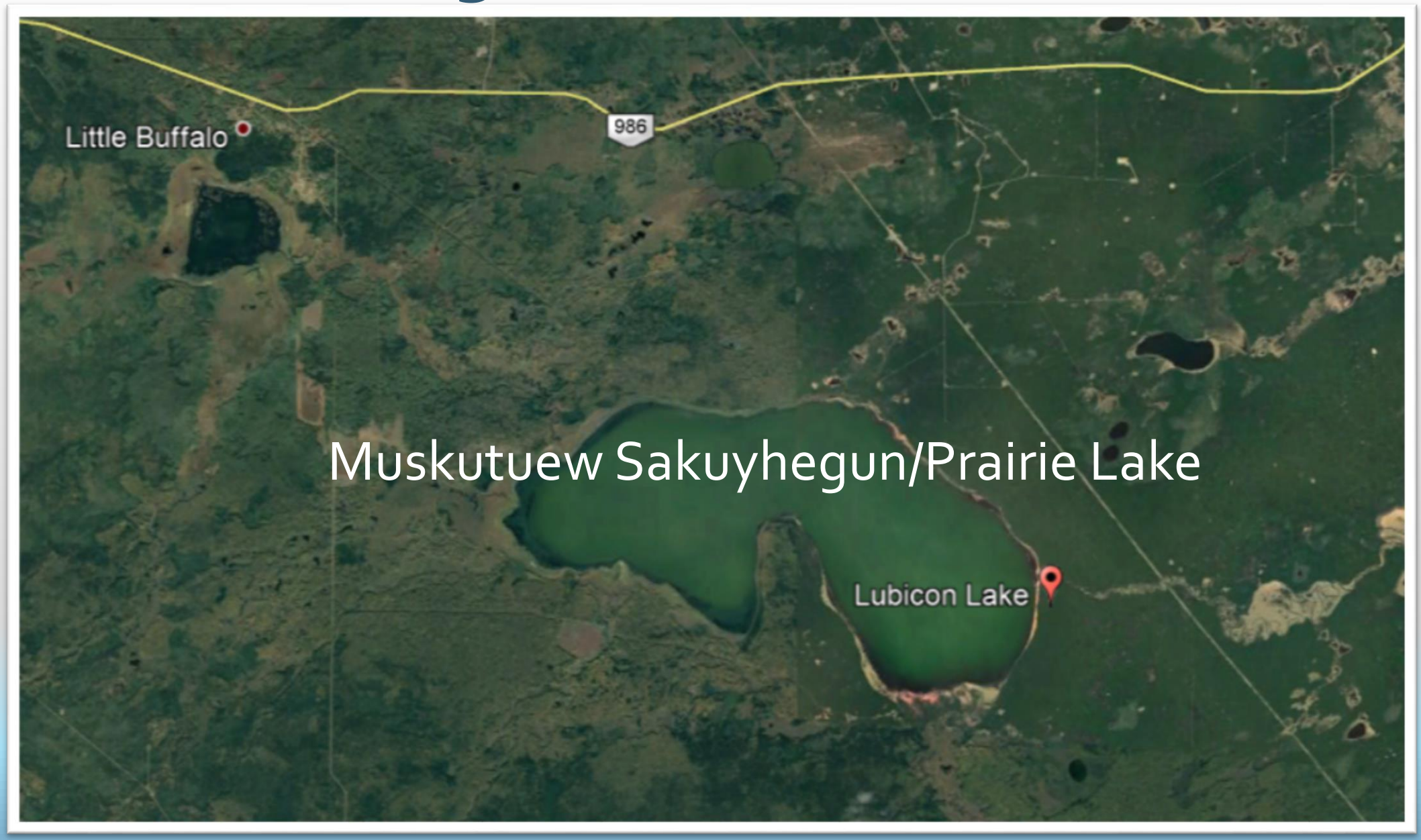
Project: Askiy Ochi Acimowin- Story of the Land

Project initiation January 2019

1. This first project phase has been developed to **evaluate and understand the effects of climate change on Indigenous traditional food, water, medicines and cultural practices**
2. This baseline understanding will help us with subsequent phases of the project including:

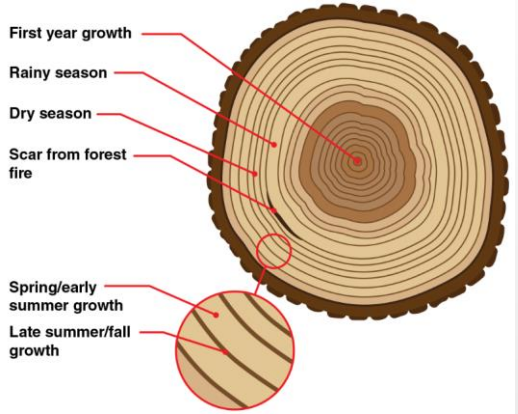
    - the Traditional Land Use study
    - training and education for the LLB youth & hands on teaching and field studies including at the cultural camp
    - development of solutions to help us overcome some of the challenges we face with climate change

What is Natural Background?



Askiy Ochi Acimowin
Story of the Land

- Historically we have learned much about past landscapes and climate through investigation of tree rings
- Today the new science of PALEOLIMNOLOGY take us further and deeper into those changes
- This 140 cm sediment core from Otter Lake in NW Alberta covers ~1,000 years of time

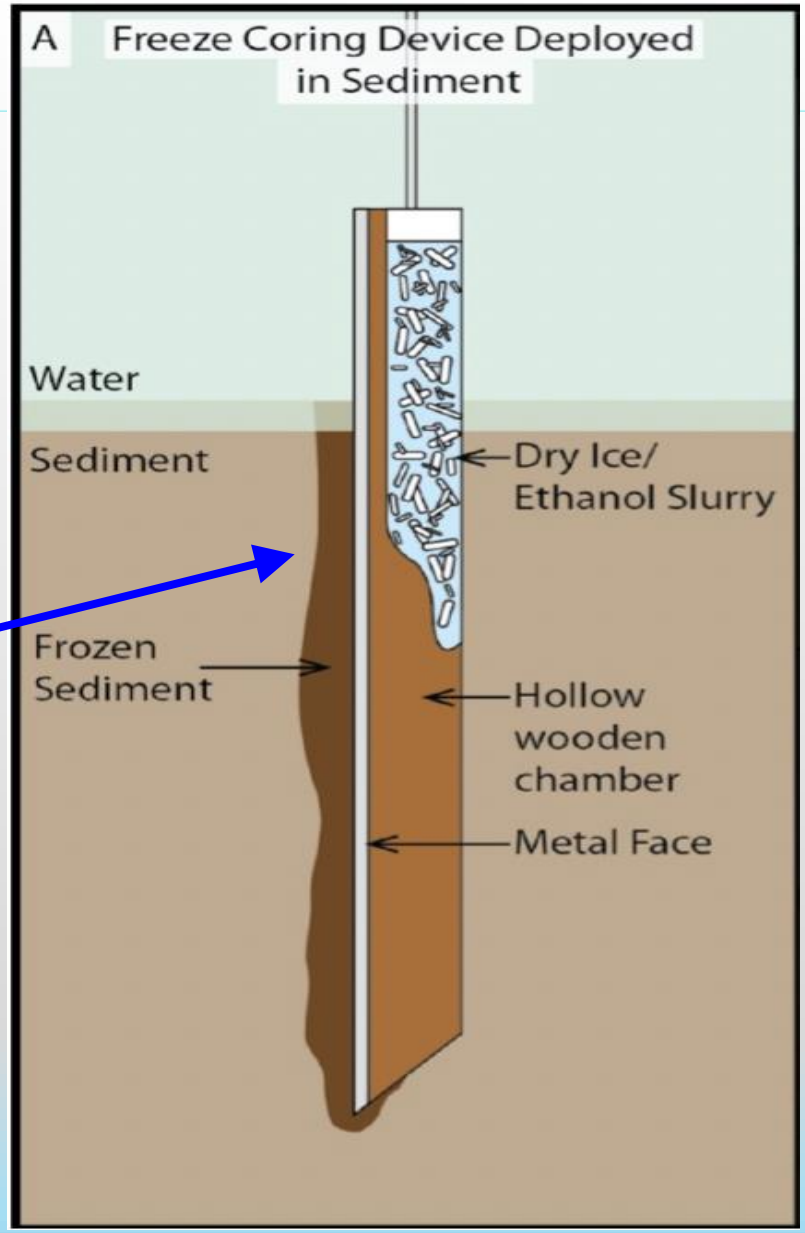


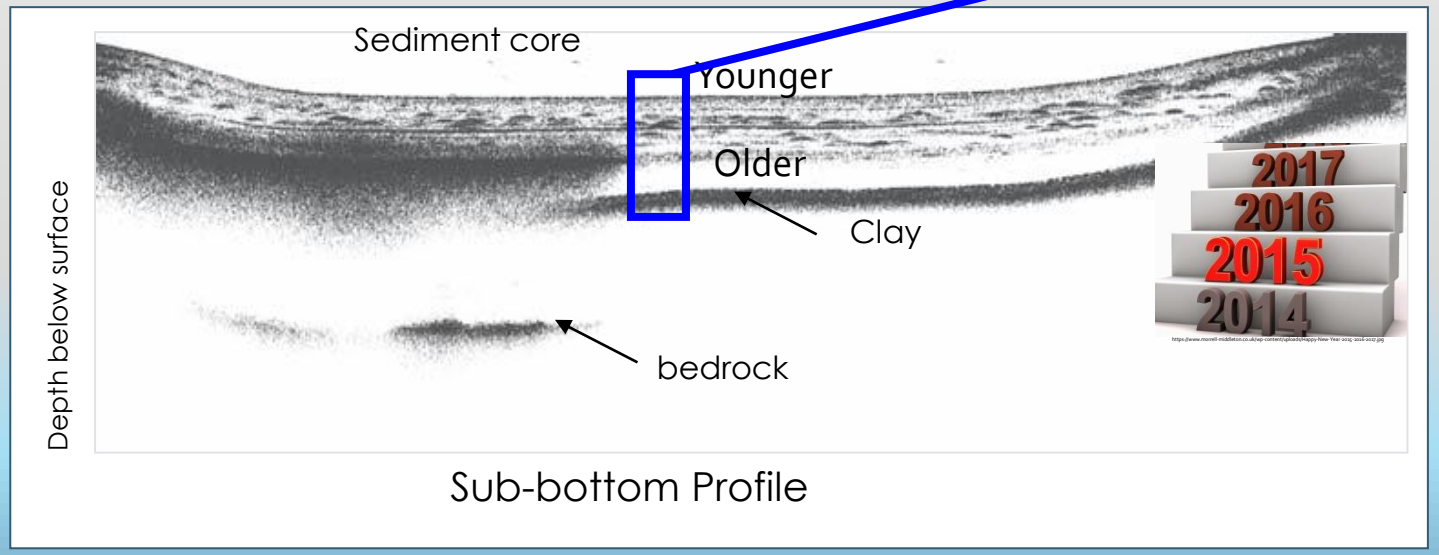
Source: https://climate.nasa.gov/news/2540/tree-rings-provide-snapshots-of-earths-past-climate/

Paleoclimatology

Limnology - study of lakes

Paleolimnology - study of past conditions of lakes





Climate Drivers

Climate is driven by natural changes in phenomena such as sea surface temperature and pressure, movement of the trade winds and solar activity.

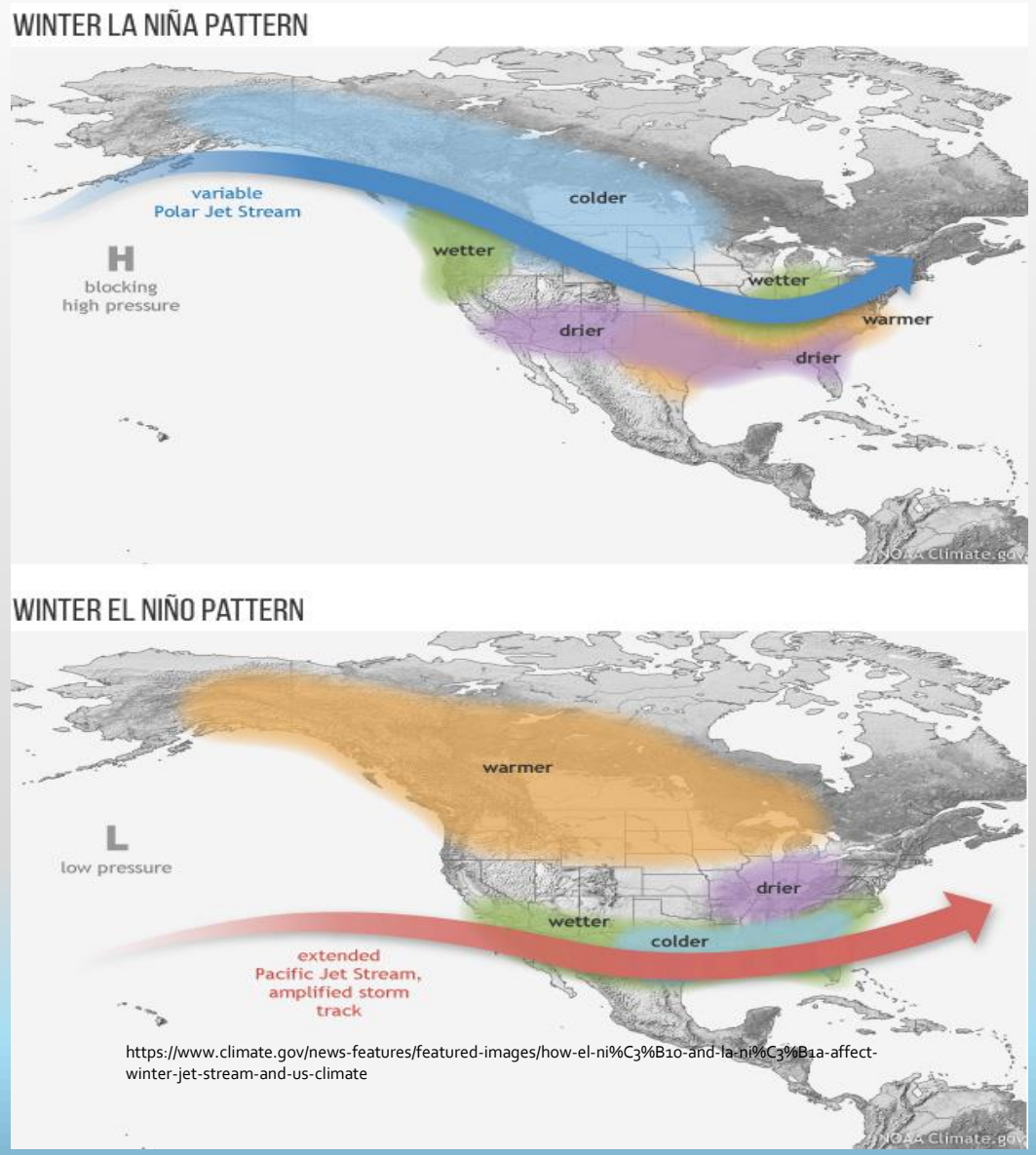
Common natural climate drivers:

El Niño Southern Oscillation (ENSO)

ENSO is the cyclic behaviour of El Niño & La Niña.
Typically oscillates on 3-7 year cycles.
(discovered in 2003)

Pacific Decadal Oscillation (PDO)

Is a long-lived ENSO like pattern of Pacific climate variability.
Typically oscillates on 15-25 year cycles.
(discovered in 1996)



https://www.climate.gov/news-features/featured-images/how-el-ni%C3%B1o-and-la-ni%C3%B1a-affect-winter-jet-stream-and-us-climate

Climate Drivers

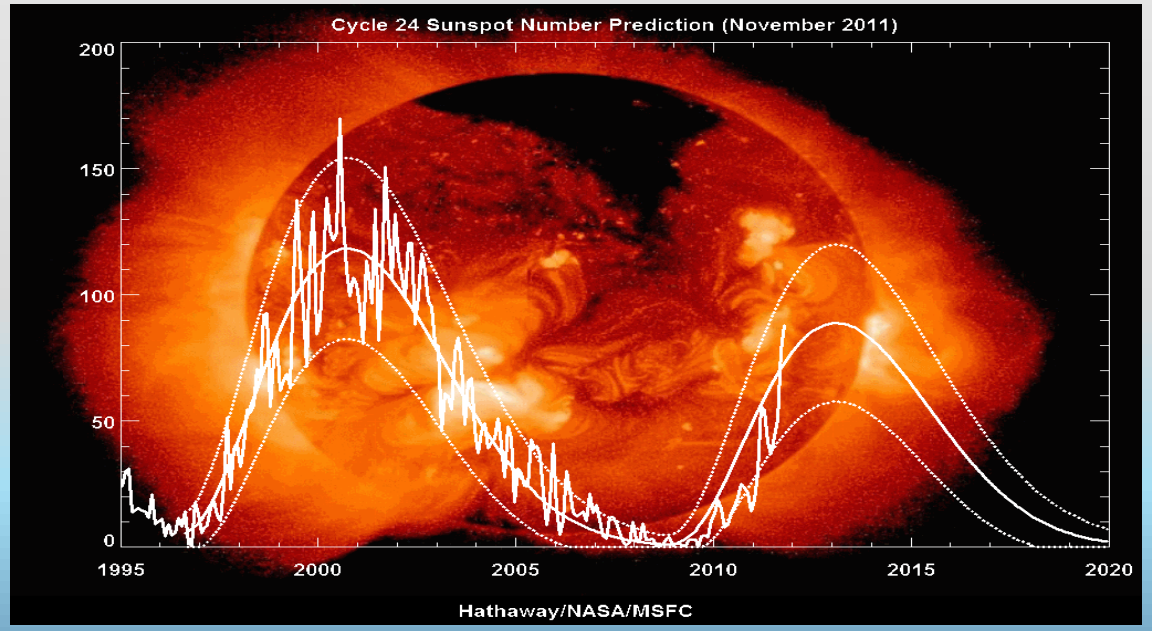
Solar activity

Sunspots are planet-sized islands of magnetism on the surface of the sun.

Changes in the amount of sunspots on the sun is cyclic = solar cycles.

Sunspot cycles range in duration from 11 to hundreds of years.

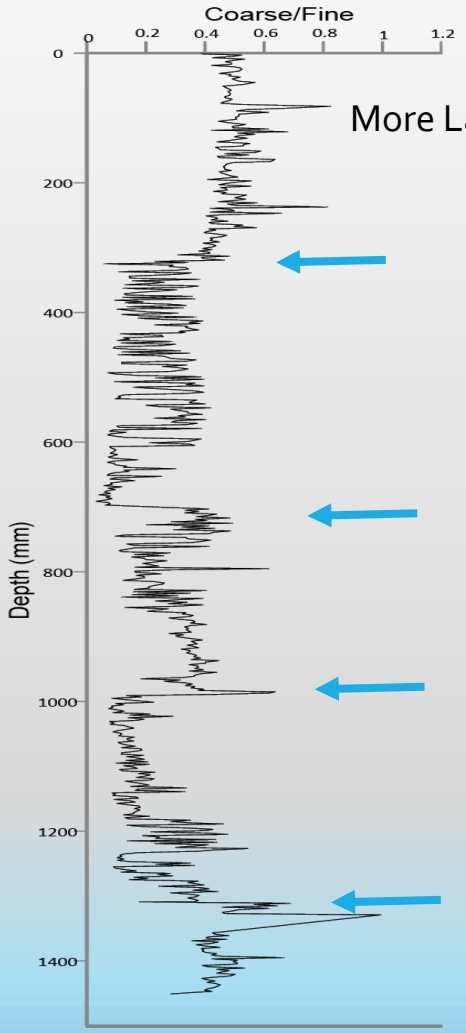
Changes in the phase of a solar cycle also influences environmental conditions such as temperature and precipitation.



- Schwabe solar cycle (11 yr)
- Gleissberg solar cycle (70-124 yr)
- Bond cycle (250-400 &1500 yr)

- Hale solar cycle (22 yr)
- deVries cycle (200 yr)
- 2300-yr cycle

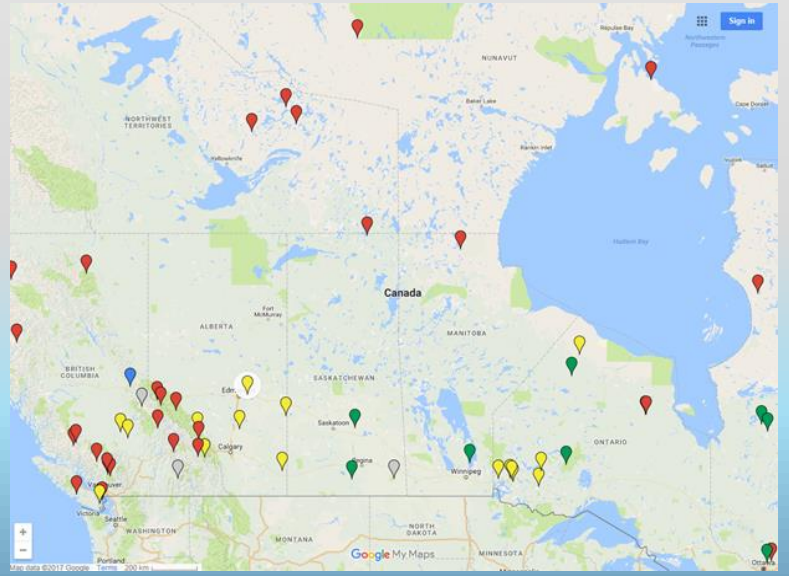
Climate Reconstructions



More La Niña-like phase

Currently entering a "neutral" PDO and neutral ENSO regime

"Cool" PDO regimes have primarily prevailed so far in 21st century.



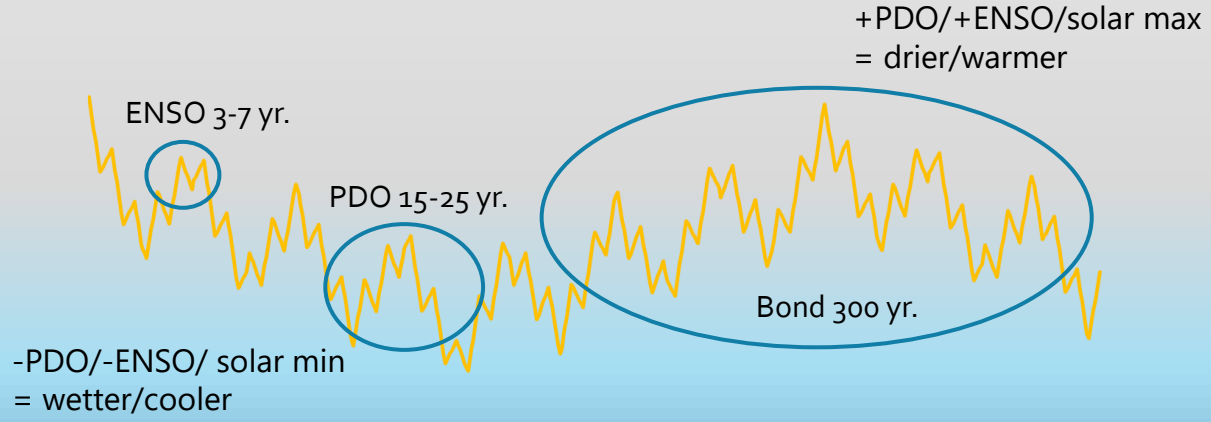
The 400-Year Wet-Dry Climate Cycle in Interior North America and Its Solar Connection

The 400-Year Wet-Dry Climate Cycle in Interior North America and Its Solar Connection

Zicheng Yu and Emi Ito

Possible solar forcing of century-scale drought frequency in the northern Great Plains

Zicheng Yu*
Emi Ito
Department of Geology and Geophysics and Limnological Research Center, University of Minnesota, Minneapolis, Minnesota 55455, USA

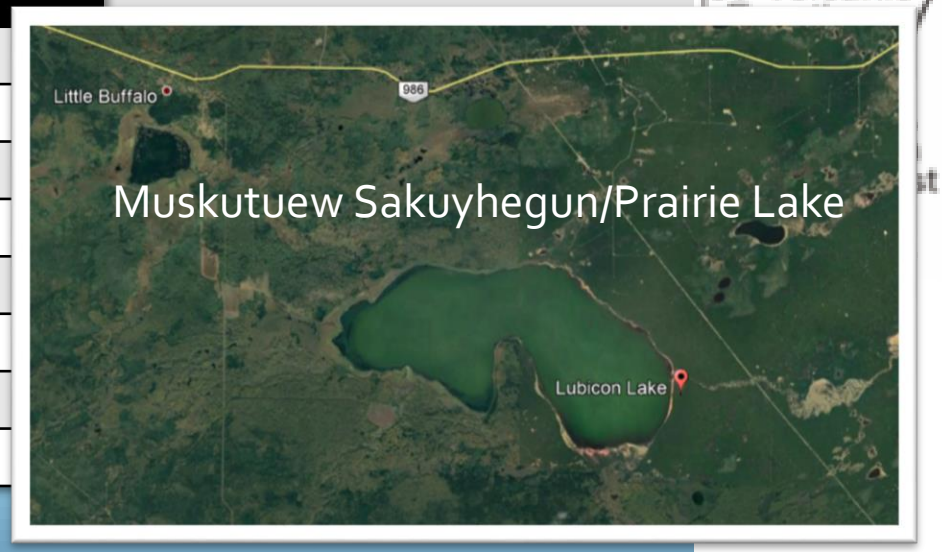


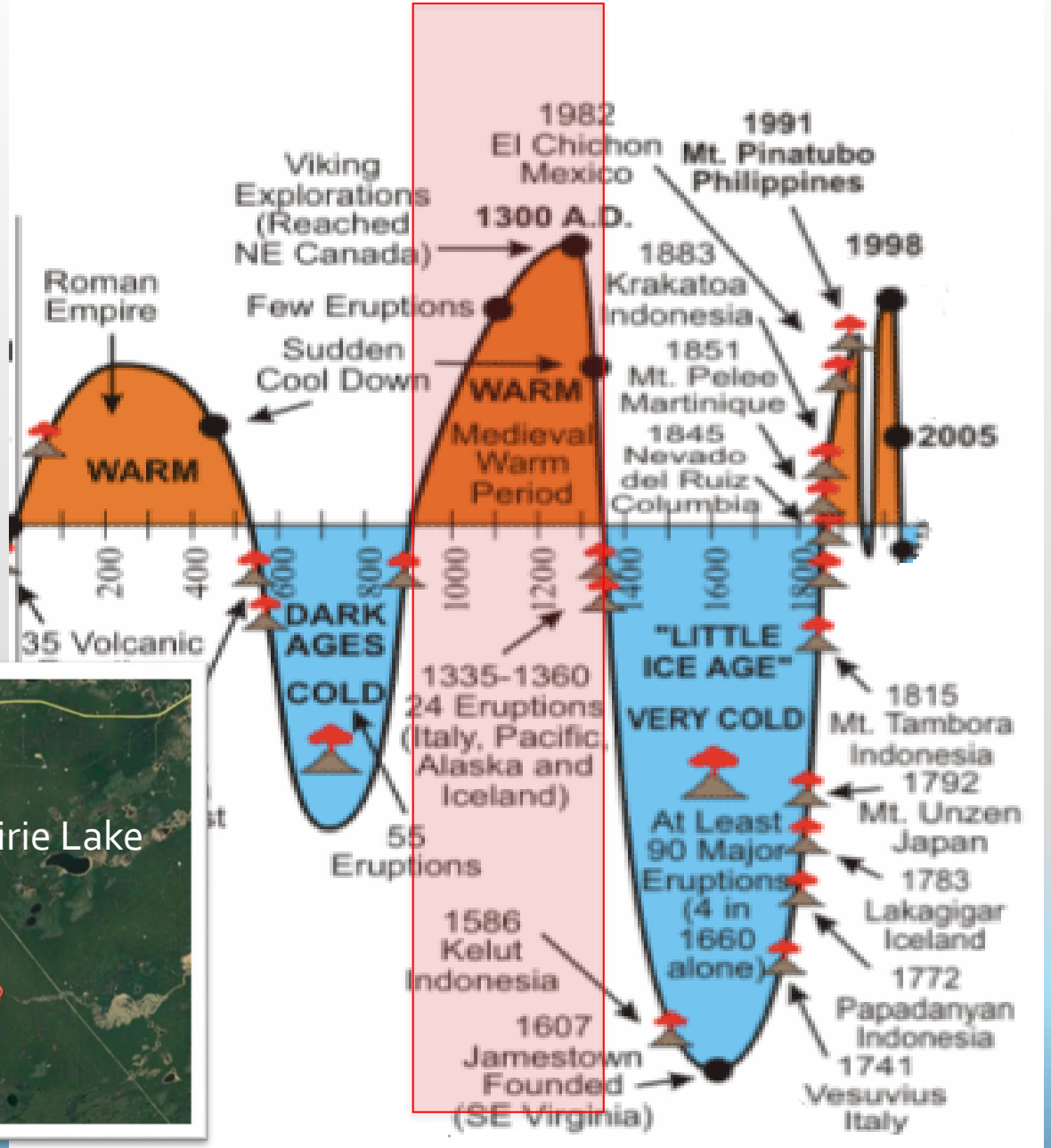
Medieval Warm Period (900 AD – 1350 AD)

During MWP population of Europe exploded reaching levels that were not matched again until the 19th Century

- Relatively disease free
- 1° C warmer than preceding 500 years
- Mild winters and dry summers

Year	Pop (mil)	% Increase
700	27	
1000	42	36
1050	46	9.5
1100	48	4.3
1150	50	4.2
1200	61	22
1250	69	13.1
1300	73	5.8

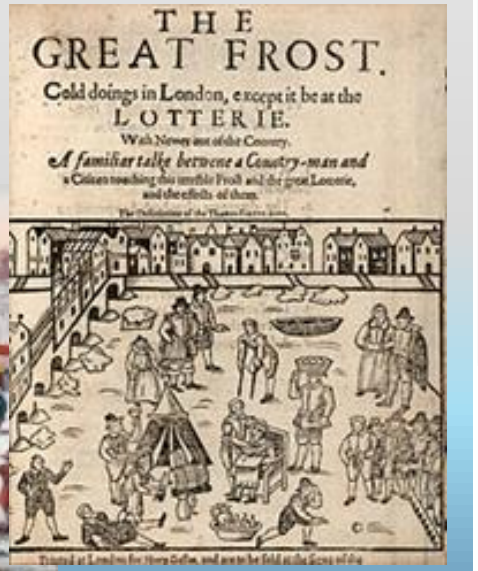




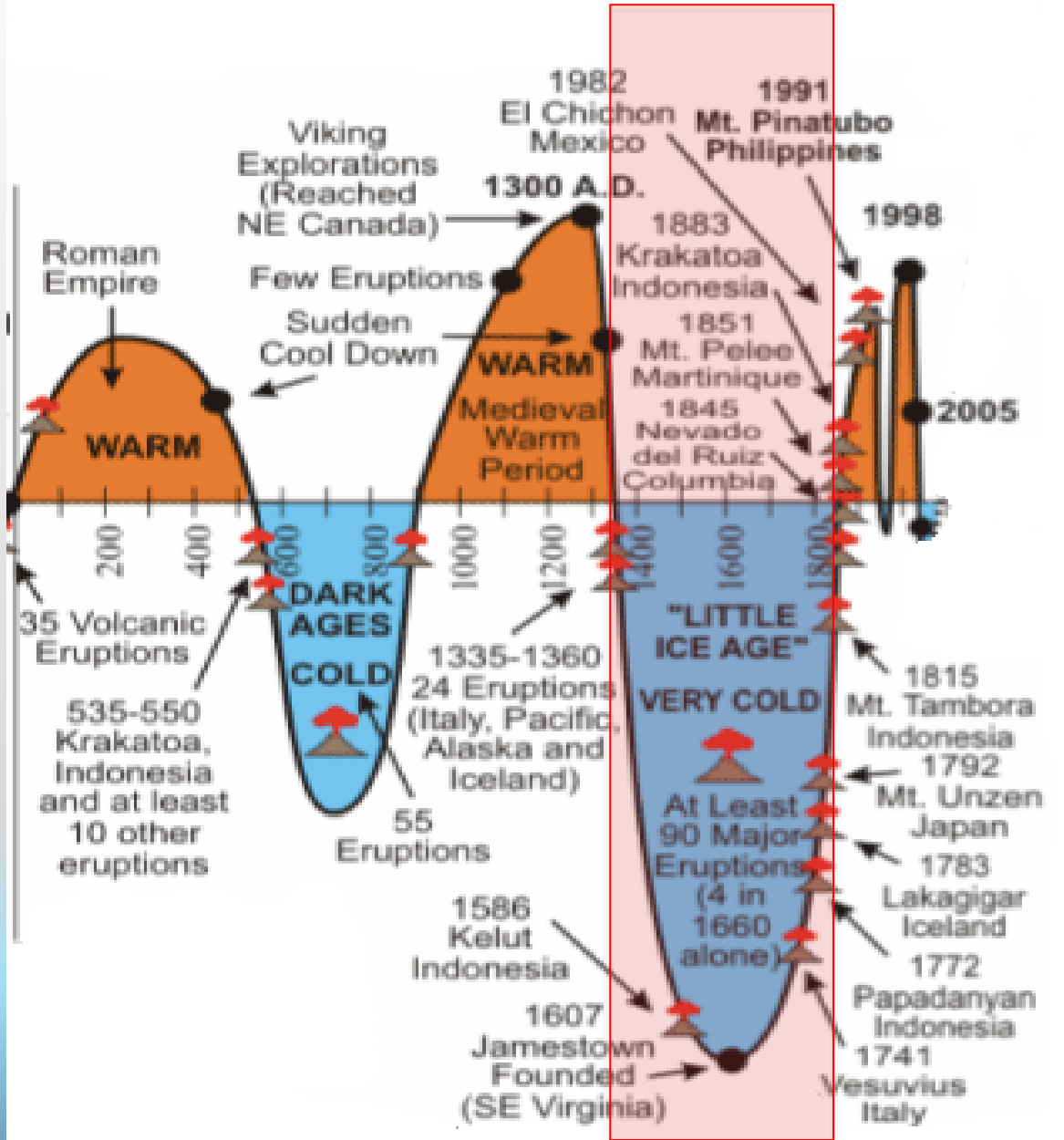
Little Ice Age (1400 AD – 1850 AD)

By the beginning of the 14th century there was significant climate cooling marked by famines in Europe

- Was characterized by climate instability
- There were summers with such continual rain that crops failed
- Other summers had such prolonged heat and drought that crops failed

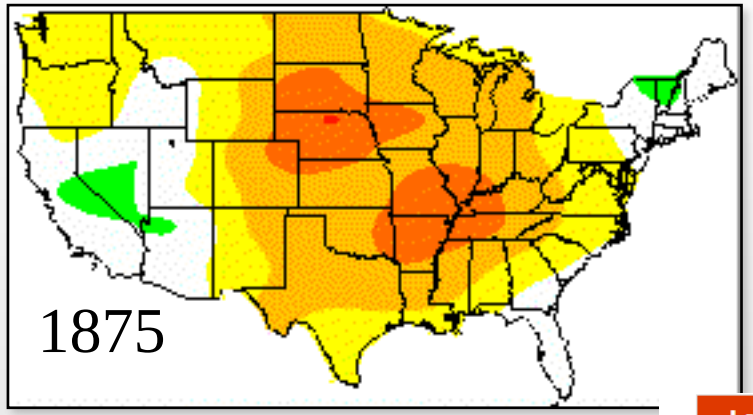


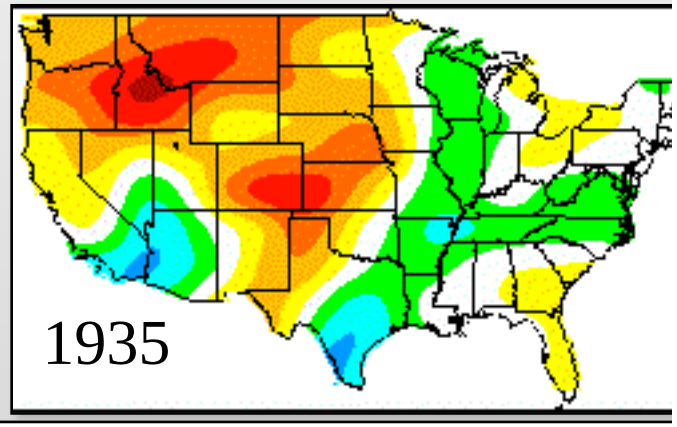
https://climatenewsnetwork.net/climate-makes-little-ice-age-puny/

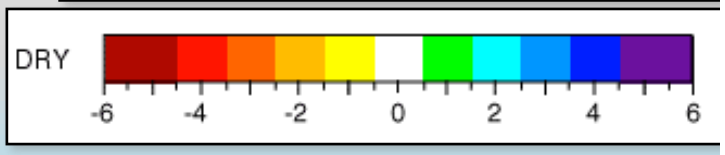


Decline in rainfall accompanying end of Little Ice Age.

Modern Times







The drought of the 1930's that affected much of the central portions of North America unfortunately coinciding with the Great Depression.

Location	°C	Day
Midale and Yellow Grass, Saskatchewan	45.0	July 5, 1937
Lillooet and Lytton, BC	44.4	July 16 & 17, 1941
St Albans, Manitoba	44.4	July 11, 1936
Emerson, Manitoba	44.4	July 12, 1936
Brandon and Morden, Manitoba	43.3	July 11, 1936
Regina, Saskatchewan	43.3	July 5, 1937
Fort Macleod, Alberta	43.3	July 18, 1941
Oliver, BC	42.8	July 27, 1939
Osoyoos, BC	42.8	July 27, 1998
Spences Bridge, BC	42.5	July 23, 1994
Medicine Hat, Alberta	42.2	July 12, 1886
Ashcroft, British Columbia	41.7	July 15, 2014
Moose Jaw, Saskatchewan	41.7	Aug 6, 1949
Kamloops, British Columbia	40.7	July 13, 2014
Winnipeg, Manitoba	40.6	Aug 7, 1949
Saskatoon, Saskatchewan	40.6	June 5, 1988

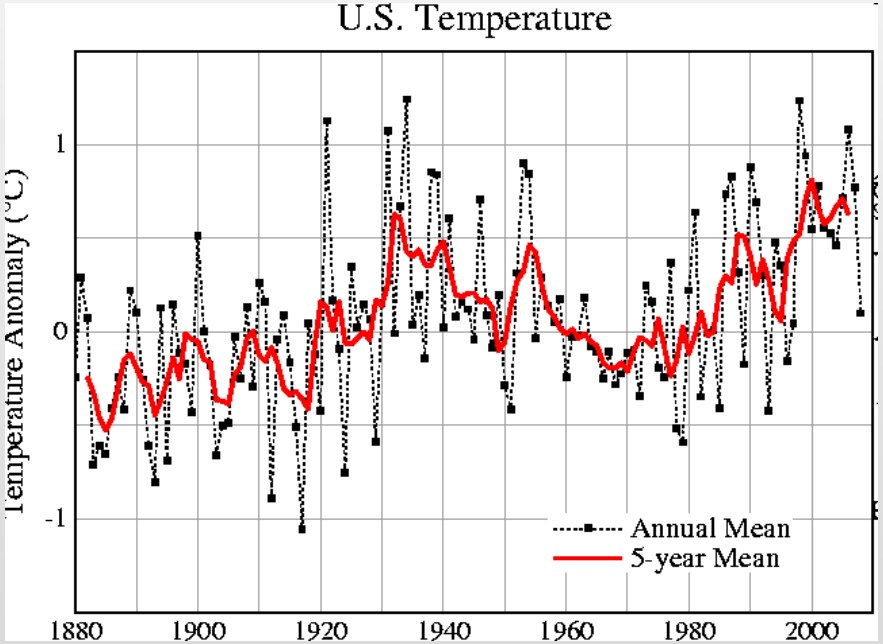
And it got hot

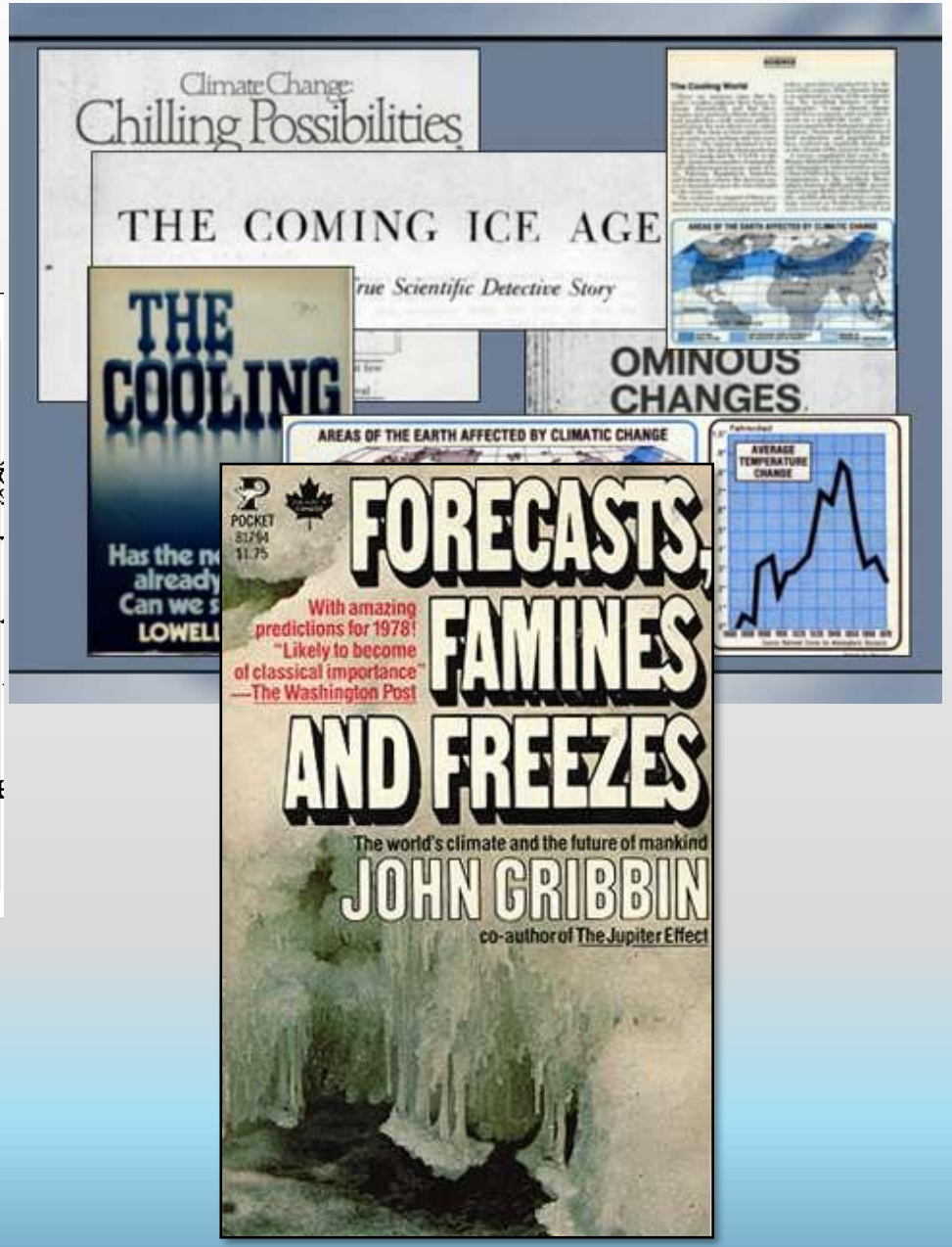
The highest temperature ever recorded in Canada was 45° C (113° F) at Midale and Yellow Grass, SK, July 5, 1937.

https://www.currentresults.com/Weather-Extremes/Canada/hottest.php

Post-Little Ice Age temperature recovery peaked in the late 1930's.

There was a multi-decadal cooling beginning about 1940 and ending about 1980.





ELDERS INTERVIEWS/LAKE SELECTION – THE FIRST DATA COLLECTION FOR THE PROJECT (Feb 2019)

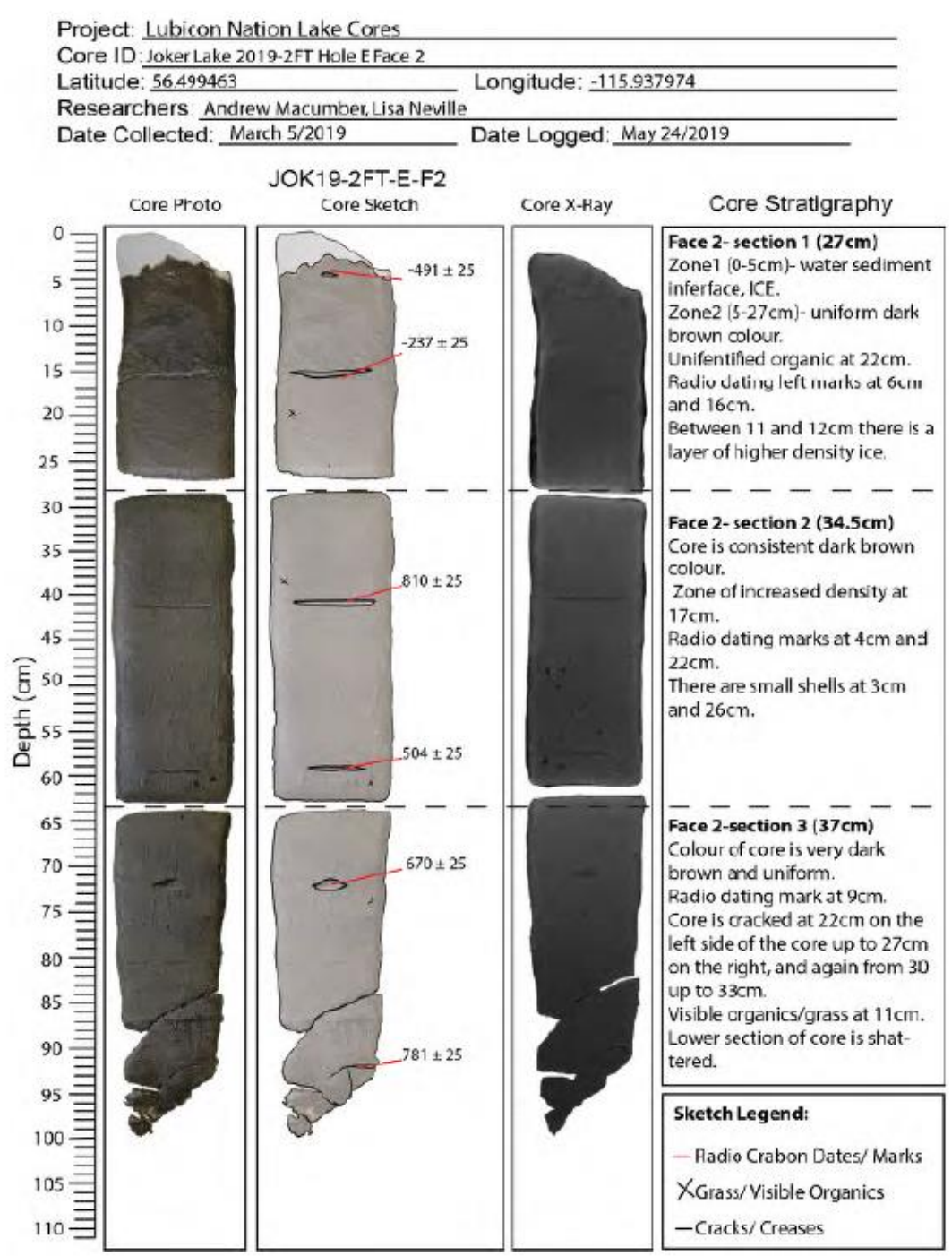
Topics Covered:

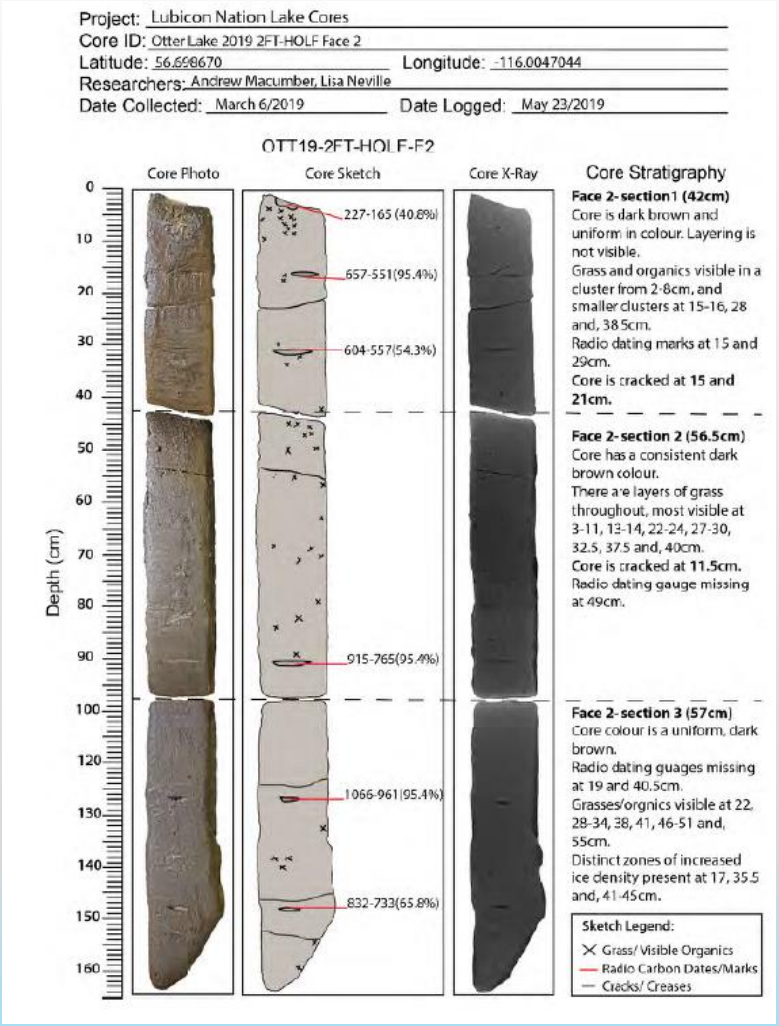
- Land Where you Lived
- Transportation
- Lakes
- Oil &Gas Impact
- Forestry
- Trapping
- Fire Events

Core Collection (Mar 2019)

UP CLOSE & PERSONAL

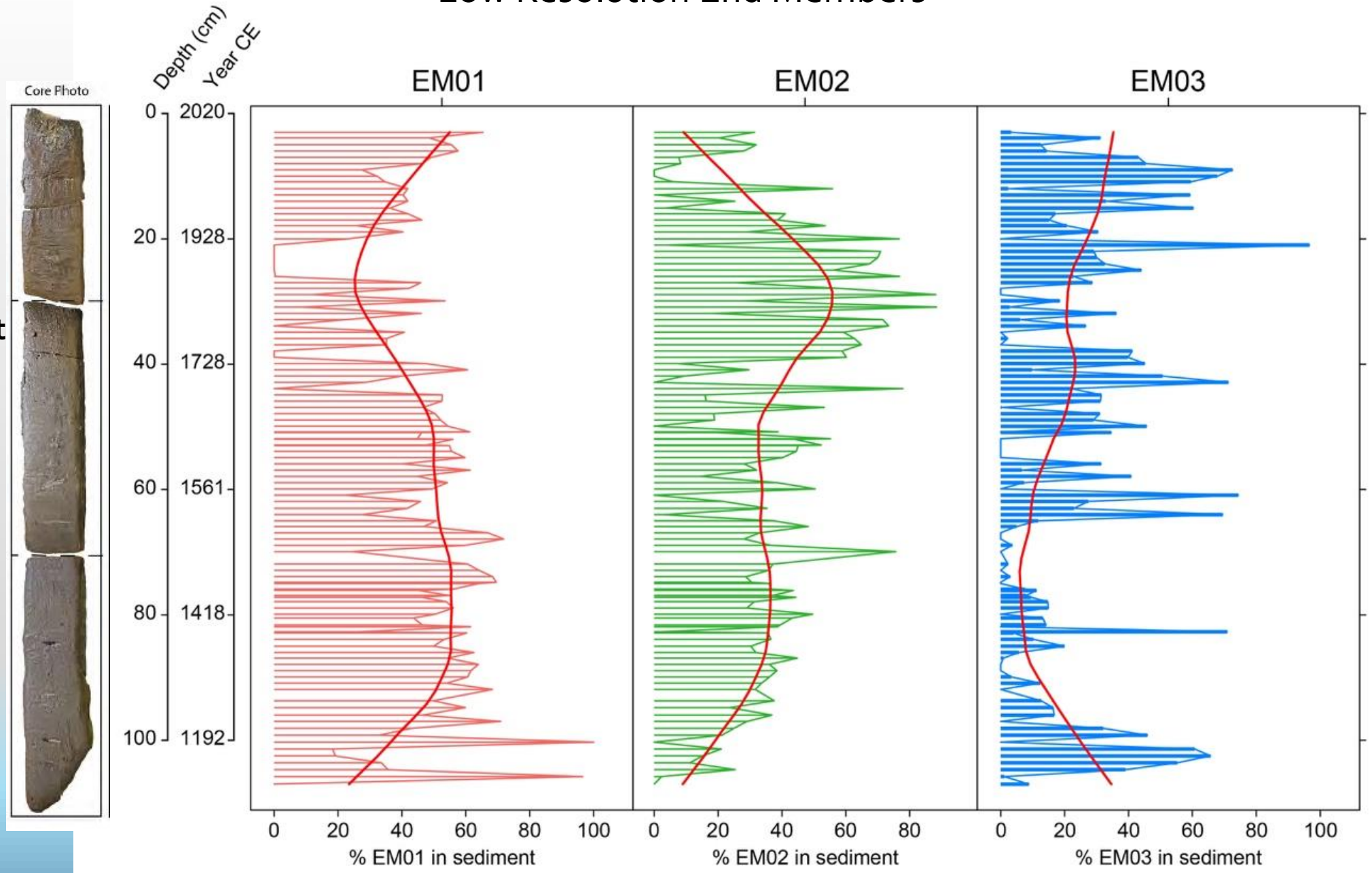
Our Project Cores



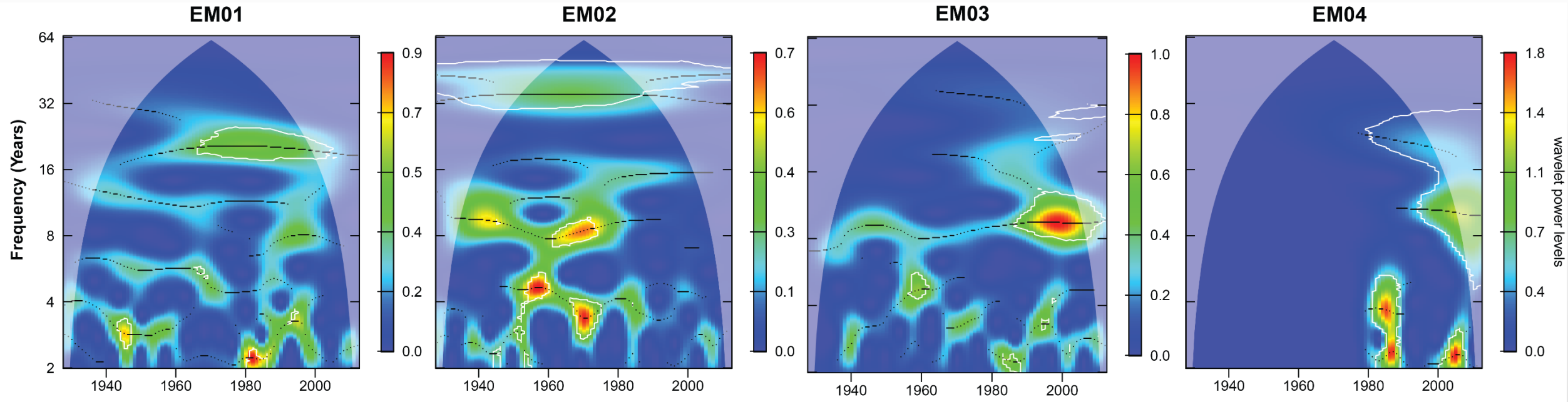


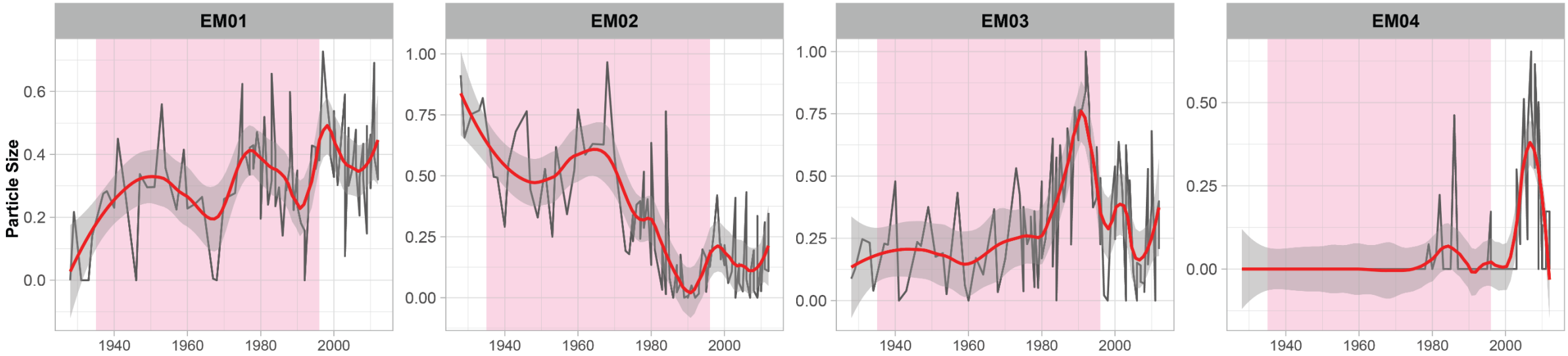
Low Resolution End Members

Spectral & Wavelet
~ 200 Suess
100-140 Gleissberg
15-25 & 50 70 PDO

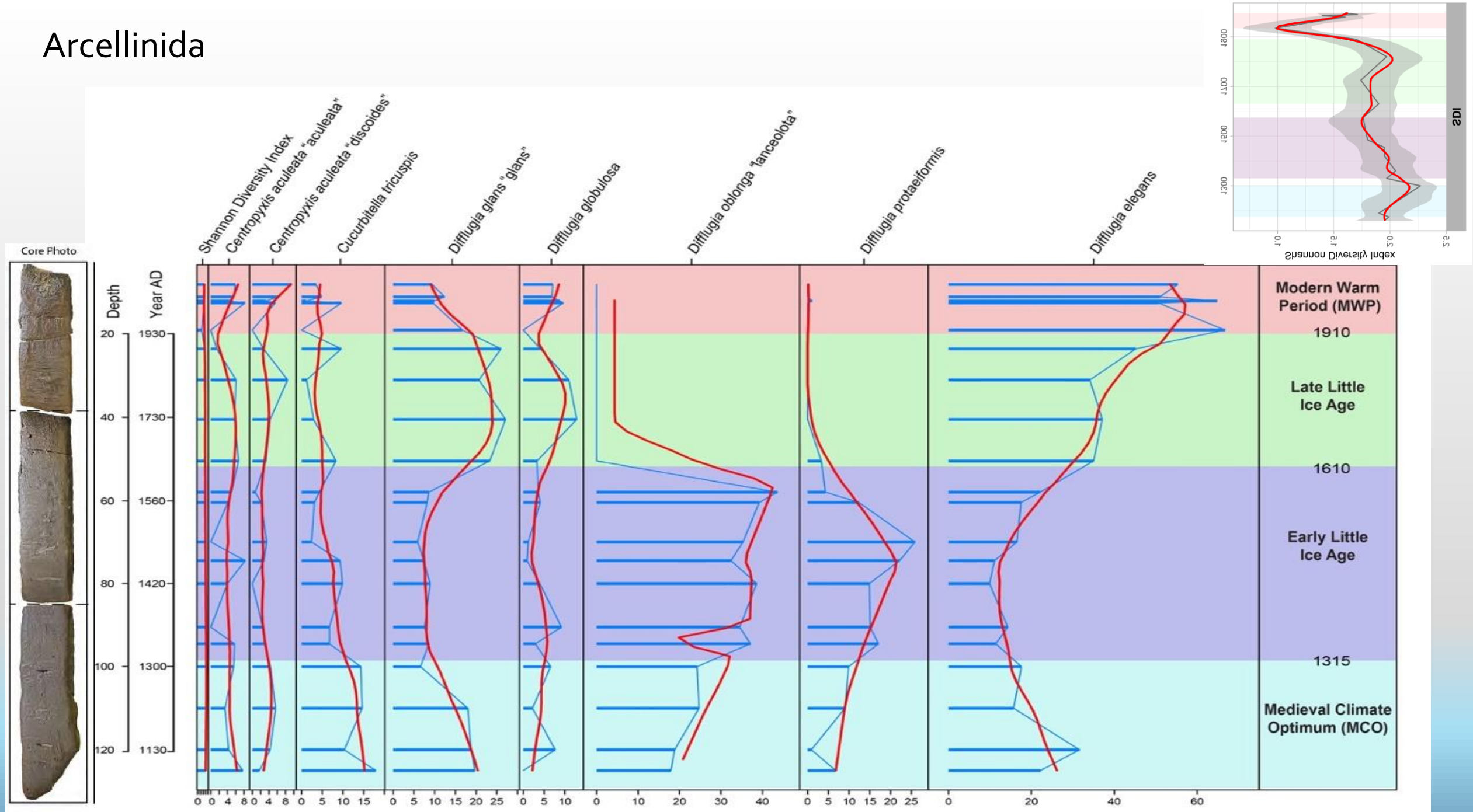


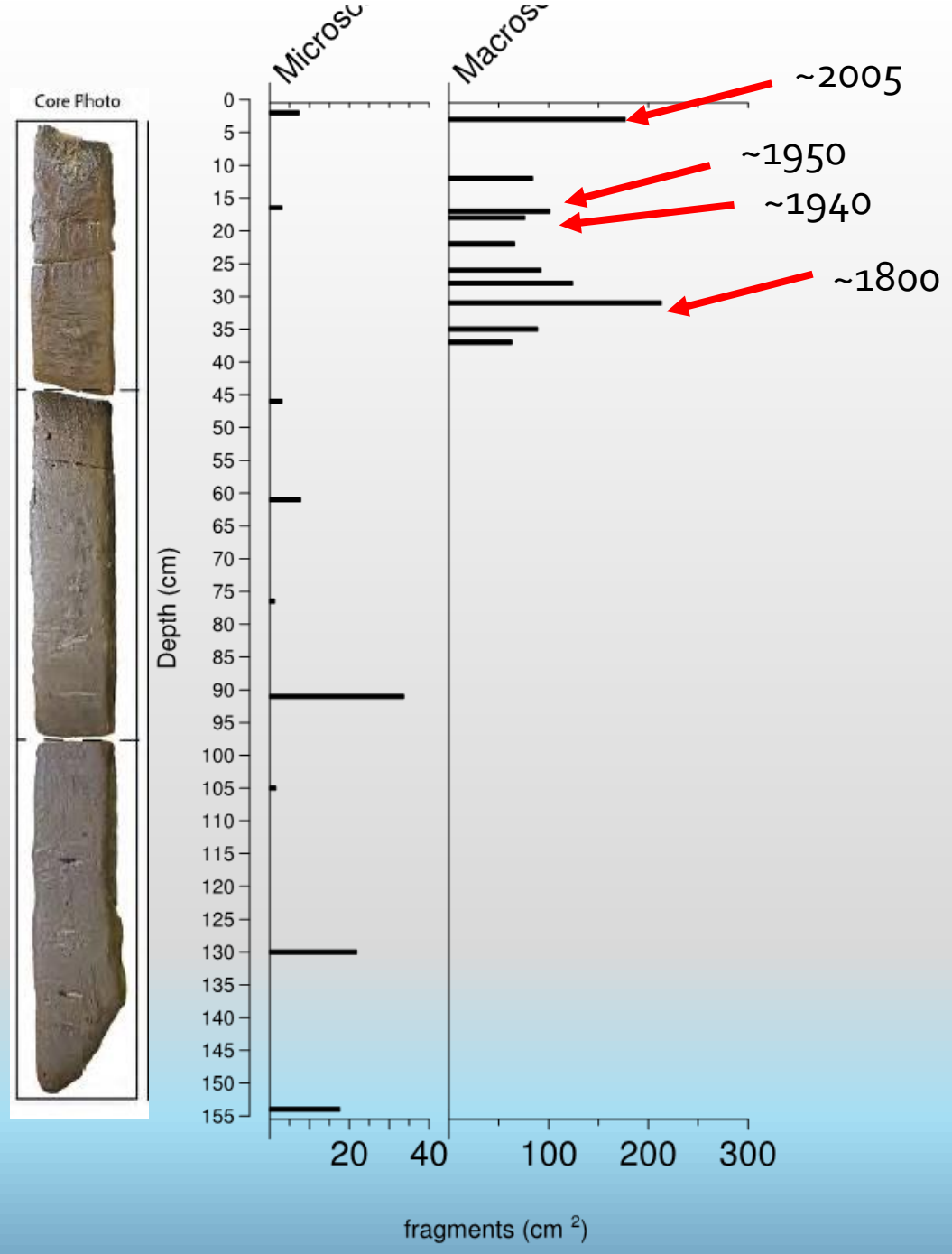
High Resolution End Members and Wavelets

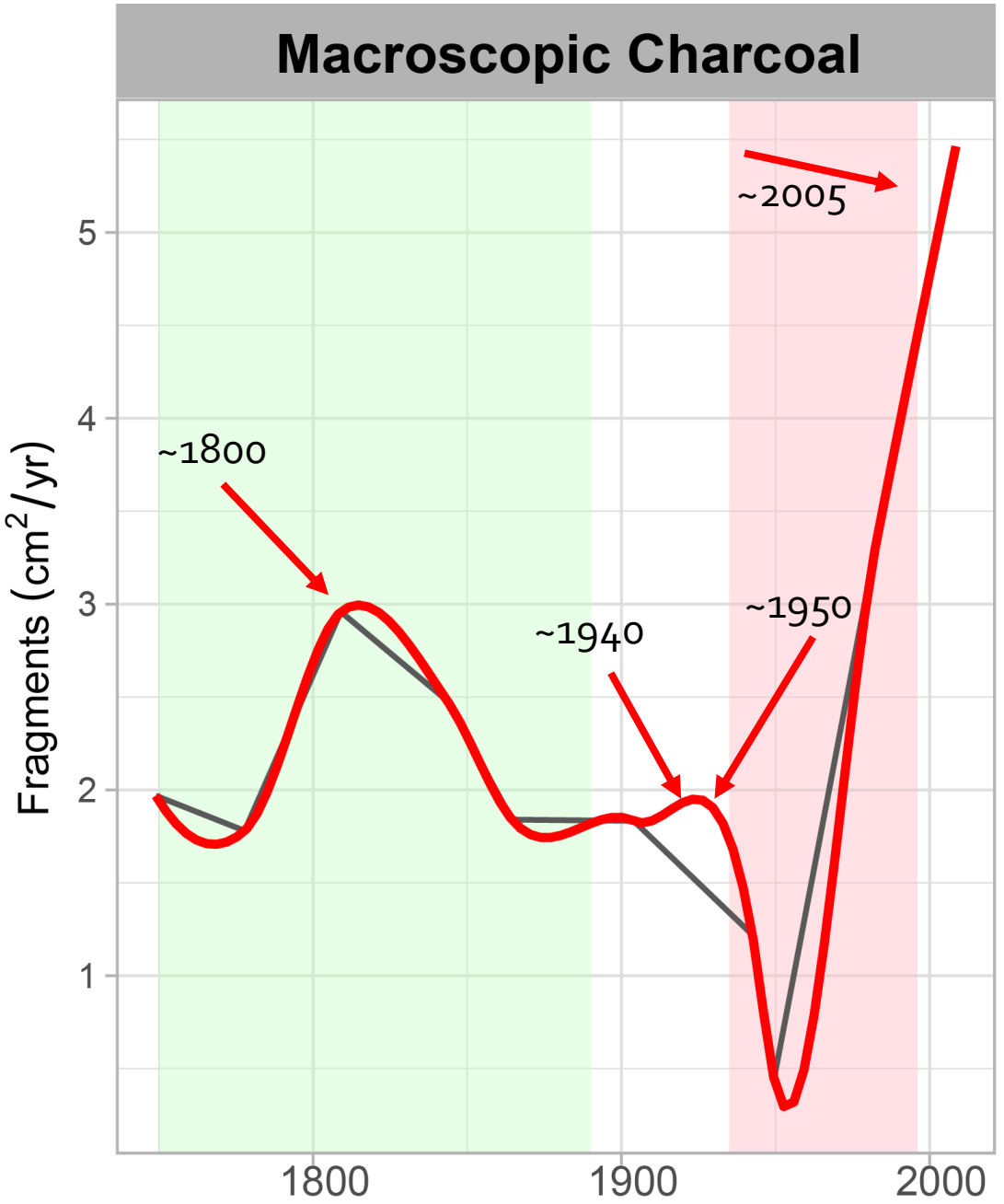




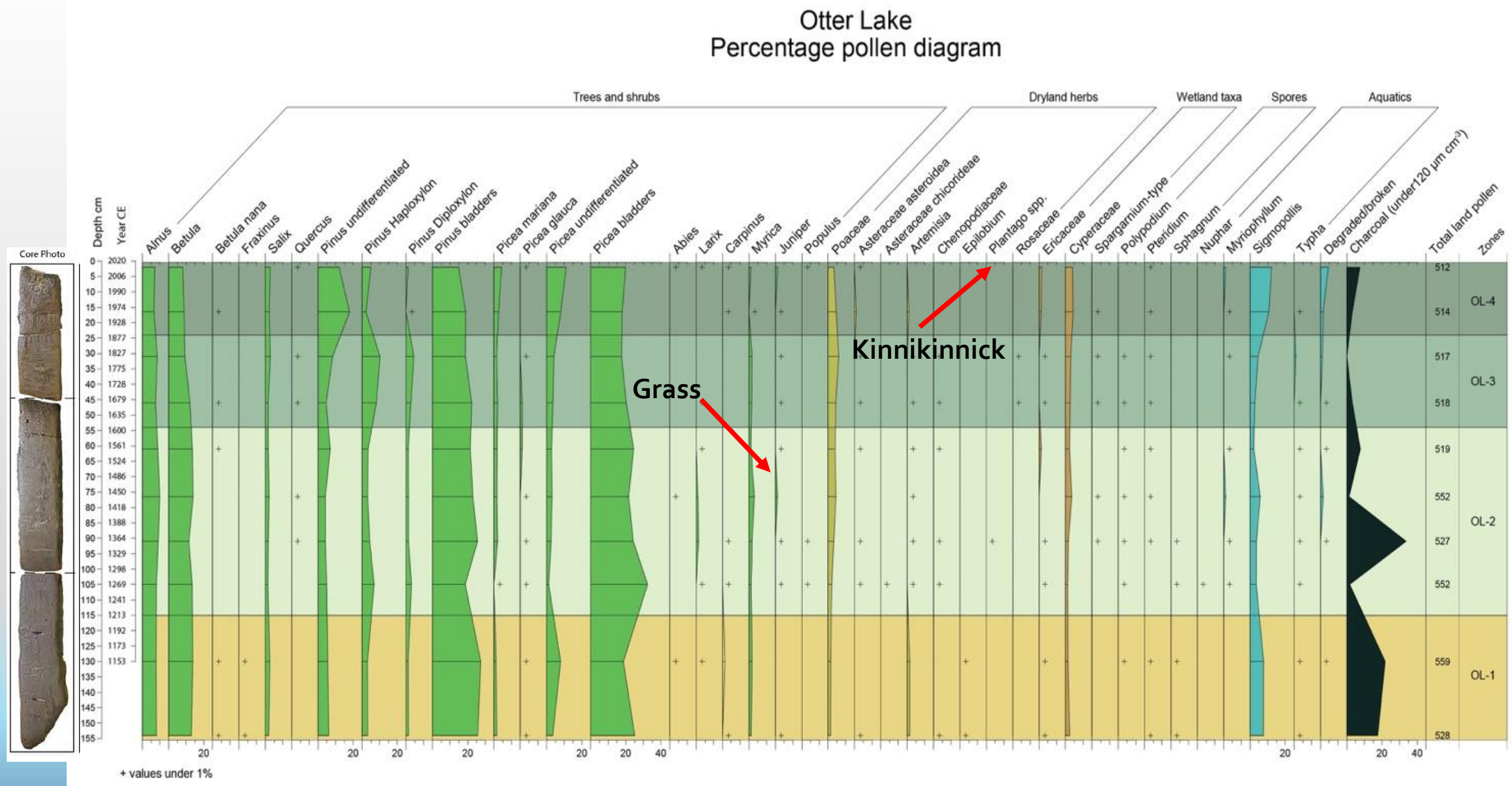
Arcellinida







Charcoal Accumulation Rate


Otter Lake
Percentage pollen diagram
Trees and shrubs
Dryland herbs
Wetland taxa
Spores
Aquatics
Core Photo
Depth cm
Year CE
Alnus
Betula
Betula nana
Fraxinus
Salix
Quercus
Pinus undifferentiated
Pinus Haploxylon
Pinus Diploxylon
Pinus bladders
Picea mariana
Picea glauca
Picea undifferentiated
Picea bladders
Abies
Larix
Carpinus
Myrica
Juniper
Populus
Poaceae
Asteraceae asteroidea
Asteraceae chicorideae
Artemisia
Chenopodiaceae
Epilobium
Plantago spp.
Rosaceae
Ericaceae
Cyperaceae
Spargarnium-type
Polypodium
Pteridium
Sphagnum
Nuphar
Myriophyllum
Sigmopollis
Typha
Degraded/broken
Charcoal (under120 µm cm³)
Total land pollen
Zones
Kinnikinnick
Grass
OL-4
OL-3
OL-2
OL-1
+ values under 1%

Key Outcomes

Traditional Knowledge Results

On the one side of the core, imagery and wording representing the stories and historical knowledge gained from the Elders & Knowledge Keepers

Western Science Results

On the other side of the core, the western science results will be described (e.g. the large deposit of ash indicates an intense forest fire).

ACKNOWLEDGEMENTS

This project was undertaken with the financial support of the Government of Canada through the federal **Department of Environment and Climate Change**

The concept for the Story of the Land originated in our project collaborators shop: **Enviro-Verse**: **Sean Kelly**, President & Lisa Neville (now with AGAT Labs)

AGAT Laboratories graciously donated Dr. Lisa Neville's field time and technical expertise, and they continue to allow Lisa to support this project in her new role with AGAT

Dr. R. Tim Patterson, Ph.D., Professor with the Department of Earth Sciences at Carleton University leads the paleolimnology aspects of the project

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