GI 261 – Cyclic Stratigraphy and Astrochronology

Who am I
Who are you
What the class is about
What you need to know
What you need to do

Jin-Si R Over

Geographer

Woods Hole Coastal and Marine

Jin-Si Over is a geographer with the Woods Hole Coastal and Marine Science Center. A drone pilot and structure-from-motion specialist, she supports the Remote Sensing Coastal Change group and Aerial Imaging and Mapping group with GIS and surveying experience.

Education and Certifications

- M.S. Earth and Ocean Sciences University of Victoria, British Columbia, 2019,

  B.S Geology, University of North Carolina Wilmington, 2016

https://www.usgs.gov/staff-profiles/jin-si-r-over
https://www.usgs.gov/news/researcher-spotlight-jin-si-over

Ant-mimicking spider - *Myrmarachne formicaria*

We are looking for this small spider that looks like an ant.

Stiamo cercando questo piccolo ragno che sembra una formica.
Buscamos a esta pequeña araña que parece una hormiga.
Nous recherchons cette petite araignée qui ressemble à une fourmi.
Wir suchen nach dieser kleinen Spinne, die wie eine Ameise aussieht.

♂

♀

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DA
Saint Lawrence River
Lake Champlain
Adirondack
Lake Placid
Mt Marcy
1,629 m
Black
Tug Hill
Mountains
Toronto
Lake Ontario
Rochester
Buffalo
Finger Lakes
Syracuse
Mohawk Valley
Mohawk River
Albany
Lake Erie
Allegheny Plateau
Susquehanna River
Catskill Mountains
Hudson Valley
Hudson River
Delaware R
Boston
Springfield
Hartford
Providence
Long Island Sound
New York
Coastal Plain
Long Island
Atlantic Ocean
Pittsburgh
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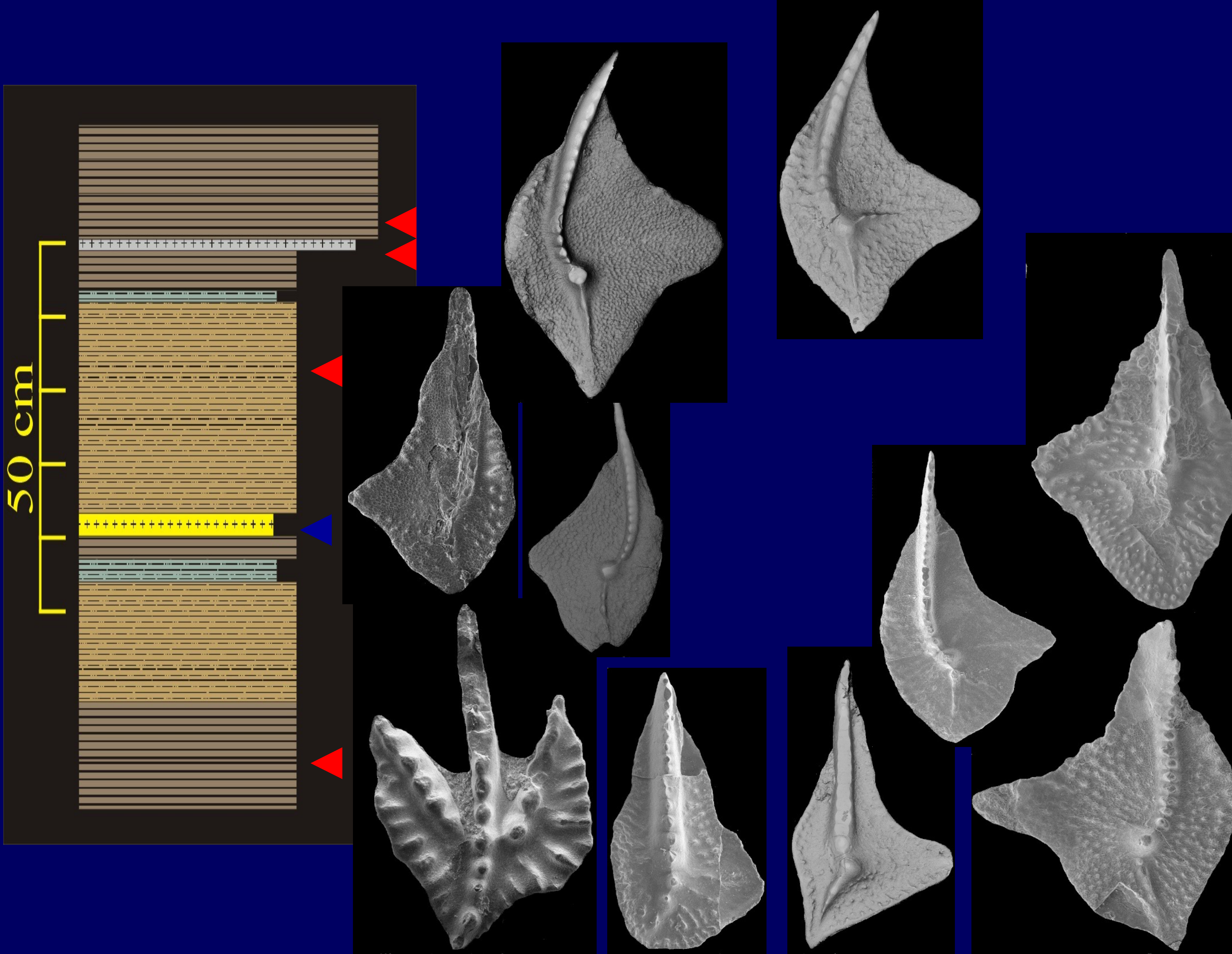
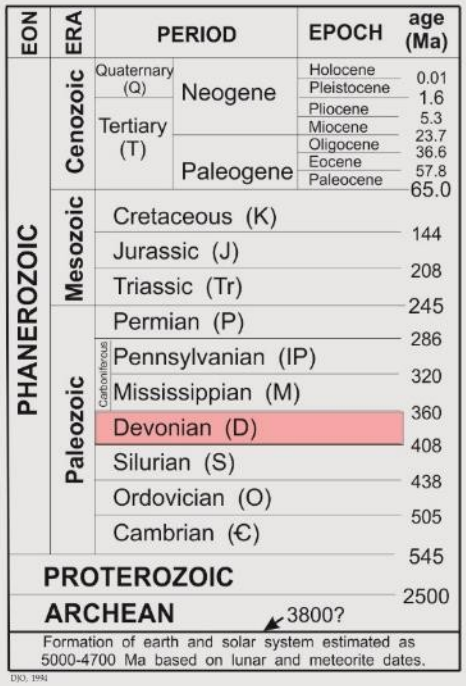
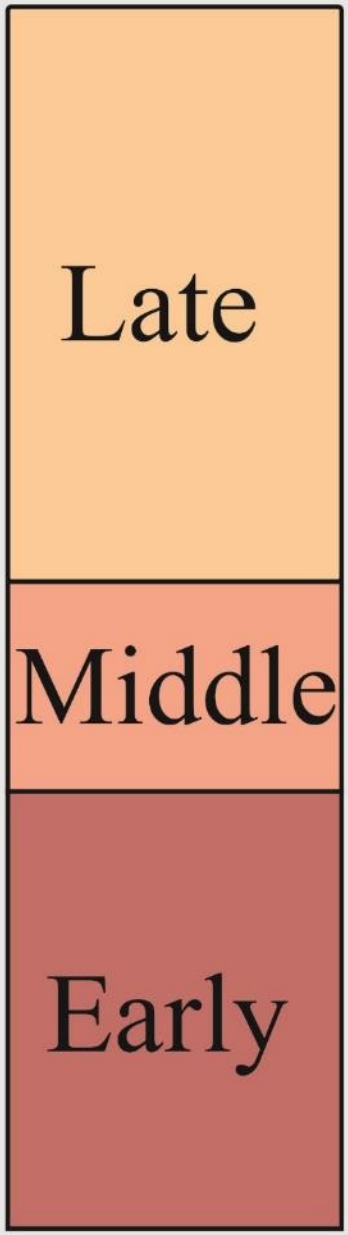
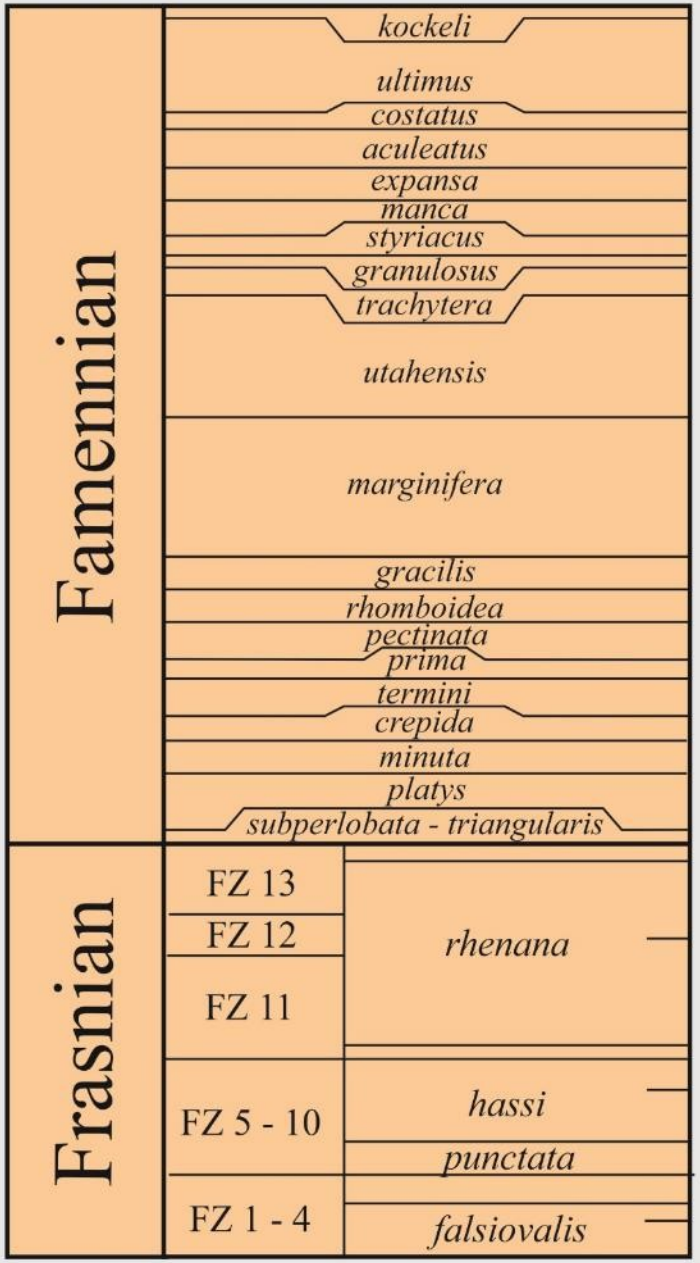
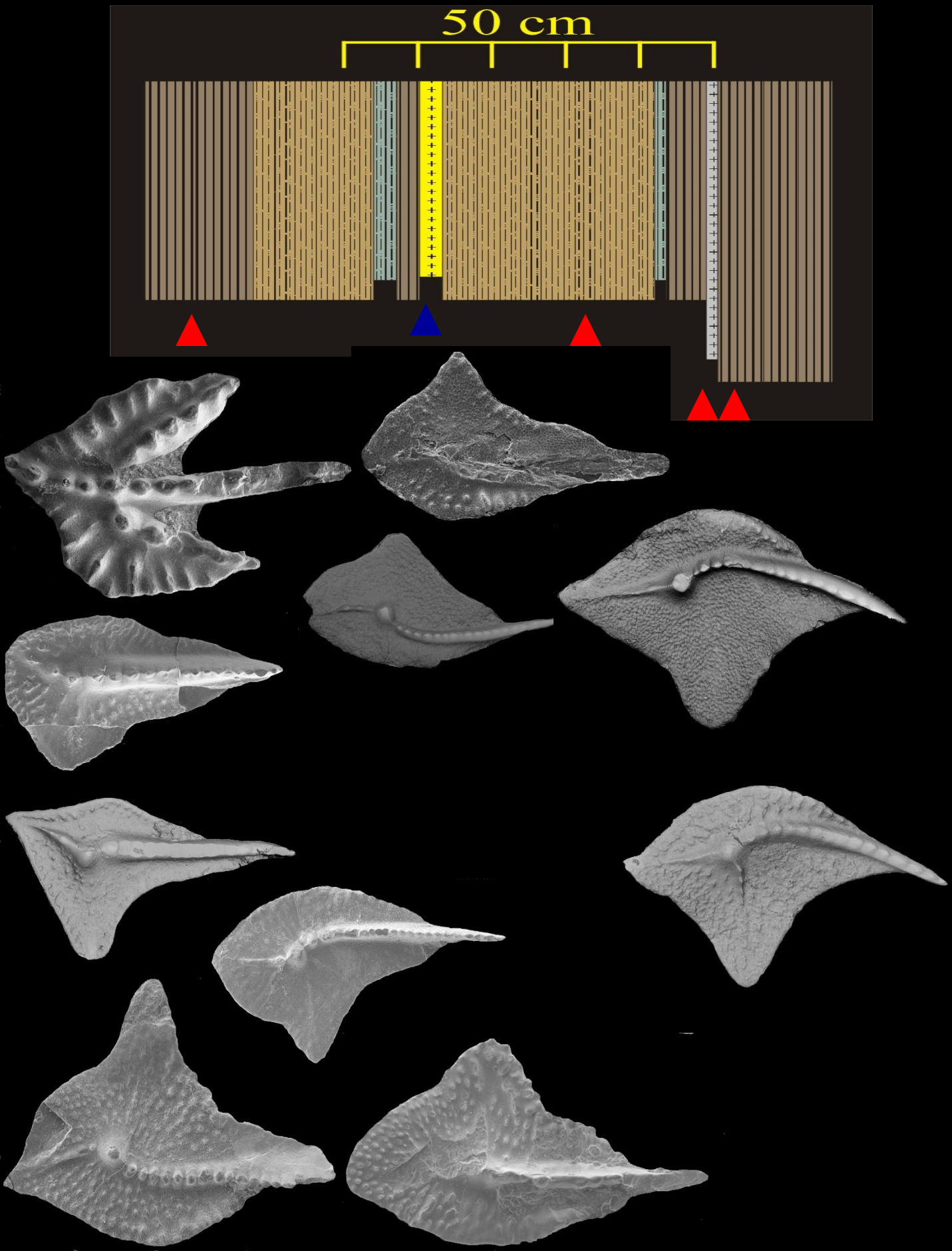
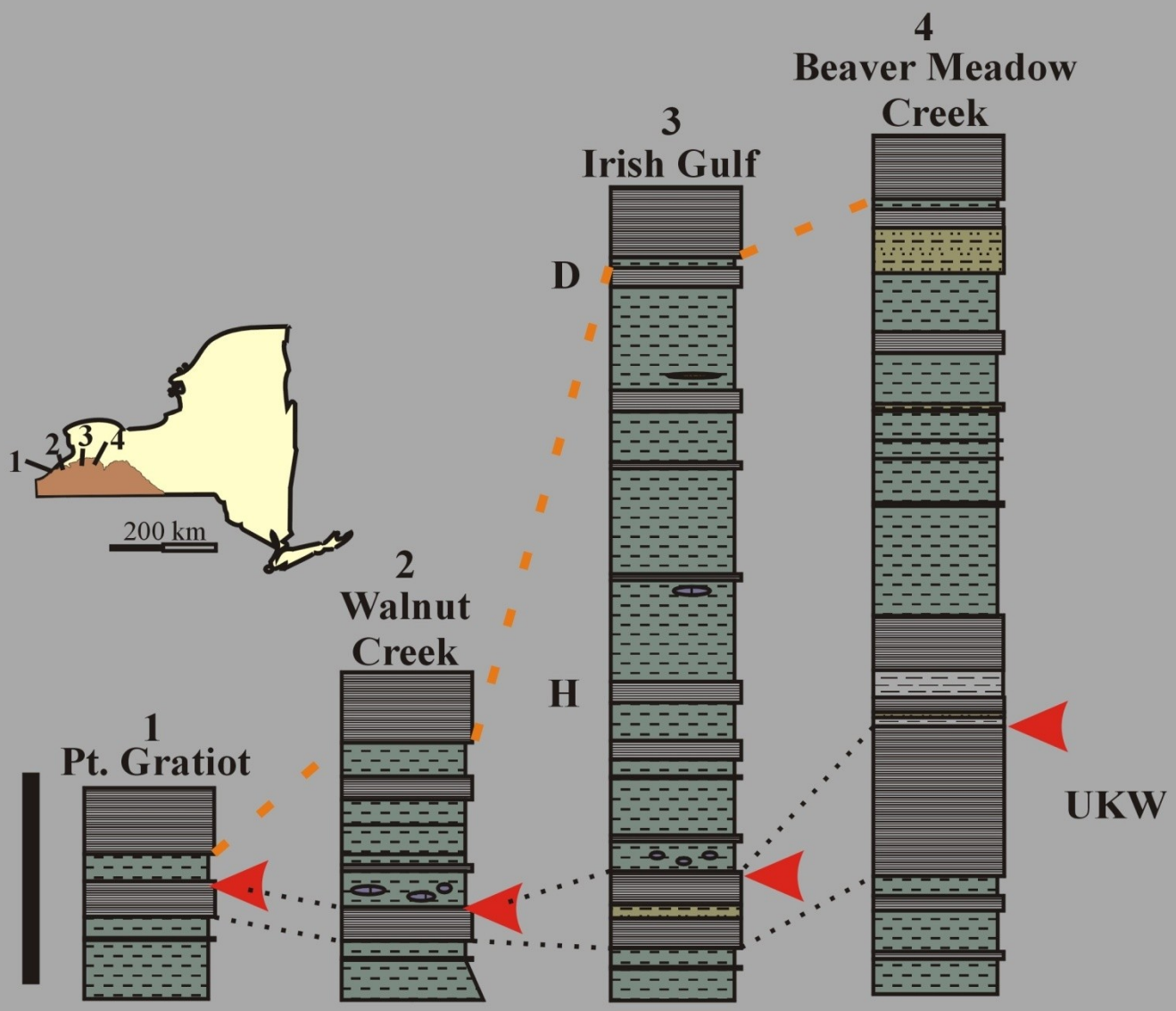

50 cm


EON
ERA
PERIOD
EPOCH
age (Ma)
PHANEROZOIC
Cenozoic
Quaternary (Q)
Neogene
Holocene
Pleistocene
0.01
1.6
Tertiary (T)
Pliocene
Miocene
5.3
23.7
Paleogene
Oligocene
Eocene
Paleocene
36.6
57.8
65.0
Mesozoic
Cretaceous (K)
144
Jurassic (J)
208
Triassic (Tr)
245
Paleozoic
Permian (P)
286
Carboniferous
Pennsylvanian (IP)
320
Mississippian (M)
360
Devonian (D)
408
Silurian (S)
438
Ordovician (O)
505
Cambrian (Є)
545
PROTEROZOIC
2500
ARCHEAN
3800?
Formation of earth and solar system estimated as 5000-4700 Ma based on lunar and meteorite dates.
DJO, 1994

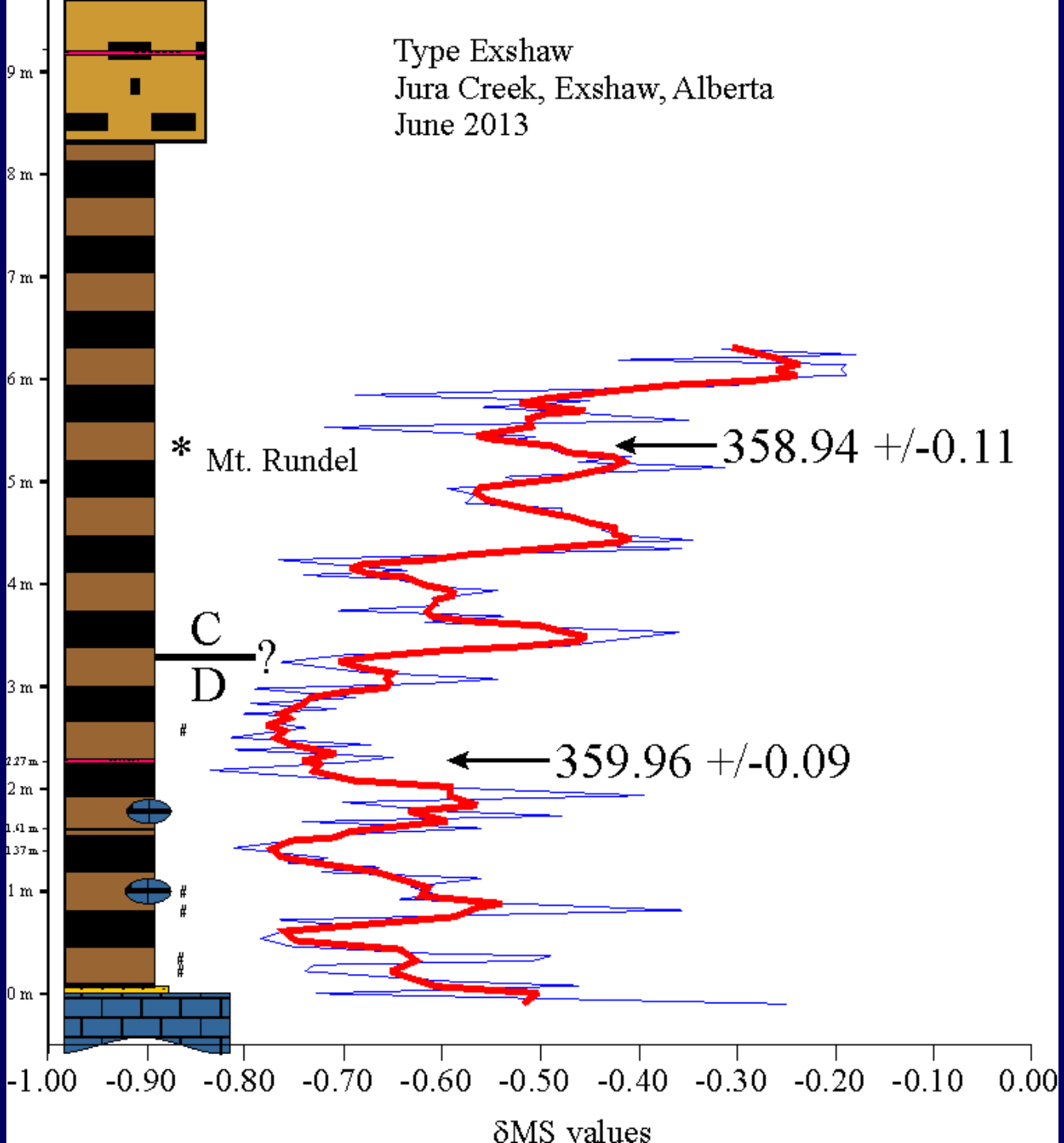

Late
Middle
Early

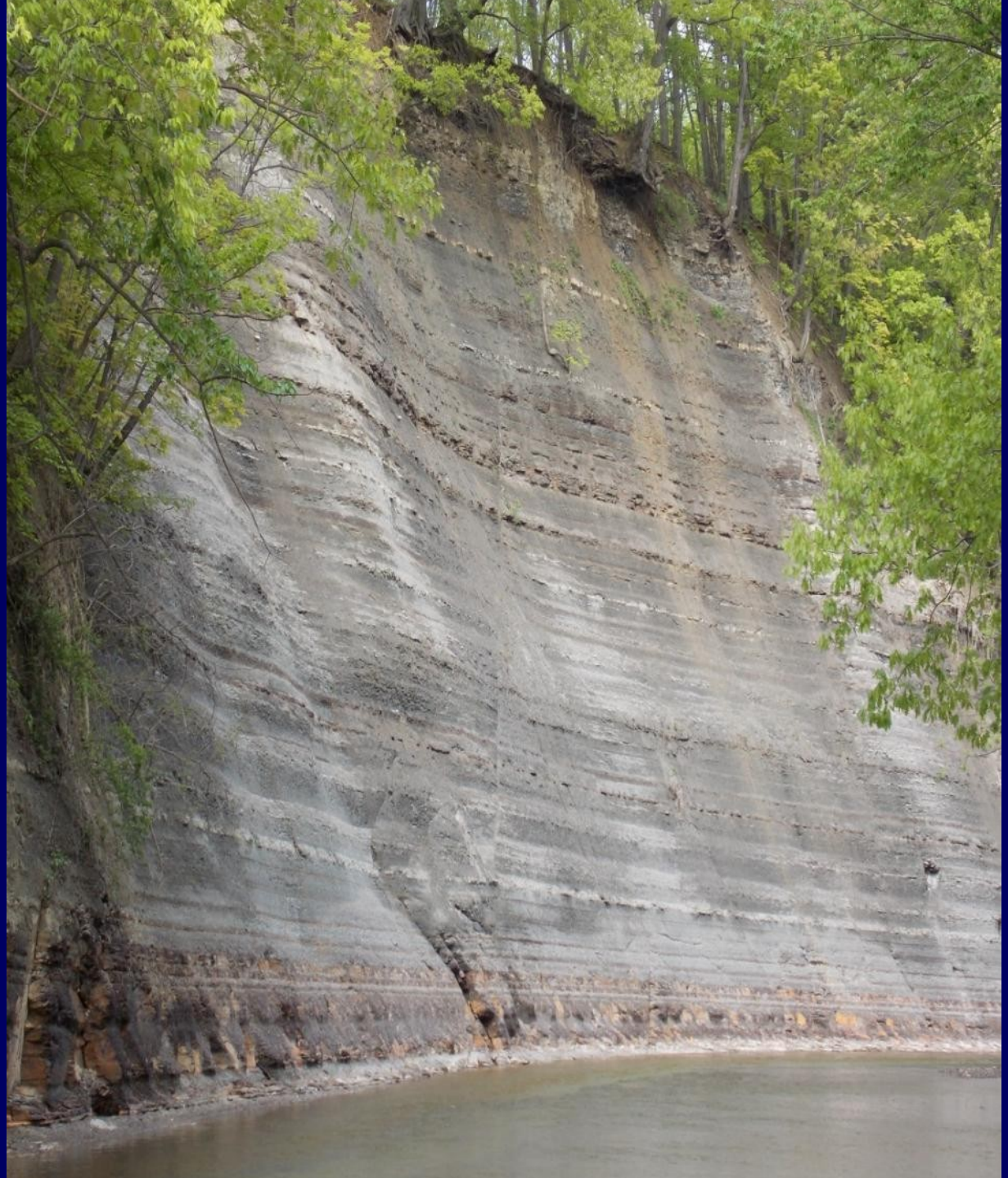

Famennian
kockeli
ultimus
costatus
aculeatus
expansa
manca
styriacus
granulosus
trachytera
utahensis
marginifera
gracilis
rhomboidea
pectinata
prima
termini
crepida
minuta
platys
subperlobata - triangularis
Frasnian
FZ 13
FZ 12
FZ 11
rhenana
FZ 5 - 10
hassi
punctata
FZ 1 - 4
falsiovalis

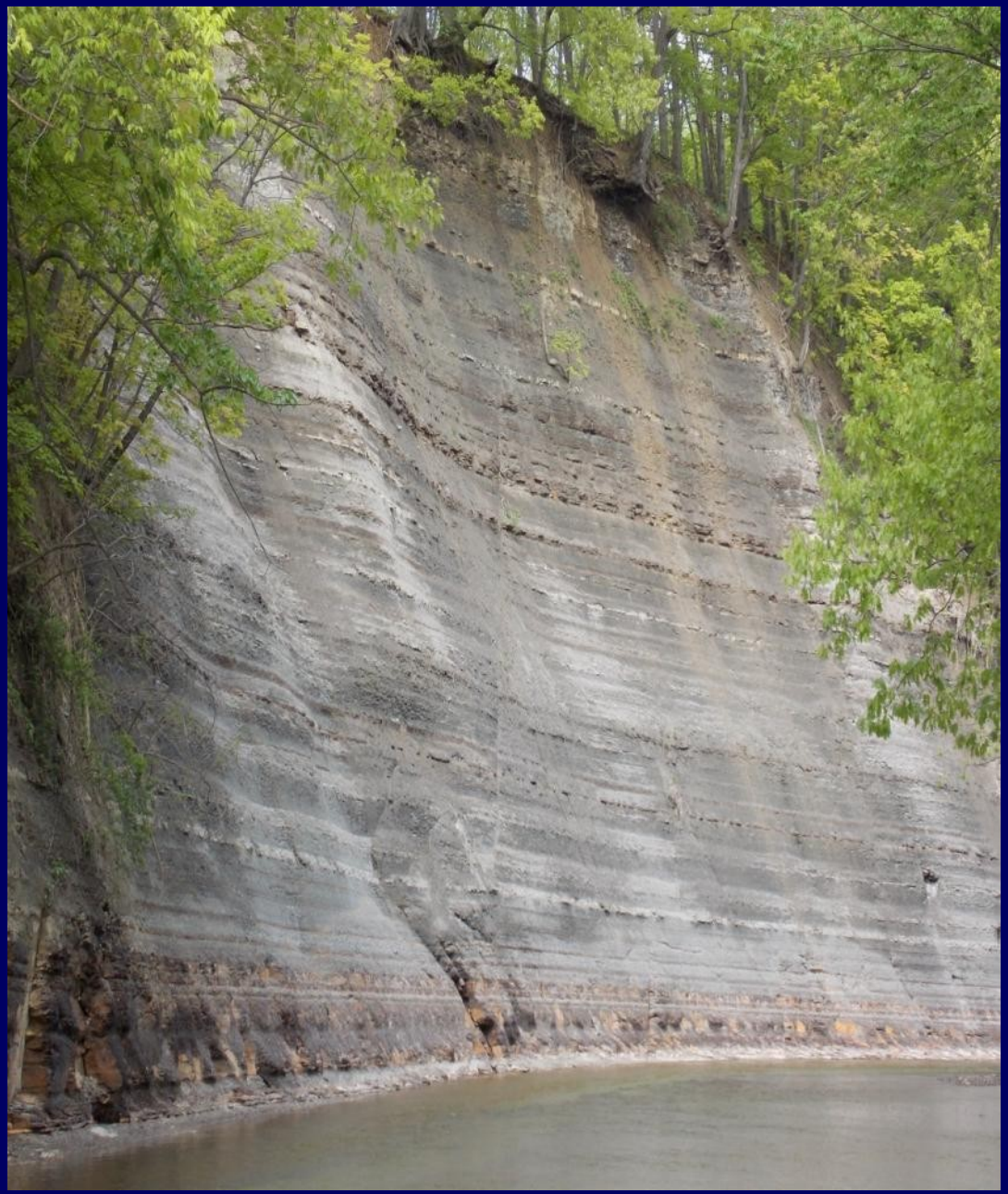

50 cm

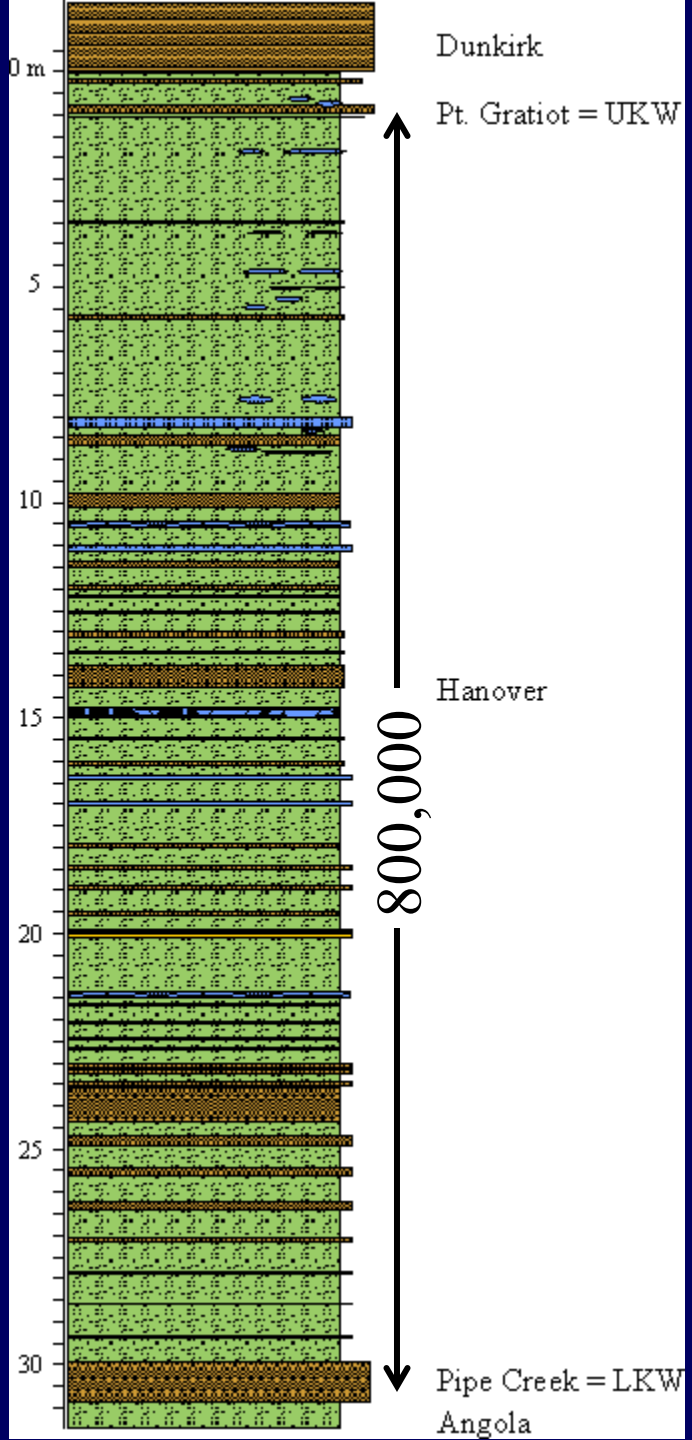

4
Beaver Meadow
Creek
3
Irish Gulf
D
H
2
Walnut
Creek
1
Pt. Gratiot
UKW
1
2
3
4
200 km

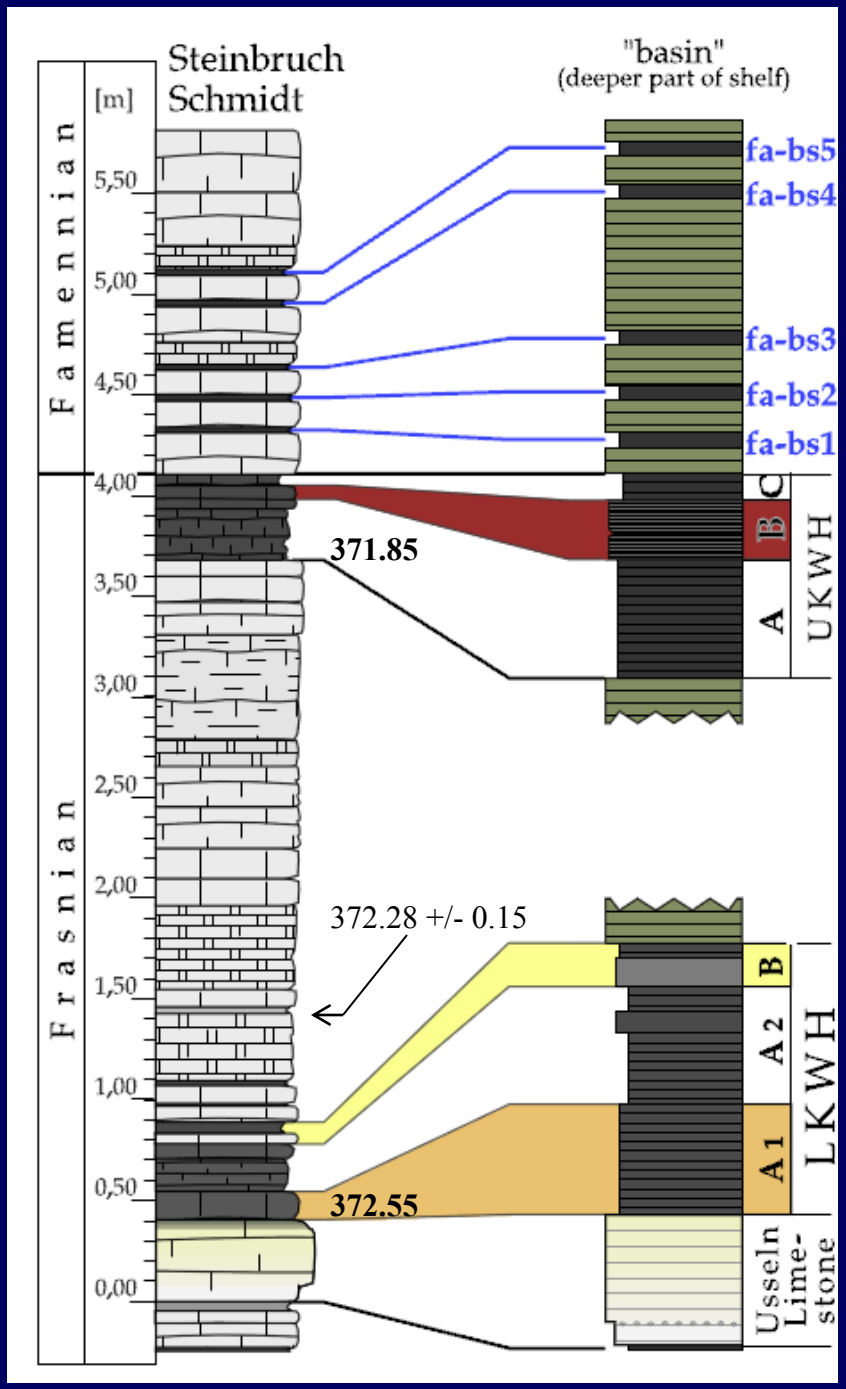

Summit Post


Type Exshaw
Jura Creek, Exshaw, Alberta
June 2013
9 m
8 m
7 m
6 m
5 m
4 m
3 m
2 m
1 m
0 m
* Mt. Rundel
358.94 +/-0.11
C
D
?
359.96 +/-0.09
-1.00
-0.90
-0.80
-0.70
-0.60
-0.50
-0.40
-0.30
-0.20
-0.10
0.00
δMS values



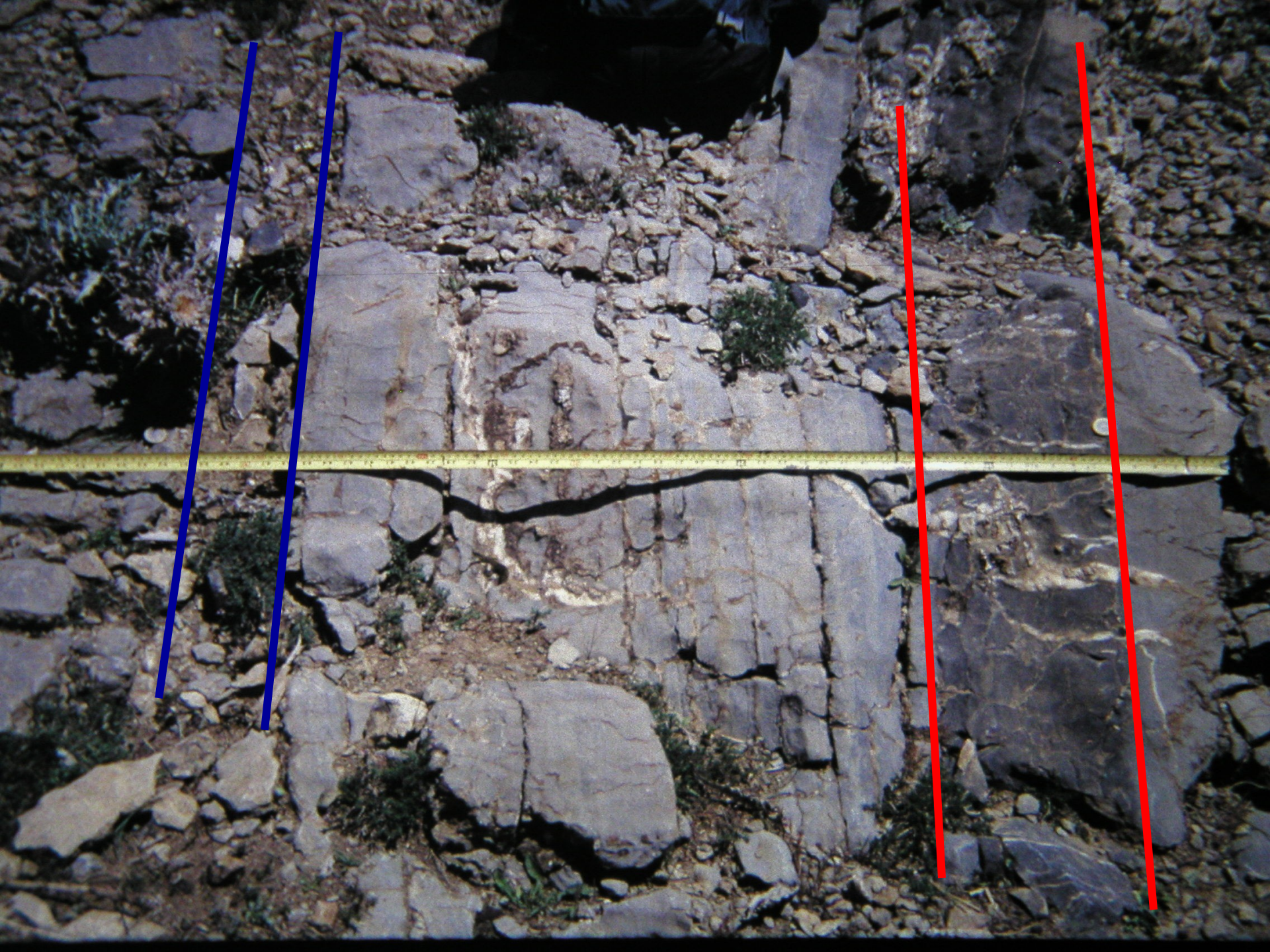


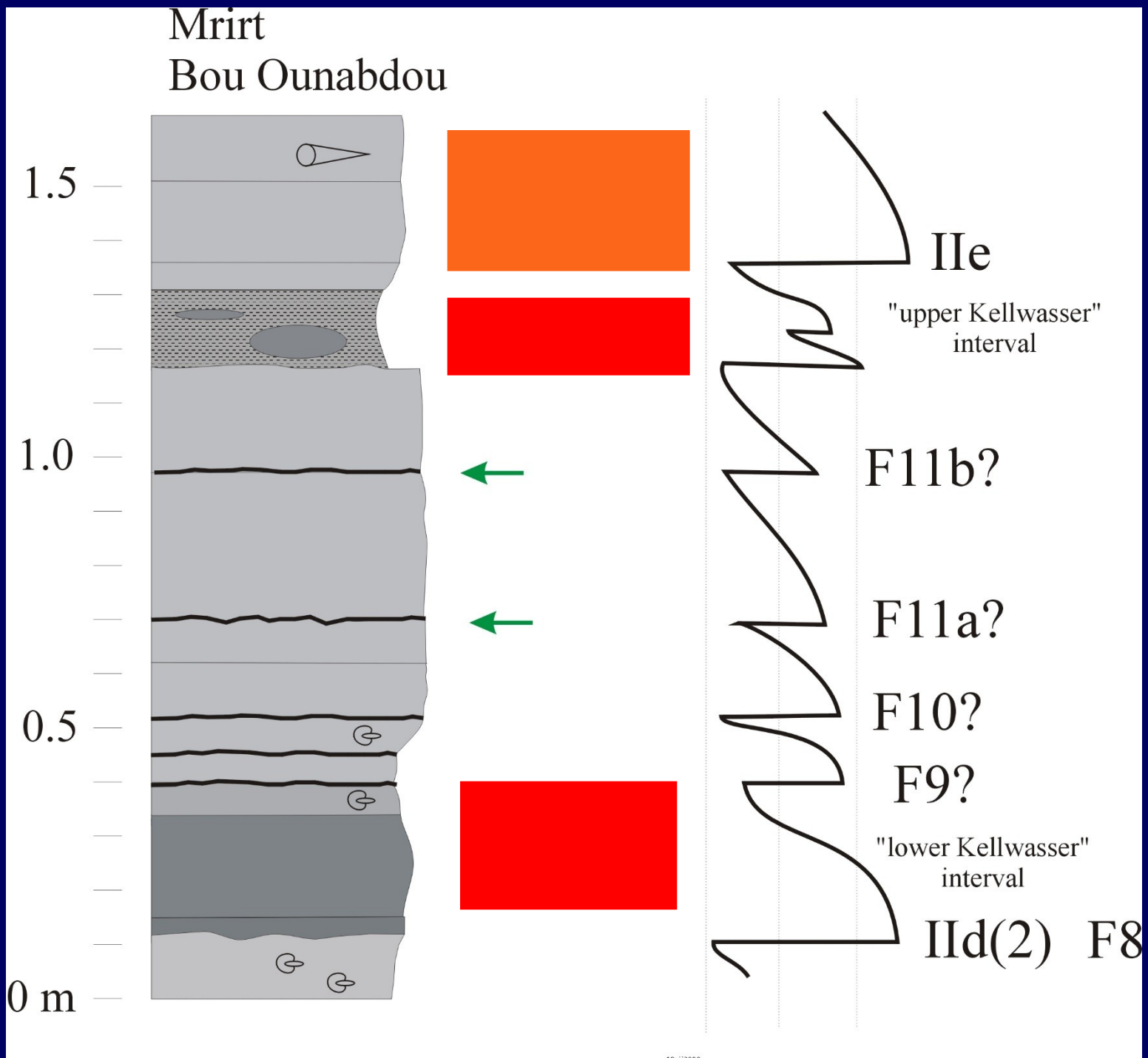

0 m
5
10
15
20
25
30
Dunkirk
Pt. Gratiot = UKW
Hanover
800,000
Pipe Creek = LKW
Angola



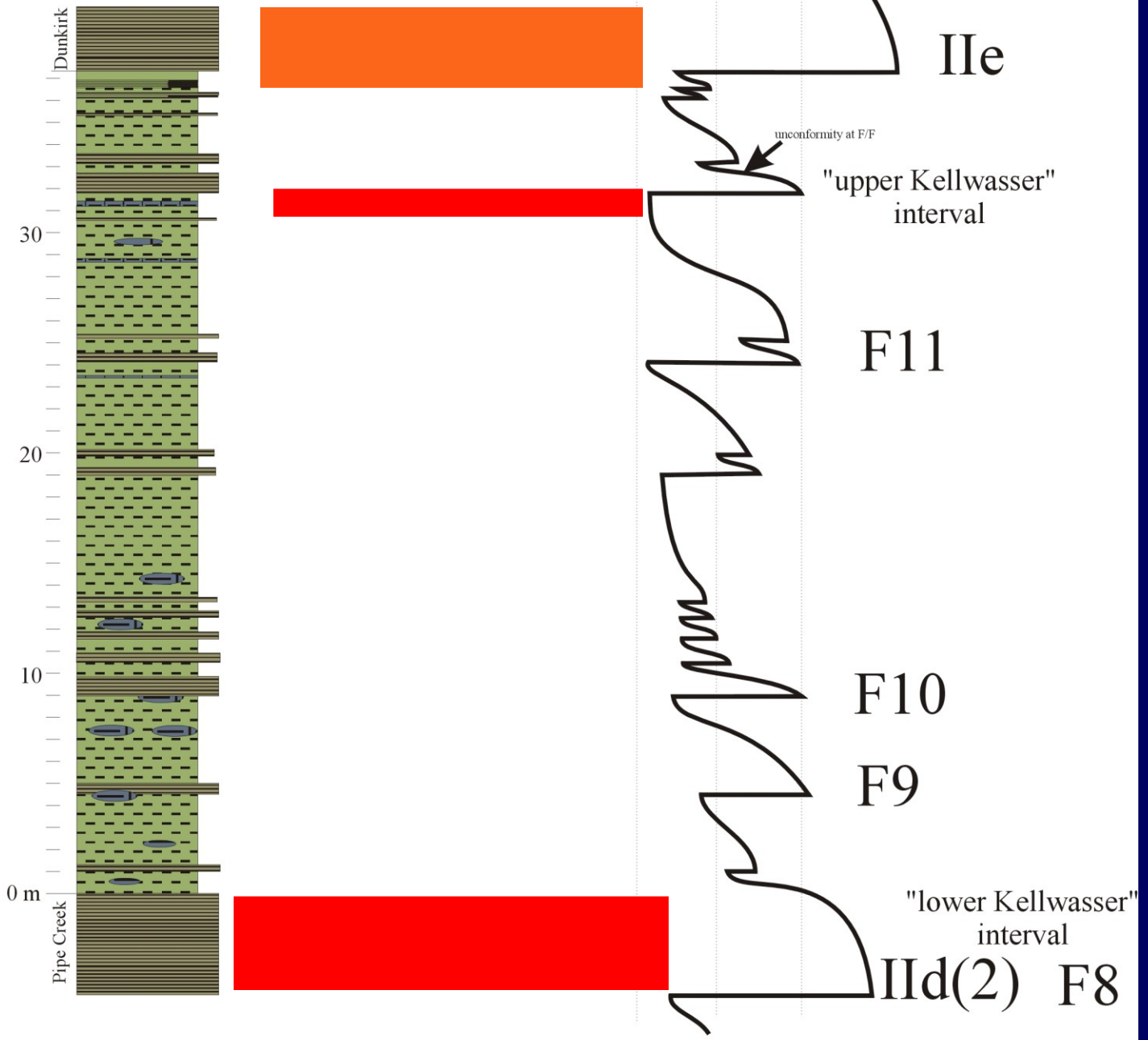
Benner Quarry

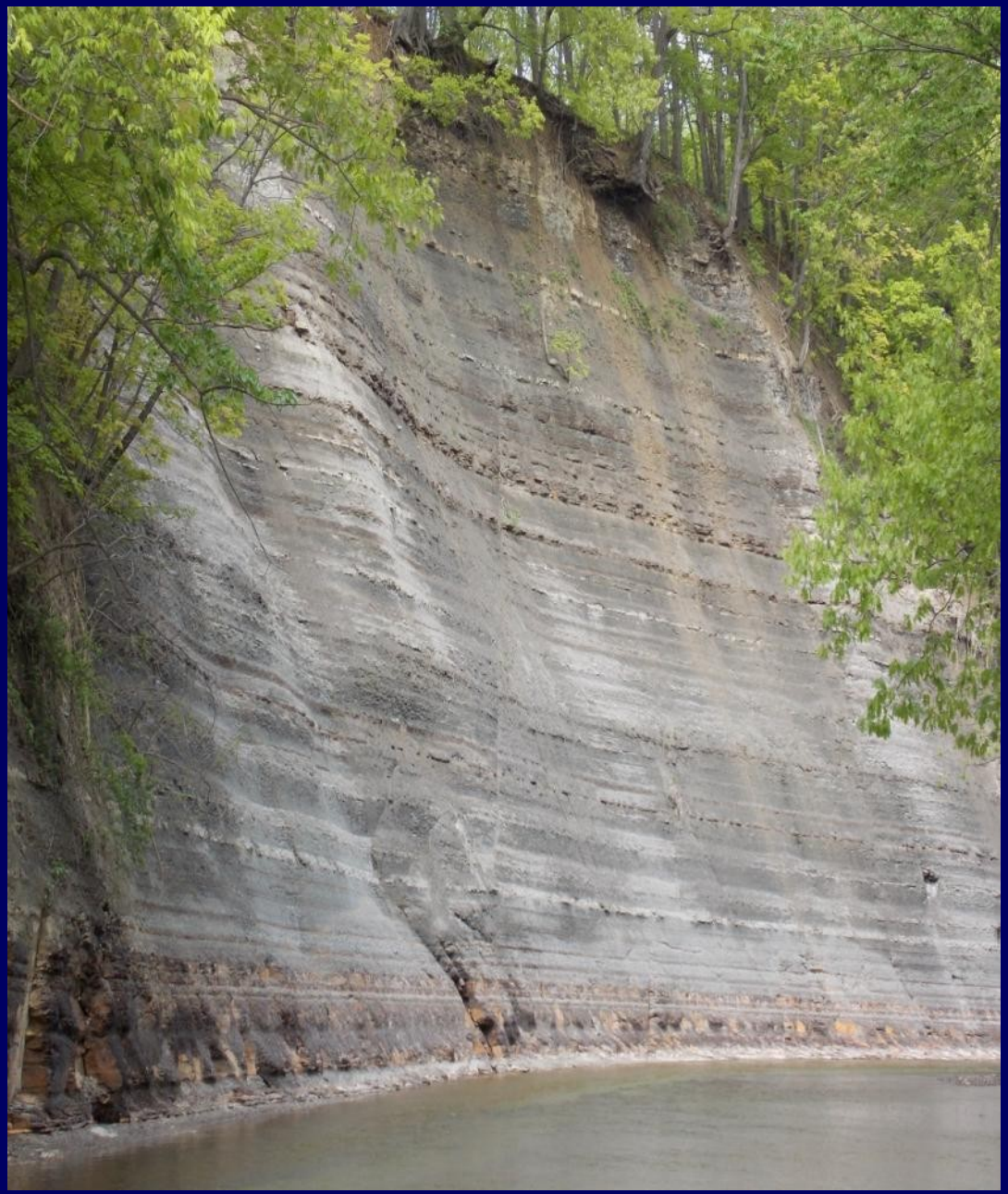
Gereke and Schindler, 2012
Schmitz pers . comm., 2014

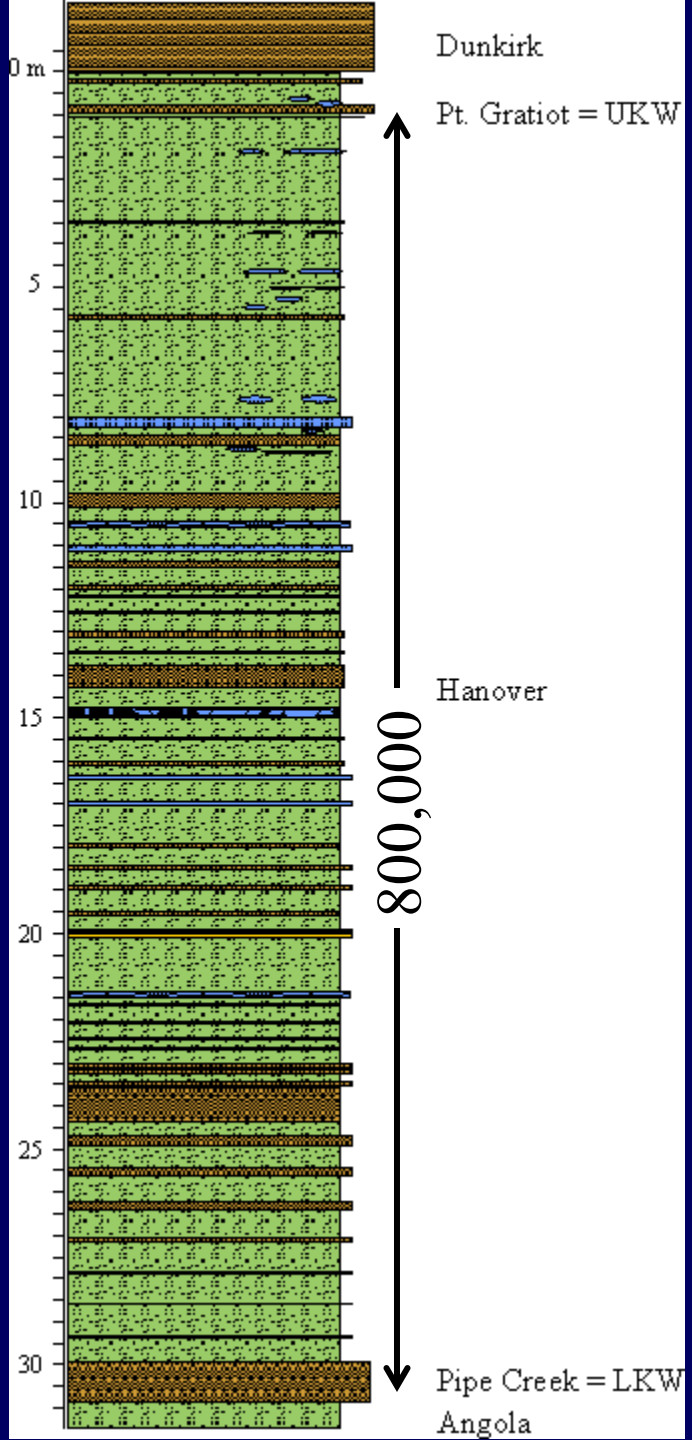



Mrirt
Bou Ounabdou
1.5
1.0
0.5
0 m
IIe
"upper Kellwasser" interval
F11b?
F11a?
F10?
F9?
"lower Kellwasser" interval
IId(2)
F8

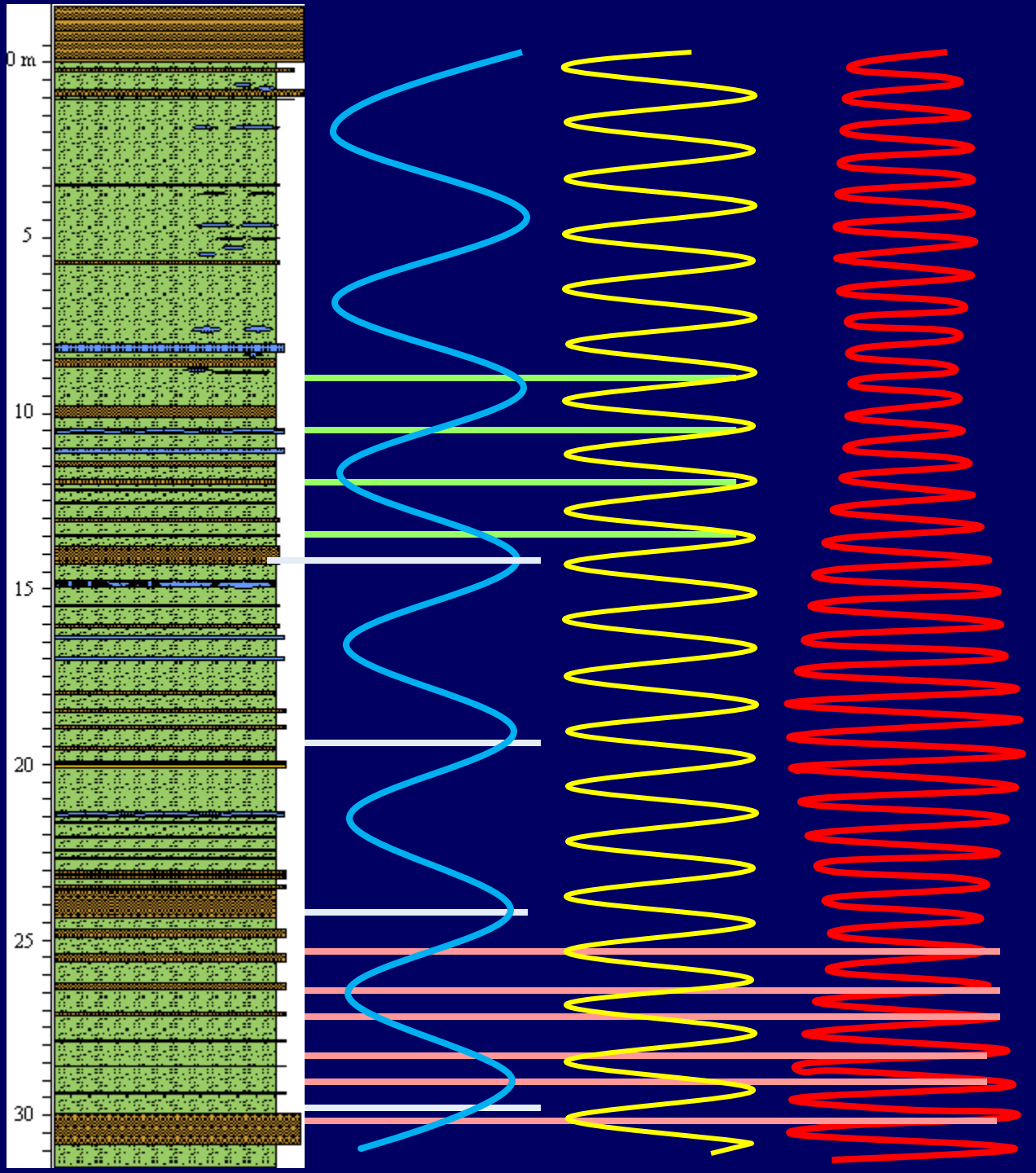
Beavermeadow Creek





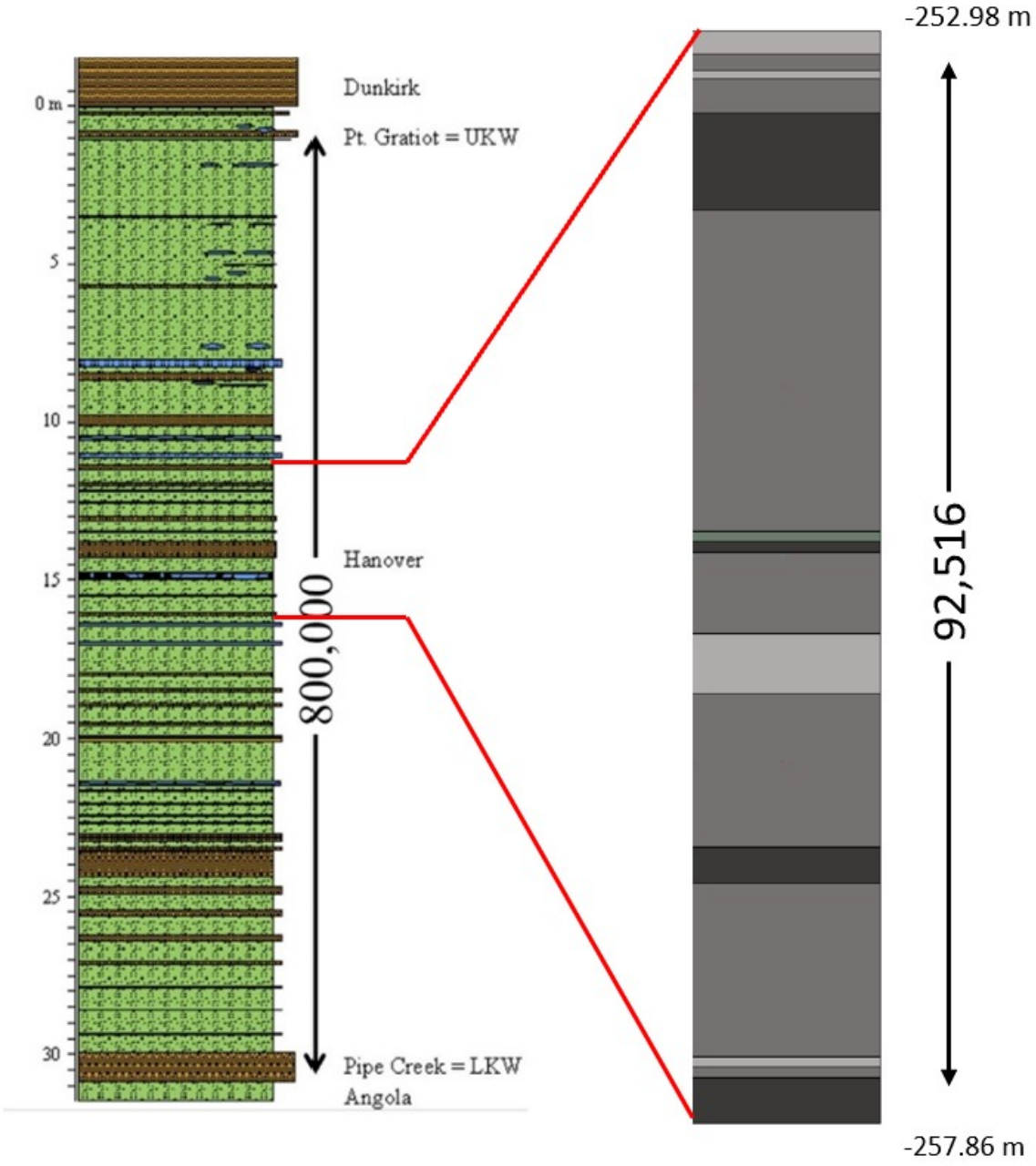

0 m
5
10
15
20
25
30
Dunkirk
Pt. Gratiot = UKW
Hanover
800,000
Pipe Creek = LKW
Angola

- Short Eccentricity cycles: ~5 m
- Obliquity cycles:
- ~2 m
- Precession cycles: ~60 cm
- Cycles occur with measured accuracy
- Dominant cycle can be used to assess deposition rate, latitude, and duration
- Haalstaat cycles – subprecession millennial scale ~5cm

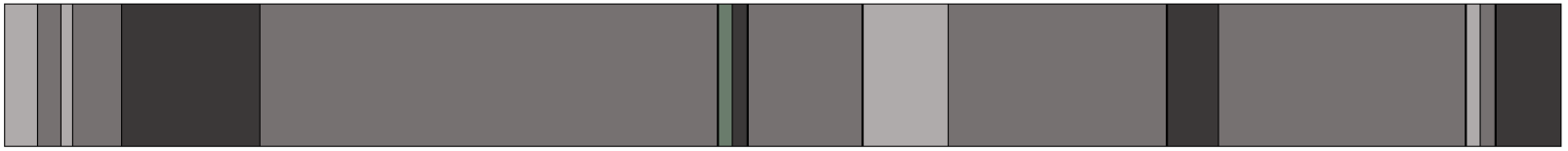


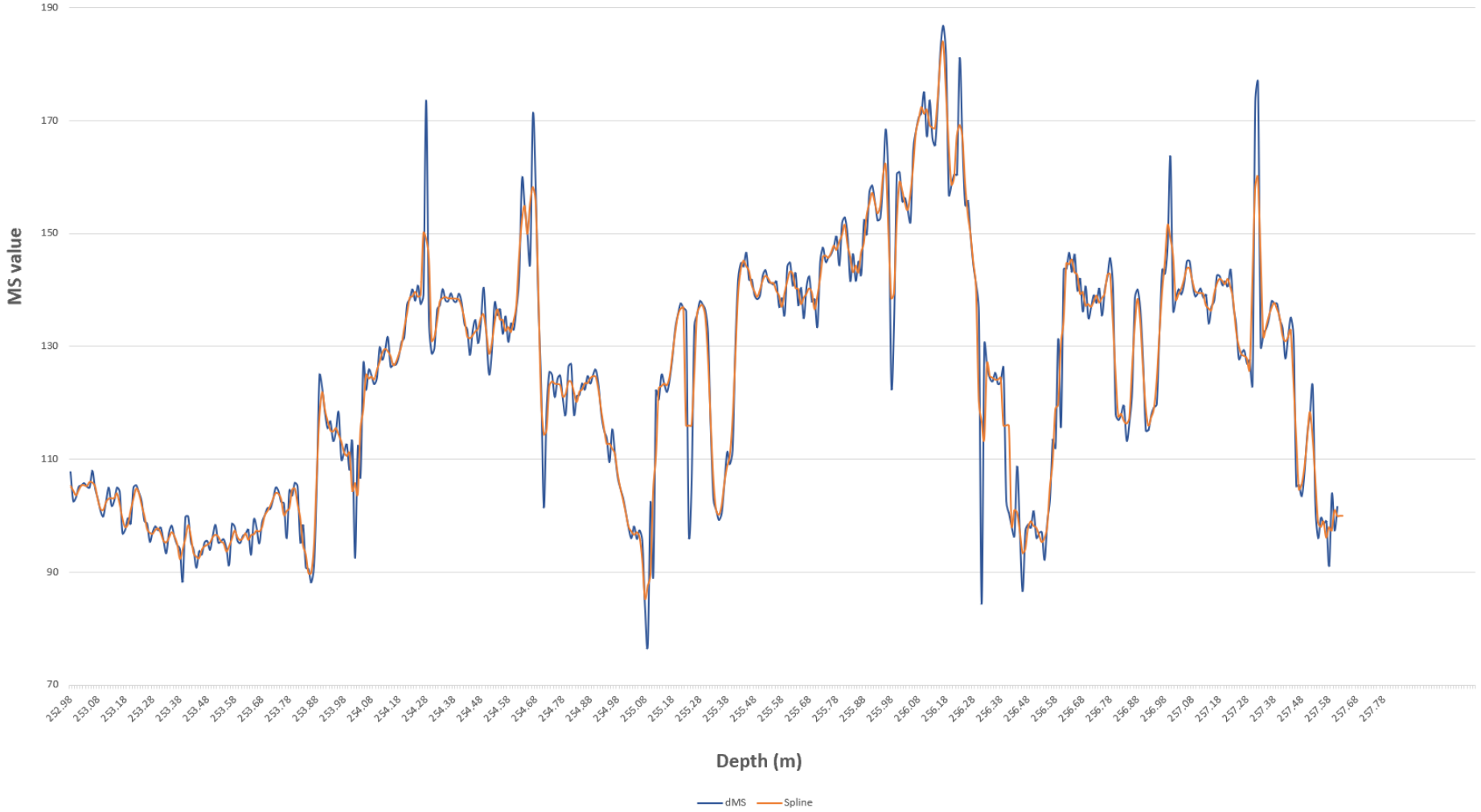

830
835

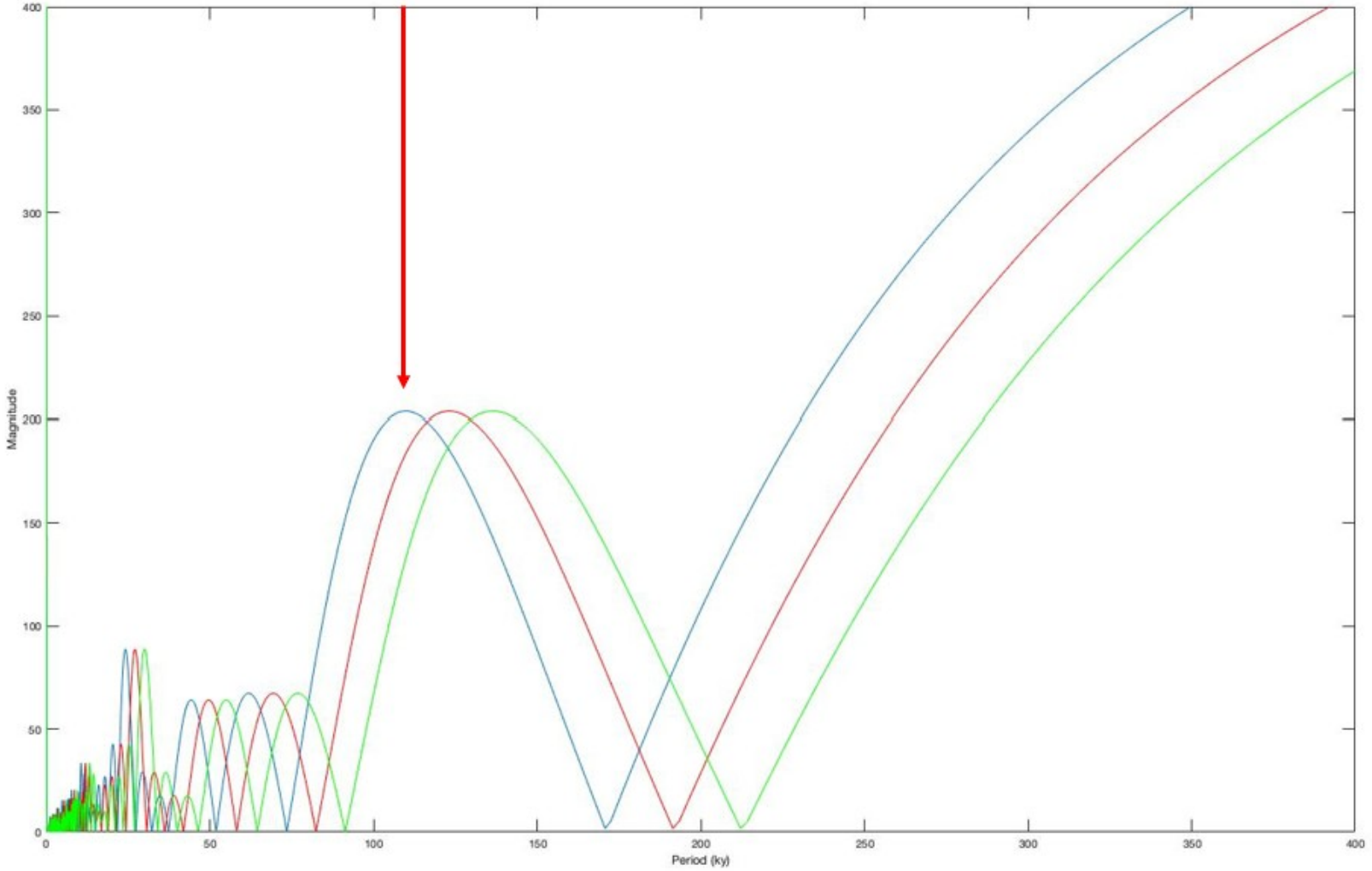
West Valley Core



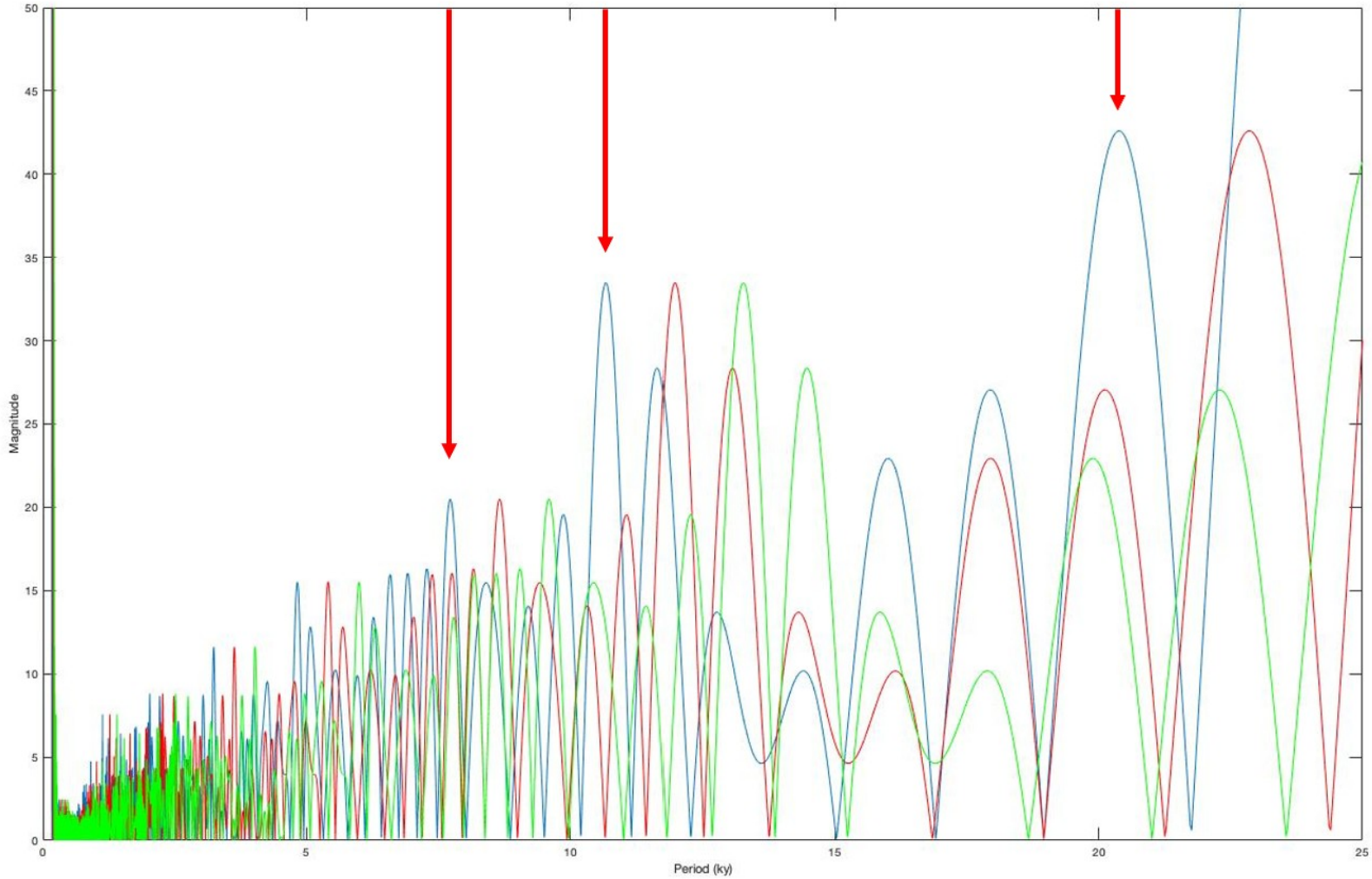
West Valley Core MS data



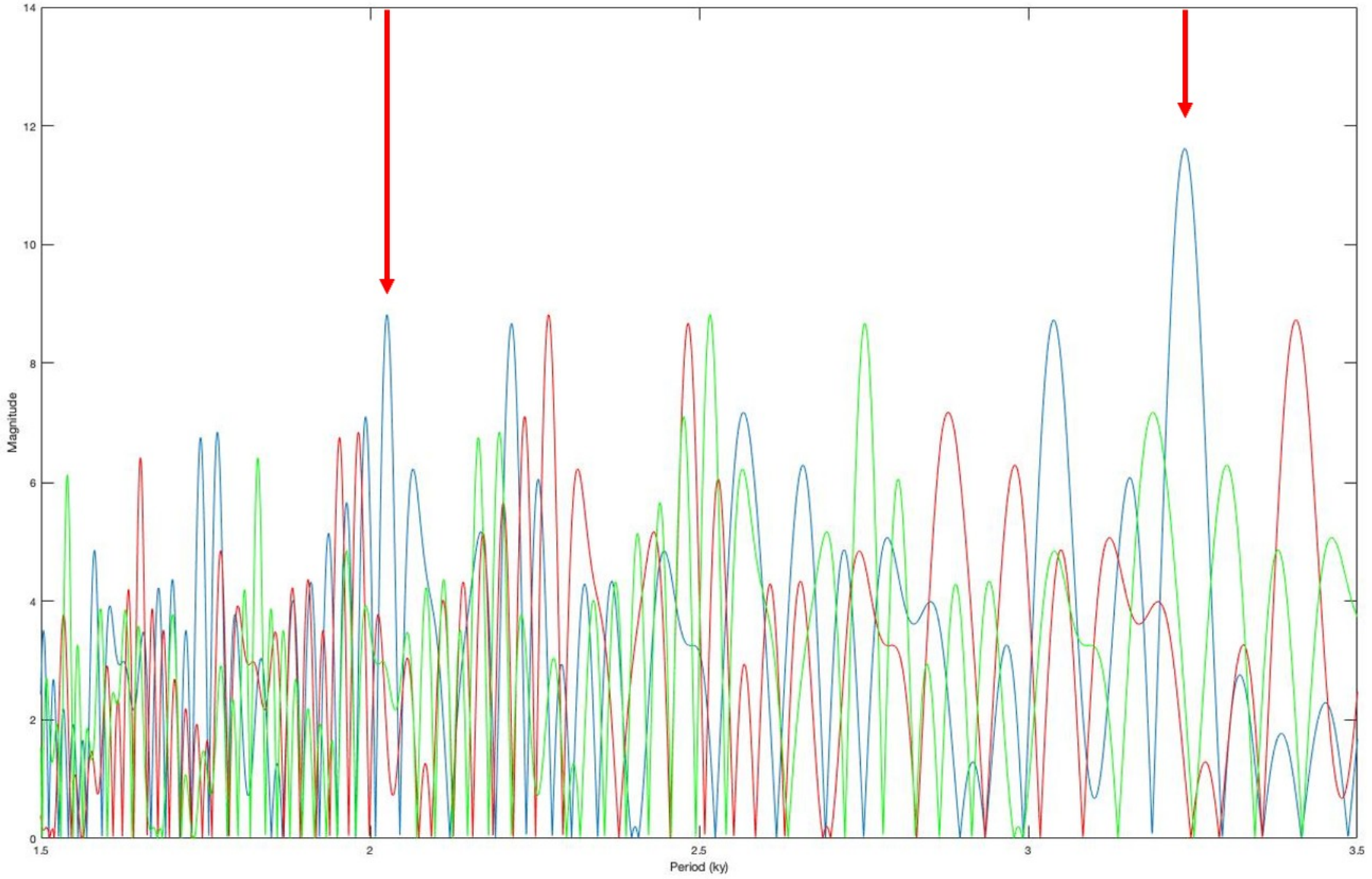




Fourier plot of the delta MS data showing peaks of interest for determination of cycles. A 400 Ky x-axis time limit is used in order to view the big picture of all of the cycles. The red arrow is pointing at a cycle occurring at 100 Ky. The blue line represents the data with an 82,516-year interval. The red line represents the data with a 92,516-year interval. The green line represents the data with a 102,516-year interval.



Fourier plot of the delta MS data showing peaks of interest for determination of cycles. A 25 Ky x-axis time limit is used in order to pick out both precession and sub-precession cycles. The red arrows are pointing to cycles occurring at 7 Ky 10-11 Ky and 19-21 Ky. The blue line represents the data with an 82,516-year interval. The red line represents the data with a 92,516-year interval. The green line represents the data with a 102,516-year interval.



Fourier plot of the delta MS data showing peaks of interest for determination of cycles. A 3.5 Ky x-axis time limit is used in order to view the fine scale sub-precession cycles. The red arrows are pointing to cycles occurring at 2.0-2.05 Ky and 3.2-3.3 Ky. The blue line represents the data with an 82,516-year interval. The red line represents the data with a 92,516-year interval. The green line represents the data with a 102,516-year interval.

https://us.fulbrightonline.org/

Who am I – Fulbright scholar – funded by the Congress of the United States.
The idea is that you learn more about the United States, you get to work on your English skills; I get to learn more about Czechia and take this information back to the US, develop Czech language skills, and work with Dr. Kumpan as well as others on collaborative research projects.

Who are you?

What the class is about – Cyclic Stratigraphy and Astrochronology

This course will review and discuss cyclic processes in the stratigraphic record and methodology for interpretation of the duration of the different cycles: Sloss super cycles, First, Second, and Third order sequences - global tectonics; Milankovitch cycles - orbital perturbations; Millennial-scale cycles - orbital perturbations and climate dynamics; and smaller scale cycles. This is a dynamic topic with relevance from Holocene to Archean climate, hydrological, and depositional studies that has implications in all aspects of sedimentary geology as the changes in climate have an impact on the distribution of organisms, weather patterns, and generation of clastic particles.

What the class is about – Cyclic Stratigraphy and Astrochronology

General review and major resources:

Hinnov, L.A., Hilgen, F.J., 2012. Chapter 4. Cyclostratigraphy and Astrochronology. *In* Gradstein, F.M., Ogg, J., Schmitz, M., Ogg, G. (eds.), The Geologic Time Scale 2012, Elsevier. p. 63–83.

Laskar, J., 2020. Astrochronology. *In* Gradstein, F.M., Ogg, J.G., Schmitz, M., Ogg, G. (eds.), The Geologic Time Scale 2020. Elsevier, Amsterdam, p. 139-158.

Strasser, A., Hilgen, F.J., Heckel, P.H., 2006. Cyclostratigraphy - concepts, definitions, and applications. Newsletter in Stratigraphy 42:75–114.

What you need to do...

syllabus

readings

students guide discussion and
assign readings

Syllabus

Week 1	15 Sept	field classes
Week 2	22 Sept	Introduction to cyclostratigrpahy and astrochronology
Week 3	29 Sept	no meeting
Week 4	06 Oct	research paper/student-faculty discussion
Week 5	13 Oct	research paper/student-faculty discussion
Week 6	20 Oct	research paper/student-faculty discussion
Week 7	27 Oct	research paper/student-faculty discussion
Week 8	03 Nov	research paper/student-faculty discussion
Week 9	10 Nov	research paper/student-faculty discussion
Week 10	17 Nov - holiday	no meeting
Week 11	24 Nov	research paper/student-faculty discussion
Week 12	01 Dec	research paper/student-faculty discussion
Week 13	08 Dec	research paper/student-faculty discussion
Week 14	15 Dec	review and summary

What you need to do...

For our next meeting you need to read Hinnov, L.A., Hilgen, F.J., 2012. Chapter 4. Cyclostratigraphy and Astrochronology. *In* Gradstein, F.M., Ogg, J., Schmitz, M., Ogg, G. (eds.), The Geologic Time Scale 2012, Elsevier. p. 63–83.

Laskar, J., 2020. Astrochronology. *In* Gradstein, F.M., Ogg, J.G., Schmitz, M., Ogg, G. (eds.), The Geologic Time Scale 2020. Elsevier, Amsterdam, p. 139-158.

Strasser, A., Hilgen, F.J., Heckel, P.H., 2006. Cyclostratigraphy - concepts, definitions, and applications. Newsletter in Stratigraphy 42:75–114.

At our next meeting we will discuss these articles and then plan for the rest of the semester which will involve assigning when you will be in charge of discussion.