FIRST HIGH-RESOLUTION MARINO-PALYNOLOGICAL STRATIGRAPHY OF LATE QUATERNARY SEDIMENTS FROM THE CENTRAL PART OF THE BULGARIAN BLACK SEA AREA

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Danail Pavlov [2], Marco Coolen [3], Liviu Giosan [3]

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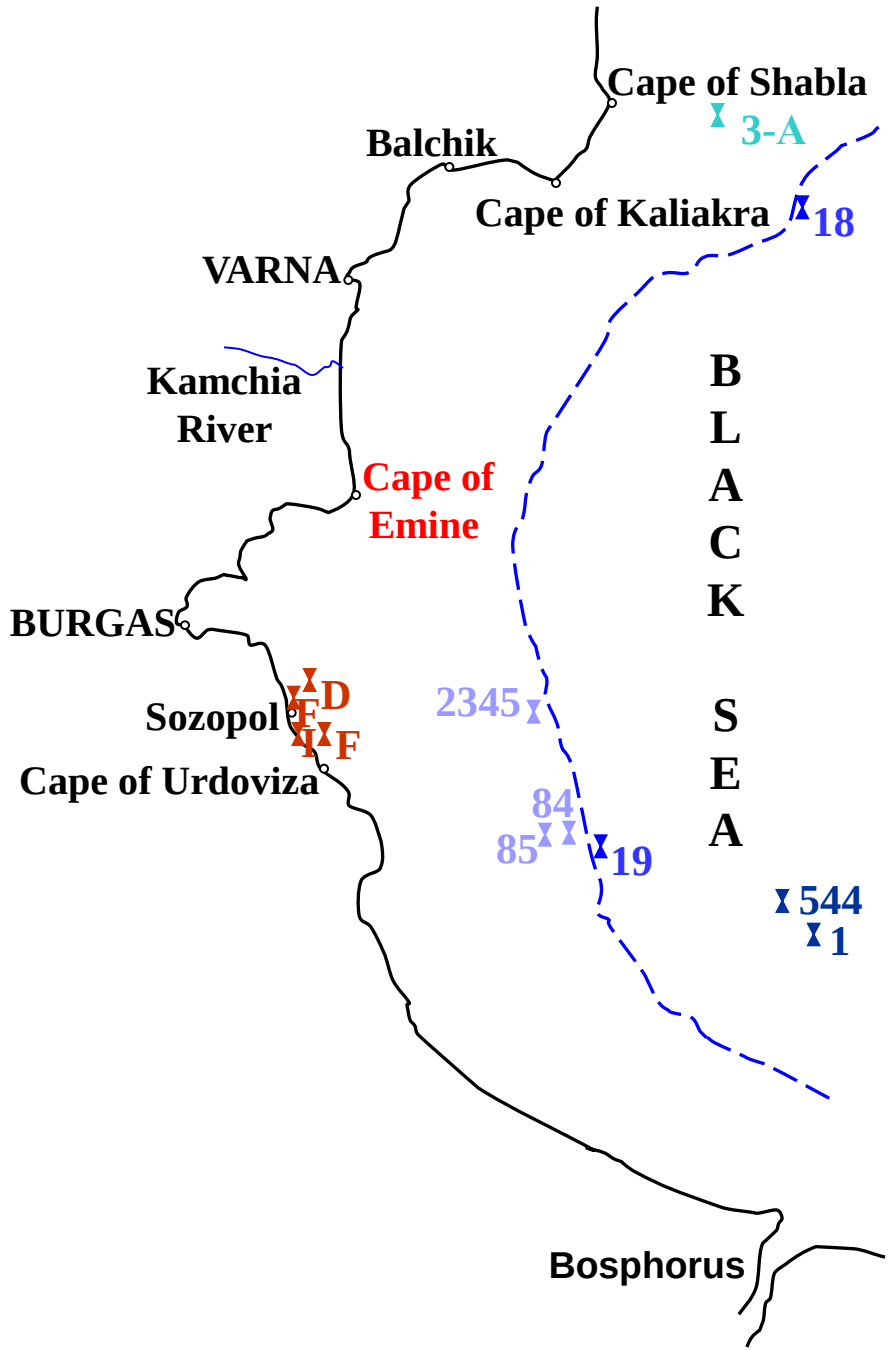
[2]Society of Innovative Ecologists in Bulgaria, Varna (Bulgaria)

[3]Woods Hole Oceanographic Institution (USA)



Location of some previous cores palynologically investigated

(Filipova-Marinova, 2006)

4 cores from the littoral (inner) shelf zone

1 core from the central shelf zone

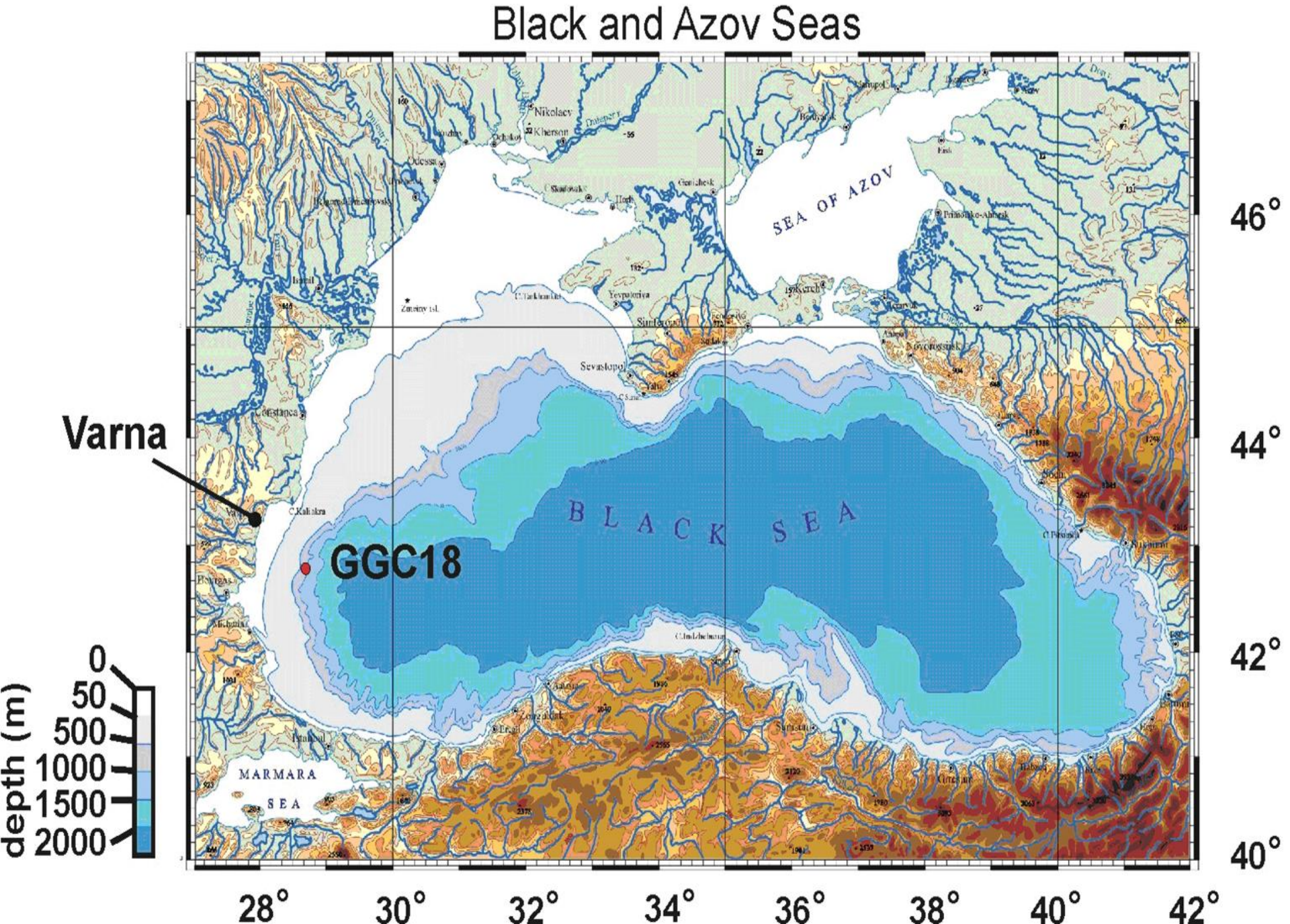
3 cores for the peripheral (outer) shelf zone

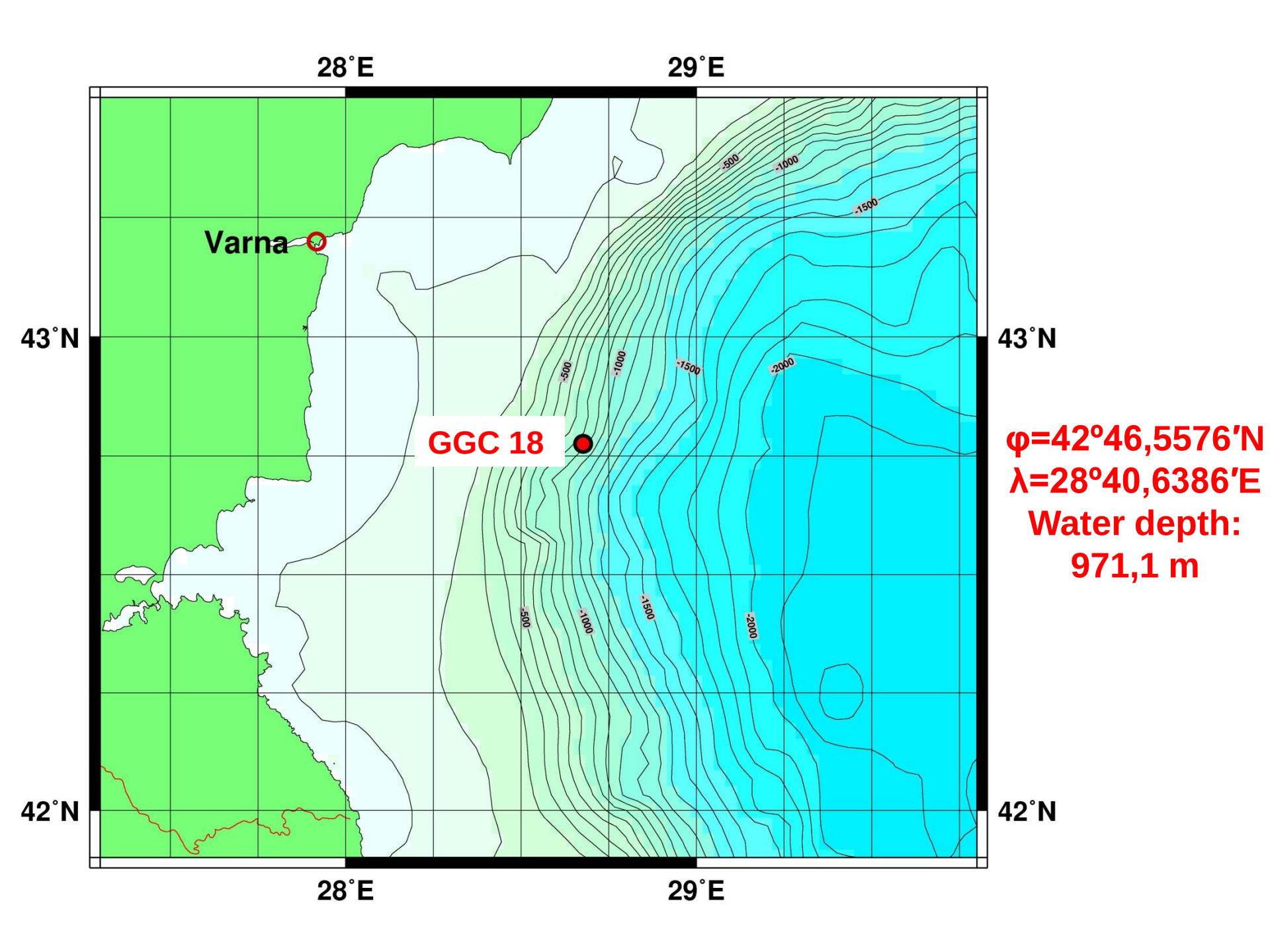
2 cores from the continental slope

2 cores from the deep-water zone (abyssal plain)

AIM

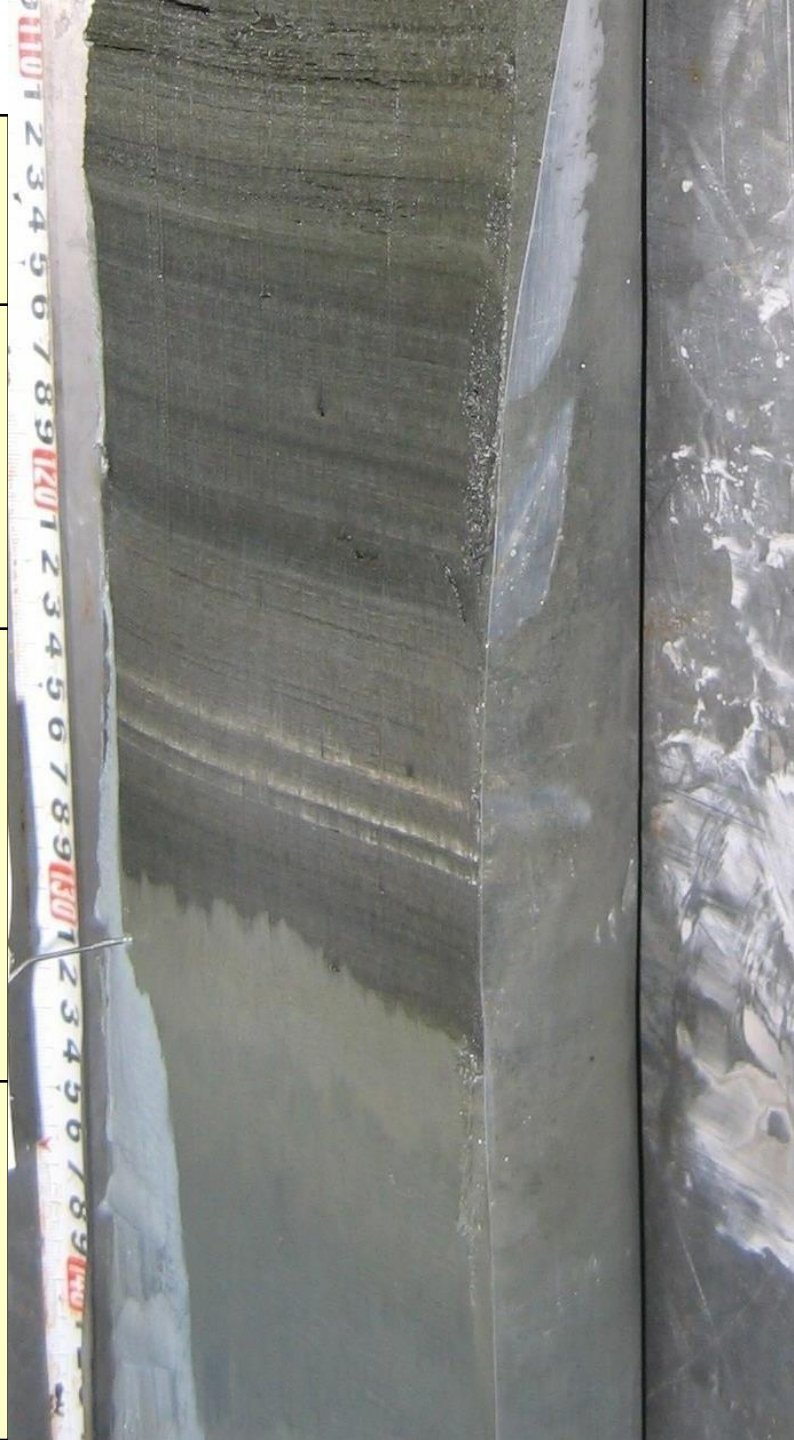
To refine the understanding of Late Quaternary evolution of the Black Sea and to provide a more detailed reconstruction of palaeoenvironmental changes in the western Black Sea area for the last 12 000 years.


Black and Azov Seas
Varna
GGC18
BLACK SEA
SEA OF AZOV
MARMARA SEA
depth (m)
0
50
500
1000
1500
2000
46°
44°
42°
40°
28°
30°
32°
34°
36°
38°
40°
42°


28˚E
29˚E
43˚N
42˚N
Varna
GGC 18
-500
-1000
-1500
-2000
φ=42º46,5576′N
λ=28º40,6386′E
Water depth:
971,1 m

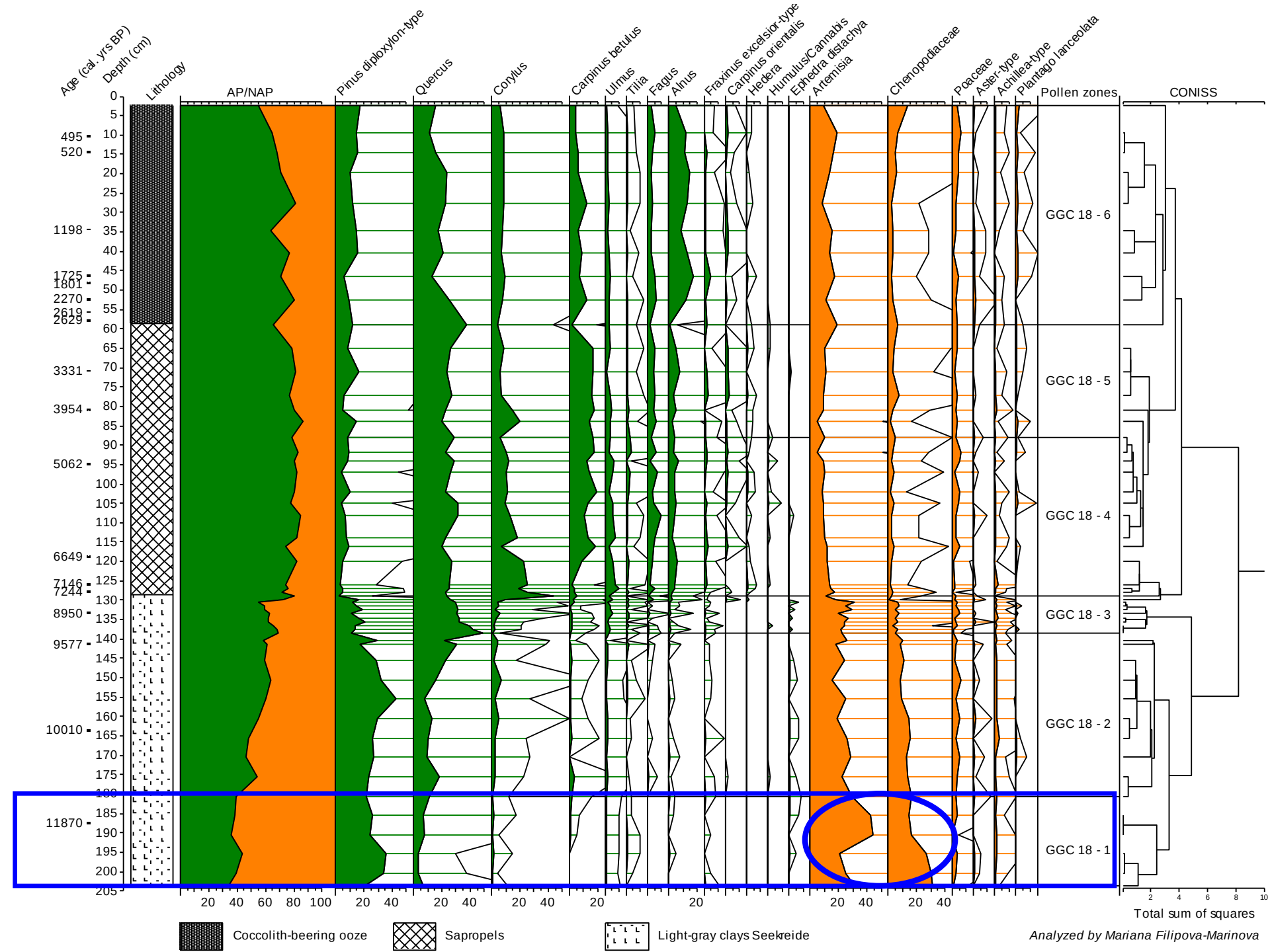
Lithology of GGC 18

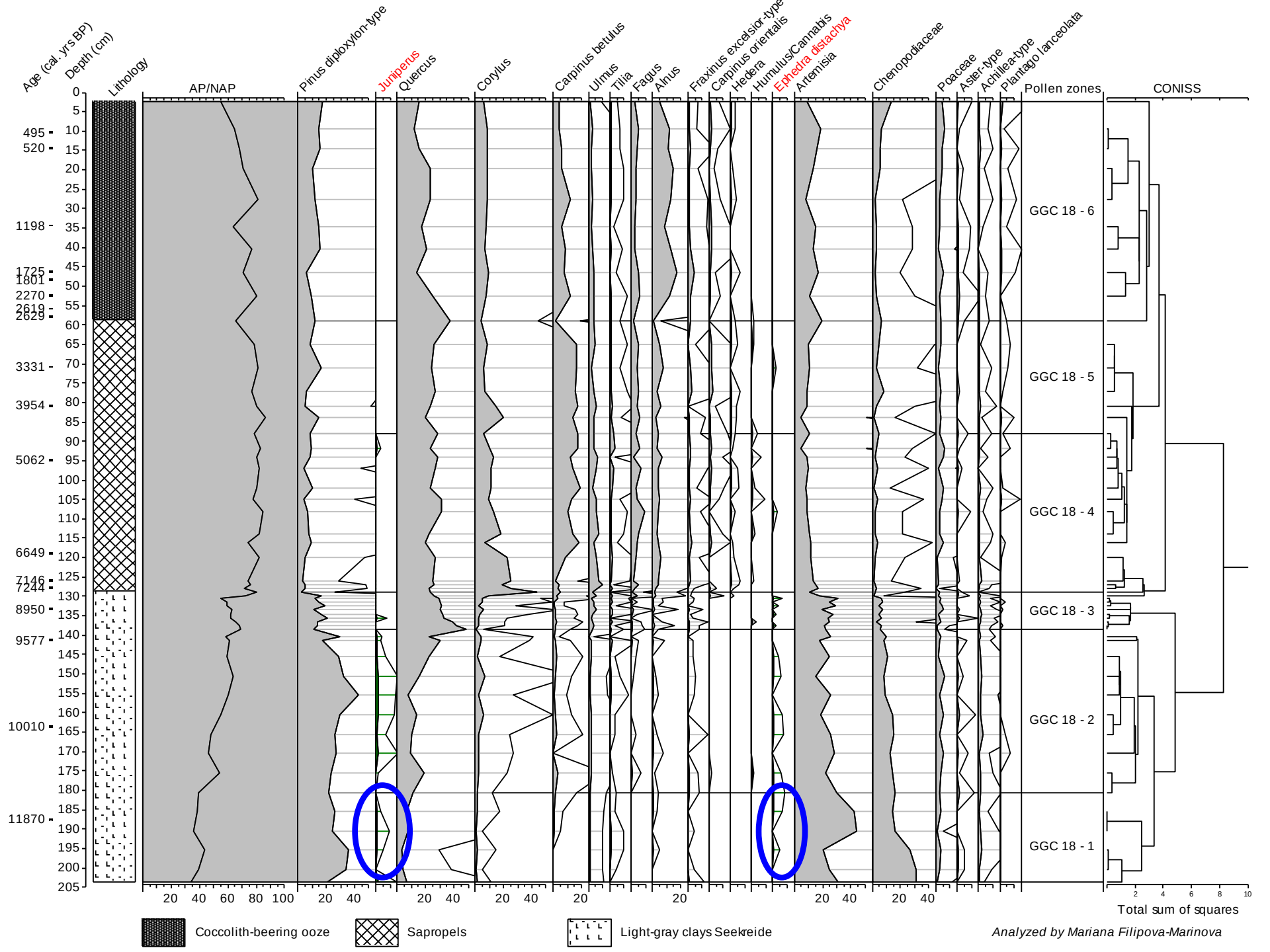
Unit (s)	Depth (cm)	Sediment	Color
I	2.5 – 58.5	Coccolith-bearing ooze	Light grey
II	58.5 – 128.5	Sapropels	Olive grey
III	128.5 – 203.5	clay	Light grey



AMS Radiocarbon dating

Depth (cm)	*Lab. №*	*Material dated*	*Uncalibrated yrs. BP*	*Calendar yrs. BP*
10,5	**OS-58560**	**Bulk**	**1020 ± 30**	**495**
14,5	**OS-58560**	**Bulk**	**1060 ± 30**	**520**
34,5	**OS-58602**	**Bulk**	**1910 ± 30**	**1198**
46,5	**OS-58502**	**Bulk**	**2390 ± 30**	**1725**
48,5	**OS-58501**	**Bulk**	**2450 ± 25**	**1801**
52,5	**OS-58498**	**Bulk**	**2890 ± 30**	**2270**
56	**OS-58559**	**Bulk**	**3120 ± 35**	**2619**
58	**OS-58499**	**Bulk**	**3150 ± 35**	**2629**
71	**OS-58559**	**Bulk**	**3700 ± 30**	**3331**
81	**OS-58560**	**Bulk**	**4200 ± 30**	**3954**
95	**OS-58561**	**Bulk**	**4990 ± 30**	**5062**
119	**OS-58587**	**Bulk**	**6420 ± 30**	**6649**
126	**OS-58500**	**Bulk**	**6840 ± 40**	**7146**
128	**OS-58556**	**Bulk**	**6910 ± 30**	**7244**
133,5	**OS-58504**	**Bulk**	**8650 ± 40**	**8950**
141,5	**OS-58588**	**Bulk**	**9170 ± 45**	**9577**
163,7	**OS-67911**	**Bulk**	**9660 ± 50**	**10010**
187,7	**OS-68230**	**Bulk**	**10450 ± 80**	**11870**


Age (cal. yrs BP)
Depth (cm)
Lithology
AP/NAP
Pinus diploxylon-type
Quercus
Corylus
Carpinus betulus
Ulmus
Tilia
Fagus
Alnus
Fraxinus excelsior-type
Carpinus orientalis
Hedera
Humulus/Cannabis
Ephedra distachya
Artemisia
Chenopodiaceae
Poaceae
Aster-type
Achillea-type
Plantago lanceolata
Pollen zones
CONISS
GGC 18 - 6
GGC 18 - 5
GGC 18 - 4
GGC 18 - 3
GGC 18 - 2
GGC 18 - 1
Total sum of squares
Coccolith-beering ooze
Sapropels
Light-gray clays Seekreide
Analyzed by Mariana Filipova-Marinova


Age (cal. yrs BP)
Depth (cm)
Lithology
AP/NAP
Pinus diploxylon-type
Juniperus
Quercus
Corylus
Carpinus betulus
Ulmus
Tilia
Fagus
Alnus
Fraxinus excelsior-type
Carpinus orientalis
Hedera
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Artemisia
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495
520
1198
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1801
2270
2619
2629
3331
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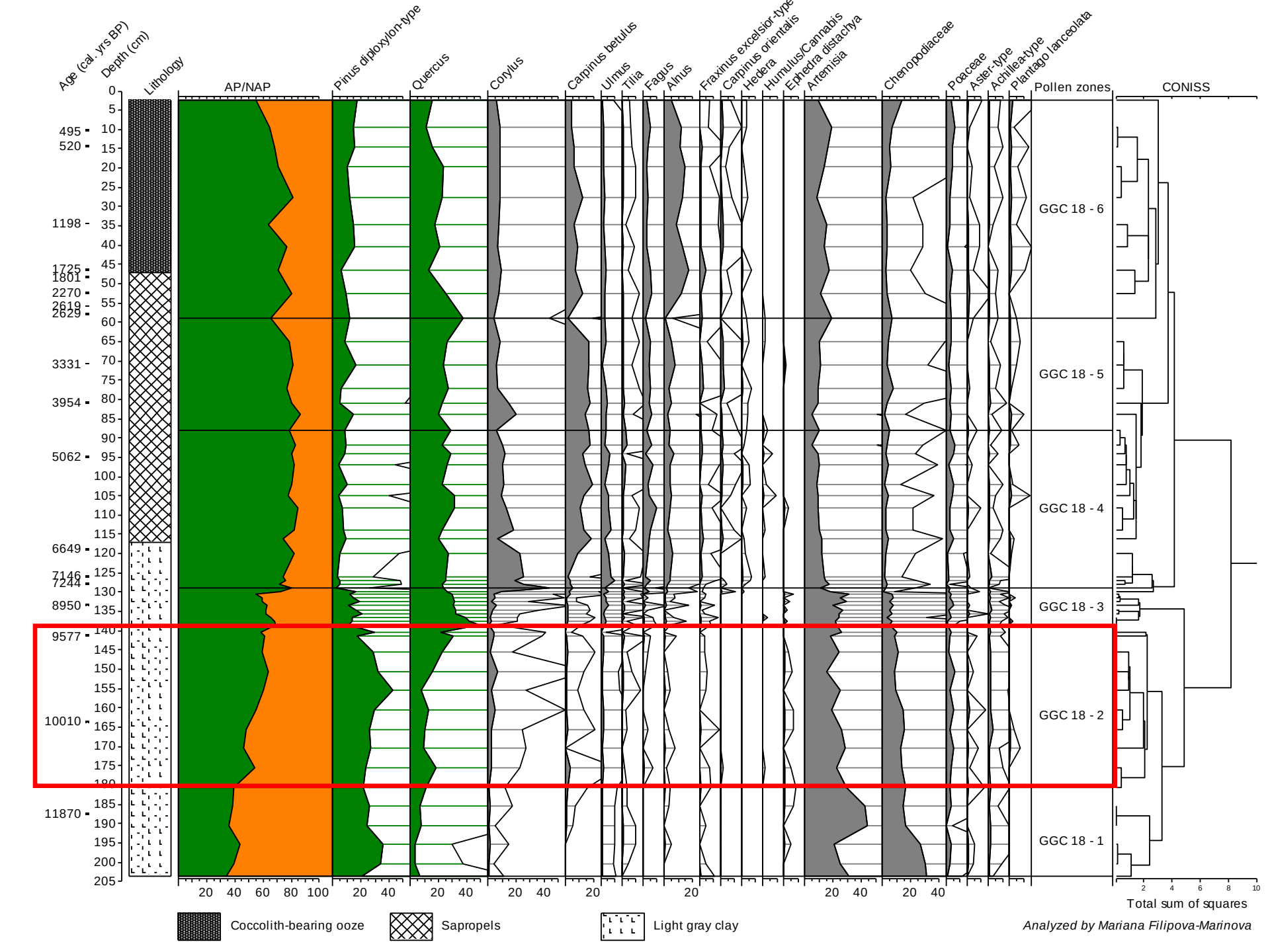
Coccolith-beering ooze
Sapropels
Light-gray clays Seekreide
Analyzed by Mariana Filipova-Marinova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GGC 18 - 1
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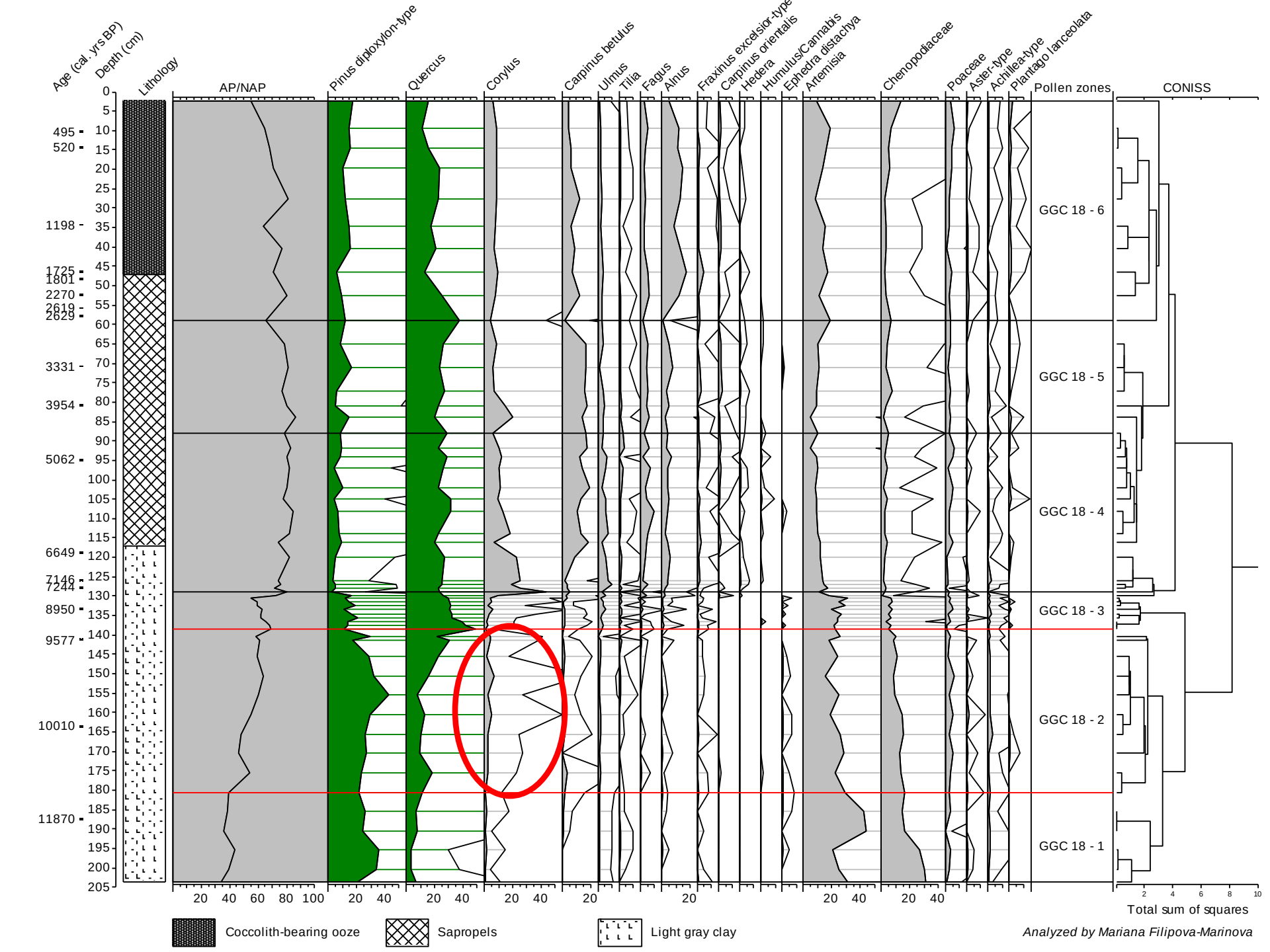
Sapropels
Light gray clay
Analyzed by Mariana Filipova-Marinova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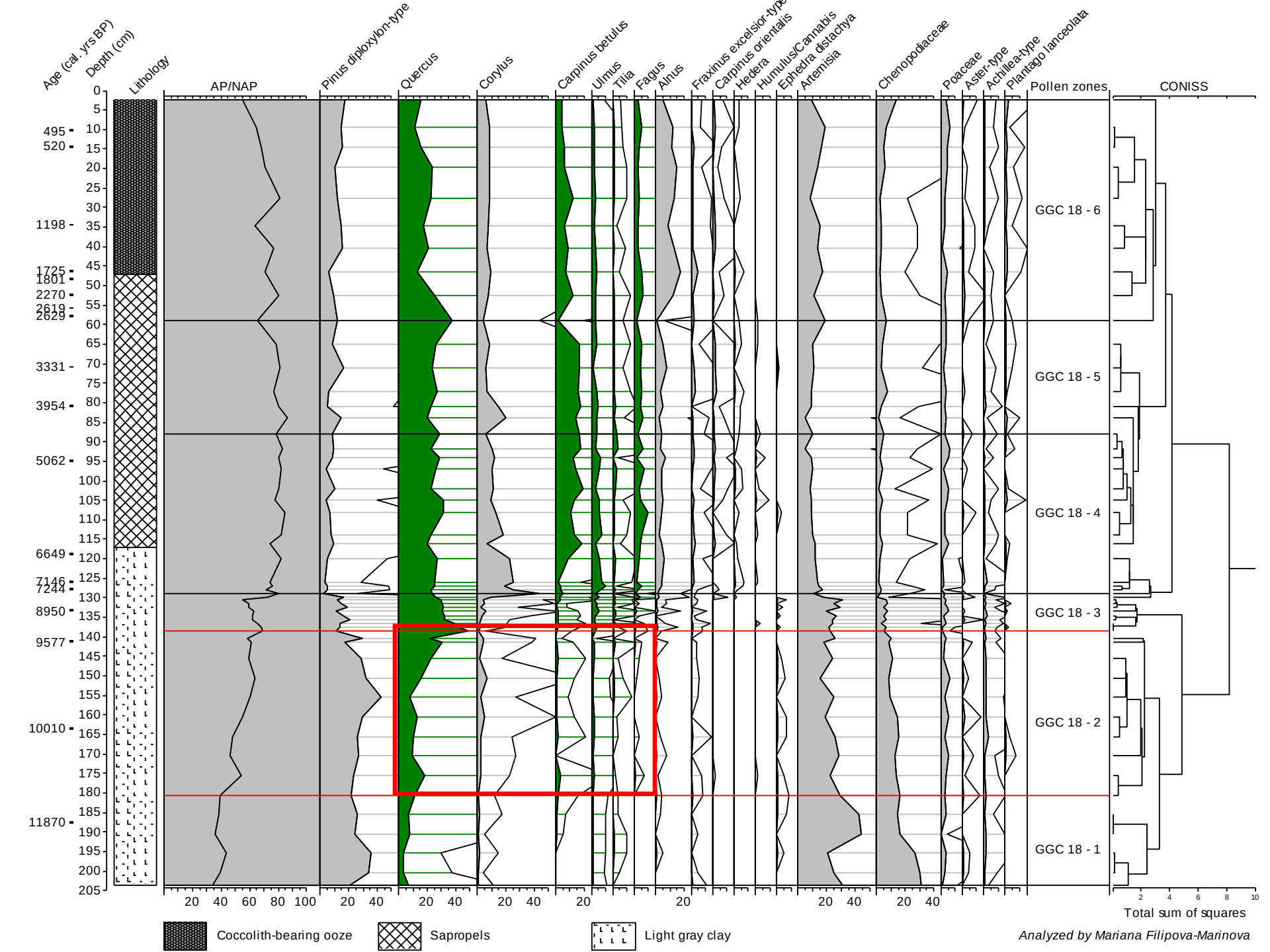
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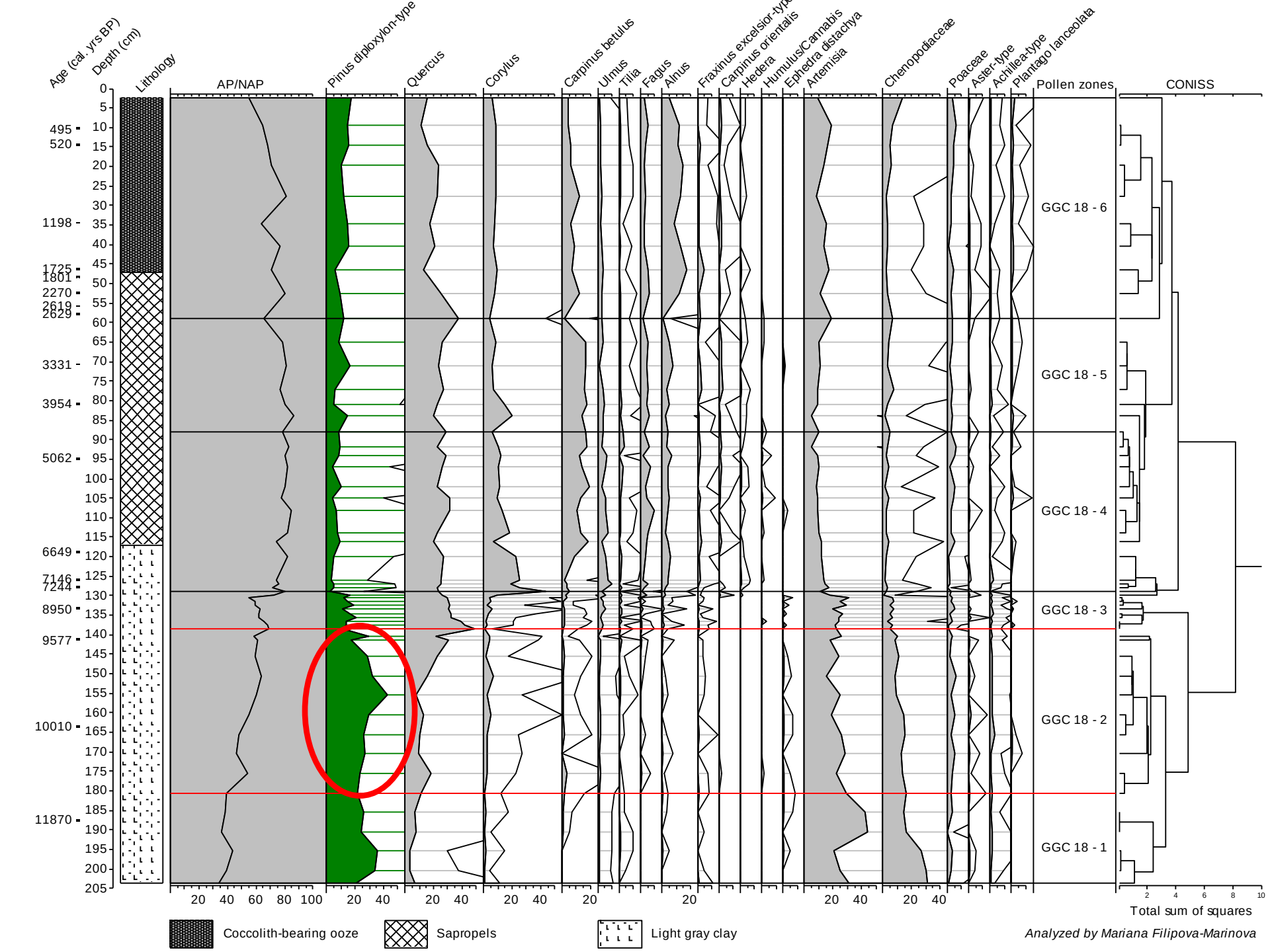
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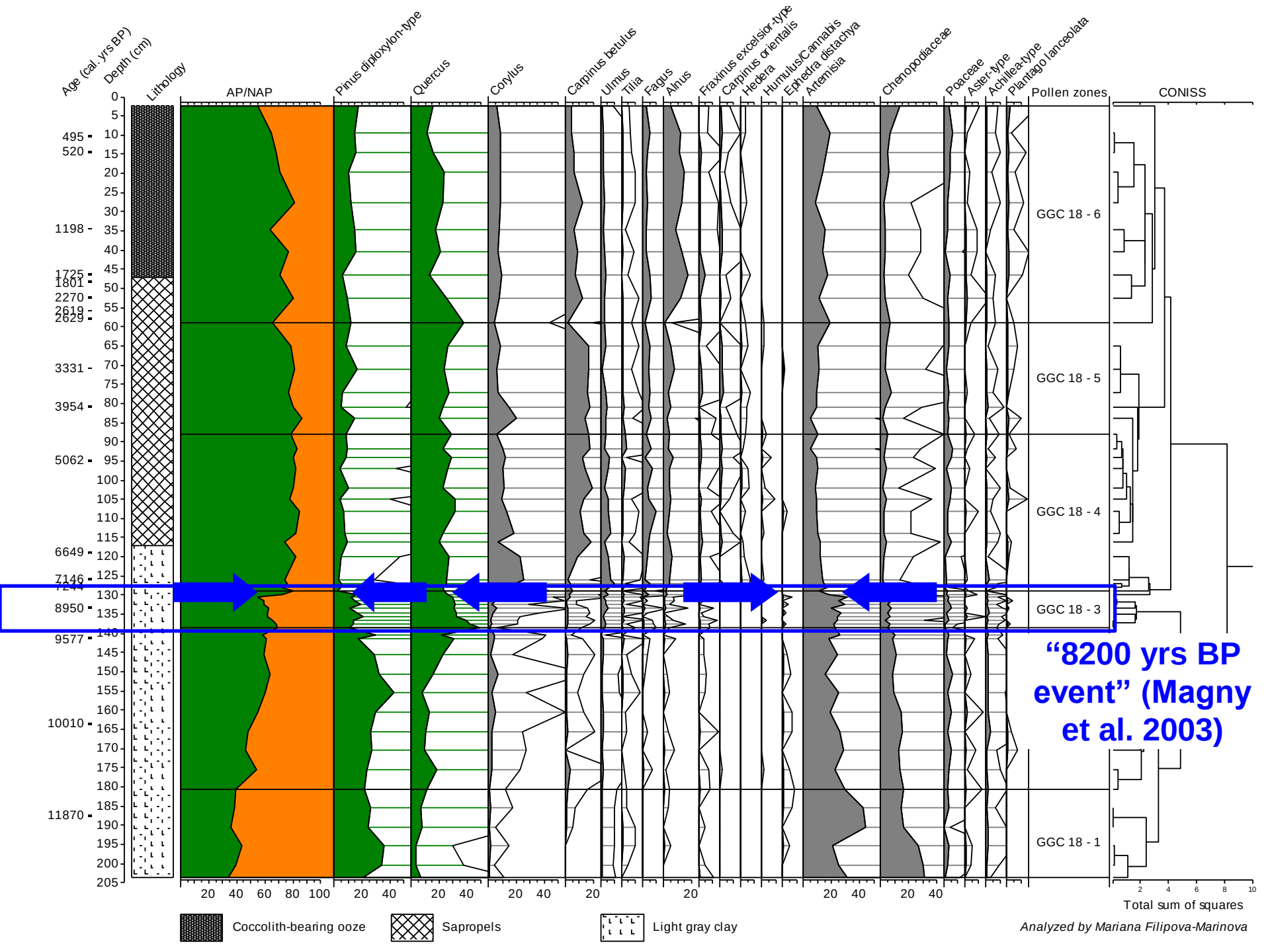
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"8200 yrs BP event" (Magny et al. 2003)
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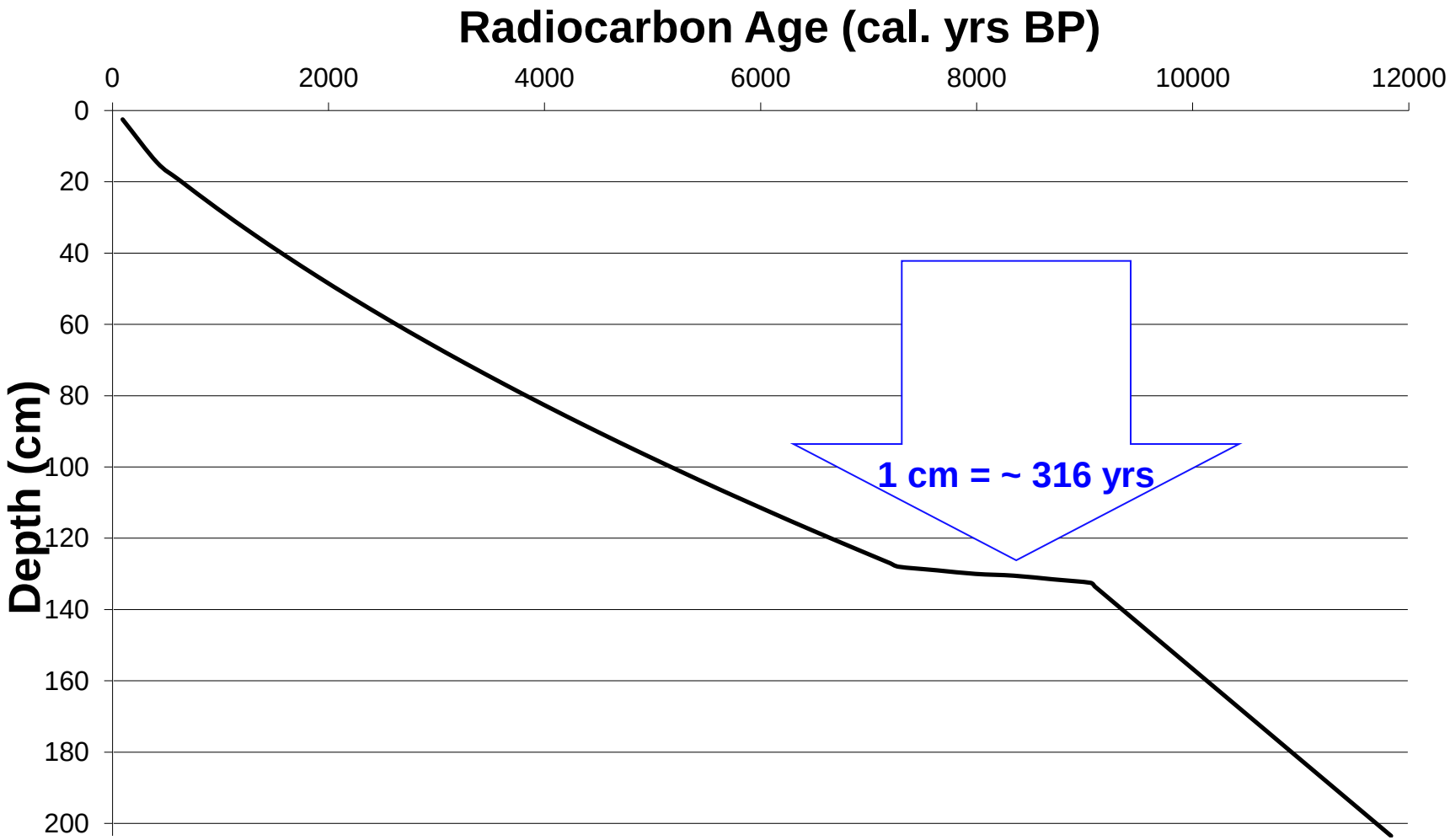
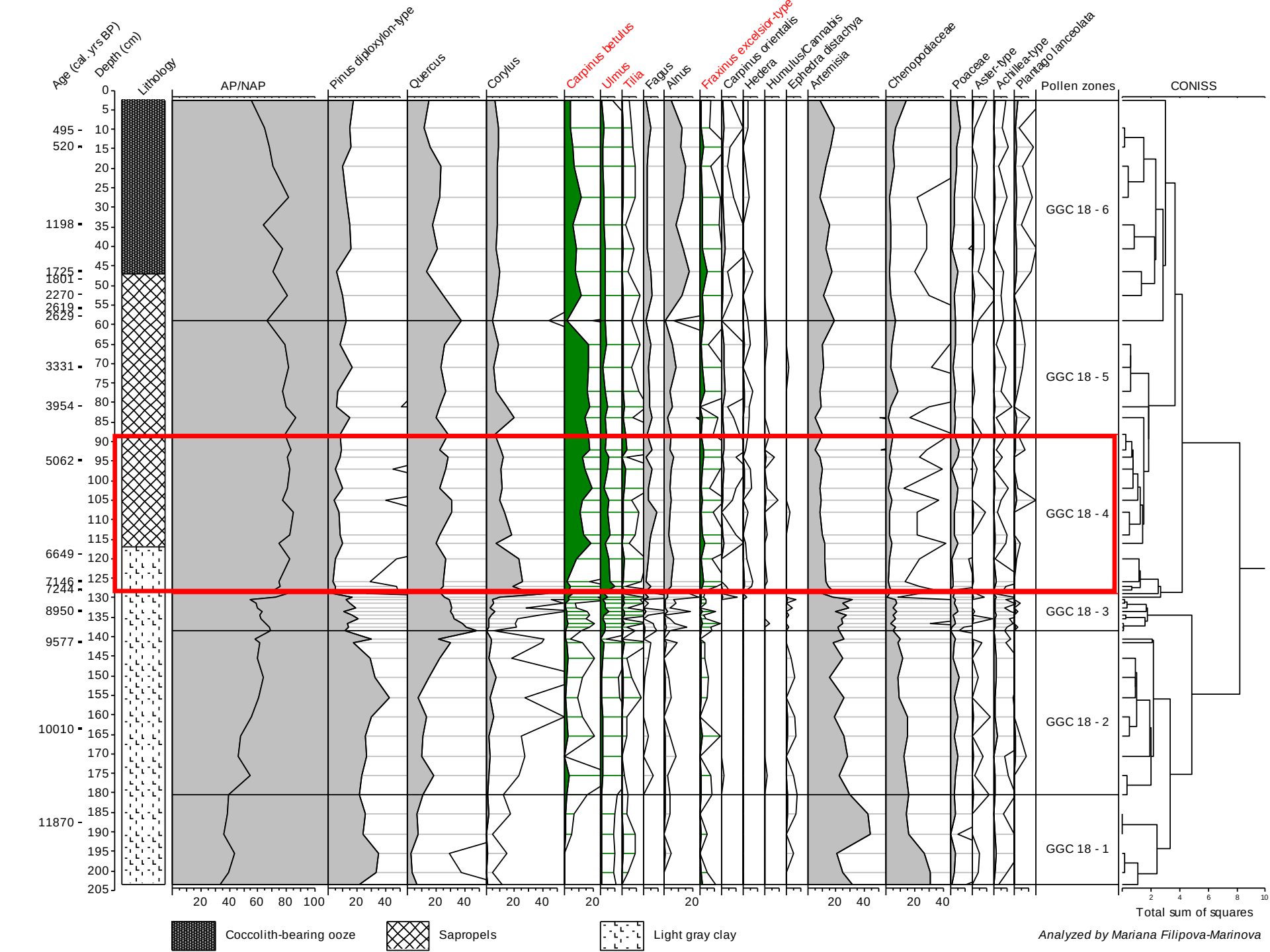
Sedimentation rate of GGC-18, based on the established Age vs. Depth model

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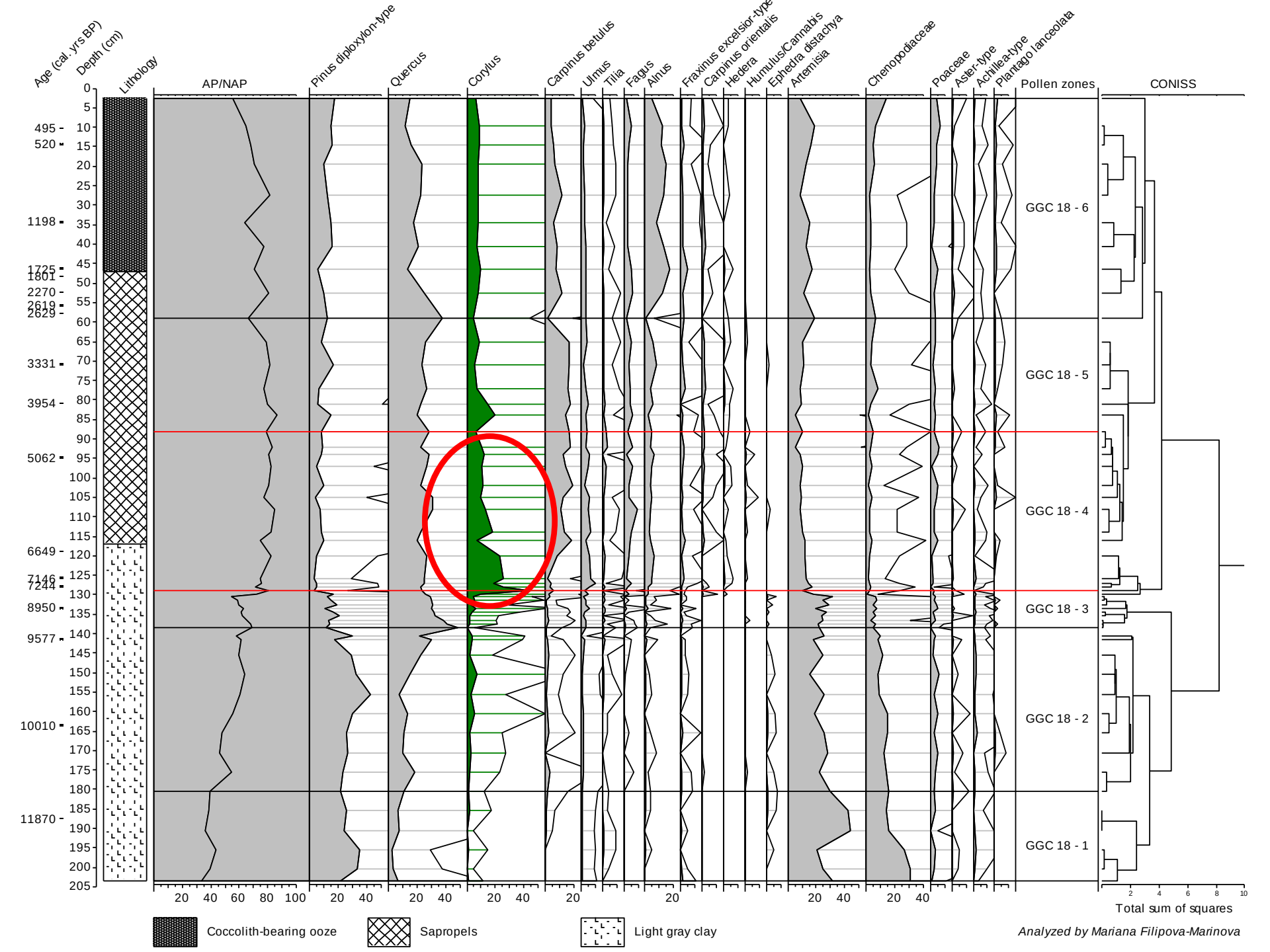
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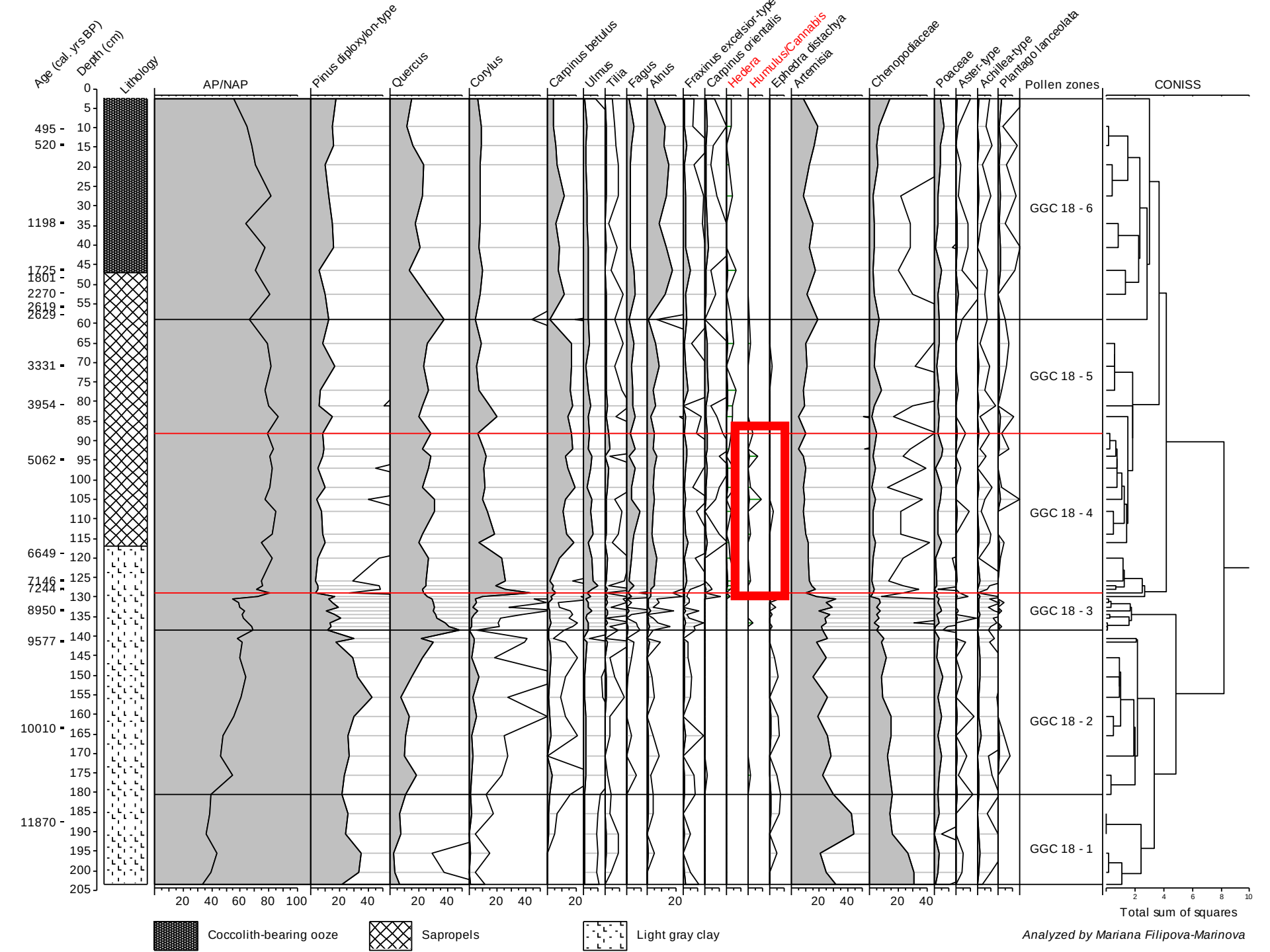
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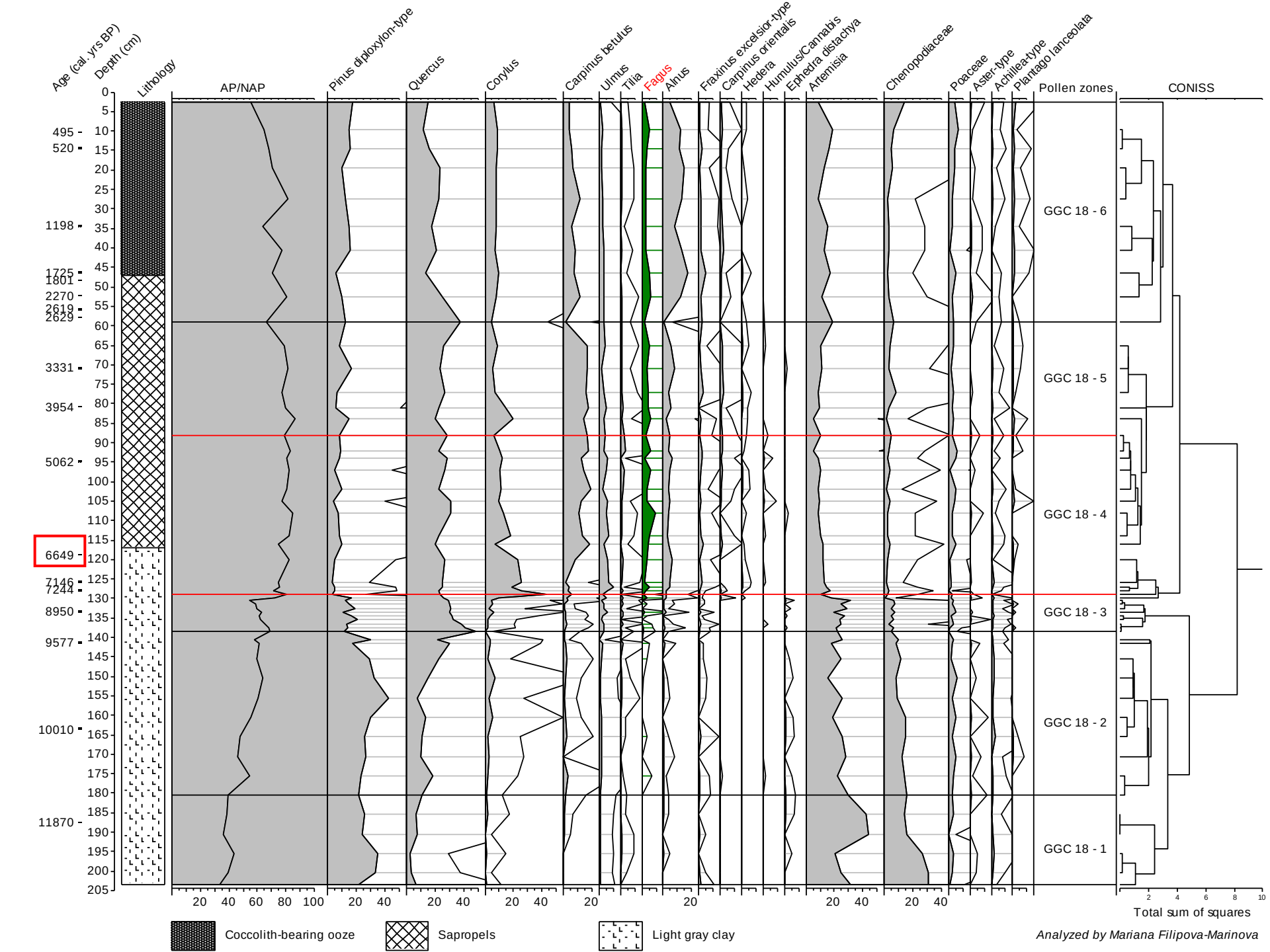
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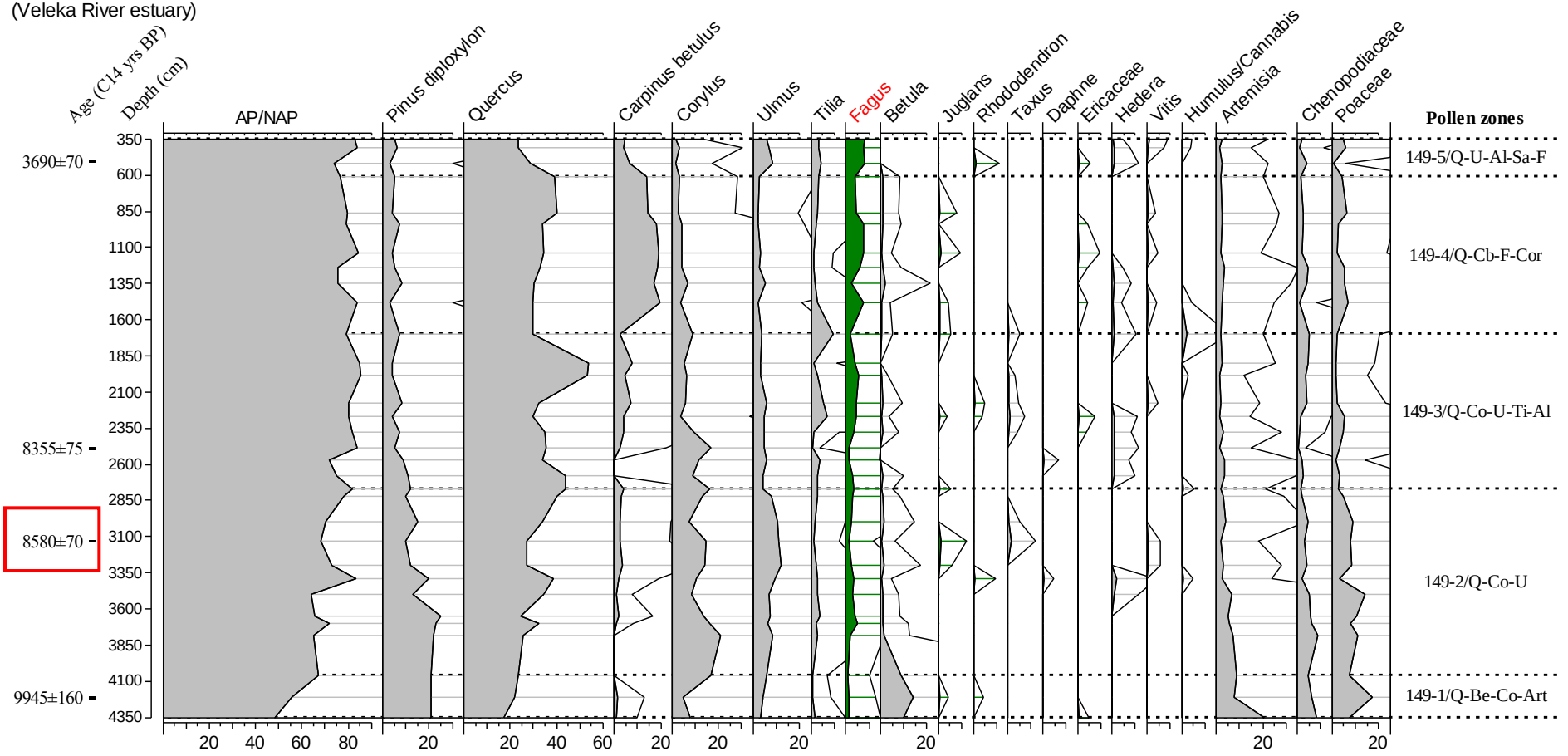
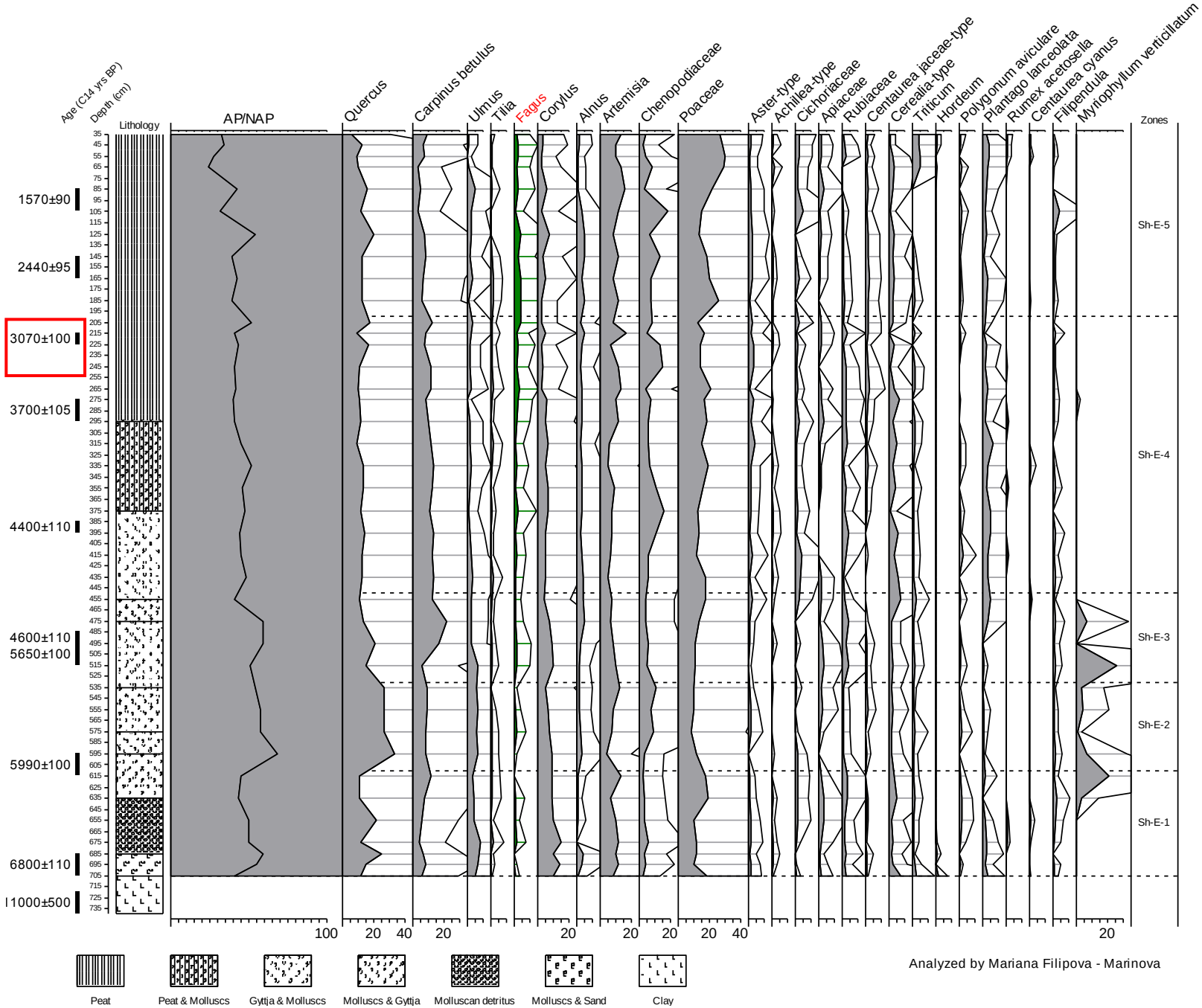
Simplified percentage spore-pollen diagram of Core 149
(Veleka River estuary)

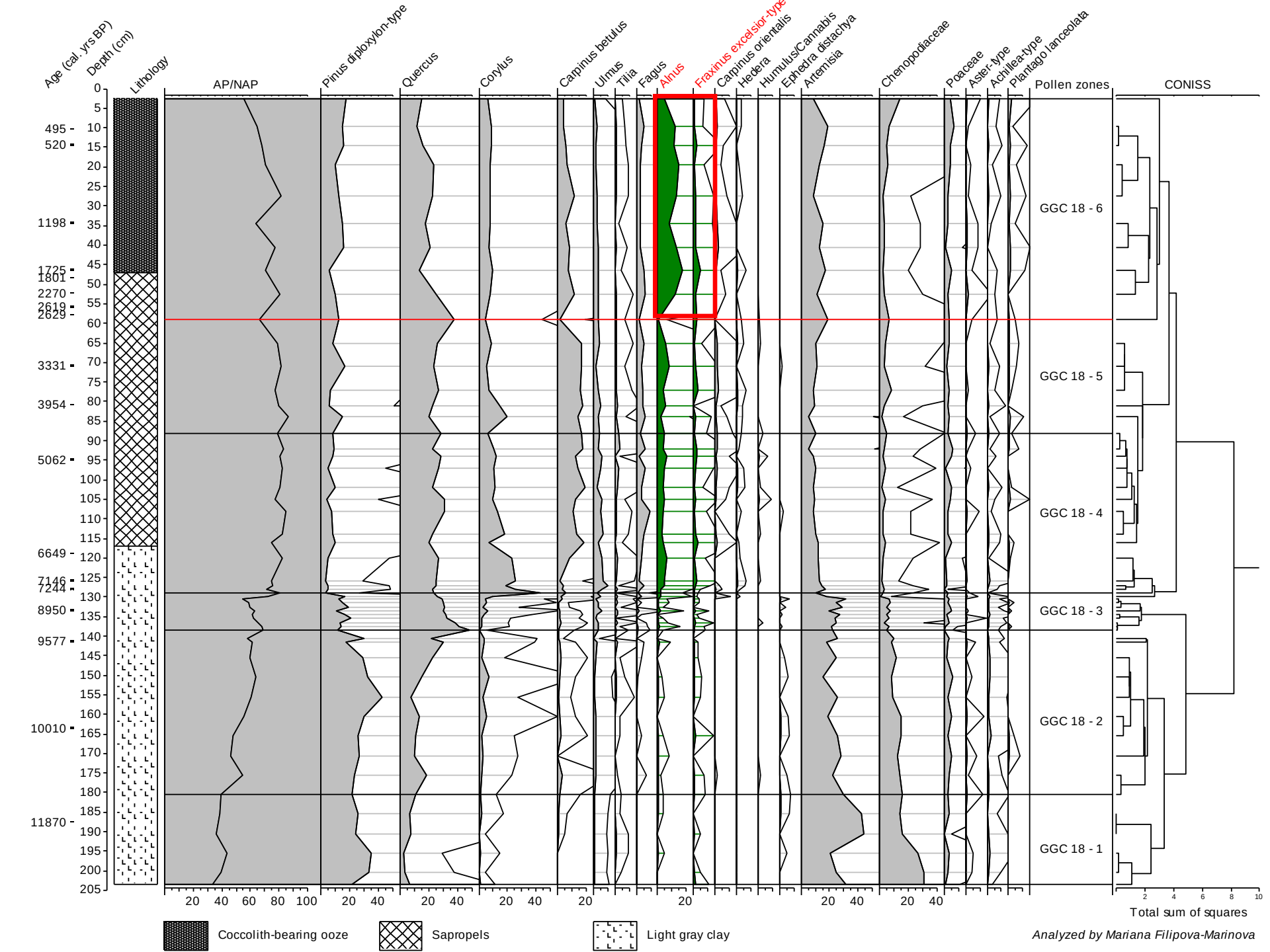


Analyzed by Mariana Filipova-Marinova

Simplified percentage spore-pollen diagram of Core Shabla-Ezeretz 2



Analyzed by Mariana Filipova - Marinova


Age (cal. yrs BP)
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Carpinus betulus
Ulmus
Tilia
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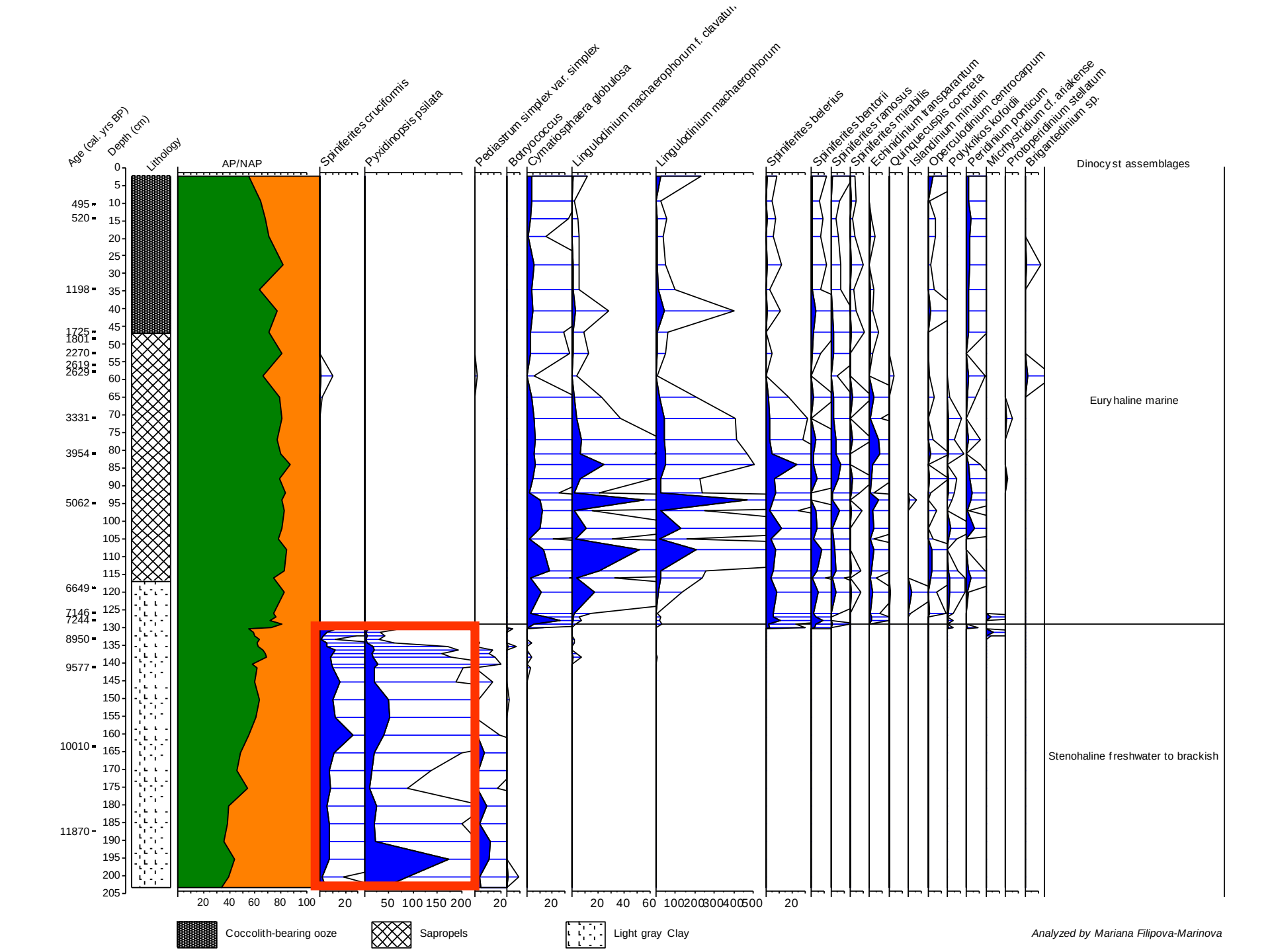
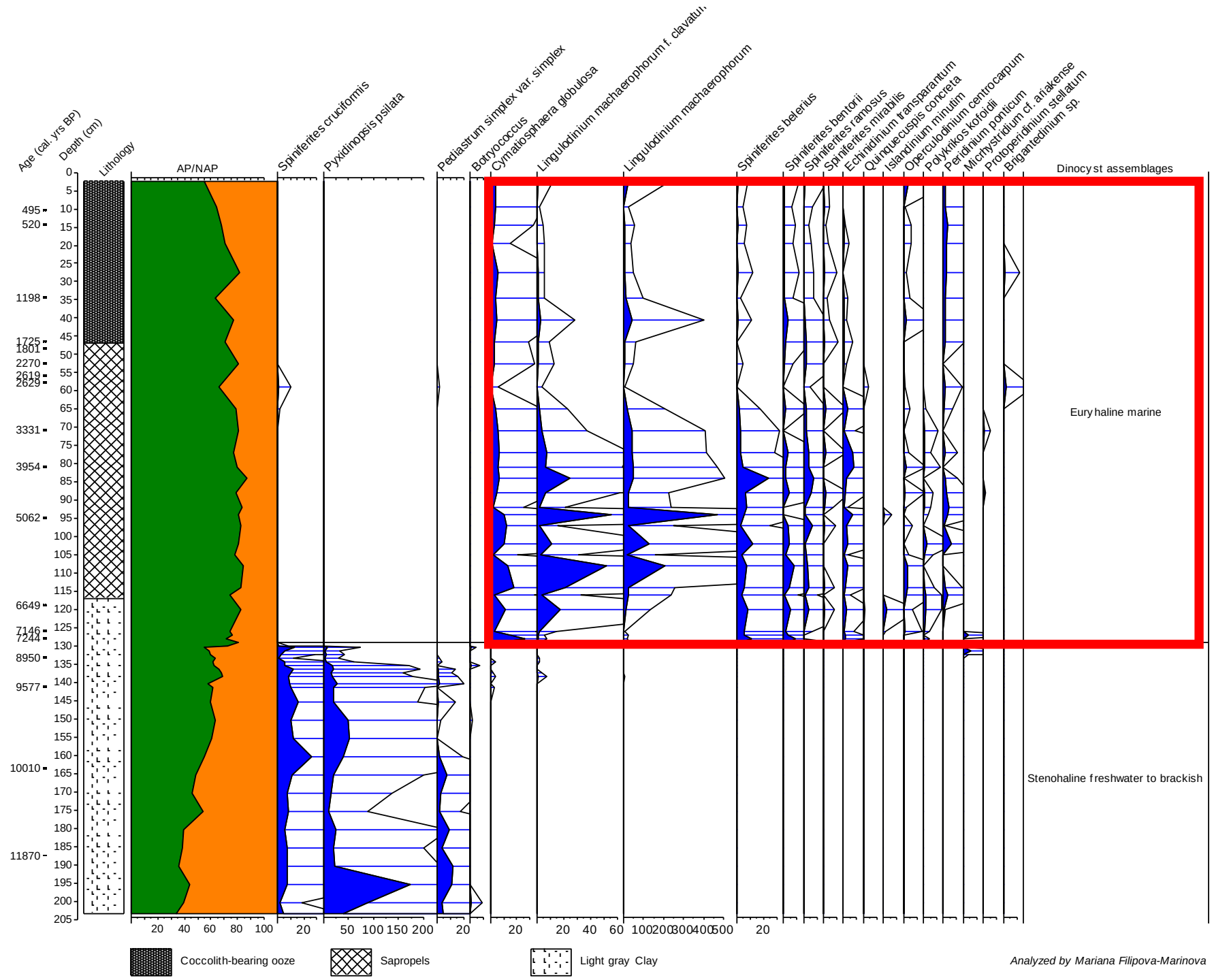

Age (cal. yrs BP)
Depth (cm)
Lithology
AP/NAP
Spiniferites cruciformis
Pyxidinopsis psilata
Pediastrum simplex var. simplex
Botryococcus
Cymatiosphaera globulosa
Lingulodinium machaerophorum f. clavatum
Lingulodinium machaerophorum
Spiniferites belerius
Spiniferites bentorii
Spiniferites ramosus
Spiniferites mirabilis
Echinidinium transparantum
Quinquecuspis concreta
Islandinium minutum
Operculodinium centrocarpum
Polykrikos kofoidii
Peridinium ponticum
Michystridium cf. arakense
Protoperidinium stellatum
Brigantedinium sp.
Dinocyst assemblages
Euryhaline marine
Stenohaline freshwater to brackish
Coccolith-bearing ooze
Sapropels
Light gray Clay
Analyzed by Mariana Filipova-Marinova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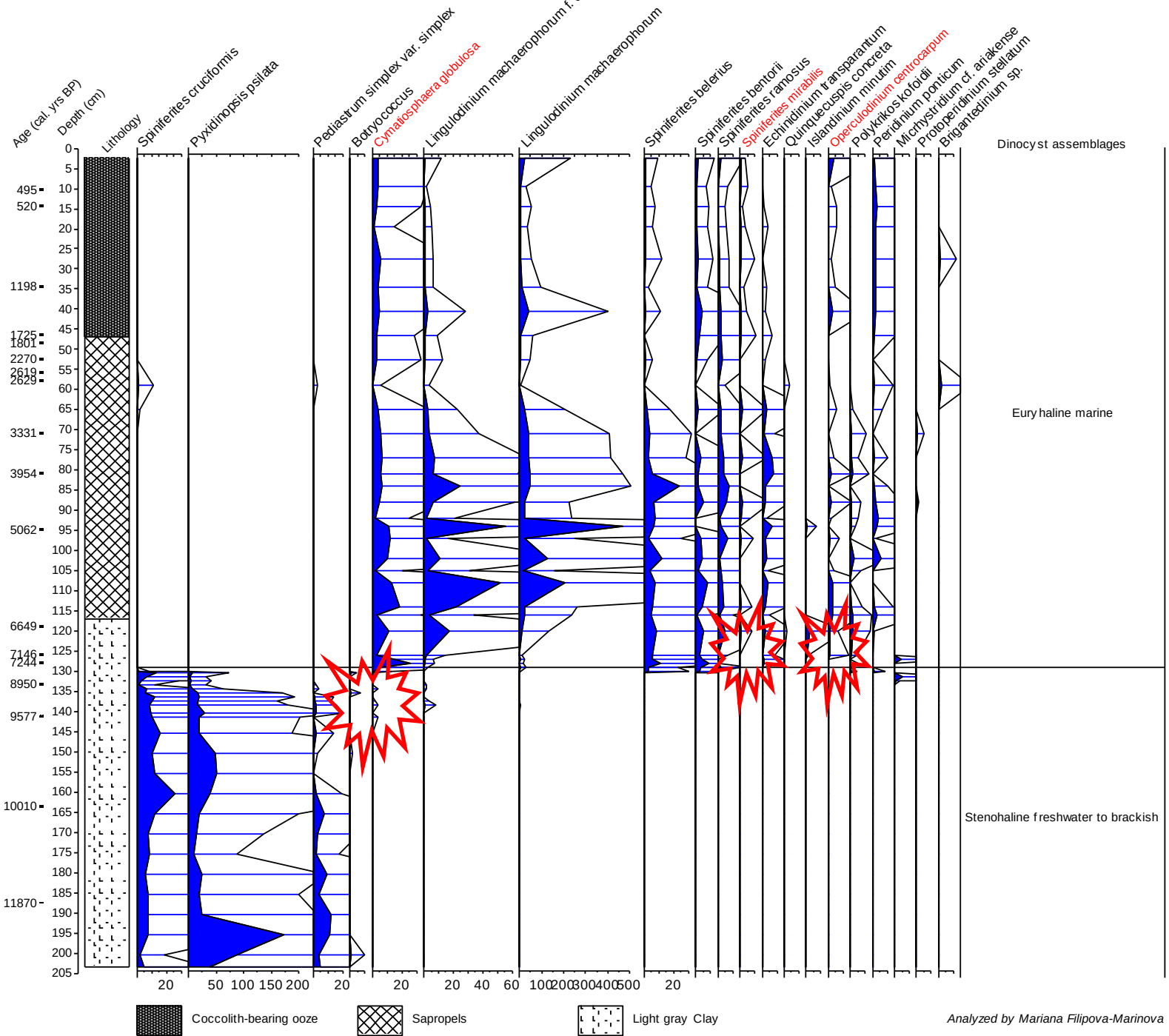
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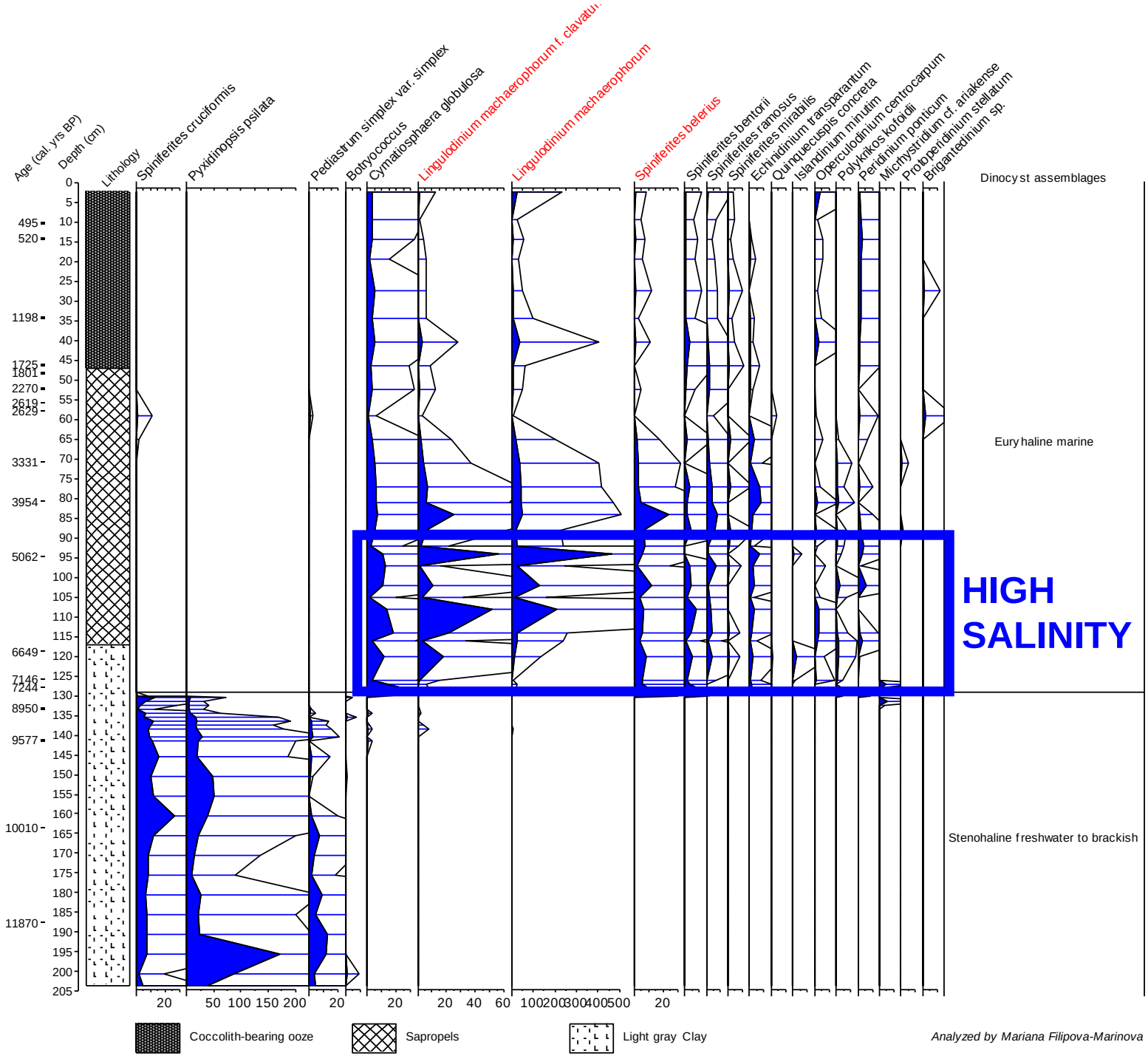
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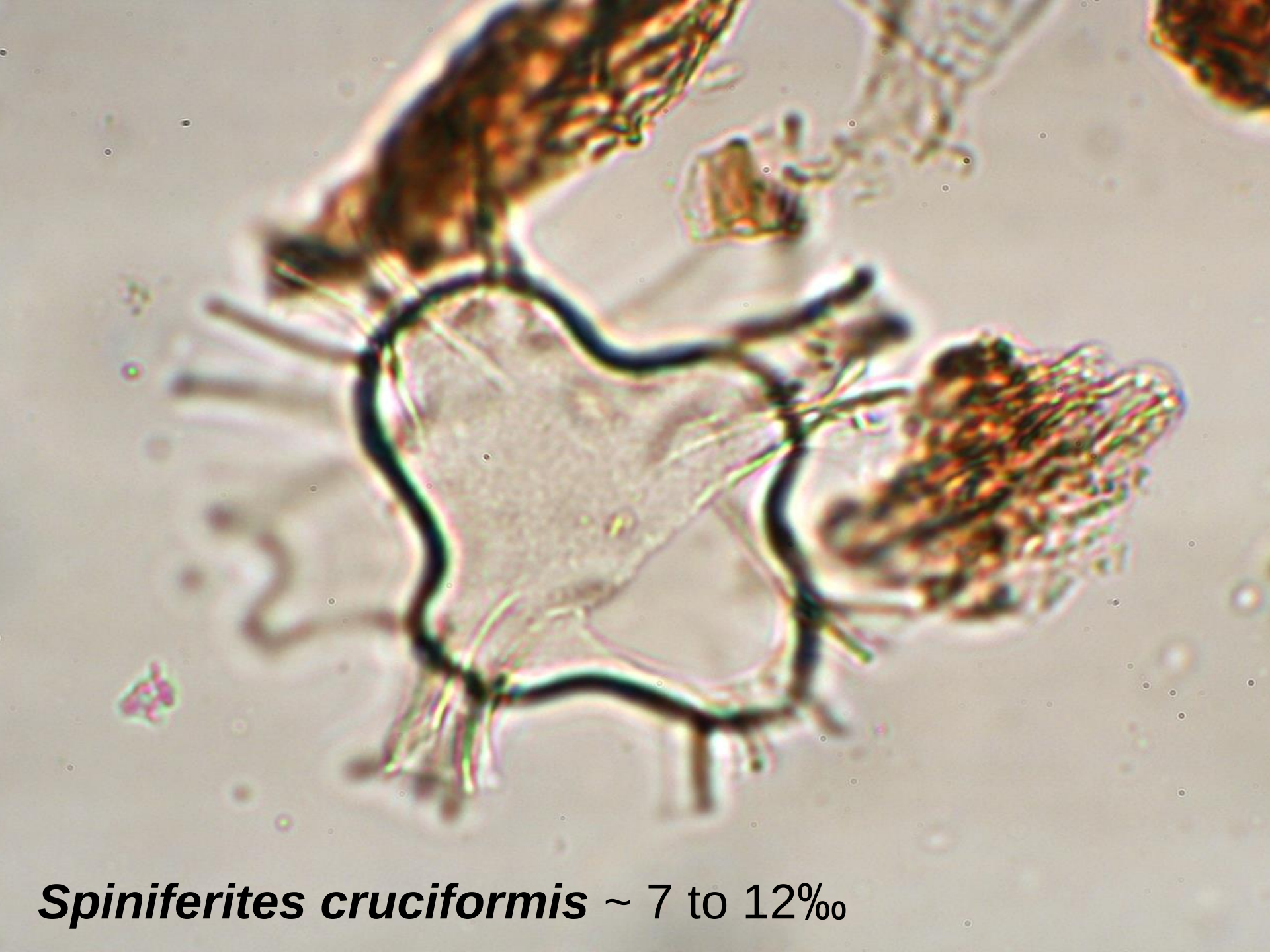
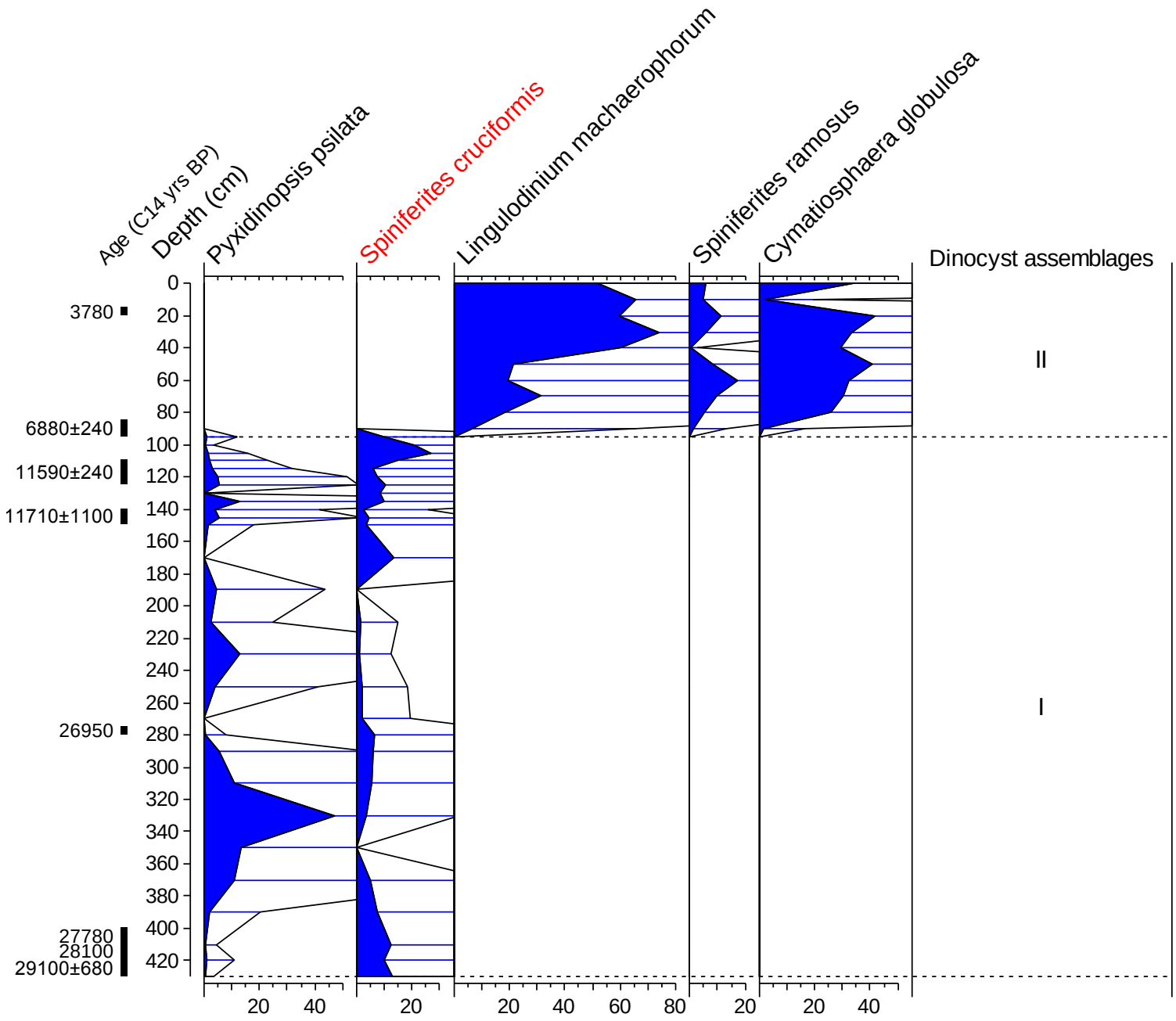
Spiniferites mirabilis
Echinidinium transparantum
Quinquecuspis concreta
Islandinium minutum
Operculodinium centrocarpum
Polykrikos kofoidii
Peridinium ponticum
Micrhystridium cf. ariakense
Protoperidinium stellatum
Brigantedinium sp.
Dinocyst assemblages
495
520
1198
1725
1801
2270
2619
2629
3331
3954
5062
6649
7146
7244
8950
9577
10010
11870
Euryhaline marine
HIGH SALINITY
Stenohaline freshwater to brackish
20
50 100 150 200
20
20
20 40 60
100200300400500
20
Coccolith-bearing ooze
Sapropels
Light gray Clay
Analyzed by Mariana Filipova-Marinova

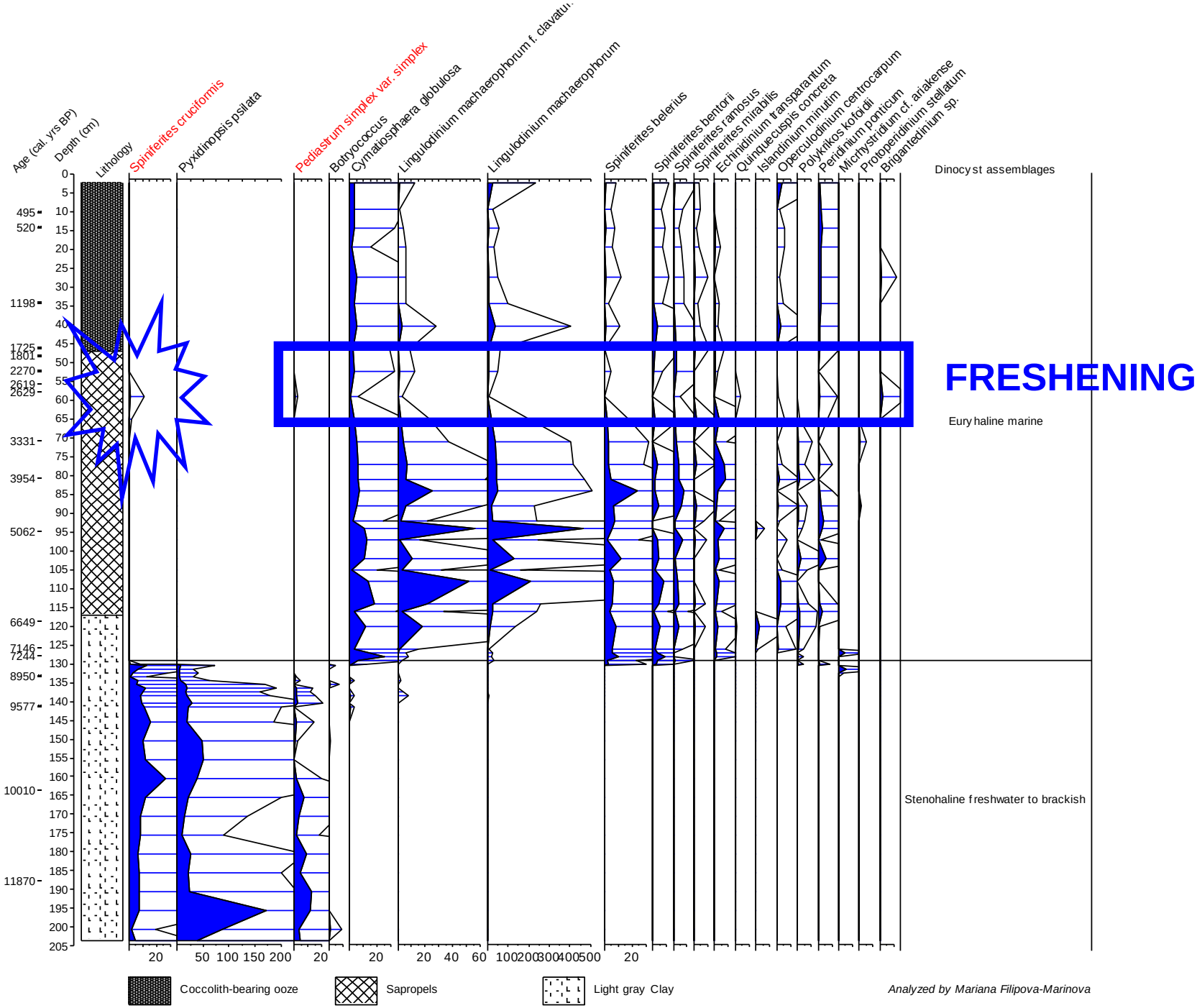


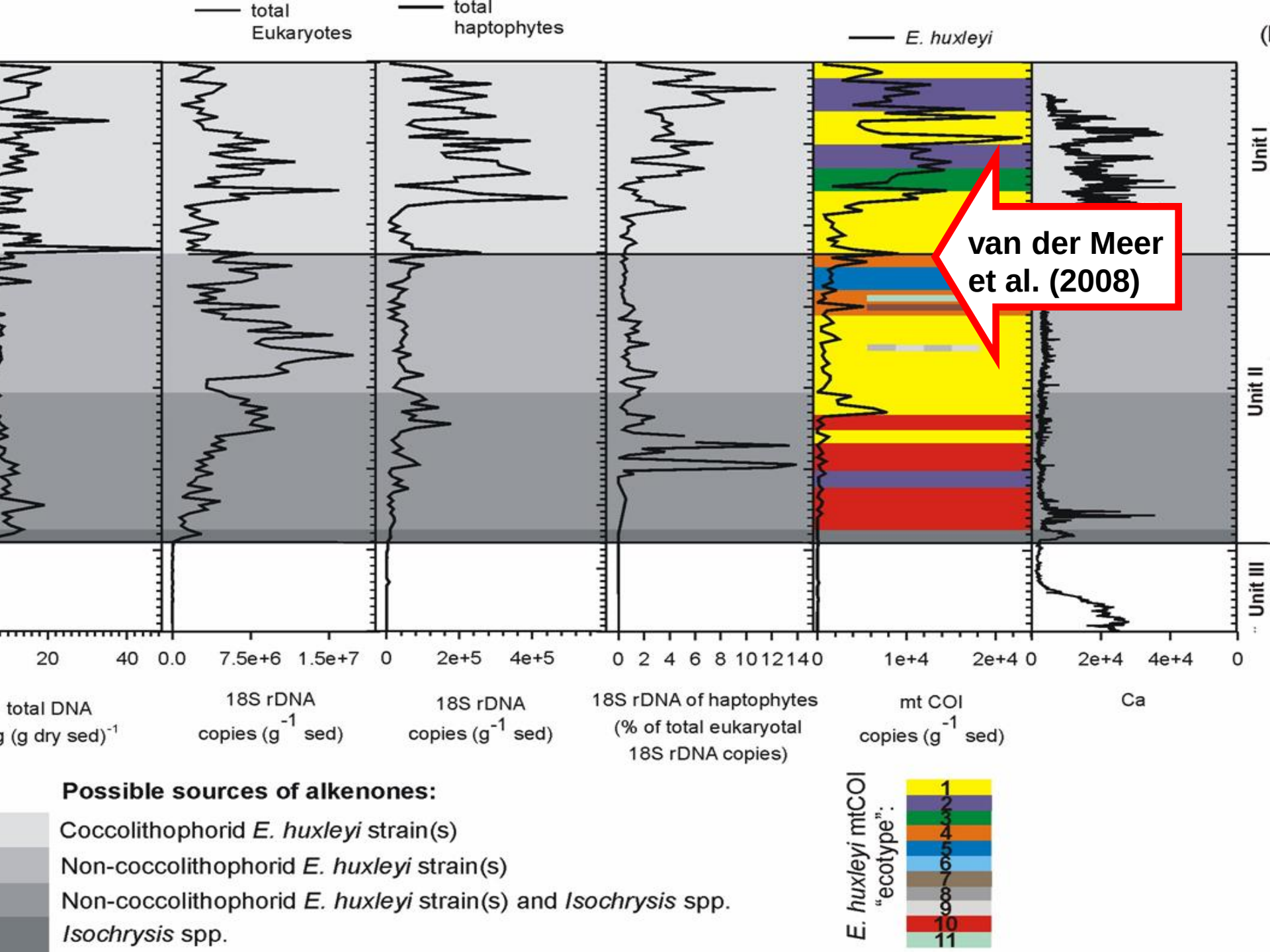
Spiniferites cruciformis ~ 7 to 12‰

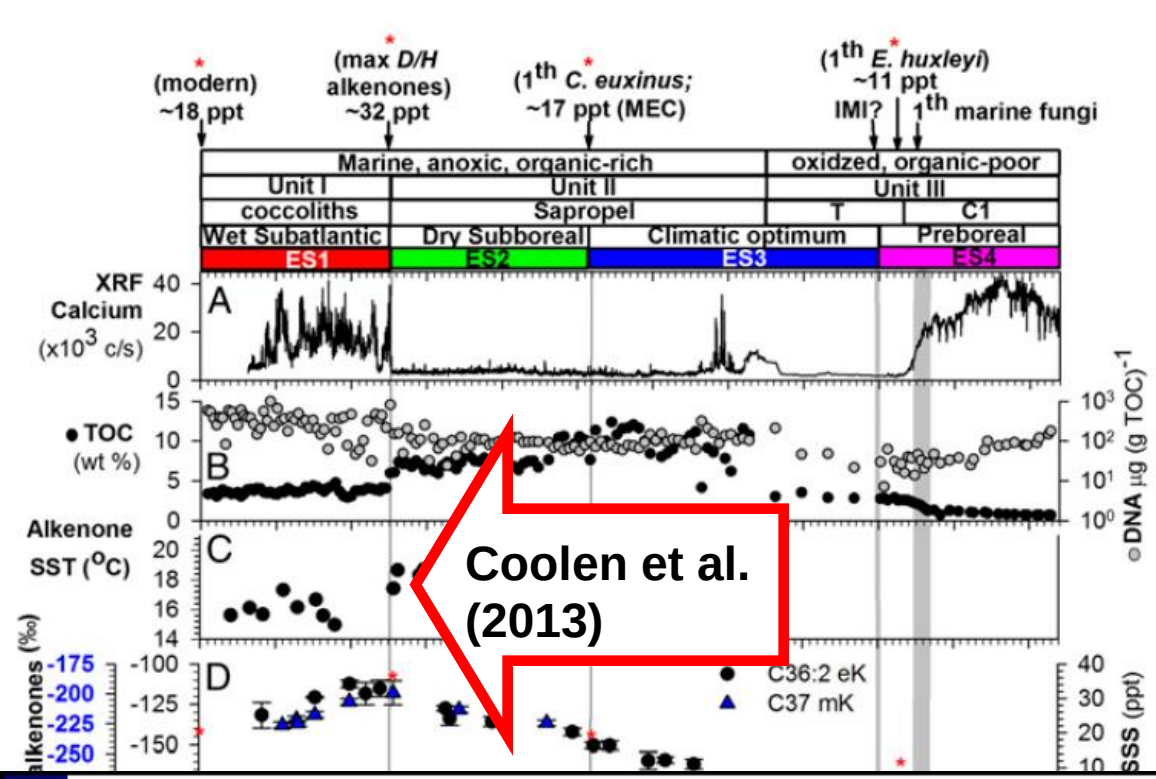
Core 2345, southern Bulgarian Black Sea Shelf



Analyzed by Mariana Filipova-Marinova


Age (cal. yrs BP)
Depth (cm)
Lithology
Spiniferites cruciformis
Pyxidinopsis psilata
Pediastrum simplex var. simplex
Botryococcus
Cymatiosphaera globulosa
Lingulodinium machaerophorum f. clavatu
Lingulodinium machaerophorum
Spiniferites belerius
Spiniferites bentorii
Spiniferites ramosus
Spiniferites mirabilis
Echinidinium transparantum
Quinquecuspis concreta
Islandinium minutum
Operculodinium centrocarpum
Polykrikos kofoidii
Peridinium ponticum
Micrhystridium cf. ariakense
Protoperidinium stellatum
Brigantedinium sp.
Dinocyst assemblages
FRESHENING
Euryhaline marine
Stenohaline freshwater to brackish
Coccolith-bearing ooze
Sapropels
Light gray Clay
Analyzed by Mariana Filipova-Marinova


total Eukaryotes
total haptophytes
E. huxleyi
Unit I
Unit II
Unit III
van der Meer et al. (2008)
20
40
0.0
7.5e+6
1.5e+7
0
2e+5
4e+5
0 2 4 6 8 10 12 14 0
1e+4
2e+4 0
2e+4
4e+4
0
total DNA
g (g dry sed)-1
18S rDNA copies (g-1 sed)
18S rDNA copies (g-1 sed)
18S rDNA of haptophytes (% of total eukaryotal 18S rDNA copies)
mt COI copies (g-1 sed)
Ca
Possible sources of alkenones:
Coccolithophorid E. huxleyi strain(s)
Non-coccolithophorid E. huxleyi strain(s)
Non-coccolithophorid E. huxleyi strain(s) and Isochrysis spp.
Isochrysis spp.
E. huxleyi mtCOI "ecotype":
1
2
3
4
5
6
7
8
9
10
11



Evolution of the plankton paleome in the Black Sea from the Deglacial to Anthropocene

Marco J. L. Coolen[a,1], William D. Orsi[b], Cherel Balkema[a], Christopher Quince[c], Keith Harris[c], Sean P. Sylva[a], Mariana Filipova-Marinova[d], and Liviu Giosan[b]

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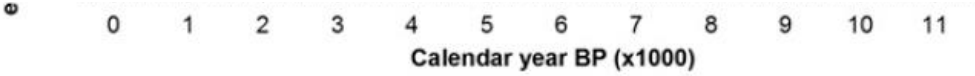
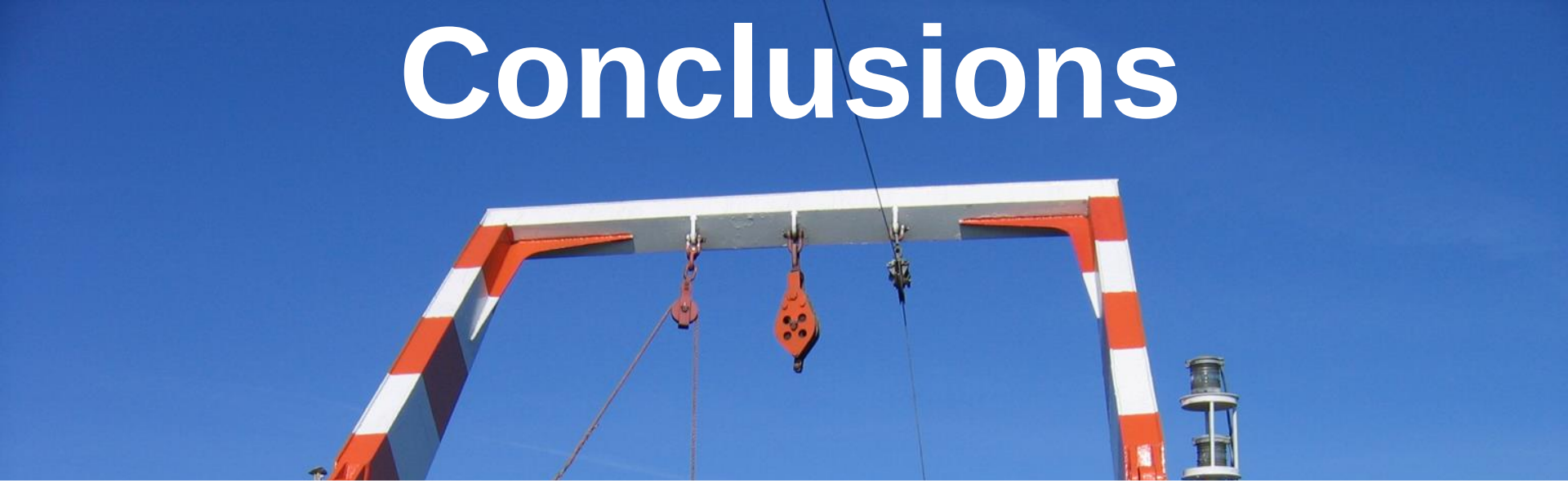



Conclusions

Conclusions



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First high-resolution marinopalynological stratigraphy of Late Quaternary sediments from the central part of the Bulgarian Black Sea area

Mariana Filipova-Marinova [a,b,*], Danail Pavlov [b], Marco Coolen [c], Liviu Giosan [c]

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[c] Woods Hole Oceanographic Institution, 360 Woods Hole Rd., Woods Hole, MA 02543, USA

Conclusions

- Open oak forests were spread in the Eastern Stara Planina Mts. at the beginning of the Holocene and shows early migration of the major temperate arboreal taxa such as *Quercus, Ulmus, Tilia* and *Carpinus betulus*.

- The vegetation palaeosuccession continues with the spreading of mixed oak forests from 8950 cal. yrs. BP until 2620 cal. yrs. BP followed by destructive changes due to human impact and climate deterioration.

Conclusions

- **The extremely low sedimentation rate is connected with the ”8200 yrs. BP cold event”. This rapid cooling event is reported for the first time both in marine sediments from the Bulgarian Black Sea area, as well as by pollen analysis of such materials.**
- **The first major pulse of marine waters is recorded after about 7990 cal. yrs BP with a maximum of *Lingulodinium machaerophorum*.**
- **Substantial freshening of Black Sea surface waters in the last 2750 cal. yrs BP is established and connected with climate changes.**

Thank you for the attention!