FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG
NATURWISSENSCHAFTLICHE
FAKULTÄT

GeoZentrum
Nordbayern

Analytical Paleobiology

Trilobite regional α-diversity pattern

Fabian Dirscherl

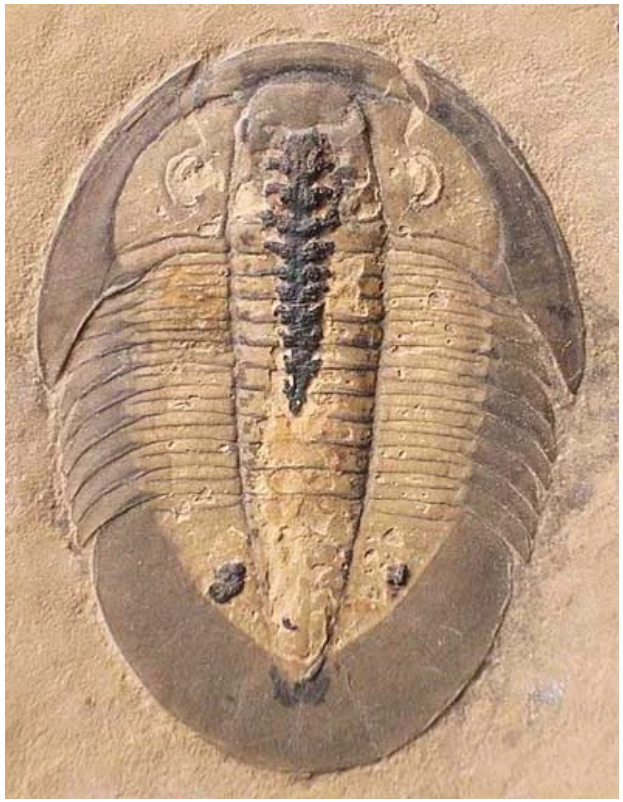
3 August 2020

- **Introduction**

  - Cambrium to Permian

  - Highly diverse class

  - Index Fossil



Scinexx.de

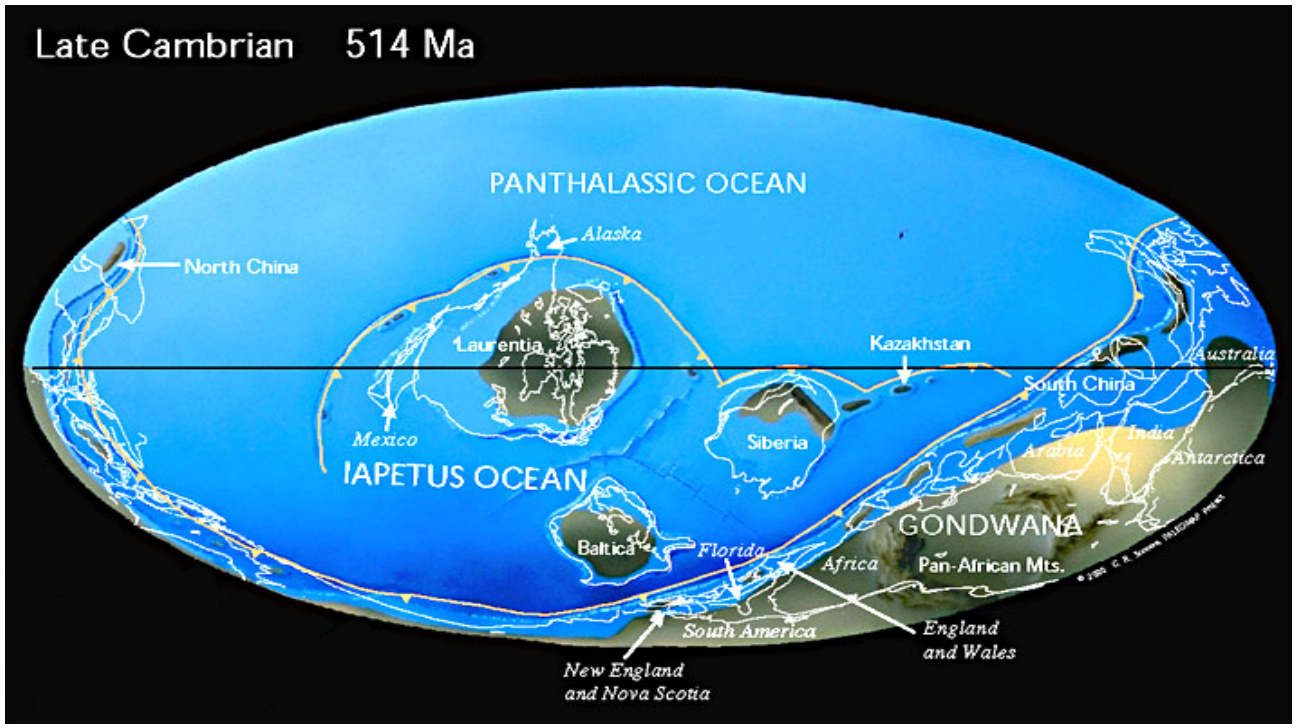
Fossilien.de

- **Aim**

  - Hypothesis:

The α-diversity dynamic of trilobites changes signiticantly in various regions over time

- Creating paleomaps
- Plotting the source
- Calculating α-diversity in different regions
- Compare the results



- **Methods**

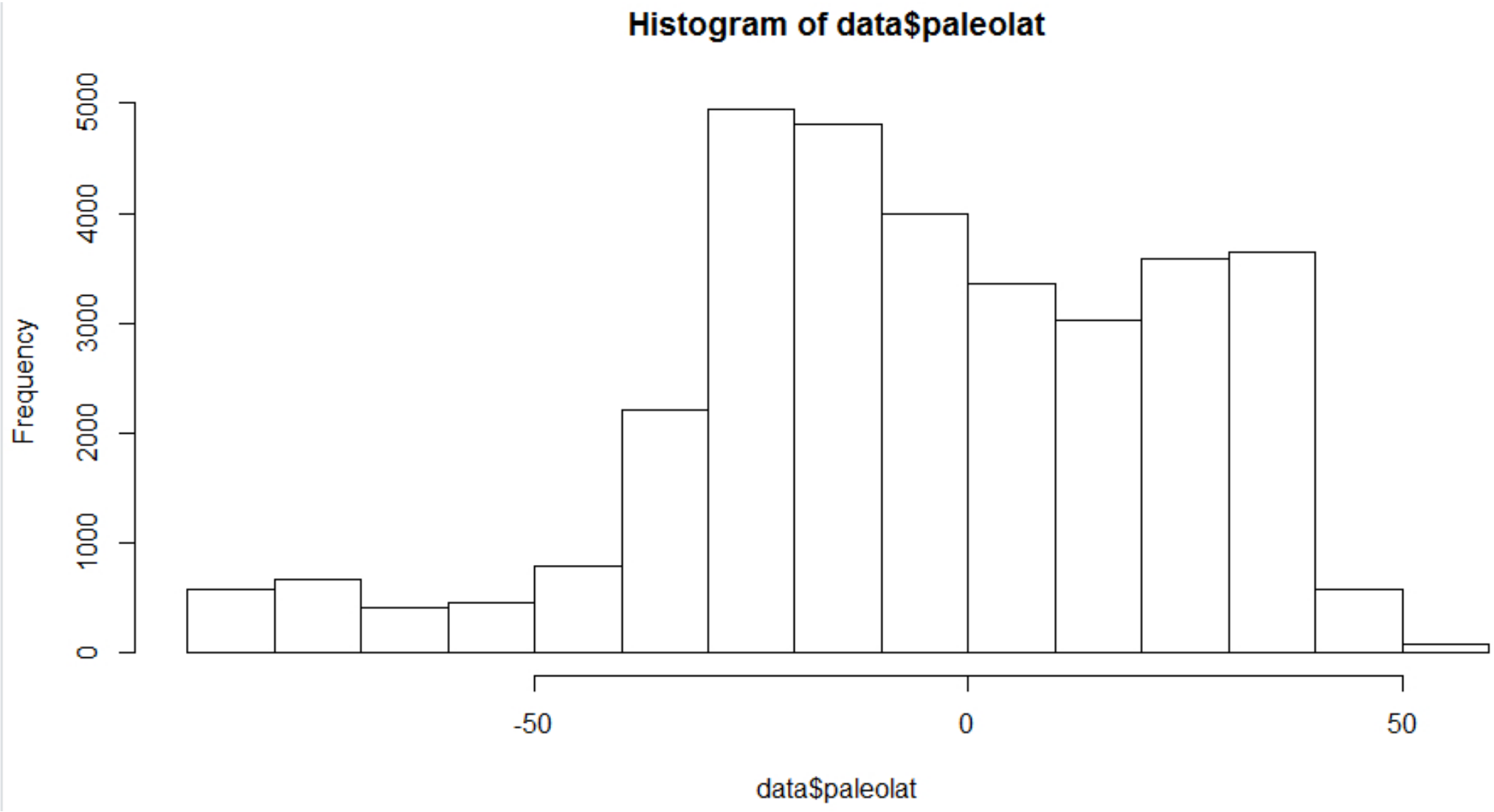
  - Checking the dataset

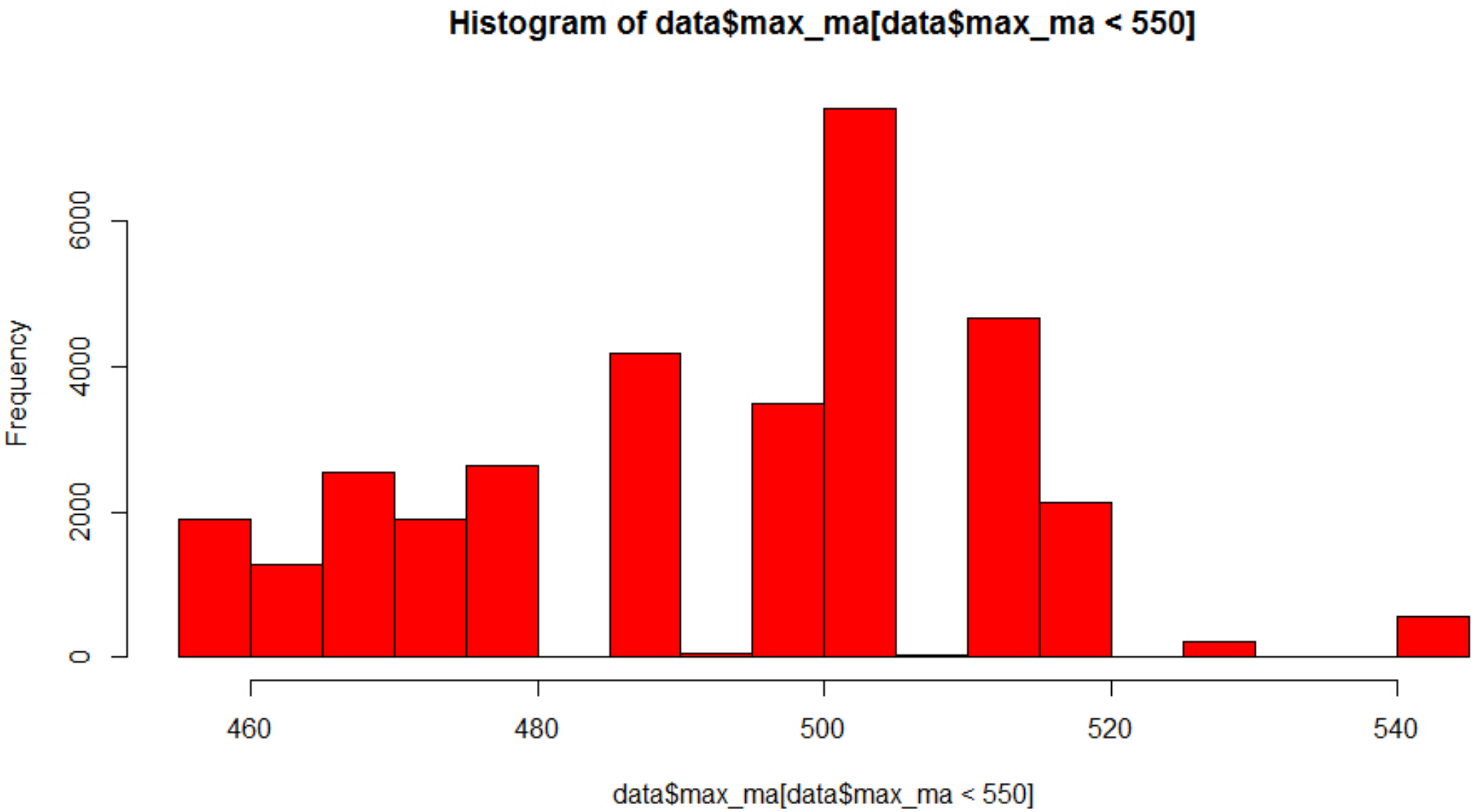
  - Processing the data

    -> Limiting the age

    -> Delete lines and columns

  - Quick first plots

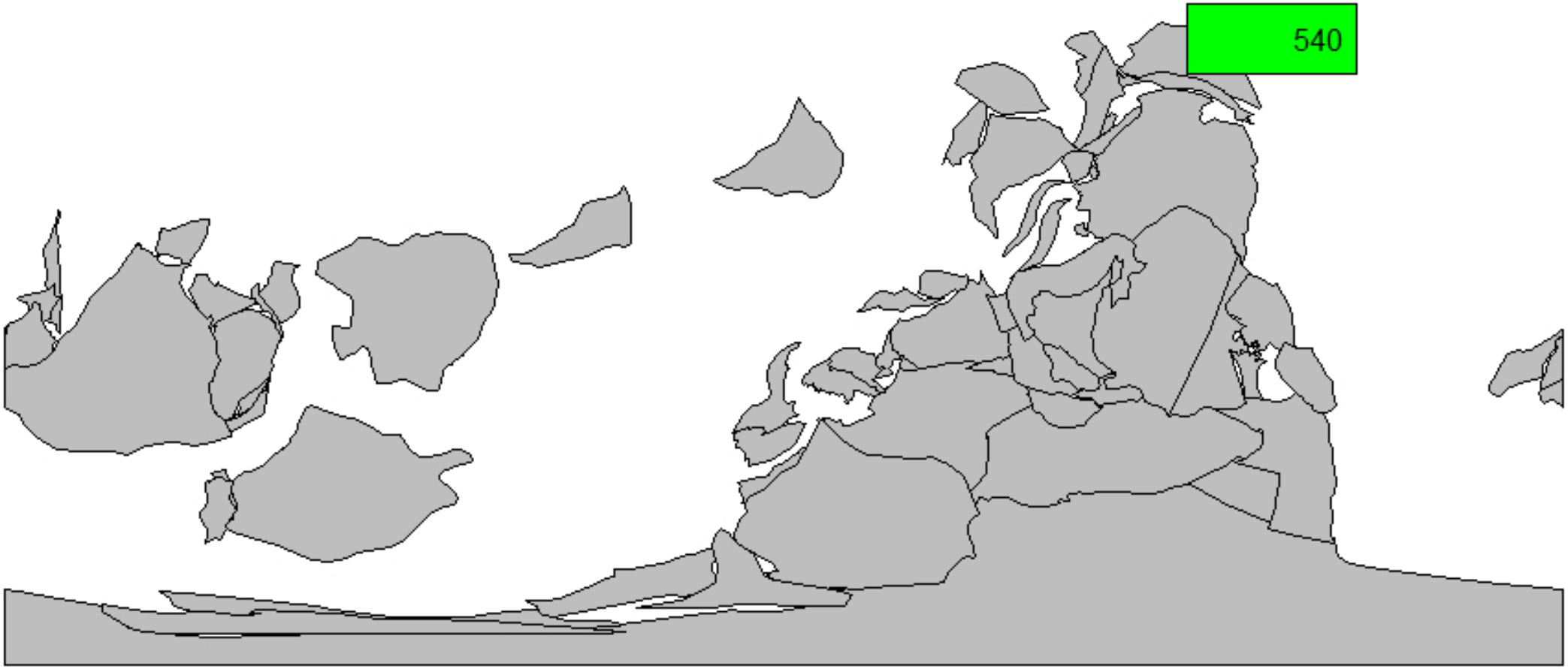

Histogram of data$paleolat
Frequency
0
1000
2000
3000
4000
5000
-50
0
50
data$paleolat


Histogram of data$max_ma[data$max_ma < 550]
Frequency
0
2000
4000
6000
460
480
500
520
540
data$max_ma[data$max_ma < 550]

- Creating paleomaps
  from Early Cambrian to Late Ordovician
- packages used:
  - -> velociraptr
  - -> rgdal
  - -> RCurl
  - -> paleoMap
  - -> mapast
  - -> divDyn
  - -> chronosphere

kometmetall.de

550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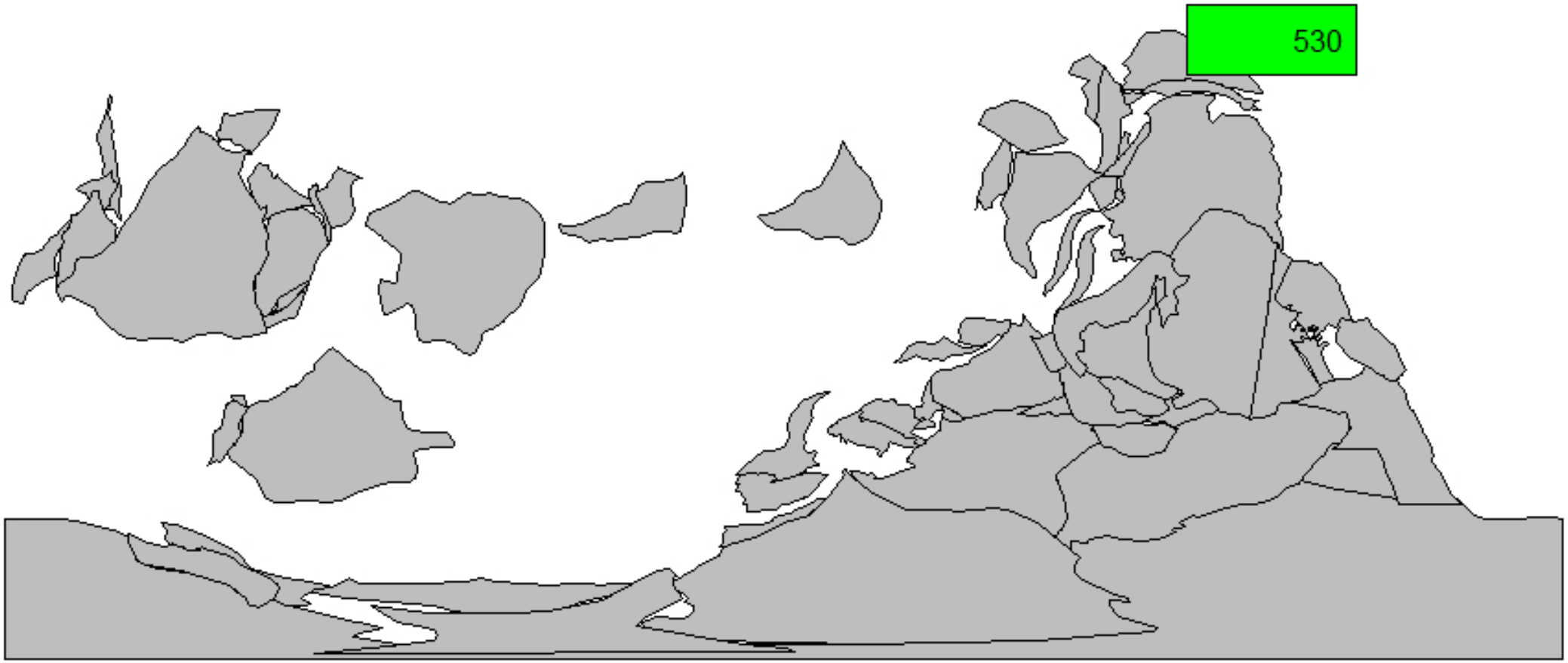
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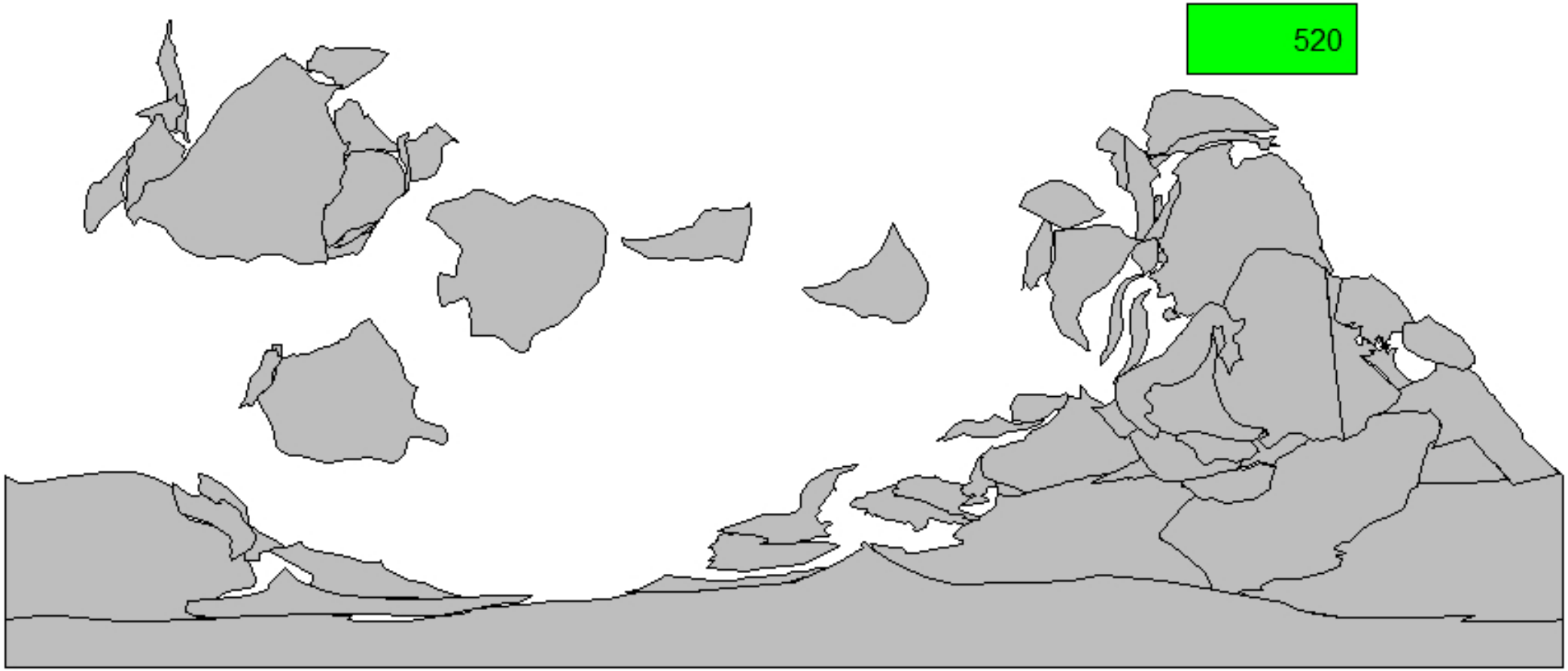
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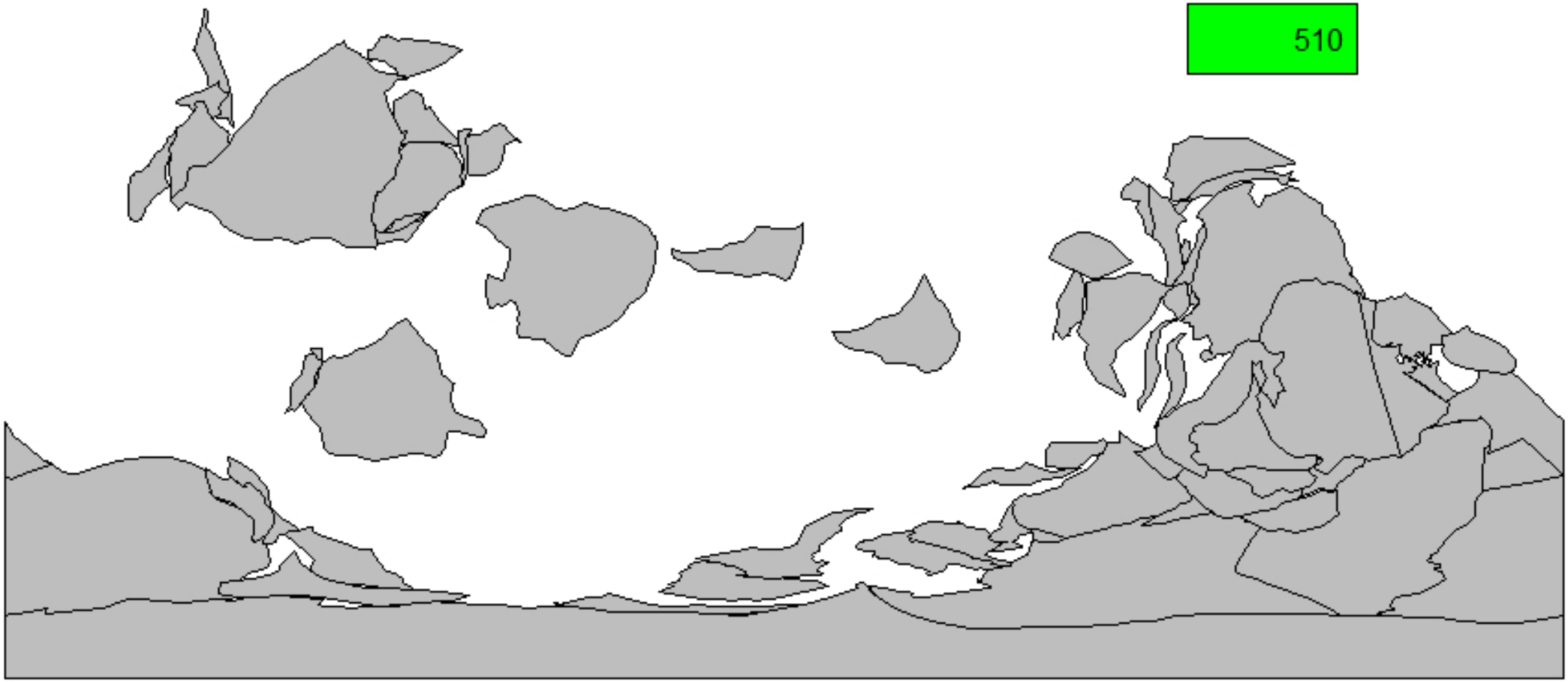
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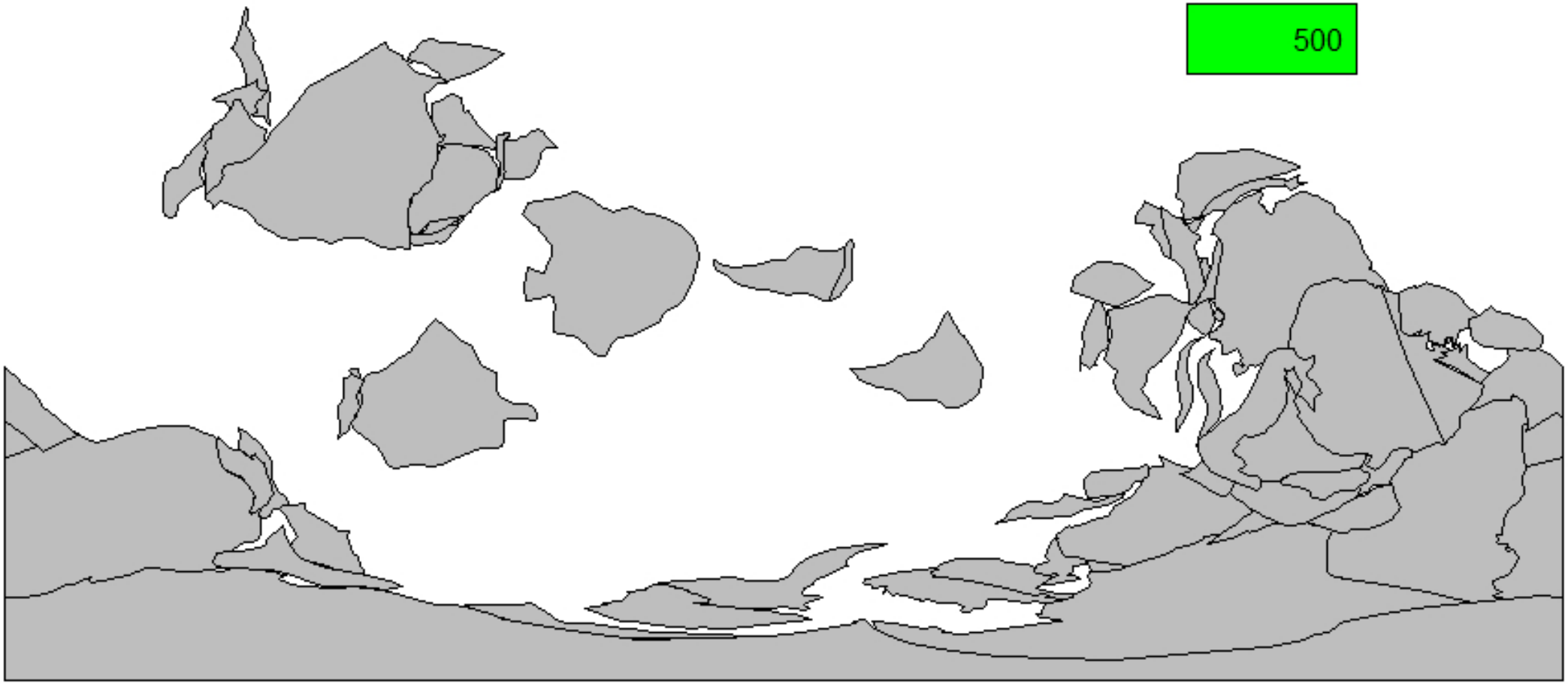
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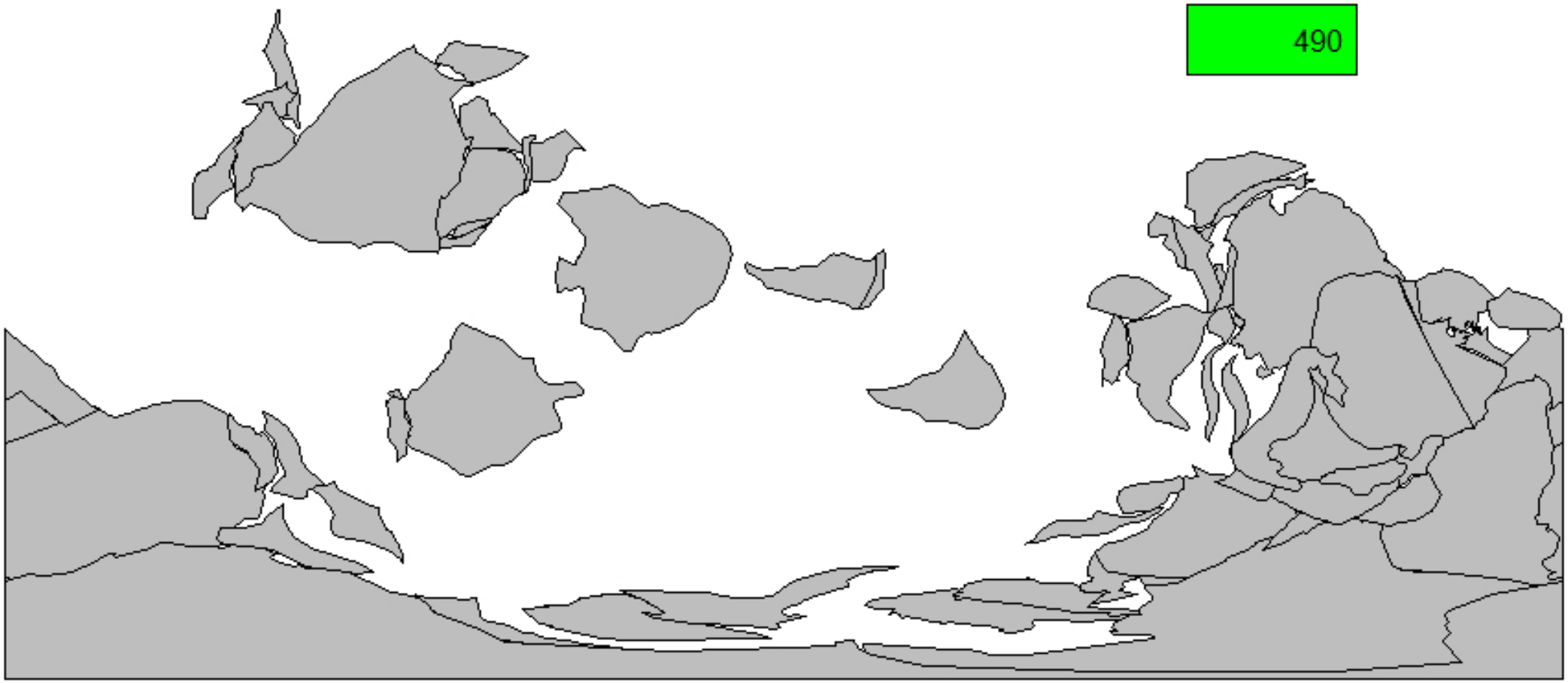
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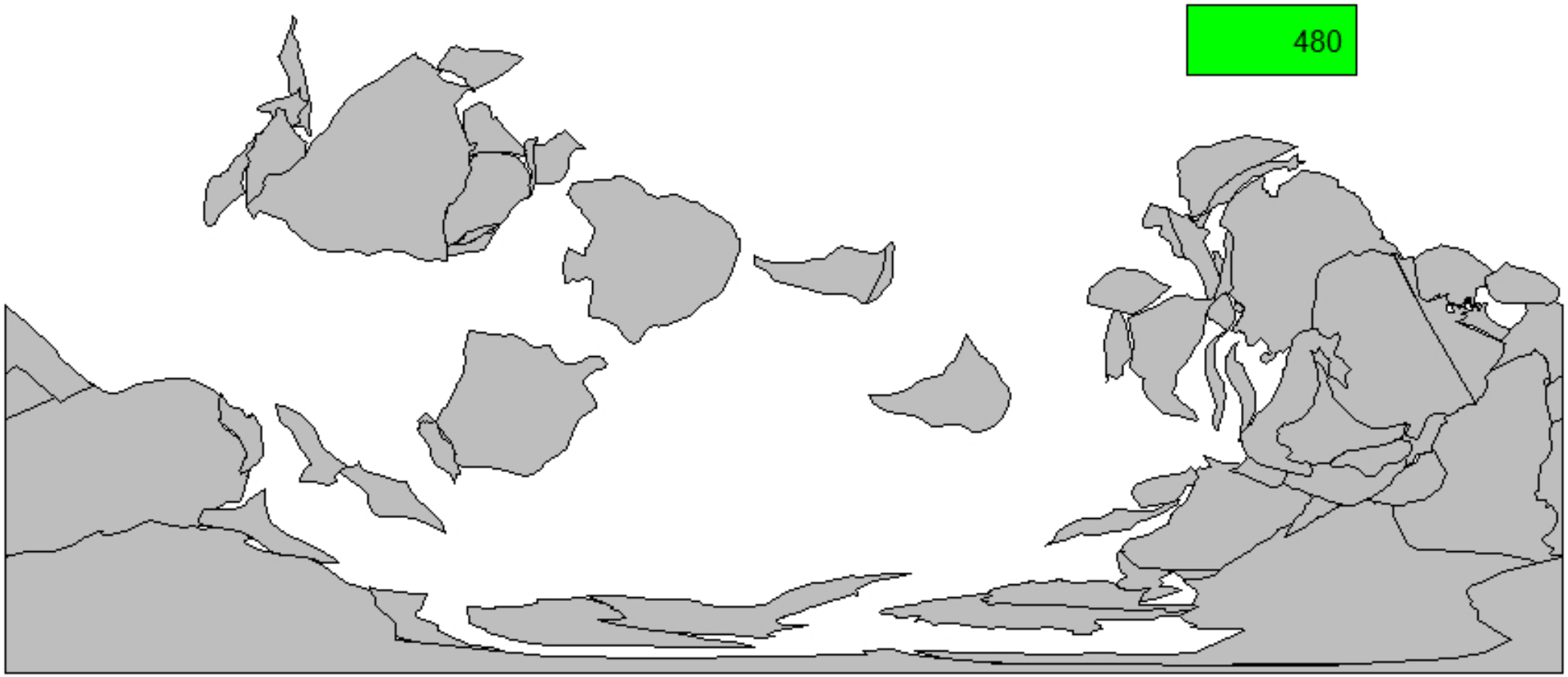
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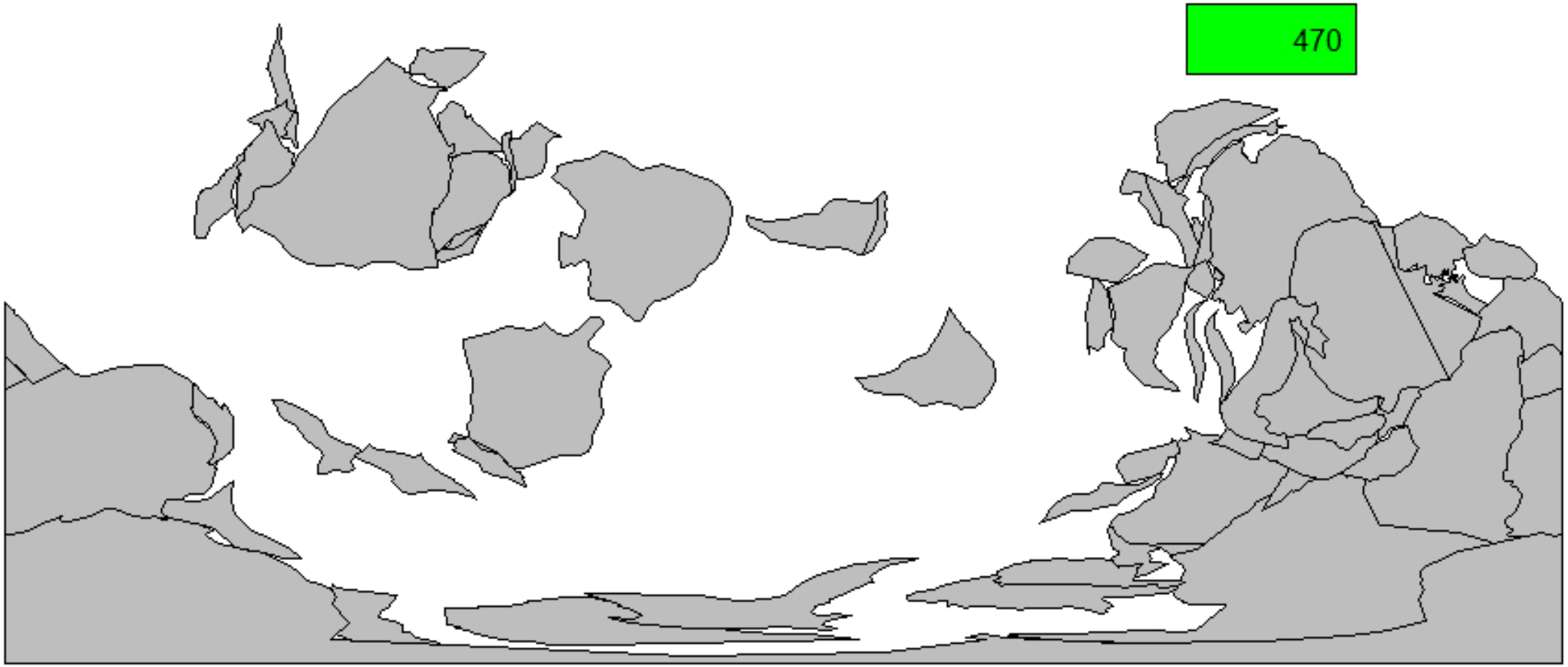
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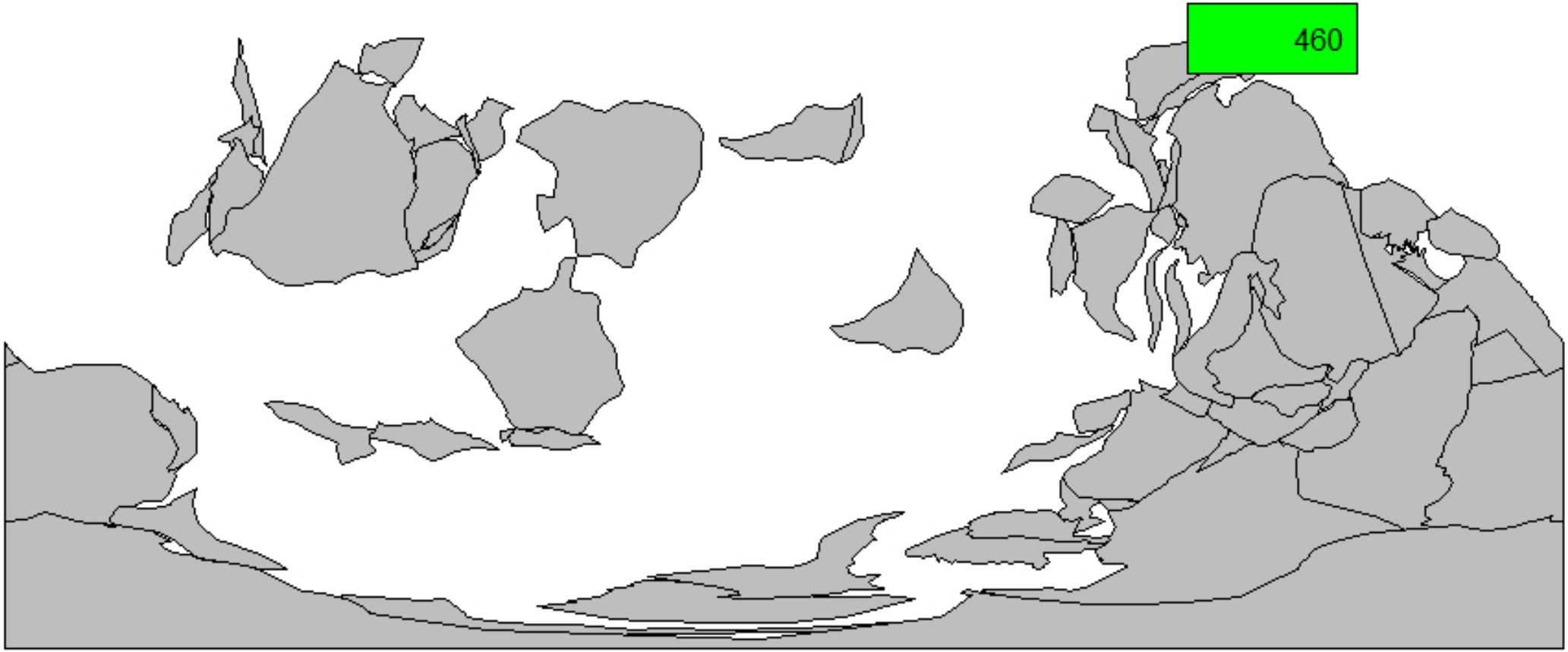
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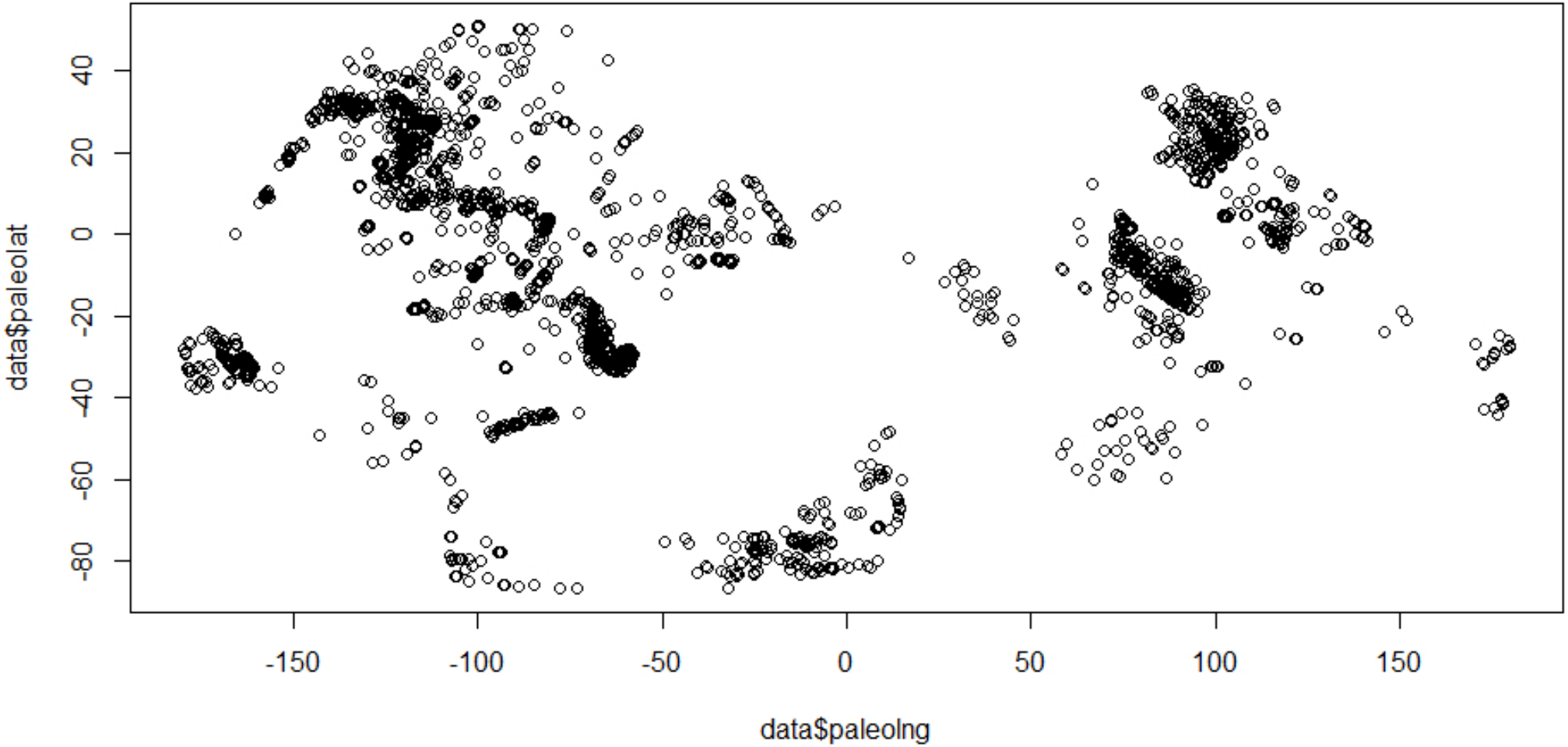
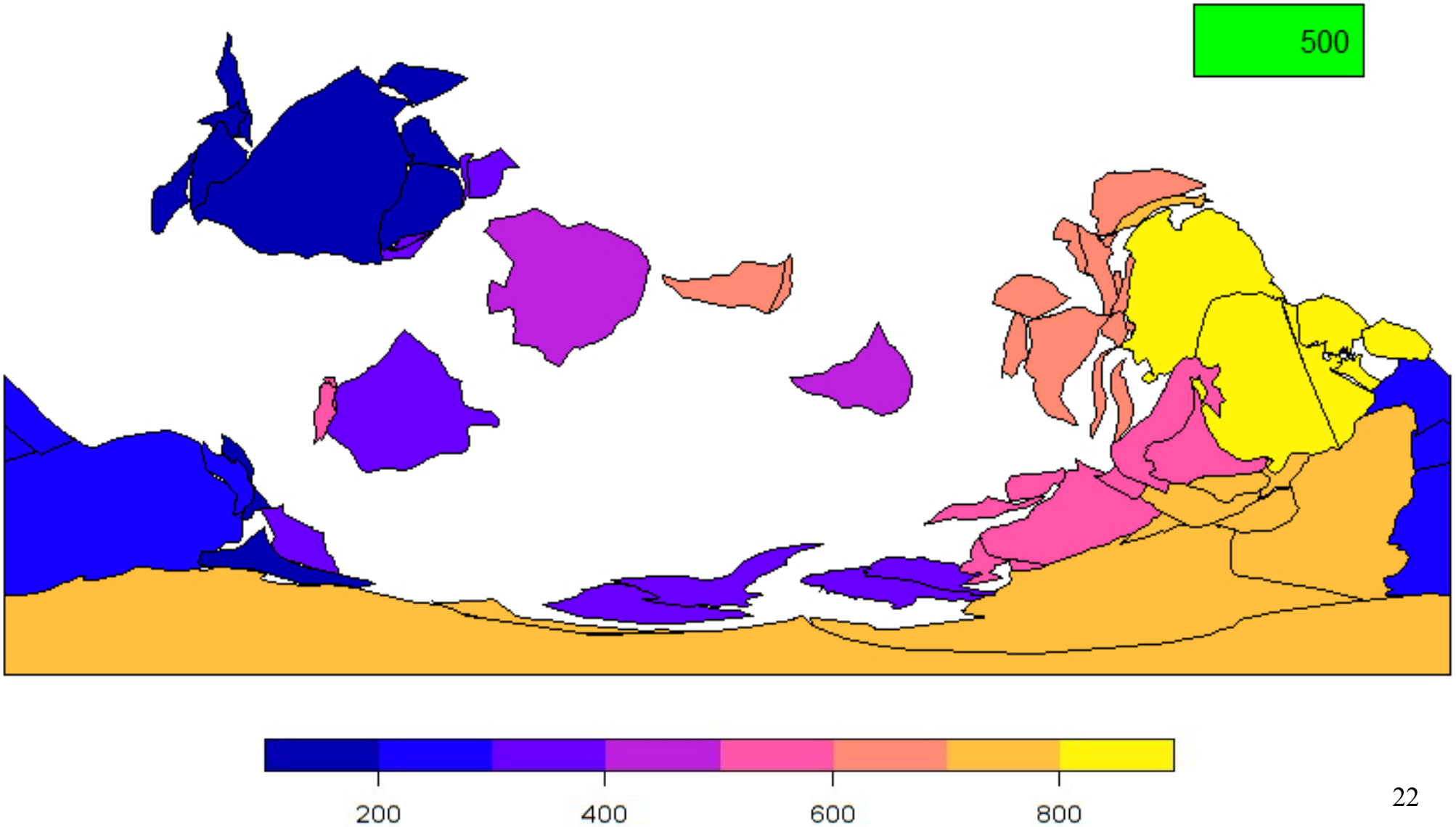
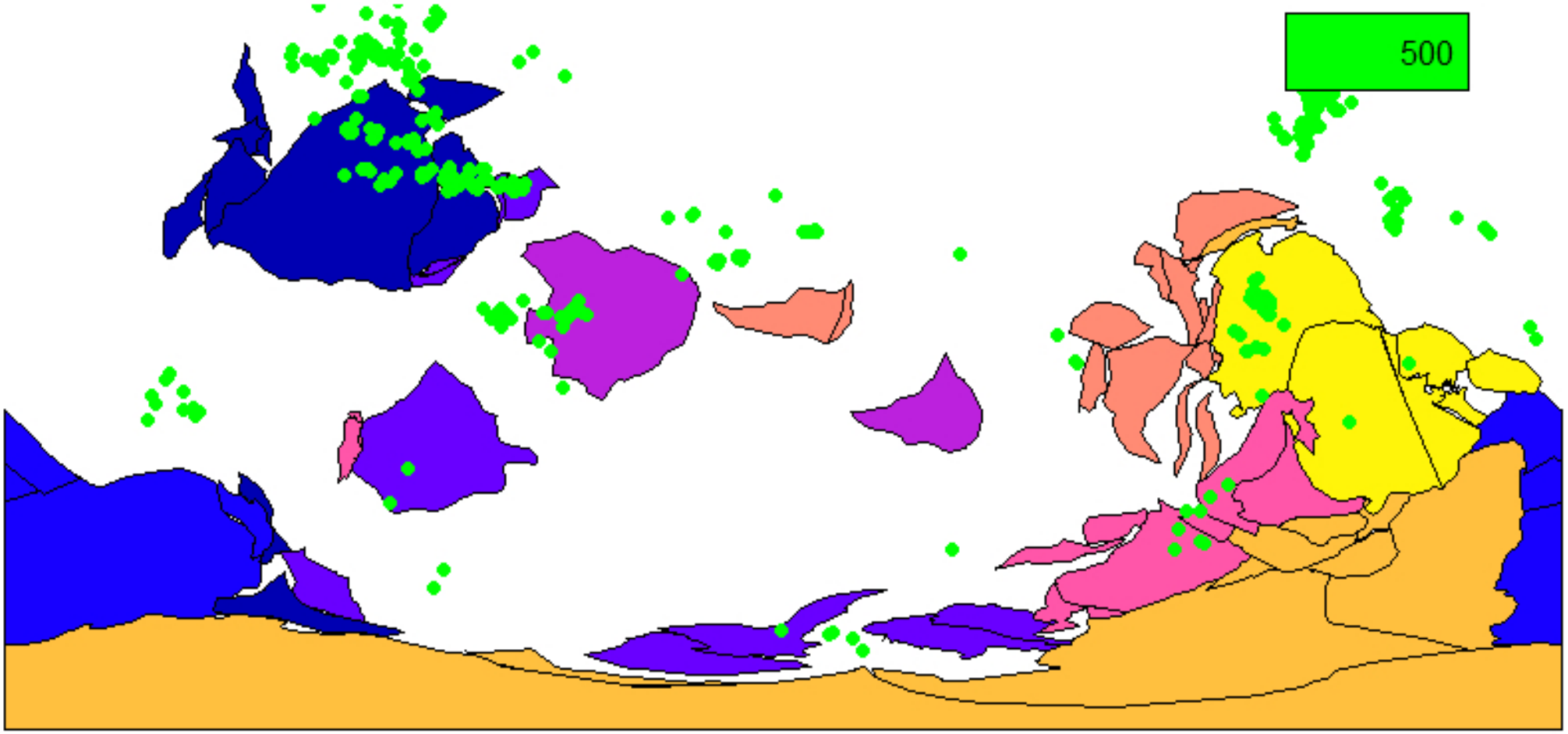
450


data$paleolat
40
20
0
-20
-40
-60
-80
-150
-100
-50
0
50
100
150
data$paleolng

- Geoplates for specific areas

```
> table(data$geoplate)

  101   102   103   104   106   108   109   123   127   201   202   291   302   304   305   311   313   315
12096   372    28   158    13   102    11    13   274  1523     6   413  3059   525  1030   233   618   725
  401   402   501   503   504   505   512   601   602   604   611   612   616   628   707   714   801   802
 1453  2521   160    71    13    71    18   239    12  1623  4657     3     1    16    21   294   712    59
  806
    2
```


500
200
400
600
800

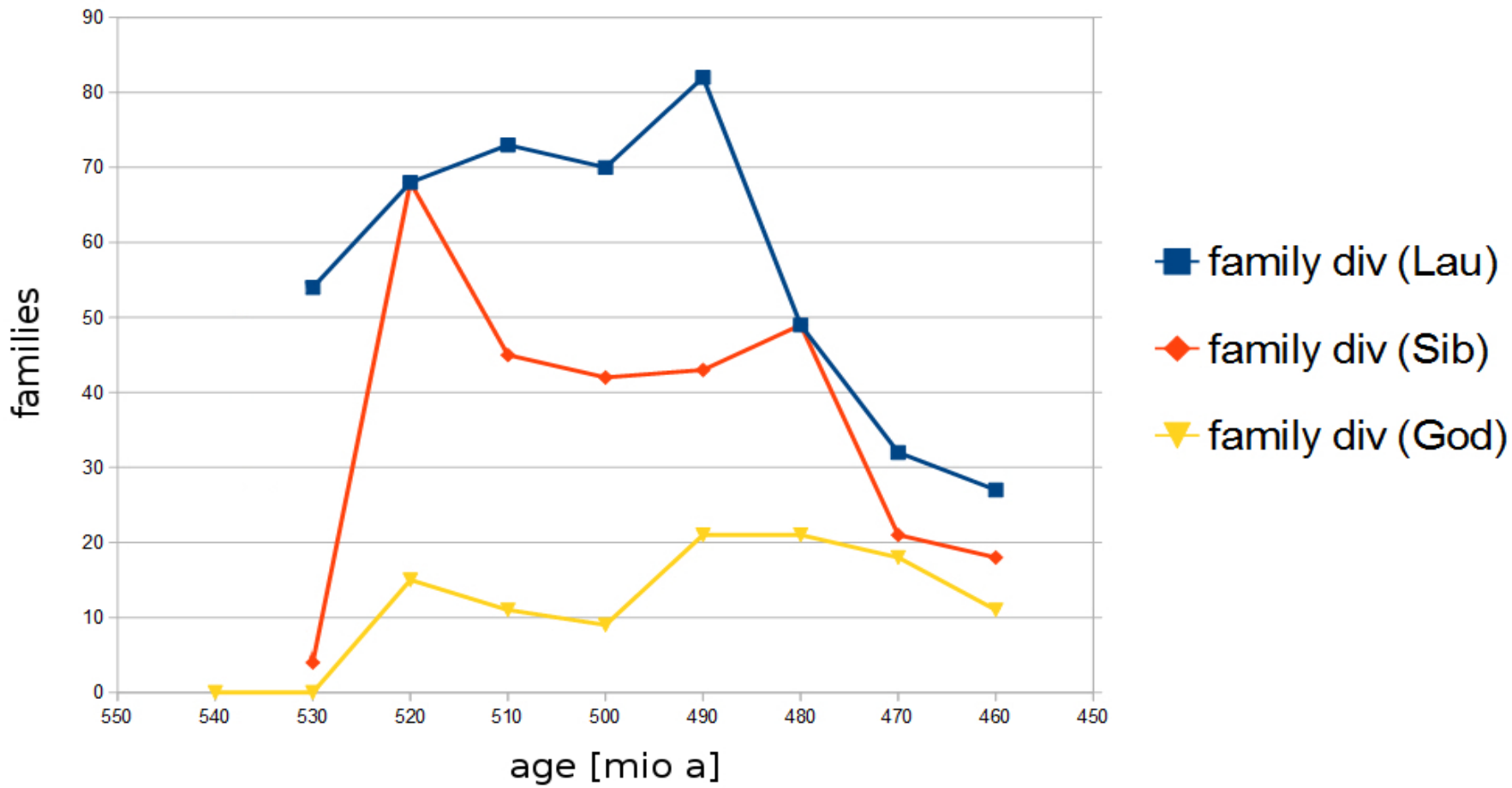

500

- α-diversity for three regions

-> Laurencia, Sibiria and Gondwana

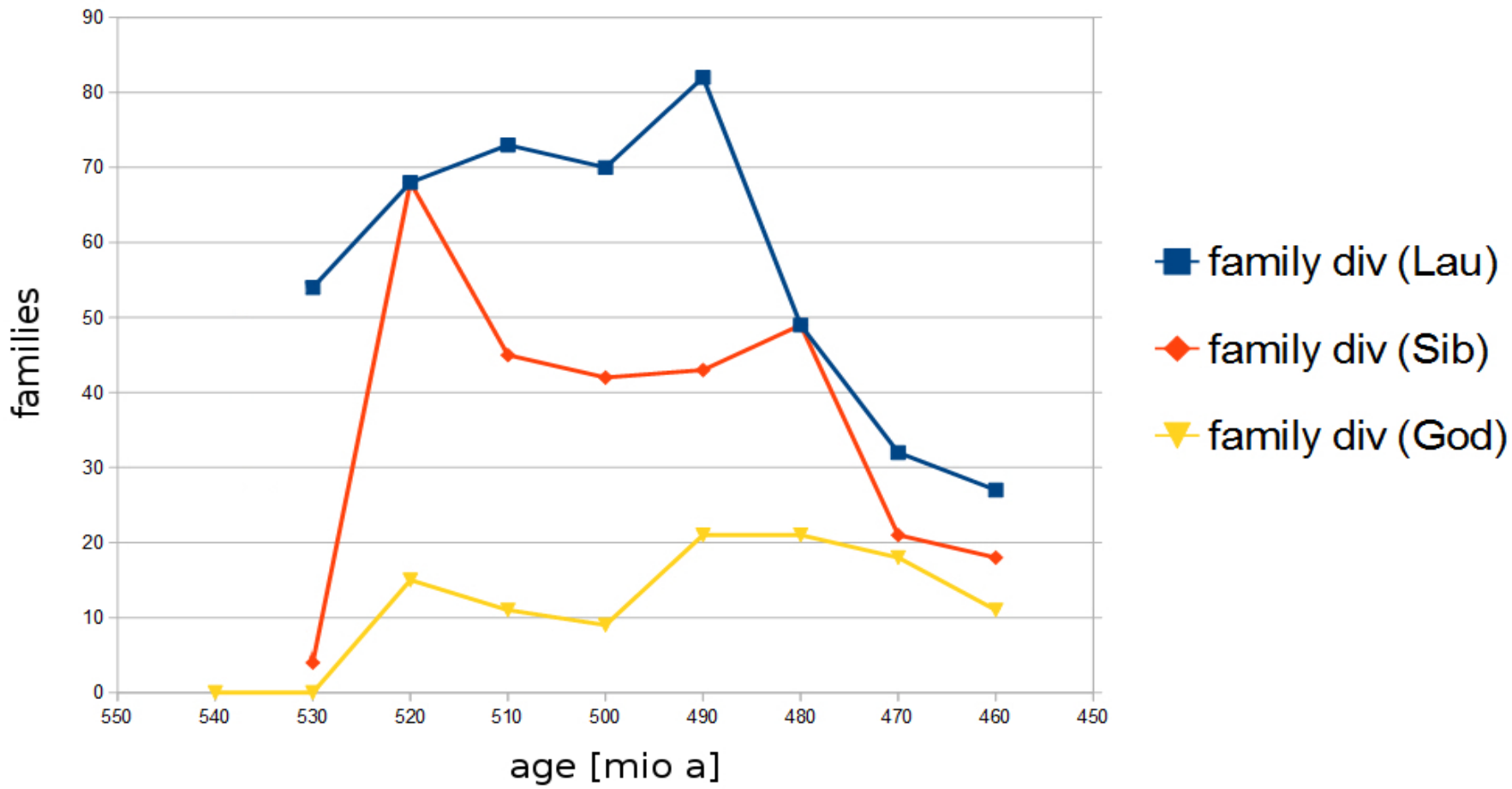
```
> table(data55$family)

    Acrocephalitidae           Agnostidae           Agraulidae      Alokistocaridae       Alsataspididae
                   1                  218                    4                   32                    8
     Anomocarellidae           Antagmidae       Aphelaspididae         Asaphiscidae         Bolaspididae
                   6                    3                  188                   34                    4
        Burlingiidae    Catillicephalidae           Cedariidae      Centropleuridae        Ceratopygidae
                   1                  125                   47                    1                    6
    Cheilocephalidae       Clavagnostidae       Conocoryphidae       Corynexochidae      Crepicephalidae
                  66                    9                    1                    3                  283
  Diceratocephalidae      Dikelocephalidae       Diplagnostidae     Dokimokephalidae     Dolichometopidae
                   6                  131                  187                  330                   29
         Dorypygidae    Ellipsocephalidae Ellipsocephaloididae           Elviniidae           Eodiscidae
                  17                    1                   35                  289                    3
           Eulomidae           Eurekiidae           Harpetidae           Harpididae     Holocephalinidae
                   1                   41                   24                    6                    1
          Hungaiidae           Idahoiidae         Illaenuridae        Kingstoniidae        Leiostegiidae
                   6                   93                   58                  257                   29
      Llanoaspididae         Loganellidae     Lonchocephalidae          Marjumiidae         Menomoniidae
                  70                   10                  118                   40                   62
       Metagnostidae       Missisquoiidae             Nileidae  NO_FAMILY_SPECIFIED         Norwoodiidae
                  11                   17                    5                   57                   43
     Odontopleuridae          Olenellidae             Olenidae     Oryctocephalidae     Parabolinoididae
                   1                    4                   52                    5                  124
        Peronopsidae        Phalacromidae        Phylacteridae       Plethopeltidae     Pterocephaliidae
                  20                    1                  115                   99                  234
     Ptychagnostidae       Ptychaspididae       Ptychopariidae        Raymondinidae      Remopleurididae
                  15                  159                   17                    8                   22
        Shumardiidae      Solenopleuridae       Spinagnostidae    Tricrepicephalidae       Zacanthoididae
                   1                   13                   17                  124                    7
```

α-diversity curves



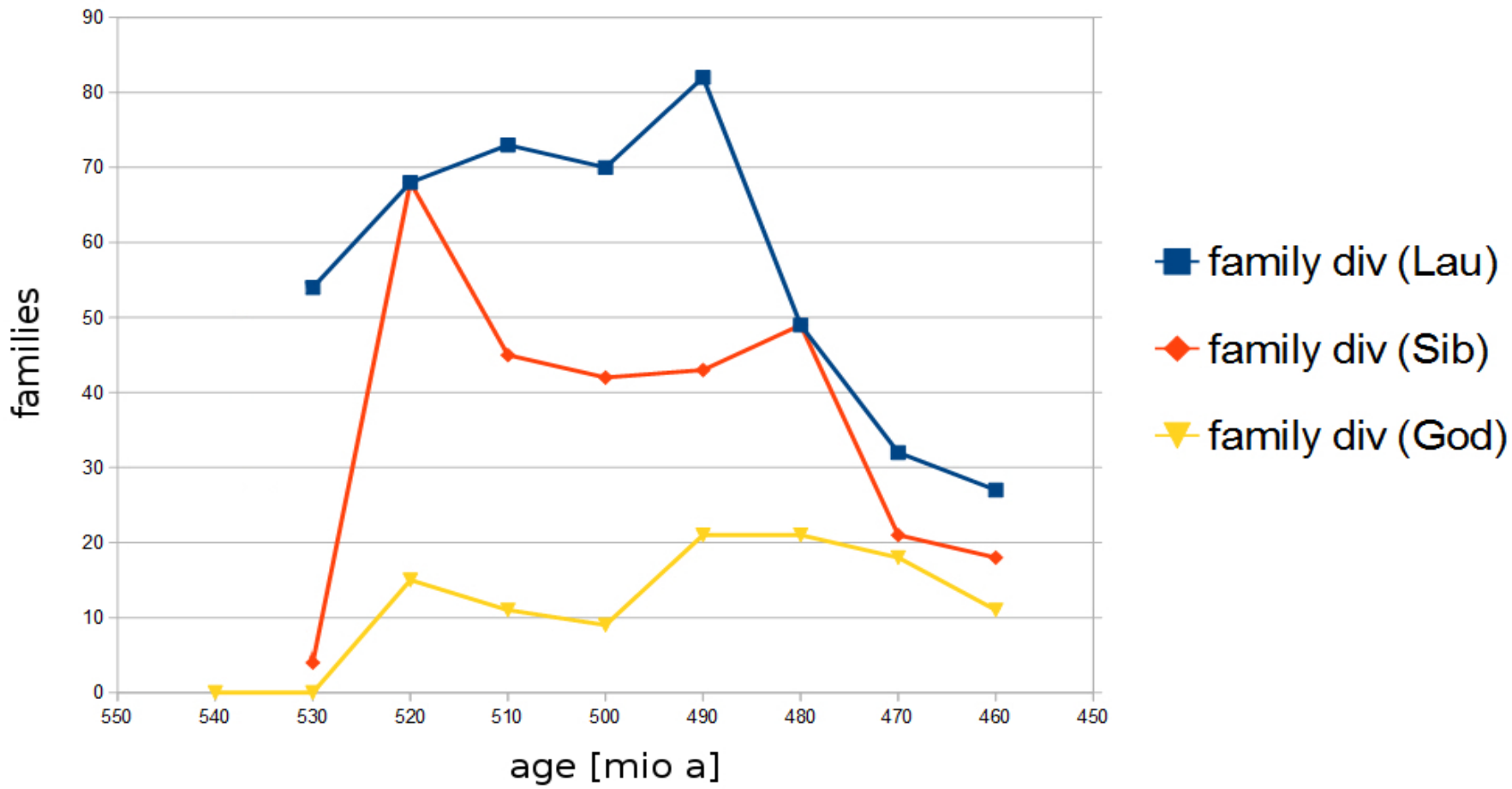
- all three regions show a similar diversity curve
- what are the reasons for the curve structure?
  + first increase
    -> Cambrian Explosion

α-diversity curves



- all three regions show a similar diversity curve
- what are the reasons for the curve structure?
  + first increase
    -> Cambrian Explosion
  + peak in Late Cambrian
    -> warm climate -> less glaciation -> more habitats?

α-diversity curves



- all three regions show a similar diversity curve
- what are the reasons for the curve structure?
  + first increase
    -> Cambrian Explosion
  + peak in Late Cambrian
    -> warm climate -> less glaciation -> more habitats?
  - less diversity
    -> extinction events Cambrian/Ordovican

References

- Literature

- R. Lerosey-Auril and R. Feist (2012): Quantitative Approach to Diversity and Decline in Late Palaeozoic Trilobites, *Springer Science*, p- 535-555

- J. Javier Álvaro et al. (1999): Trilobite diversity patterns in the Middle Cambrian of southwest Europe: a comparative study, *Elsevier: Palaeogeography, Palaeoclimatology, Palaeoecology*, Vol. 151, Issua 4, p. 241-254

- Internet

- cran.r-project.org

- git-hub.com

- spektrum.de

- wikipedia.org

- scotese.com

- mineralienatlas.de

- youtube.com

Thank you for your attention!