

**Examination: Introduction to Palaeoecology**  
**03-03-2004: 14:00-17:00 AM**

Write down your name and student number on each answer sheet!

**Question 1.**

- What is palaeoecology and what is the major difference with ecology?
- Explain the principle of Uniformitarianism (Actualism) and give two reasons why this principle does not always hold in palaeocological studies.
- Give five examples of archives that can be used for palaeocological studies.
- What are the three important temporal and spatial scales involved? Give an example for each scale. *tydelijk ruimtelijk*

**Question 2.**

- What is a proxy?
- Give four examples of proxies.
- What is  $^{18}\text{O}$ ?
- What are typical  $^{18}\text{O}$  values for seawater, mid-latitude rivers and polar ice caps and what determines their differences?
- Explain the relation between glacial-induced sea level changes and  $^{18}\text{O}$  values in benthic foraminiferal species.
- Similar as e), but explain now the changes in  $^{13}\text{C}$  values

**Question 3.**

- What are the main periods for the precession, obliquity and eccentricity cycles?
- During a precession minimum, Northern Hemisphere summers receive more or less insolation than during a precession maximum? Explain.
- At  $67.5^\circ\text{N}$  and  $67.5^\circ\text{S}$  latitudes winter insolation intensities are controlled by precession or obliquity? Explain.
- What is the Milankovitch theory?

**Question 4.**

The monsoon is a well-known low-latitude climate system that brings a lot of rain to India and northern Africa in boreal (=northern Hemisphere) summer. The Earth's orbital cycles may influence the intensity of the monsoon.

- a) Give two possible mechanisms. *Intensity of sunlight*
- b) What proxies can be used to reconstruct past changes in monsoon intensity? *lakes + rivers in North Africa*
- c) During boreal winter the Southern Hemisphere will receive the largest amount of monsoon rainfall. Due to the astronomical perturbations also the intensity of this winter monsoon may change as well. Argue if both summer and winter monsoons will increase in intensity at the same astronomical configuration (at the same time) or not. *no, als NH meeste instraling krijgt dan van zuid*

*half de jaar over 24 uur dezelfde hoeveelheid licht maar niet dichtbij de zon staan*

**Question 5.**

Which modes of preservation do you encounter in the plant fossil record and which type of information do they carry?

**Question 6.**

Plant fossils are one of the foremost used and best terrestrial biological proxies for the reconstruction of the environment. Describe briefly the basic principal approaches, such as taxonomical and non – taxonomical, and discuss their advantages and disadvantages. *advantages: they can't move on our transport. Only after death*

**Question 7.**

Palaeobotanical evidence shows that the first land plants evolve during the Silurian and Devonian.

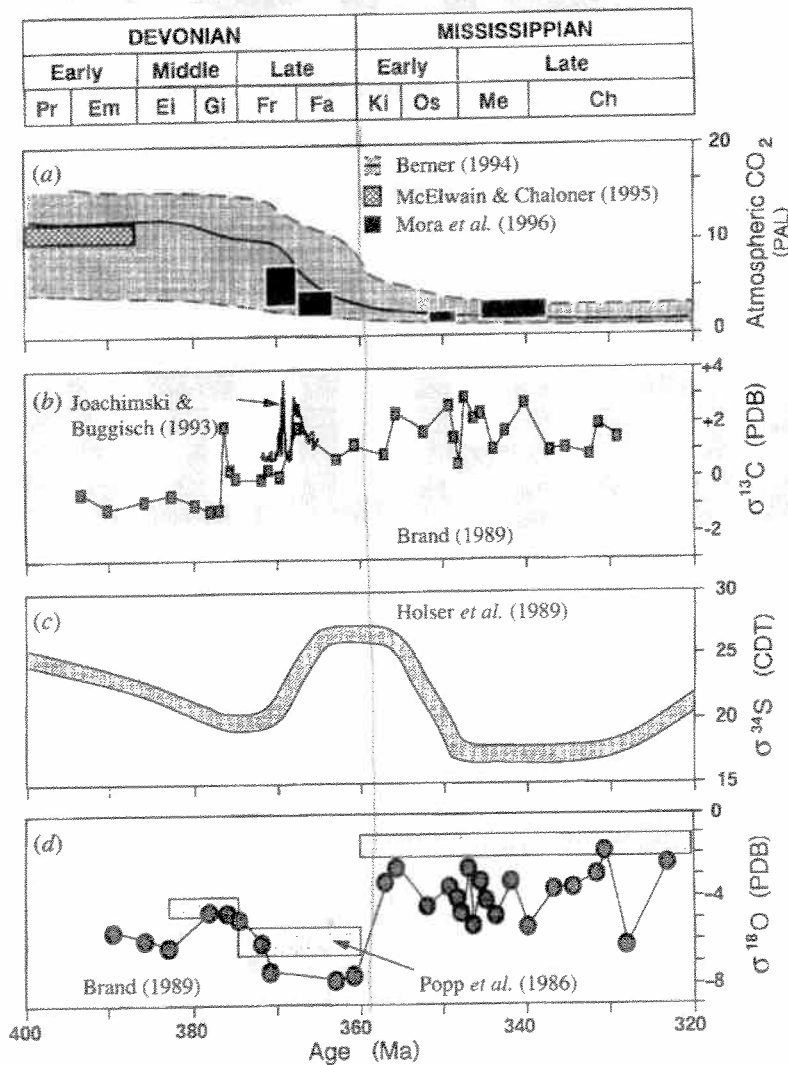
- a) What are the morphological features of these primitive plants and which anatomical features do they invent in order to move from the aquatic to the terrestrial environment? *green surface -> silica and wax*
- b) How does the advent of land plants influence the global Carbon cycle and which evidence exist in the geochemical record? Explain your story together with a graph of the geochemical proxy through this time interval. *konst*

*Carbon record over plant development. Evidence of swampy conditions from oxygen in plant remains*

**Question 8.**

Apart from the Carbon cycle terrestrial vegetation has also major impacts on the other biogeochemical cycles, such as those of Nitrogen and Phosphorous, which may have resulted in the mass extinction among marine biota at the end of the Devonian. reader

Summarize the changes in the biogeochemical cycles and the series of events with the help of the figure below. Note that the  $^{18}\text{O}$  and  $^{13}\text{C}$  both have been measured on  $\text{CaCO}_3$  whereas  $^{34}\text{S}$  has been measured on gypsum ( $\text{CaSO}_4$ ).



Lichtere isotoop S?  
Of zwaardere?

atm + marine

**Question 9.**

Explain the global Carbon cycle at a hierarchy of different time scales. Start with the short Carbon cycle at seasonal to decadal time scale, than at a time scale of thousands of years finally at a timescale of million of years.

- a) Which are the relevant reservoirs, which are the major fluxes for each of these cycles?
- b) How do they contribute to fluctuations in the atmospheric CO<sub>2</sub> level?

sediments

deep sea

in surface ocean kept itself as carbonate included.

**Question 10. (Bonus)**

The annual cycle is often claimed to have been observed in the geological record.

- a) Why should the annual cycle be recorded in the geological record? And give four examples of annual layering found in the geological record.
- b) How should you attempt to correlate paleoclimatic records from tree ring records and ice cores? And why?
- c) What is dendrochronology and why is it important?
- d) What would be your approach to demonstrate that thin laminations in sedimentary succession are of annual origin?

dikte jaarringen

CO<sub>2</sub>-lagen

jaarwissel

jaarwissel