

Examination Reconstructing Quaternary Environments (GEO4-4409)

January 30, 2014

Answers to the open questions may be given in English or Dutch, in any case: please answer concise and readable !

For every sub-question you can earn 4 points. (subtotal 60)

The second part consists of **20 multiple choice (MC) questions** based on the presented papers. Only one answer is supposed to be correct. For each of the correct MC answers you can earn 2 points. (subtotal 40)

The results will be available within 2 weeks and published on blackboard,

Good-luck !

OPEN questions:

- 1) Give a short and to-the-point description of the following subjects:
 - a) OSL
 - b) Cryptotephrochronology
 - c) Equilibrium Line Altitude

- 2) Dating:
 - a) In a coring from the western part of the Netherlands marine shells are present at about 15 meters below the present sea level in a fluvial deposit underlying a layer of coversand. How old are these shells and how can they be dated?
 - b) What is AMS-dating, and how can it be applied in dating past fluvial activity?
 - c) How would you date the glacial deposits that can be found in the Netherlands, and what will be the approximate age (in kyrs BP).

- 3) Proxies:
 - a) Give 3 proxies that can be used to reconstruct past summer and 3 proxies for winter temperatures.
 - b) How can you use the Loss on Ignition method for the reconstruction of environmental changes?
 - c) Compare the indicator values of pollen and plant macro-fossils.

- 4) Events:
 - a) When was the onset of the Quaternary, and how is it defined?
 - b) Give at least 3 interstadials that occurred before the Last Glacial Maximum and describe how they can be recognised in terrestrial environments in comparison with stadials that occurred during the same time-interval.
 - c) What was causing mega-faunal extinctions in the Late Quaternary, give 3 examples of extinct species with approximate age of extinction.

- 5) Synthesis:
 - a) Sketch the Greenland oxygen isotope record for the Last Glacial-Interglacial Transition, give the approximate ages on the vertical axis;
 - b) make a comparison with the vegetation development in the Netherlands;
 - c) which methods can you use to correlate these records ?

Multiple Choice questions (MC): write down only a, b, c, or d !

- 6) Which of the following features is NOT a good indicator for past permafrost conditions?
- Sand-wedges
 - Cryoturbations
 - Drop-stones
 - Pingos
- 7) Annually laminated sediments provide a fantastic dating archive. What is the general principle behind the formation of biochemical varves ?
- Preservation of diatom spring, carbonate summer and organic winter layers
 - Preservation of carbonate spring, diatom summer and organic fall layers
 - Preservation of organic spring, carbonate summer and diatom winter layers
 - Preservation of diatom spring, organic summer and carbonate fall layers
- 8) The Subboreal-Subatlantic Transition can be recognised in peat bogs all over Europe. What is characteristic for the boundary ?
- A change from light subboreal to dark subatlantic coloured peat
 - A change in the species composition of testate amoebae
 - A change in AP/NAP composition
 - A change in the species composition of chironomids
- 9) Coleoptera (beetles) are used as climate proxies. Which species are generally used for temperature reconstructions?
- Aquatic species
 - Terrestrial species
 - Herbivorous species
 - Carnivorous species
- 10) Dendrochronological records can be matched to each other because of common structure in the tree ring pattern. Why should individual records be detrended before comparing them to other records ?
- Difference in growth of the trees
 - Differences in location where the trees grew
 - Differences in age of when the trees grew
 - Differences in climate when the trees grew
- 11) A diatom study from Spain revealed distinct changes during the Last Weichselian, what can be concluded based on the changes in diatom composition ?
- Severe cold phases occurred during the period under investigations
 - Severe warm phases occurred during the period under investigation
 - Severe dry phases occurred during the period under investigation
 - Severe wet phases occurred during the period under investigation
- 12) What is one of the most characteristic elements in the Eemian vegetation in Europe ?
- The occurrence of dry continental species such as spruce (*Picea*)
 - The occurrence of subtropical species such as hemlock (*Tsuga*)
 - The occurrence of cold adapted species such as birch (*Betula*)
 - The occurrence of warm species such as hornbeam (*Carpinus*)

- 13) Glacial deposits can be dated in several ways, classically geomorphological evidence was used to date the deposits relatively, but now absolute dating is more and more used. Which element is currently most used in exposure dating glacial boulders ?
- ^{10}Be
 - ^{14}C
 - ^{16}O
 - ^{40}Ar
- 14) What is the stomatal index (SI) ?
- The number of stomata per species
 - The number of stomata per leaf
 - The number of stomata per square unit leaf
 - The number of stomata relative to the number of epidermis cells
- 15) The Middle Devensian woolly Rhino that has been found in the UK as described in the paper by Danielle Schreve was relatively well preserved in fluvial terrace deposits and could also be dated indirectly by:
- AMS dating of the peat by which it was buried
 - OSL dating of the clays underlying the bone remains
 - Relative dating using terrace stratigraphy
 - Palynology of the stomach contents
- 16) The Beuningen gravel bed is a horizon within coversand deposits in NW Europe and is dated to around...
- 11.5 ka cal BP
 - 13 ka cal BP
 - 15 ka cal BP
 - 20 ka cal BP
- 17) Periglacial evidence from France in the form of large polygonal networks tells us that during formation of the structures:
- mean annual air temperatures were below 0 degrees
 - mean winter temperatures were below 0 degrees
 - mean annual air temperatures were below -8 degrees
 - mean winter temperatures were below -8 degrees
- 18) Due to recent warming, permafrost degradation is taking place in Siberia. However, in the Holocene several other warm periods are recorded in for instant fossil trees. Which of the following proxies cannot be used to reconstruct climate in these periods?
- $\delta^{13}\text{C}$
 - $\delta^{14}\text{C}$
 - $\delta^{18}\text{O}$
 - ring width
- 19) What is the approximate age of Marine Isotope Stage 11
- 200 ka
 - 300 ka
 - 400 ka
 - 500 ka

- 20) For the Early Holocene several cooling events are reported in the North Atlantic region. The 8.2 event has been recognized in lake sediments as:
- An increase in AP percentage (arboreal pollen)
 - A decrease in LOI values (Loss on Ignition)
 - An increase in IRD (Ice Rafted Debris)
 - A decrease in NAP percentage (non arboreal pollen)
- 21) Kettleholes in Northern Poland are especially suitable for reconstructing:
- Elsterian glacial conditions
 - Eemian vegetation development
 - Weichselian fluvial dynamics
 - Holocene waterlevel changes
- 22) Volcanic ashes can be used to compare ice, marine and terrestrial records. In North Atlantic deposits volcanic ashes can be dated by
- AMS dating
 - Ar/Ar dating
 - OSL dating
 - Correlation to other datable records
- 23) Which of the following statements is TRUE:
- Lake Agassiz is a lake that formed during the Younger Dryas due to the melting of the Ice sheet;
 - After Lake Agassiz was formed by meltwater, it suddenly drained causing the ocean circulation to stop temporarily until the lake fully disappeared;
 - The draining of Lake Agassiz lasted for less than 100 years causing an abrupt climate change;
 - Lake Agassiz experienced several phases of lake level lowering and subsequent rising over a period of thousands of years;
- 24) With respect to the preceding period the Medieval Climate Anomaly in the Western Mediterranean was characterized by:
- colder and wetter climate conditions
 - warmer and wetter climate conditions
 - warmer and drier climate conditions
 - cooler and drier conditions
- 25) According to Hoek (1997) the Lateglacial vegetation development in the Netherlands is characterized by the succession of pine (*Pinus*), birch (*Betula*) and willow (*Salix*) trees. Which is the general order of appearance in Dutch Lateglacial pollen diagrams ?
- Pine, Birch, Willow
 - Willow, Pine, Birch
 - Pine, Willow Birch,
 - Willow, Birch, Pine

THE END