Benha University **Fossilization and plant fossils (219G)**
Faculty of Science **Final Ex. (48 marks)**
Geology Department **Time Two Hours**
2nd year Geology &
Botany and Chemistry **Date 18-1-2017.**

Model Answer

I- Fossilization

I- Write on four only from the following: **(8 marks)**

a – The Nebular Hypothesis

The Nebular Hypothesis

A great spherical cloud of hot gases that slowly rotated. As it rotated, it continually speeded up and the result is a flattened disc.

b- Index fossils criteria

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1- Short stratigraphical (vertical) range; so the time between appearance and extinction is short.

2- Wide geographic range (horizontal distribution); so it is found in many places around the globe

3- Must have hard parts; that easily fossilize, either calcareous, siliceous, phosphatic or organic.

4- Must have enough morphological characters; that easily identified and distinguished.

5- Independence of facies; as would be expected from a free-swimming animals

6- Must be extremely abundant; so that it is likely to be found in even very small samples such as drill cores

c- Binomial Nomenclature of fossils.

The fundamental unit of biological classification is the species.

Members of a species are able to interbreed and give rise to fertile offspring. Palaeontologists, lacking evidence of reproductive isolation of ancient "species", focus on morphological definitions of species. Above the species level are increasingly more inclusive groups which are defined by certain characteristics possessed by all their members.

Binomial Nomenclature Linnaeus (1758)
Types: (Holotype& Paratypes)Type species:Open Nomenclature: affinis= aff. e.g *Lopha*aff. *dichotoma*confer = cf. e.g *Lopha*cf. *dichotoma*sp. e.g *Lopha*sp. Synonyms: Homonyms: Law of priority:

d- Common mineral components of the skeleton of marine organisms.

Common mineral components of the skeleton of marine **organisms.**

Calcium carbonate $CaCO_3$ Principal mineral components of most sea shells. Two common calcareous minerals in sea shells:

Aragonite – unstable over geological time.

Aragonitic shells commonly are dissolved (preserved as moulds) or transform to calcite (poor preservation of primary textures).

Calcite – stable over geological time. Consequently, calcitic (e.g. brachiopod) shells tends to be well-preserved.

Silica SiO2 – Usually amorphous hydrated silica (Opal A) which commonly transforms to quartz and other silica minerals following death.

Opal may be well preserved in pelagic sediments, if deeply buried.

This is the principal “mineral” component of the skeletons of some sponges, and micro-organisms such as diatoms and radiolarians.

Skeletons may be lost or degraded through opal dissolution and obliteration of the original amorphous structure through quartz crystallization.

Calcium phosphate (apatite)

Ca3(F.Cl.OH)(PO4)3 – stable over geological time (tends to be well-preserved). Principal mineral component of bones, teeth and some shells.

e- The main physical events through the Cenozoic Era

1- The Americas were separated from Europe and Africa except for a connection across the North Atlantic where Greenland formed a passable land bridge.

2- In the Southern Hemisphere Australia and Antarctica had lost contact with all other southern lands but remained joined to each other until the Eocene.
3- Antarctica soon drifted southward into a polar position and Australia commenced a northward trip that is still continuing today.

4- The formation of the great Alpine and Himalayan ranges, were basically due to northward movement of Africa and other southern blocks towards Eurasian lands.

5- The Arabian peninsula, which was originally part of Africa split apart from the parent continent to create the Red Sea in the Oligocene and Miocene and at the same time pushed up the Zagros ranges and became part of the Eurasian continent.

6- The most spectacular of all was the collision of India in the Eocene and Oligocene giving rise to the Himalayan ranges and Tibetan Plateau.

7- All these dramatic movements reached a culmination in the middle Tertiary to create one of the earth's greatest disturbance the Alpine Revolution (cf. Alpine Orogeny).

II- Choose the correct answer: (5 marks)

a- One of the following is belonging to the Neogene epochs (Turonian, Cenomanian, **Miocene**).

b- One of the following is not belong to the chronostratigraphical units (Series, Stage, **Era**).

c- The *Miogypsina* is considered among the diagnostic foraminiferal genera for (Carboniferous, Eocene, **Miocene**).

d- The red algae are belonging to (Kingdom Fungi, Kingdom

Protista, Kingdom Animalia).

e- The Ammonoids are firstly appeared nearly at the Middle of the (**Paleozoic** Era, Jurassic, Eocene).

III- Correct the following sentences: (4 marks)

a- The Old Red Sandstone Continent is formed during the **Paleozoic** Era.

b-The BIF are formed during the **pre-cambrian**

c-The Cenozoic Era is subdivided into the following periods **Paleogene, N eogene, and Qauterary**.

d. The **rudists** are firstly appeared in the Jurassic and extinct at the end of the Mesozoic Era.

IV - Compare between the following: (7 marks)

a- Solnhofen and Edicara fossils.

Solnhofen Fossils are those rare fossil occurrences of soft-bodied animals which are rarely preserved in the geologic record.

Near **Solnhofen-Eichstatt area (Southern Germany) There are deposits of very fine-grained limestone (Solnhofen limestone)** was deposited in quiet broad lagoon in the Late Jurassic.

This limestone contains fishes, jellyfish, insects, pterosaurs, birds, and many other forms.

The body outlines showing jellyfish tentacles, insect wings, pterosaur wing membranes, and the feather of the oldest birds are preserved as impressions.

Edicara fossils: Fossils of many called animals appear near to the close of the Proterozoic (Edicaran or the last Period of Neoproterozoic Era). They represent fossils of three phyla (Coelenterates, Annelids, and Arthropods)

Ediacara-type fossils represent a group of soft-bodied organisms, mainly known from imprints.

b- Paleozoic and Mesozoic Mass Extinctions.

Paleozoic and Mesozoic Mass Extinctions:

Paleozoic mass extinction

When (End of…)	Species Loss**	Major Loses to
Ordovician	85 ±3%	Brachiopods & bryozoans
Devonian	83 ± 4%	Rugose & tabulate corals, armored* & jawless fish
Permian	95 ± 2%	All life! - Trilobites*, corals*, blastoids*

Mesozoic Mass extinction

Triassic	80 ± 4%	Most synapsids
Cretaceous	76 ± 5%	Dinosaurs, marine reptiles, ammonites

c- Early and Late Paleozoic marine invertebrates.

The Early Paleozoic (**Age of marine invertebrates**)

All phyla with hard parts (except Bryozoa) began in Cambrian, and many without hard parts too.

Trilobites, Graptolites, Brachiopodes, Corals, The extinct Archaeocyaths (Sponge-like animals which are limited to the cambrian). Molluscs (Nautiloids, Gastropods, Bivalves).Ostracods, Conodonts

The major Late Paleozoic marine invertebrates are Foraminifera (Fusulines), Corals, Bryozoans, Brachiopodes, Ammonoids (Goniatites), Ostracods, Echinoderms (Crinozoans and Blastoids), Conodonts in addition to the Trilobites, Graptolites,

The model answer

II- Plant Fossils

1- **(a)- Coccoliths:** are the minute calcite plates produced by unicellular marine algae, the coccolithophorides. **(1.5 marks)**

Biozone: it is the biostratigraphic unit which is an interval of geological strata that are defined on the basis of their characteristic fossil taxa. **(1.5 marks) <u>OR</u> Biostratigraphic units (biozones):** are bodies of strata that are defined or characterized on the basis of their contained fossils. **(1.5 marks)**

(b)- Shallow depth indicators environment

Due to the planktic mode of life of calcareous nannofossils, coccolithophorids do not give a clear indication of depth of sediment deposites in which they are found. However due to their small size they have usually been removed from deposits of nearshore. They are usually not preserved in modern sediments deposited below more than a few hundred to about 1000 m waterdepth, but they survive transport into greater depths by turbidity currents.

There are several genera seem to be more common in shelf areas than in the open sea such as *Pontosphaera*, *Scyphosphaera*, but *Braarudosphaera* of chalk Oligocene reported from several open ocean sites of the South Atlantic. Generally, the shelf assemblages seem more diverse than the open ocean assemblages. **(3 marks)**

(2)- Preparation techniques

The samples can be very small, the amount of a few rice grains is sufficient to prepare several Smear-Slides or prepare slides from centrifuged samples.

For routine biostratigraphic work, Smear-slides are prepared, to prepare this type of slides; the sample is cleaned then broken up and a small amount scratched off onto glass slide. In case of hard samples, can be gently crushed in a mortar, and then cuttings are spread on the glass slide. A few drops of distilled water and a flat toothpick or match serve to smear the sediment over the slide. Alternatively the samples can be smeared onto

the cover-glass in which the coccoliths lie near the objective and the few large particles do not hinder observation with a high-power objective. When the sediment is dry, the mounting medium (artificial, fluid Canada balsam or Canada balsam) is best applied.

The slide may then be cooked on a hot-plate for approximately half to one minute to make slide more durable and easier to store.

Coccoliths can be observed with a polarized light microscope with x 10 or x 12.5 oculars and an x 100 objective with oil immersion or with Scanning Electron Microscope (S.E.M) for detailed observation. **(5 marks)**

(3)- Cretaceous/Tertiary boundary

The massive change in calcareous nannofossil assemblages at the Cretaceous/Tertiary boundary was first noted and illustrated by Bramlette & Martini (1964) and has since been described in greater detail (Perch-Nielsen, 1969; 1979a,b; 1981c; Percival & Fischer, 1977; Romein, 1977), The diverse Maastrichtian assemblage disappears suddenly - probably over a few thousands of years - after mass mortality at the boundary. It is then replaced by new species and genera evolving from some 15 to 18 genera that survived the Cretaceous/ Tertiary boundary events (Perch-Nielsen, 1982; Perch-Nielsen, McKenzie & He, 1982).

Markalius inversus Zone (NP 1)

Definition: LO of Cretaceous coccoliths or FO of acme of *Thoracosphaera* to FO of *Cruciplacolithus tenuis.*

Age: Early Paleocene (Early Danian) (Cretaceous/Tertiary boundary). **(2.5 marks)**

Oligocene/Miocene boundary

The Oligocene/Miocene boundary in terms of calcareous nannofossils is placed at the top of NP 25 by some, and within NN 1 by other authors. The sequence of disappearance of *H. recta, S. ciperoensis, D. bisectus* and Z. *bijugatus* varies somewhat from section to section and the boundary is thus set differently by different authors, depending on their choice of marker species.

Triquetrorhabdulus carinatus Zone (NN I)

Definition: *LO of Helicosphaera recta and/or Sphenolithus ciperoensis to FO of Discoaster druggii.*

Age: Early Miocene and/or latest Oligocene. **(2.5 marks)**

4- Discoasteraceae

This family includes the calcareous nannofossils of star or rosette shape. Flat-lying specimens remain dark when viewed with crossed nicols since C-axis of the calcite then is vertical. The family includes about a dozen genera, most of which are usually included in *Discoaster* except some genera which are defined by different authors as *Eu-discoaster*. The genera generally used are *Catinaster- Discoaster- Discoasteroides* etc….

Catinaster of these genera includes the basket-like forms with rays which may extend beyond the outer border of the central part, while *Discoaster* all forms with relatively flat, star-or rosette-shaped bodies.

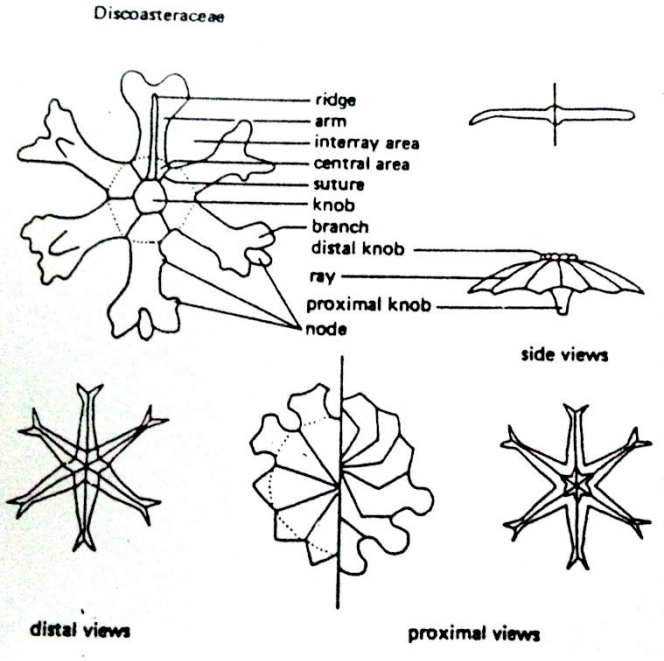
Discoaster* and *Discoasteroides

Discoaster has over 100 species which can be distinguished without problems when they are well preserved. Some of them have been used as zonal markers but many more of them are useful in biostratigraphy with their short ranges.

Discoasteroides was erected for discoasters with a large terminally concave stem flaring out as radiate elements at the end, and is used by some and not by other authors.

Catinaster

The species of *Catinaster* are easy to distinguish from discoasters by their relatively large, basket-shaped central part. **(3 marks).**



(2 marks)

Best wishes

Fatma