http://www.biltek.tubitak.gov.tr/bilgipaket/jeolojik/index.htm

Paleontology

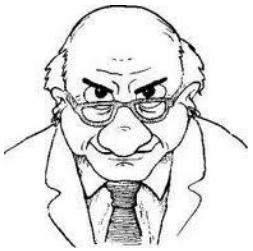
Muhittin Görmüş

Department of Geology

http://members.cox.net/jdmount/paleont.html

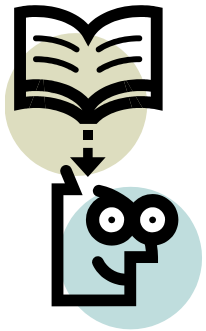
ANKARA UNIVERSITY

Lets start the first lesson by the following three important points:



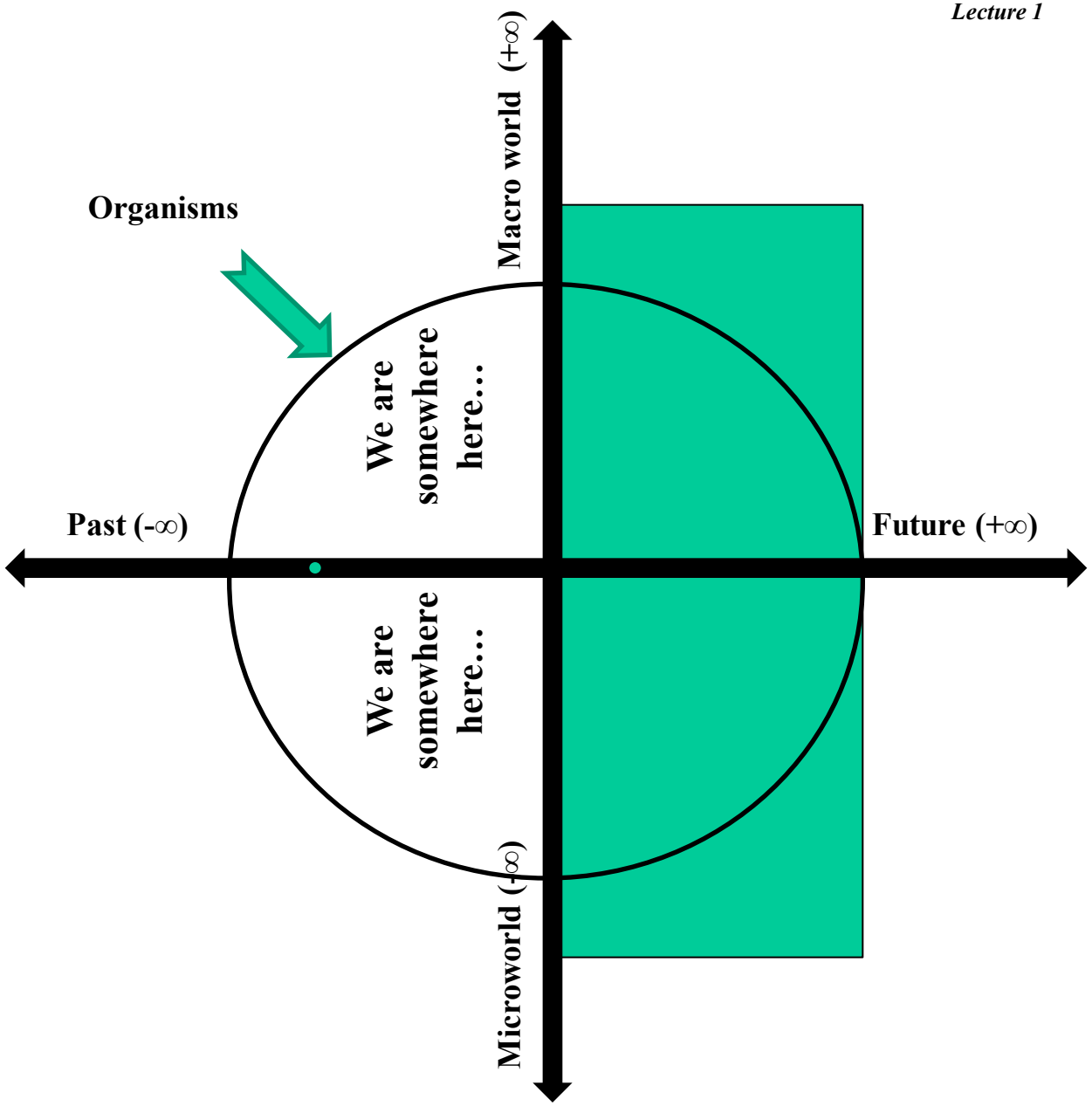
(1) do not stand up on soils and rocks without any knowladge, look at it cerafully what they have, and recognize them,

(2) fossils and minerals are the identification cards of rocks and soils



(3) walk around by your mind

Where are we?


Organisms
Macro world (+∞)
We are somewhere here…
Past (-∞)
Future (+∞)
We are somewhere here…
Microworld (-∞)

Where are we?

There have been nice statements such as…

“ALPHABET OF GEOLOGY IS FOSSILS,

ITS LANGUAGE IS ROCKS AND

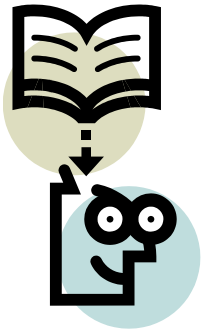
ITS BOOK IS GEOLOGICAL EVENTS

A BOOK CAN NOT BE READ WITHOUT ALPHABET”

So, our alphabet is fossils…

“FOSSILS AND MİNERALS ARE IDENTY CARDS OF ROCKS”

We have to read carefully rocks by fossils



“GEOLOGIST’S MIND IS MORE IMPORTANT THAN HIS WALKING IN A FIELD WORK”

Walk around by your mind…

Examples of macro world…

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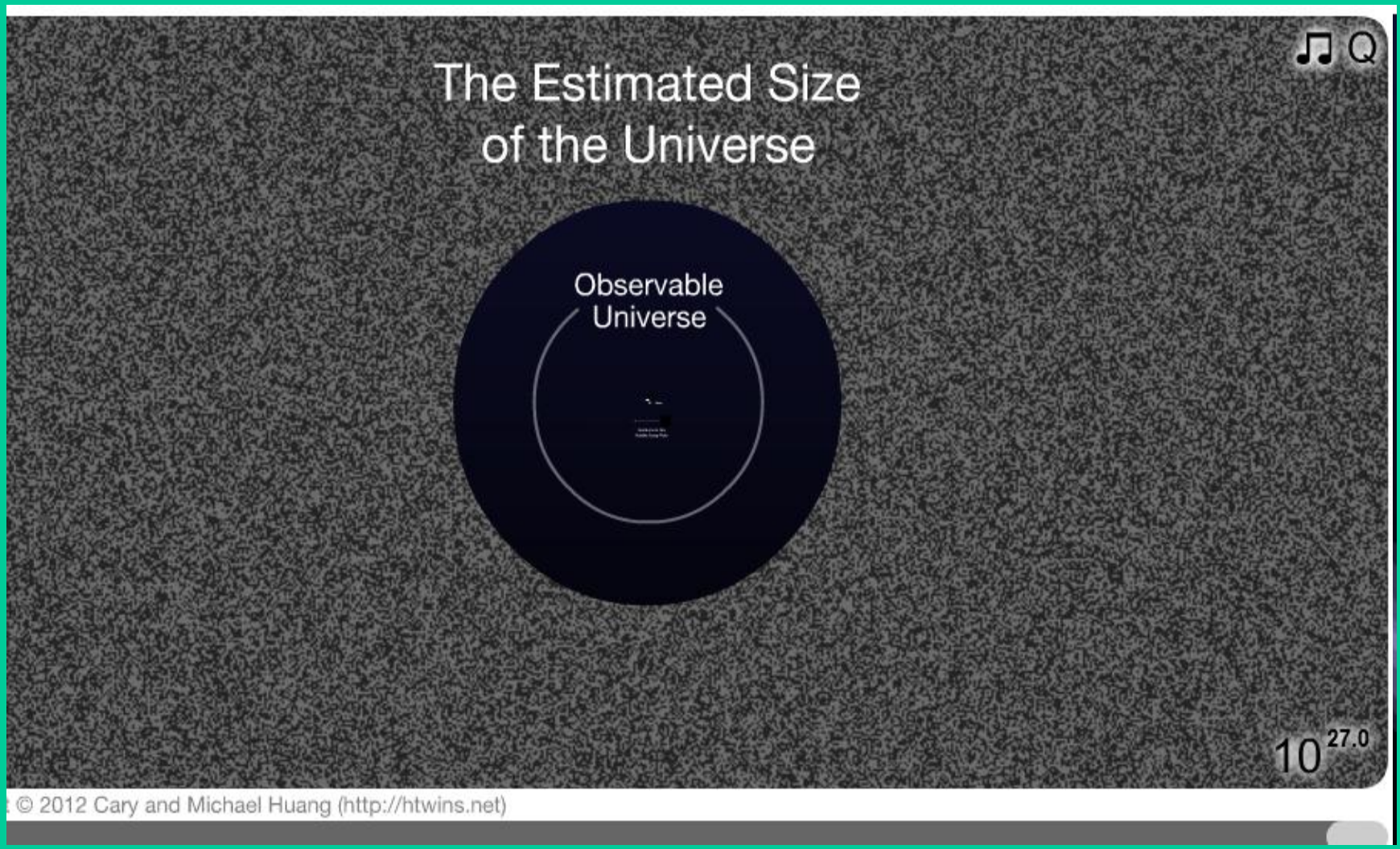

http://scaleofuniverse.com/

Observable micro world…

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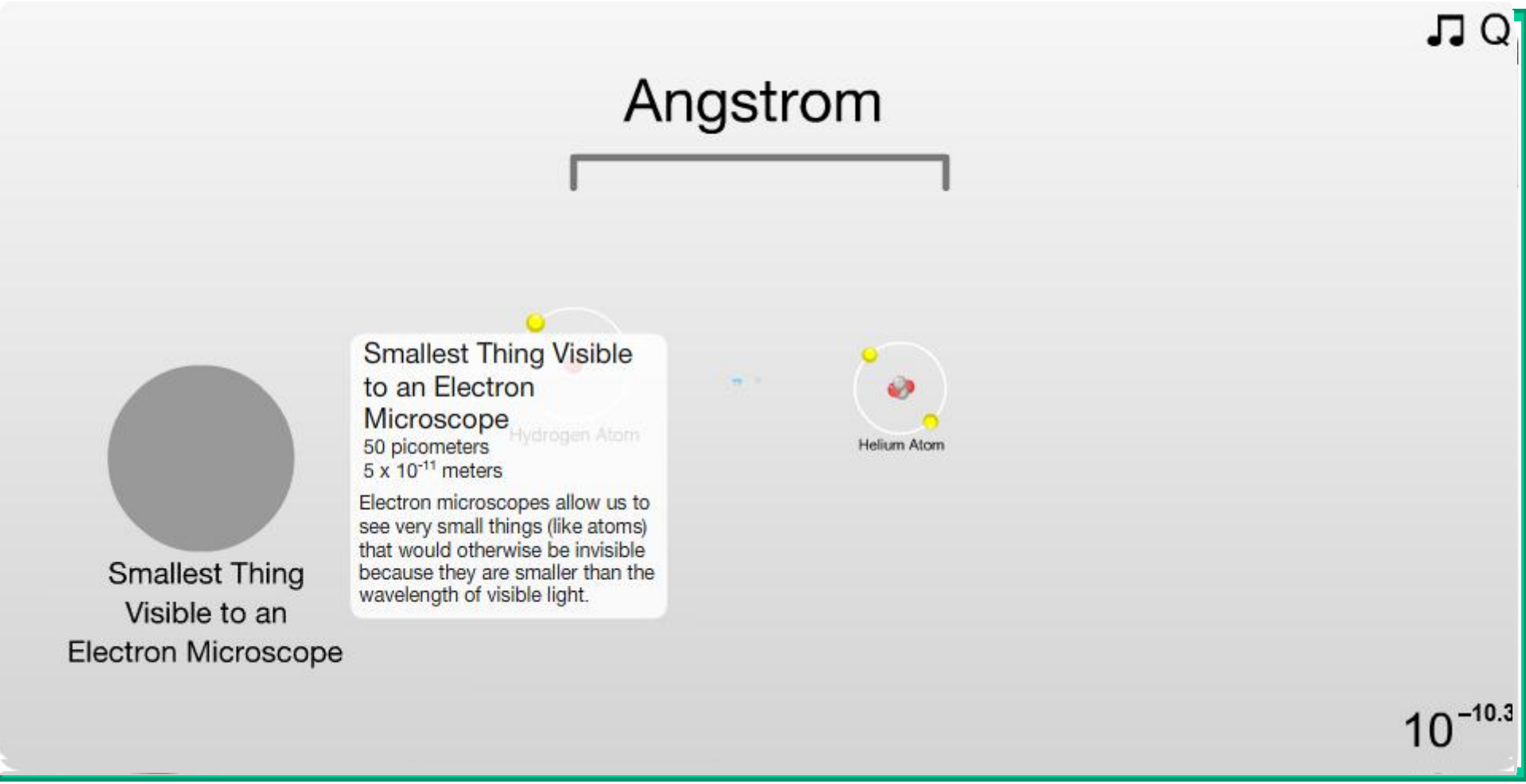
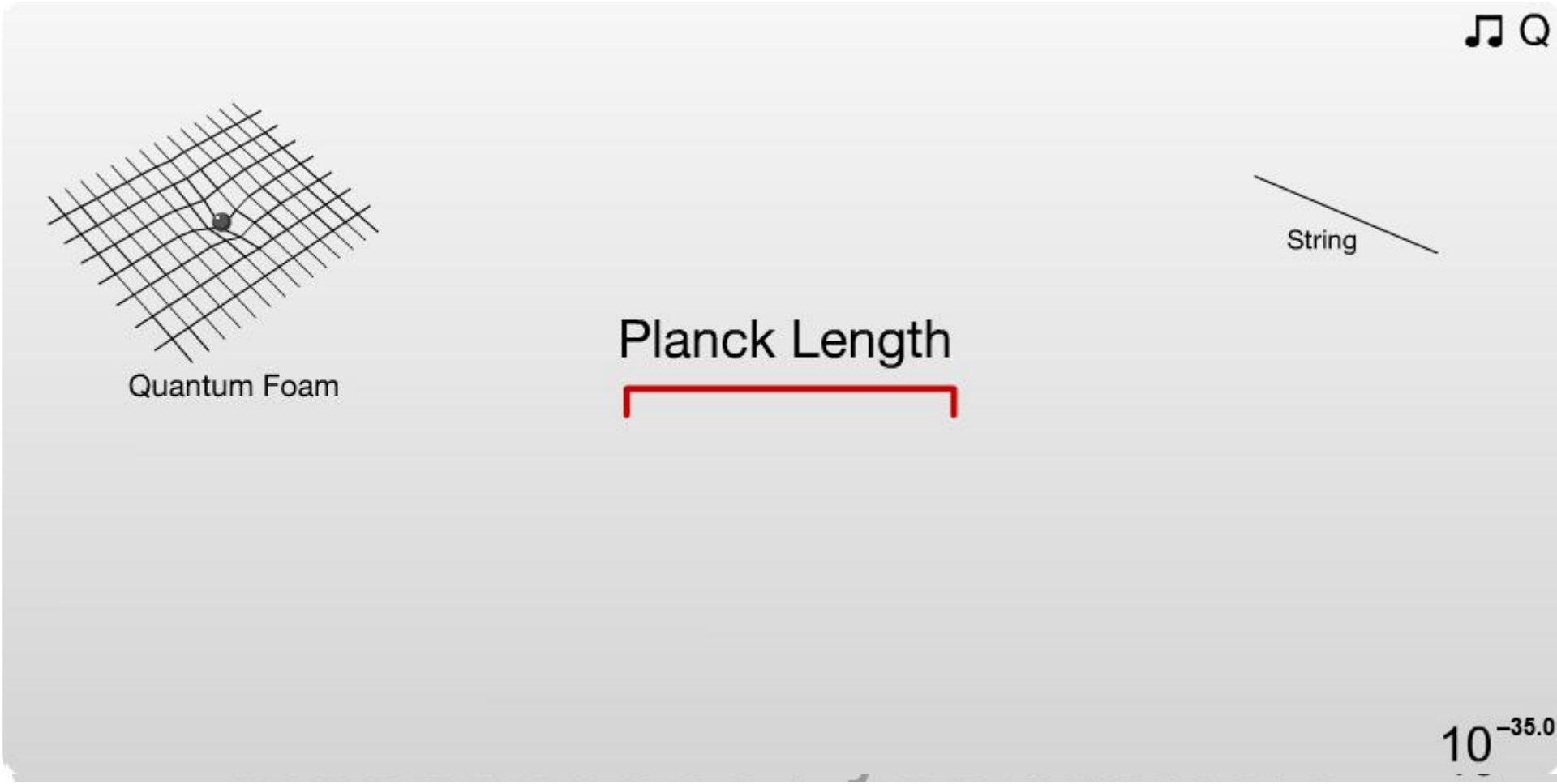


http://scaleofuniverse.com/

May be observable micro world…



http://scaleofuniverse.com/

Topics

- Related references
- Historical background
- Defination of paleontology and its subjects
- Related subjects
- Fossil and fossilization

- Geological time
- Origins of the names of the geological times
- Extinctions

Paleontology or a science references can be get from the following sources

Lecture (Course) Notes

You can obtain my course notes as well as other university course notes.

Books (Turkish and others)

-Symposium-Congress Abstracts books
-Symposium-Congress Proceeding Books
-Lecture/Course books
-Books including research and review articles

Journals (Turkish and others)

-University journals
-Institute, research instute journals
-News, magazine journal (less scientific value)

Thesis

-BSc disertations
-MSc and PhD thesis

Reports

-Scientific or expertise reports in universities
-Instute reports (e.g. DSI, MTA)

Internet web sites (Yahoo, Google and others)

Some selected Turkish Paleontology books

Bremer, H., 1978. Paleontoloji. Ege Üniversitesi, Fen Fakültesi Kitapları Serisi No: 46, Ege Üniversitesi Matbaası, İzmir, 450 s.

Dizer, A., 1983. Paleontoloji (Omurgasız). İstanbul Üniversitesi Yayınları, Sayı: 3167, Istanbul, 456 s.

Gitmez, G., 1978. Fosil Mikroplanktonlar; Dinoflagellat kistleri ve Arkitarklar. Maden Tetkik ve Arama Enstitüsü Yayınları, eğitim serisi, No: 19, Ankara, 57 s., 6 lev.

İnan, N., 2006. Paleontoloji (Fosil Bilim). Seçkin Yayıncılık, Sözkesen Matbaası, Ankara, 204 s. ISBN: 975 02 0136 1

Meriç, E., 1983. Foraminiferler. Maden Tetkik ve Arama Enstitüsü Yayınları, eğitim serisi, No: 26, Ankara, 280s., 151 lev.

Meriç, E., 1985. Mikropaleontoloji. Jeoloji Mühendisleri Odası yayını, yayın no: 19, Ayyıldız Matbaası, Ankara, 135 s.

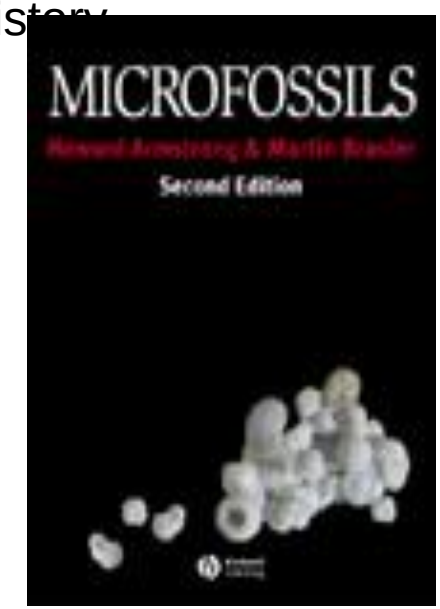
Sayar, C., 1991. Paleontoloji: Omurgasız fosiller. İstanbul Teknik Üniversitesi Kütüphanesi, sayı: 1435, Istanbul, 672 s.

Taşman-Ribnikar, M., 1973. Tatbiki Mikropaleontoloji. Maden Tetkik ve Arama Enstitüsü Yayınları, eğitim serisi, No: 15, Ankara, 154 s.

A few paleontology books in English

http://www.blackwellpublishing.com
/contents.asp?ref=0632052791&site=1

Microfossils
Second Edition **By:** Howard Armstrong, University of Durham
Martin Brasier, University of Oxford
Full Contents
Preface
Part 1 Applied micropalaeontology:
Chapter 1 Introduction
Chapter 2 Micropalaeontology, evolution and biodiversity
Chapter 3 Microfossils in Stratigraphy
Chapter 4 Microfossils, stable isotopes and ocean-atmosphere history
Chapter 5 Microfossils as thermal metamorphic indicators
Part 2 The rise of the biosphere:
Chapter 6 The origin of life and the Archean biosphere
Chapter 7 Emergence of eukaryotes to the Cambrian explosion
Chapter 8 Bacterial ecosystems and microbial sediments

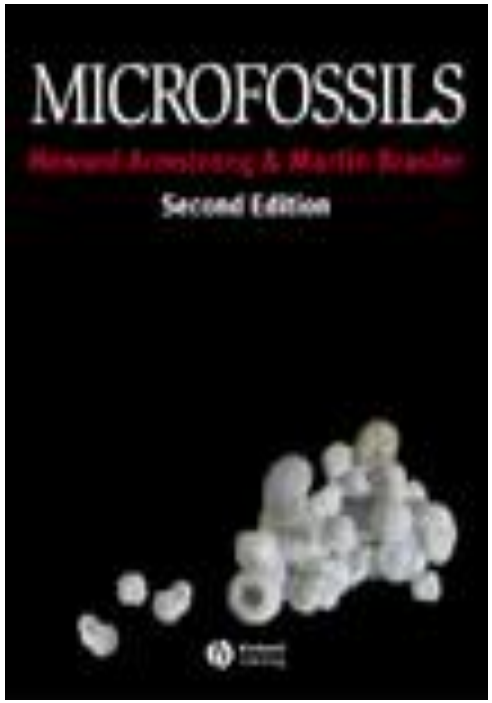


Part 3 Organic walled microfossils:

Chapter 9 Acritarchs and prasinophytes
Chapter 10 Dinoflagellates and Ebridians
Chapter 11 Chitinozoa
Chapter 12 Scolecodonts
Chapter 13 Spores and pollen

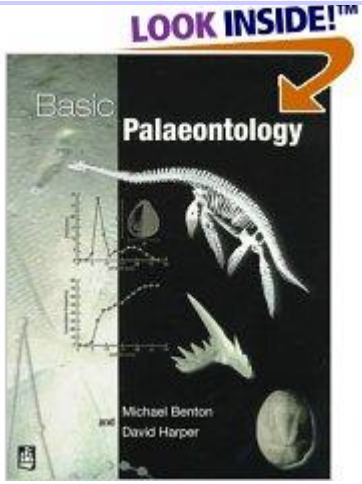
Part 4 Inorganic walled microfossils:

Chapter 14 Calcareous nannoplankton: Coccolithophores and Discoasters
Chapter 15 Formainifera
Chapter 16 Radiozoa (Acantharia, Phaeodaria and Radiolaria) and Heliozoa
Chapter 17 Diatoms
Chapter 18 Silicoflagellates and Chrysophytes
Chapter 19 Ciliophora: Tintinnids and Calpionellids
Chapter 20 Ostracods
Chapter 21 Conodonts
Systematic Index
General Index

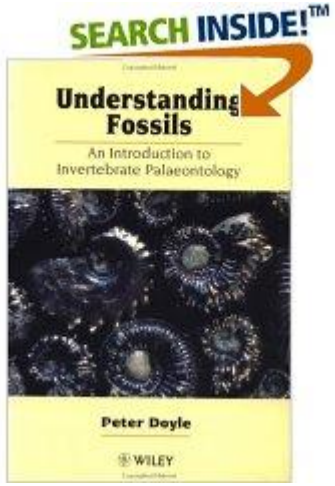


SELECTED REFERENCES

www.amazon.com



Basic Palaeontology by Michael J. Benton, David A.T. Harper



Understanding Fossils : An Introduction to Invertebrate Palaeontology by Peter Doyle

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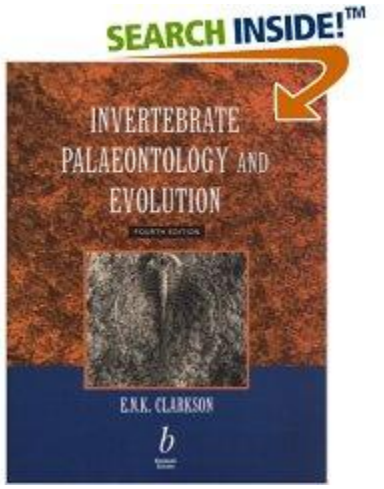
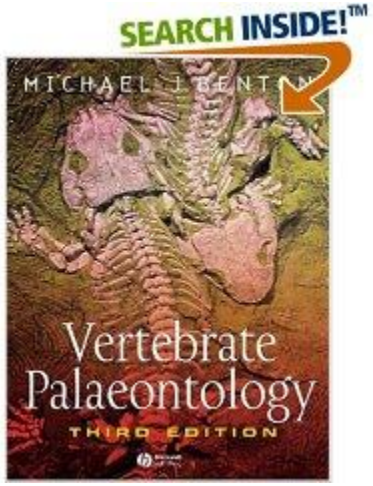
www.amazon.com

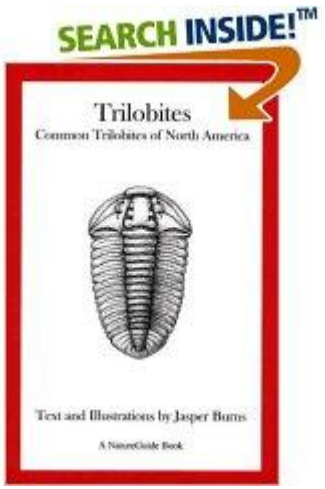


Invertebrate Palaeontology & Evolution (Paperback)
by E. N. K. Clarkson, Euan, N.K. Clarkson

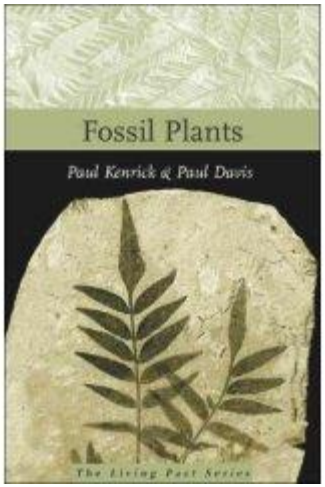


Vertebrate Palaeontology (Paperback)
by M. J. Benton, John Sibbick

SELECTED REFERENCES

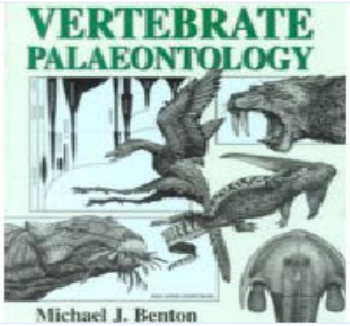


Trilobites: Common Trilobites of North America (A NatureGuide book) by Jasper Burns



Fossil Plants (Smithsonian's Living Past) by Paul Kenrick, Paul Davis

ShopperReports



Read product information for the Vertebrate Palaeontology

Product Rating

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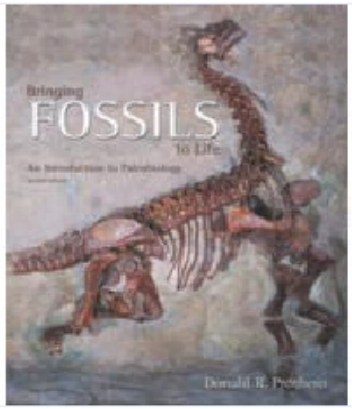
Key Information	
Authors	•
Nonfiction Category	Science • Textbook •
Nonfiction Subcategory	Science-Life Sciences / Biology • Science-Paleontology • Textbooks, Upper Level •
Book Editions	
Book Editions	Paperback455 pagesNovember 30, 2004Blackwell PubM. J. BentonJohn Sibbick1"(d) x 9.25"(h) x 7.25"(w), 2 lbs.0632056371 • PaperbackJanuary 01, 1997Nelson Thornes1.25"(d) x 10"(h) x 7.75"(w), 2.5 lbs.0412738104 • Hardcover452 pagesJanuary 01, 1997Nelson Thornes1.25"(d) x 10.25"(h) x 8"(w), 2.85 lbs.0412738007



Read product information for the Bringing Fossils to Life: An Introduction to Paleobiology

Product Rating

Key Information	
Authors	Donald R. Prothero •
Nonfiction Category	Textbook •
Nonfiction Subcategory	Textbook, Lower Level •
Book Editions	
Book Editions	PaperbackMay 01, 2003McGraw-Hill College1"(d) x 11"(h) x 8.5"(w), 2.26 lbs.0073661708 • PaperbackIllustrated457 pagesOctober 01, 1997McGraw-Hill College0.75"(d) x 11"(h) x 8.75"(w), 2.1 lbs.0070521972

Historical Perspectives on Fossils

- They were interpreted as “Shaped Stones”, “Lightning scars, supernatural temptations, divine jokes and mysterious vapors”, or they were washed in during biblical flood, or they were crawled into rock and died or “something dug up” (Latin).

Modified after
www.d.umn.edu/gk12/

Leonardo da Vinci

(1452-1519)

Leonardo sketched fossils and recognized them as the remains of ancient life.

www.d.umn.edu/gk12/

Niels Stenson (a.k.a. Nicholas Steno) (1638-1686)

- Observations on sediments:
  - Superposition
  - Original horizontality
  - Original lateral continuity

www.d.umn.edu/gk12/

Niels Stenson (a.k.a. Nicholas Steno)

(1638-1686)

- "Tongue stones" looked like teeth because they were teeth!
- Fossils are remains of once living creatures (revival of DaVinci's interpretation).

www.d.umn.edu/gk12/

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PALEO: Ancient
ONTO: Organism / Life
LOGY: Science

Defination of paleontology

So,
PALE-ONTO-LOGY: Ancient organism or ancient life science

However, what does it mean “ancient organism” ?
-A death organism which was died yesterday, two days ago or one year ago.
-A death organizm which was died thousand or million years ago? Which one is the paleontology interesed in?
Surely there must be a distinctive time for life seperation.
Distinctive time is related to human-being history.

So, if we say ancient life is related to the thousands, million years ago before human being. We have to define the “fossil” term. From that point, ancient life leave fossil remains in sediments and sedimentary rocks and metamorphic rocks that was originated and formed from the sedimentary rocks.
Shortly, paleontology means “the science of fossils”

What is a Fossil?

(from Latin *fossus*, literally "having been dug up")

"Remains or traces of any recognizable organic structure, whether of plants or animals, preserved in rocks to indicate extinct life"

Dr. Osama E.A Attia

Subdivisions of Paleontology

Paleontology subjects

BIOLOGY	Zoology	Botanic
(NEONTOLOGY)	Vertebrate Animals	
	Invertebrate Animals	
PALEONTOLOGY	Paleozoology	Paleobotanic

Paleontology

- Micropaleontology (with some specific subjects such as palinology)
- Macropaleontology
  - Vertebrate paleontology
  - Invertebrate paleontology

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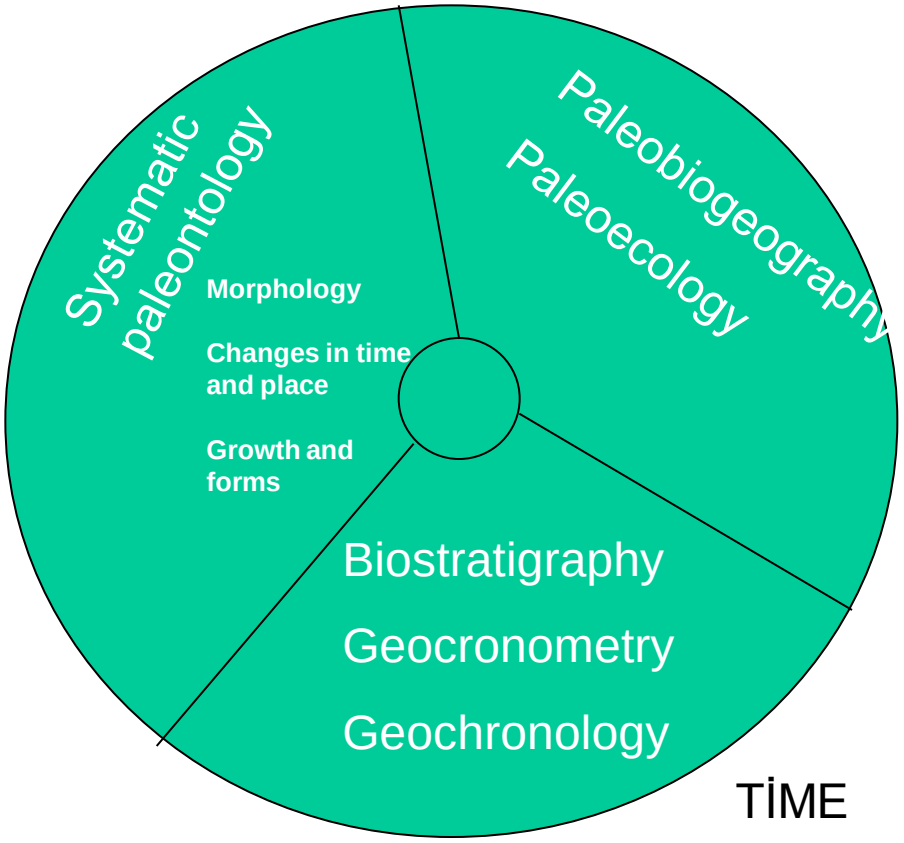
Related subjects



ORGANISM

ANCIENT ENVİRONMENT

TİME

The main topic in Paleontology is Taxonomy (systematic paleontology). Taxonomy searches organisms by grouping them. So, each group may be called as a taxon (taxa plural of taxon)

Comparison of micro and macrofossils

Microfossil (micropaleontology)	Macrofossils (paleontology)
- Size: usually micron,	cm, m
- Occurrance: They may also be seen in the sediments that do not comprise macrofossils.	They are seen clearly in outcrops
- Richness: They are more abundant than macrofossils	They may also be rich in the sediments
- They may obtain more reliable/accurate data for interpretation of aging or paleoenvironment	They may also give more reliable results
- They are useful material for petrol and other economic researches	
- SEM, and light microscobes are necassary for their details.	

Fossil & fossilization

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FOSSIL: Remains of organisms before the mankind history.

Remains include the followings:

(1) Shell or skeleton remains (*body fossils*), *Body fossils* - element original body of ancient organisms (e.g., bones, shells, teeth)

(2) Traces of feeding, moving, settling etc. (*trace fossils*), *Trace fossils* - traces and structures recording activity of ancient organisms (e.g., fossilized nests, gastroliths, footprints, burrows, tooth marks, root marks)

(3) Organic compounds (*chemical fossils*) *Chemical fossils* - relics of biogenic organic compounds that may be detected geochemically in rocks (isotopically enriched carbon, sponge compounds)

(4) Coprolites

(5) Negative image of the organism (*mold fossils)*, a fossilized impression made in the substrate - a

(6) Fillings (*cast fossils)*, they were formed when a mold is filled in.

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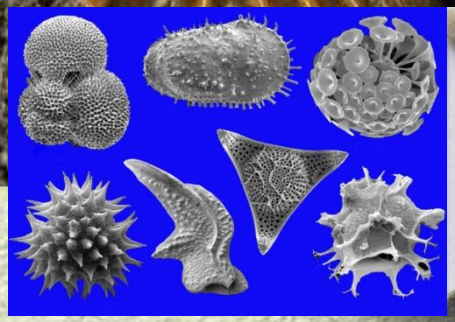
Trilobite fossil, Flexicalymene

http://geologymatters.org.uk/2010/10/29/fossils/

Ammonite fossil

http://www.hispanicallyspeakingnews.com/notitas-de-noticias/2013/06/15/

1. Body fossils



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Macrofossils from http://lifesciencedaily.com/wp-content/uploads/2011/05/Fossils.jpg
Microfossils from http://www.bgr.bund.de/EN/Themen/GG-Stratigraphie/Bilder/fossilgruppen_1_g_en.html, http://www.foraminifera.eu/

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Permian mammal-like reptile tracks, Arizona
http://paleo.cc/ce/tracefos.htm

2. Traces

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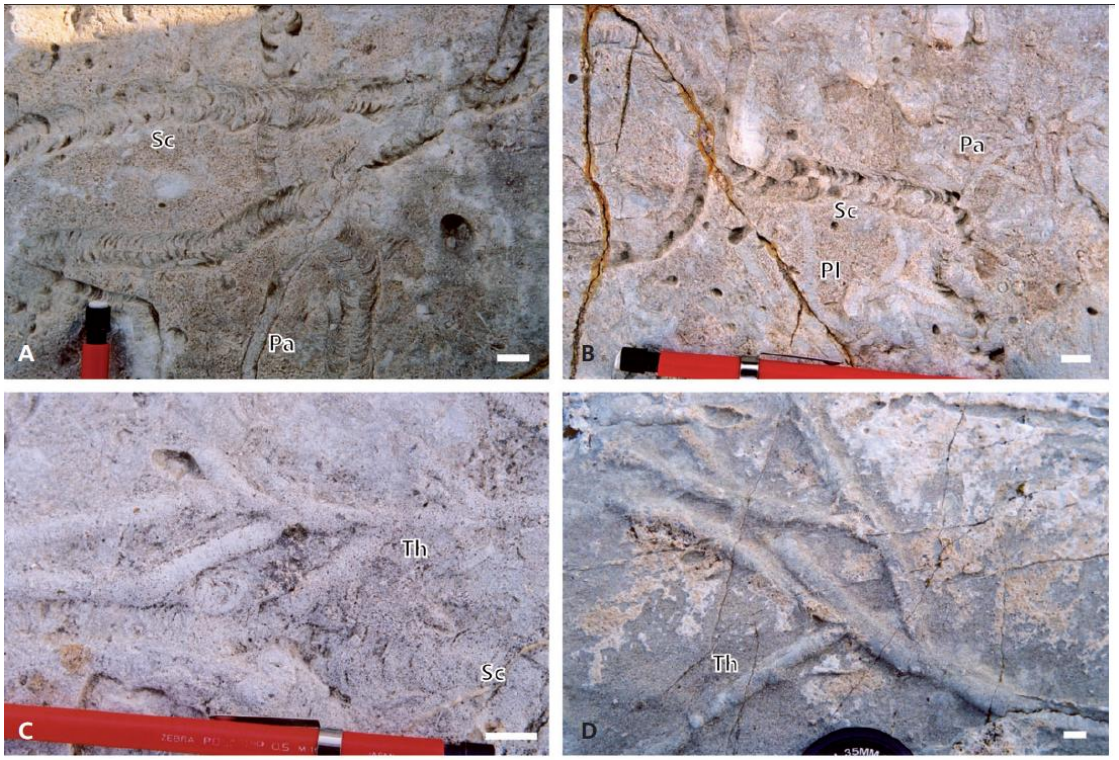
Lower Cretaceous Dinosaur Tracks, Central Texas
© 2006, Glen J. Kuban

http://paleo.cc/ce/tracefos.htm



Eocene trace fossils from the Isparta Area
Nielsen et all. 2010

Fossil & fossilization

Eocene trace fossils from the Isparta Area
Nielsen et all. 2010

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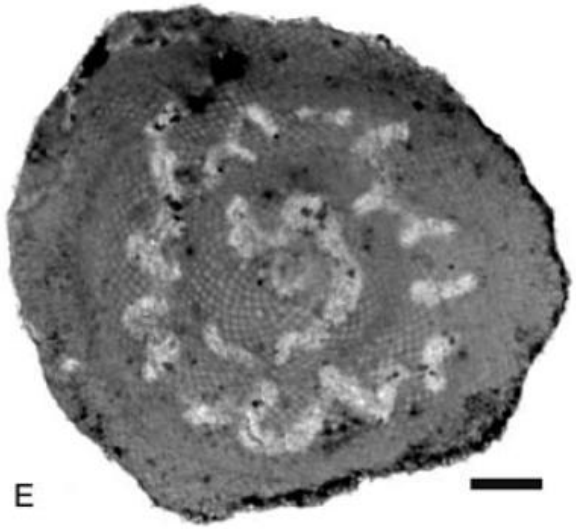

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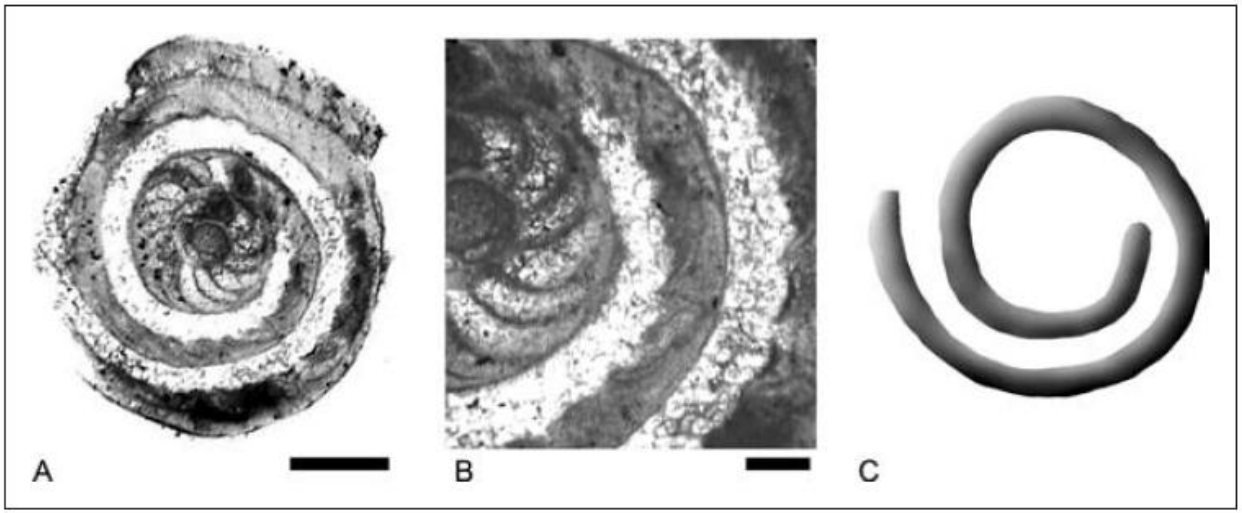

Fig. 7 - *Trypanites helicus* isp. nov. A, DIN Dinar7, thin section 28, holotype. Scale bar 1 mm. B, Close-up showing that the filling consists of calcitic cement. Scale bar 0.3 mm. C, Three-dimensional reconstruction of the holotype.

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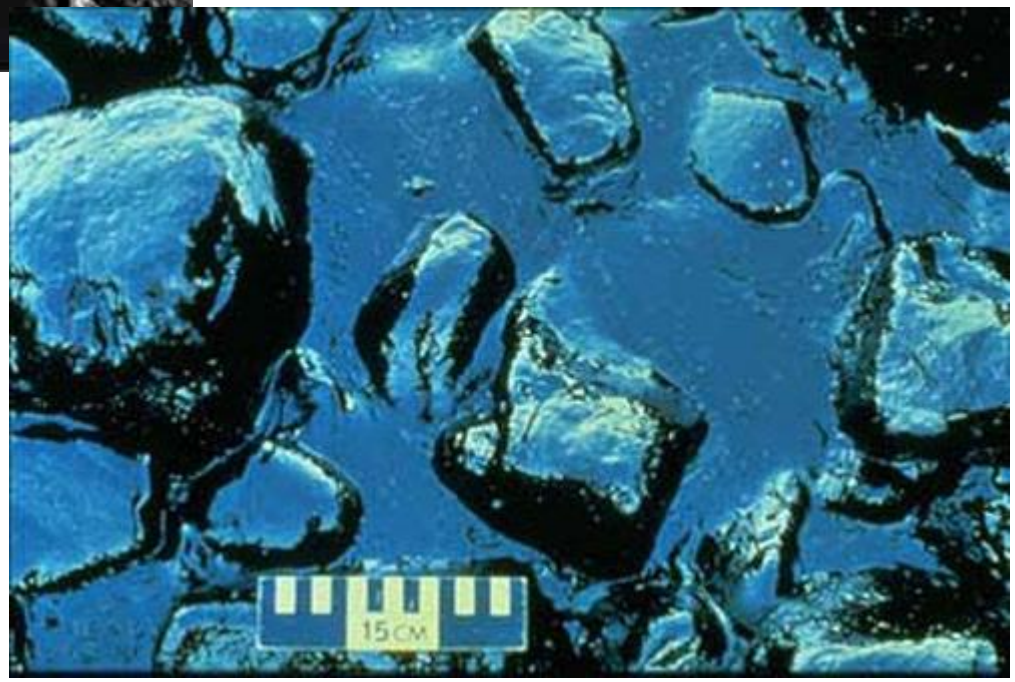

3. Organic compounds

4. Coprolite

This is a coprolite. It is preserved excrement, in this case from a fox like animal. Coporolites provide valuable clues to the diet of the animals that produced them. (*)

Atrypa **coprolite**
http://www.ablogtoread.com/waiter-there-is-some-shit-in-my-artya-watch/

A turtle coprolite (Eocene), Madagastar
http://home.entouch.net/dmd/bathroom.htm

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Coprtolites = *korpos* meaning "dung" and ; *litho* meaning "stone"

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5. Molds

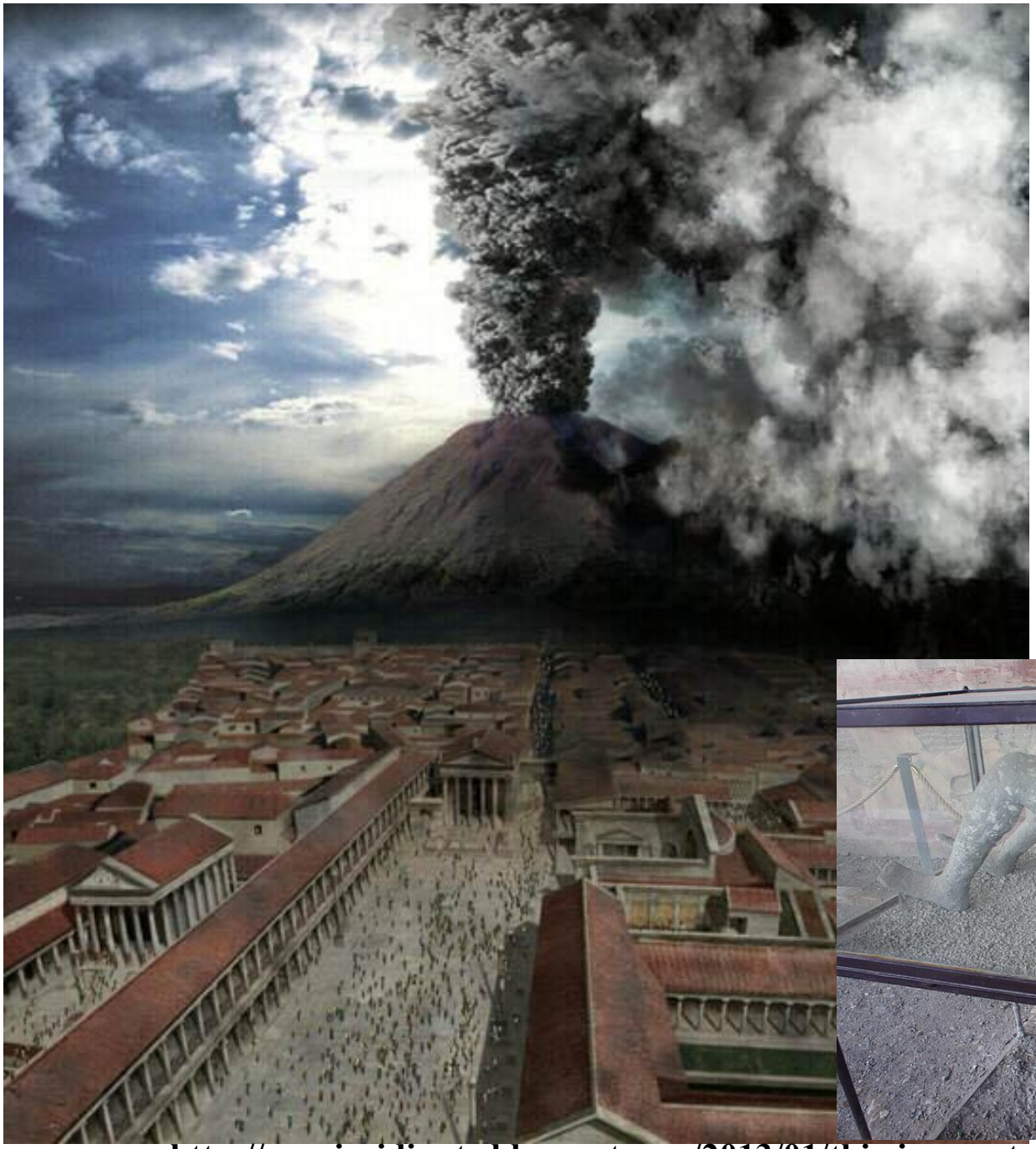
An external impression of the remains of an organism
http://web.eps.utk.edu/courses/HistoricalGeo/molds.html

6. Casts

http://occ1.webs.com/invertebrates.htm

Is It fossil or Not?

Photo credit:
American Coal Foundation



http://pensieridinate.blogspot.com/2013/01/this-is-worst-day-of-my-life.html

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Where can we see fossils?

Fossils may be seen in sediments or sedimentary rocks of terrestrial or marine paleoenvironmets. Sediment examples such as sits, sands, gravels, clays etc., or sedimentary rock examples siltstone, sandstone, conglomerates, mudstones, limestones etc.

Metamorphic rocks originated from the sedimentary rocks may also include the fossil remains. ----------

If we think of

(1) water environmets are usually depositon areas

(2) water/land ratio is ¾

(3) plate movements were realised during billion and million years. and geomorphology is mainly related to tectonic movements;

It is usual that we may see the fossil anywhere, even in our home basement if it is a sedimentary rock. ----------

So, the fossils may also be seen in artic and desert areas, mountains such as top of the Himalia, Torides; deep water bottoms such as Mariana Trench.

Fossil & fossilization

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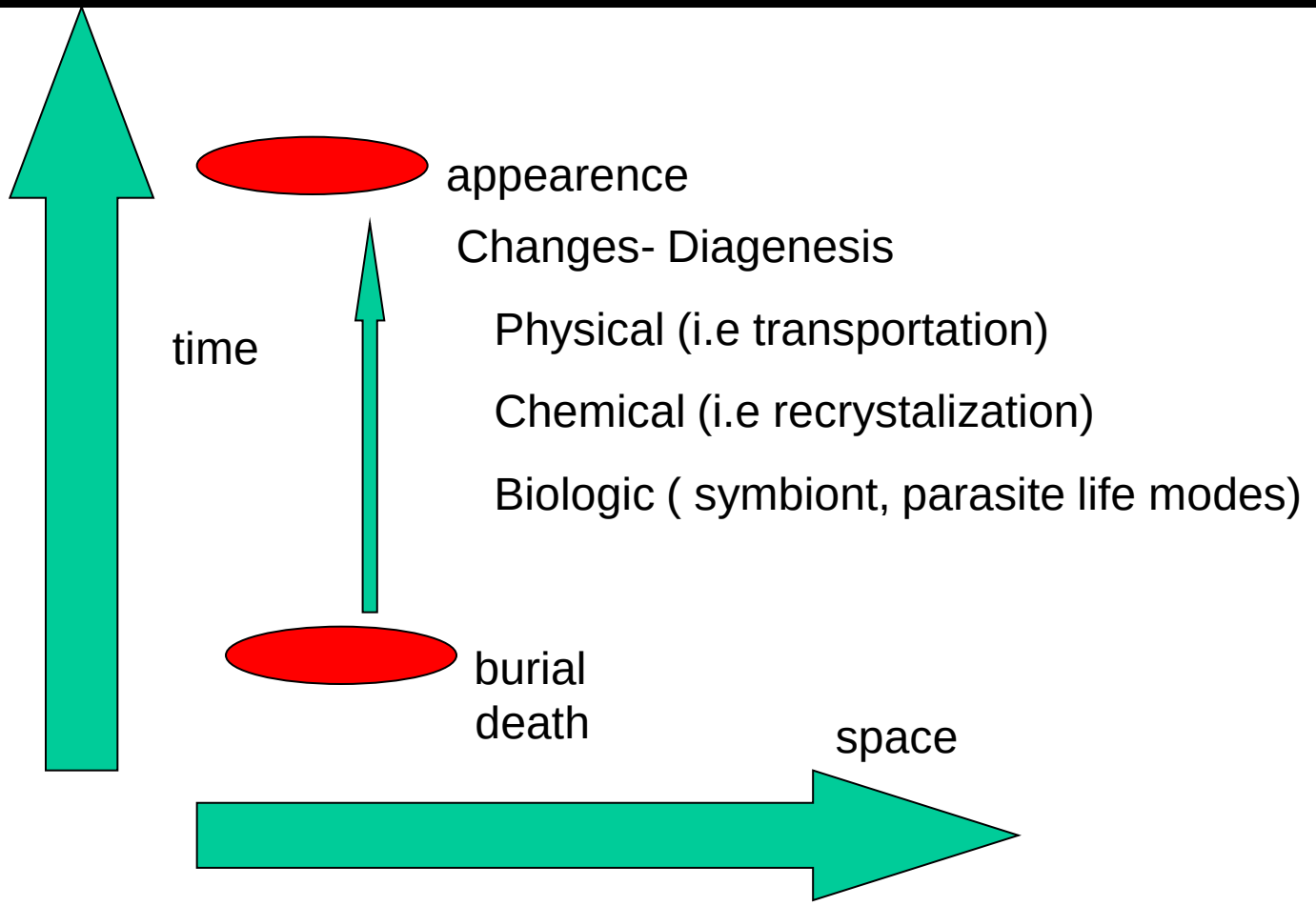

Fossilization: From burial to appearance; it includes all events (chemical, physical and biological) related to an organism.

A fosil occurrence stages:

http://www.biltek.tubitak.gov.tr/bilgipaket/jeolojik/Fanerozoik/index.htm

Fossil & fossilization

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What conditions promote fossilization?

1- Rapid Burial

2- Hard Skeleton

3- Suitable Environment

4- Lack of Oxygen

Fossilization: It covers the survival of the organism's remains after death and its transition into a fossil.

Dr. Osama E.A Attia

Preservational Conditions in Marine & Terresterial Environments

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Terresterial Environment	Marine Environment
▪ Conditions of fossilization less favorable. ▪ Deposition less common	▪ Conditions of fossilization much more favorable. ▪ Deposition more common
▪ Organisms are not buried immediately after death ▪ Chances of preservation poor	▪ Organisms are buried immediately after death ▪ Chances of preservation very common
Few number of organisms my covered & preserved as in : volcanic ash, dust, vaves, rivers, lakes, etc…	Large number of organisms my covered & preserved in sea bottom and ocean floor

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Modes of Fossilization

Unaltered: simple burial, some weathering (like insects or plant parts trapped in amber, a hardened form of tree sap)

Permineralization=petrification: Dissolved minerals precipitate in pore space. Rock-like minerals seep in slowly and replace the original organic tissues with silica, calcite or pyrite, forming a rock-like fossil - can preserve hard and soft parts - most bone and wood fossils are permineralized. Seen in many vertebrate fossils.

Recrystallization: Calcite crystals reorder and grow into each other. Original mineralogy remains, but structure is lost.

Replacement: Partial to complete replacement of crystals of one mineralogy with another. Includes silicification, pyritization, phosphatization.

Carbonization:carbon film left in place of tissues - this may preserve outlines of soft parts, seen in some lagerstatten deposits. Only the carbon remains in the specimen - other elements, like hydrogen, oxygen, and nitrogen are removed

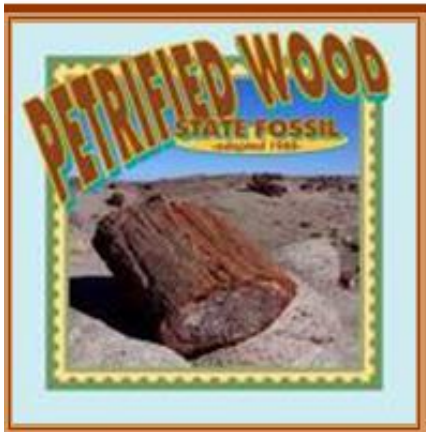
Fossilization by soft bodies. A mamut fossil in Sibiria, Dinosorous fossil in China including soft parts of organism are the examples.

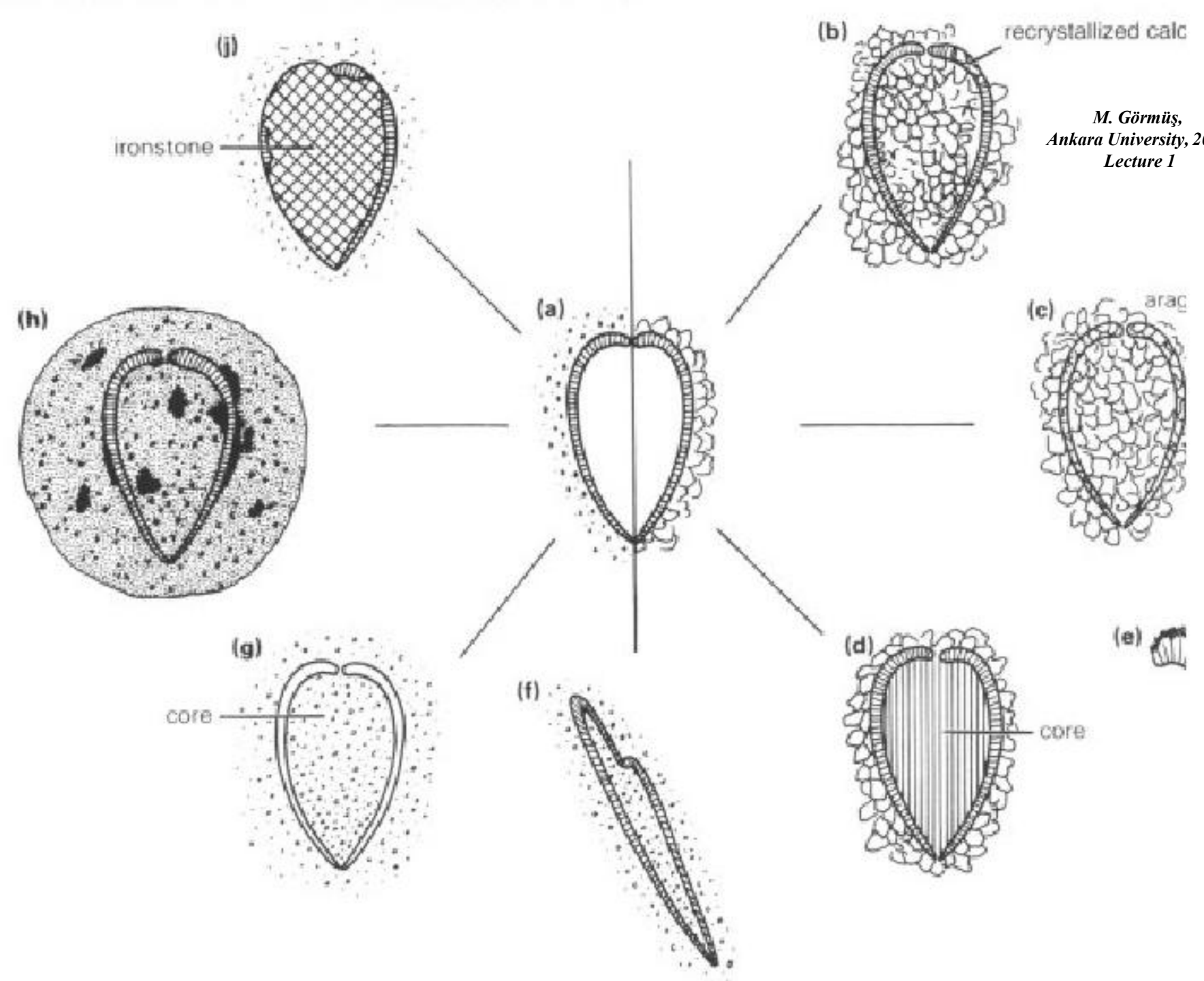
Organic compounds: Oil, coal

Authigenic preservation: molds and casts of organisms that have been destroyed or dissolved.

Traces

Pseudofossils

		
Petrification	Mineralization	Imprint
		
Freezing	Amber	Tar Pit
		
Trace Fossil	Cast and Mold	Other Methods



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Fossil Preservation

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The method and completeness of fossilization determines how much information can be extracted from the fossil. Preservation can be complete with the original material preserved. An example would be a wooly mammoth trapped in Arctic ice. This provides a tremendous amount of information, even DNA is preserved.

OR, fossilization could be only a foot print or a burrow left by an animal which has only limited value to the paleontologist. (*)

Actual Remains of the Organism:

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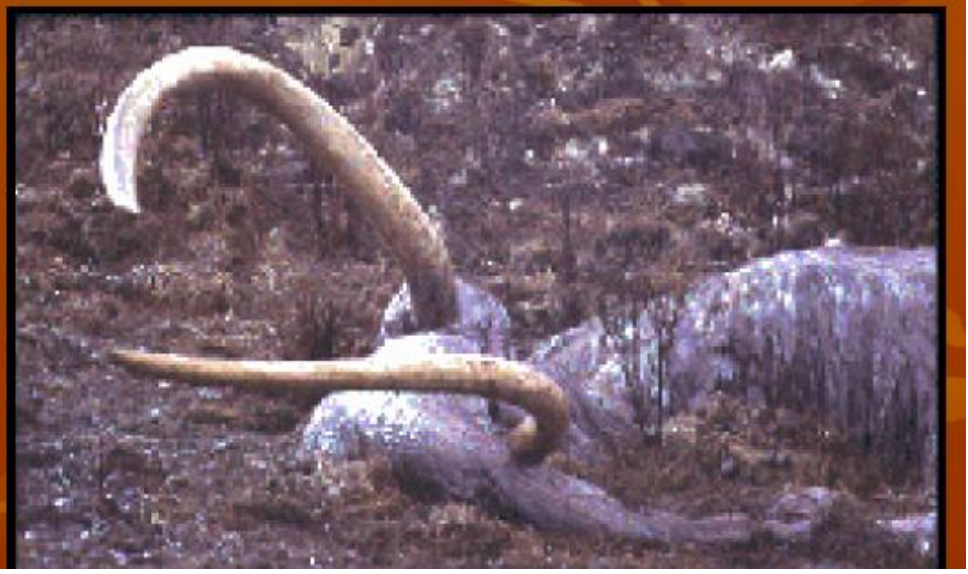
a- Remains of the entire organism: ex. Mammoth



Actual Remains of the Organism:

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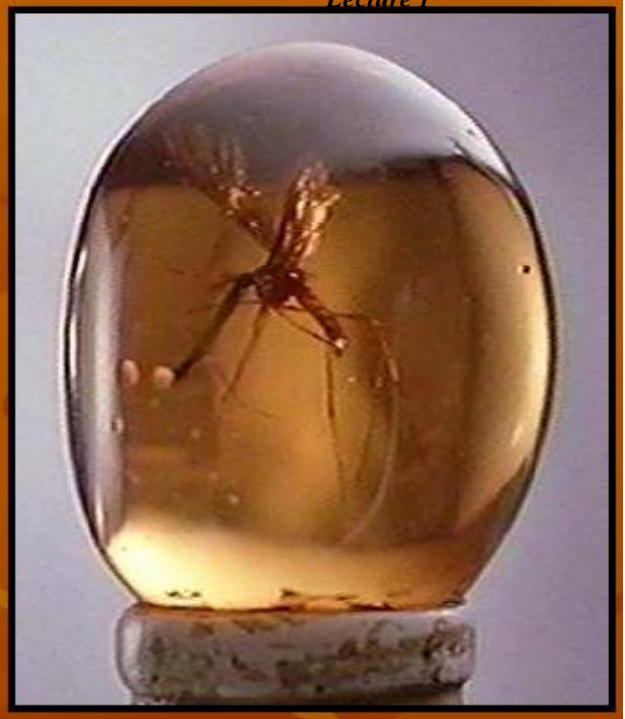
a- Remains of the entire organism: ex. Insect in Amber



Actual Remains of the Organism:

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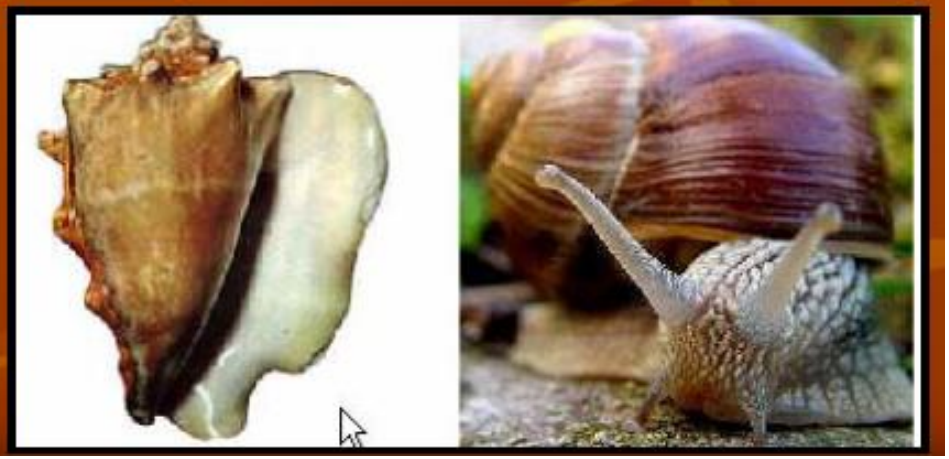
b- Remains of the original hard parts



***Vaccinites vesiculosus*, Umman**

http://www.ruhr-uni-bochum.de/sediment/rudinet/images/saiwbio.jpg

http://www.ruhr-uni-bochum.de/sediment/rudinet/images/saidraw.jpg

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Fossil Preservation

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Aside from the very unusual preservation of the wooly mammoth in glacial ice (which is very rare), most fossil preservation is in 3 distinct methods. (*)

REPLACEMENT CARBON FILM CAST OR MOLD

Let's take a look at some examples of each of these. (*)

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Replacement

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Replacement refers to the removal of the original remains of an organism and the substitution of that matter with mineral deposits.

Other than the preservation of the original parts of the organism (like the wooly mammoth, or mummification), preservation by replacement is the next best means of maintaining information about the organism. (*)

Altered Remains of the Organism:

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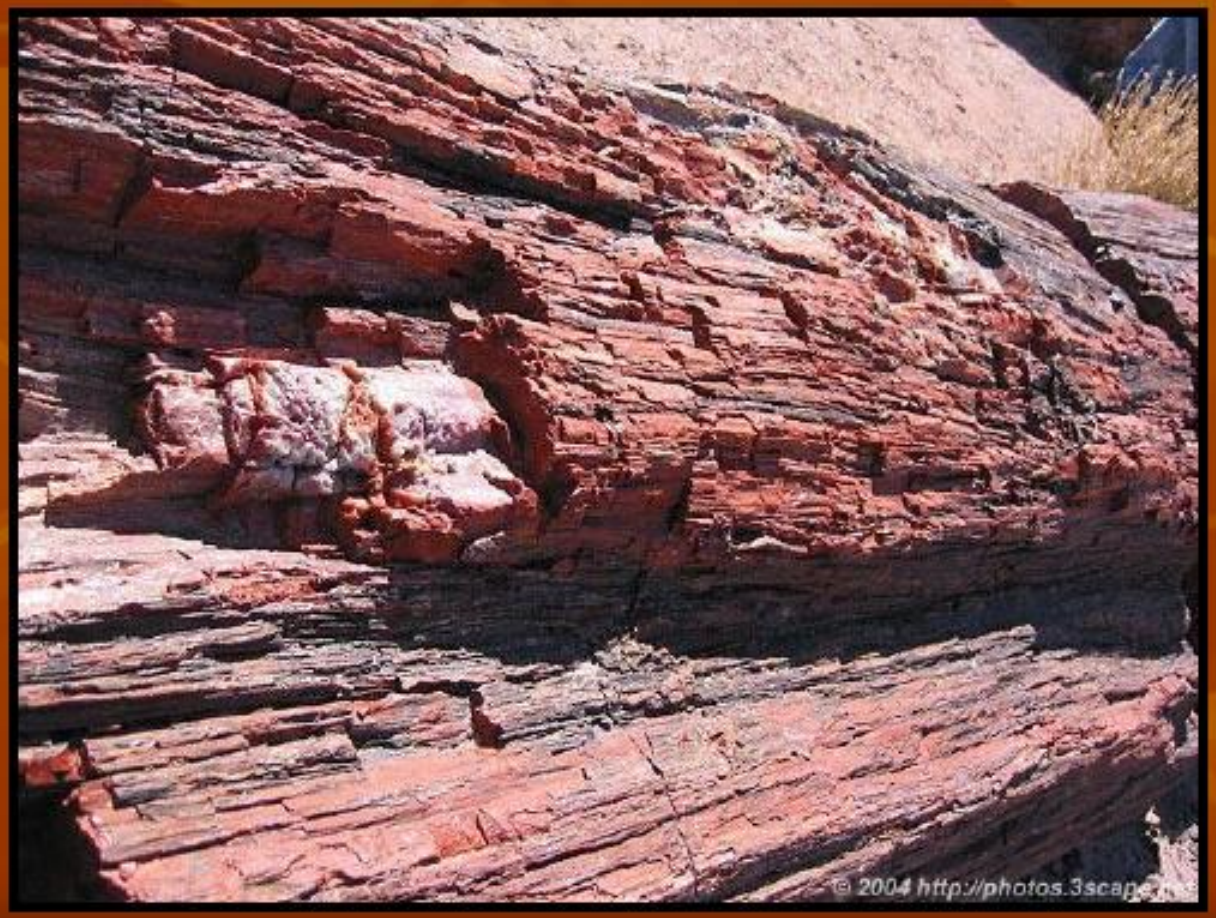
C- Replacement:

ex. Petrified wood



Altered Remains of the Organism:

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C- Replacement:

ex. Pyritization

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Replacement

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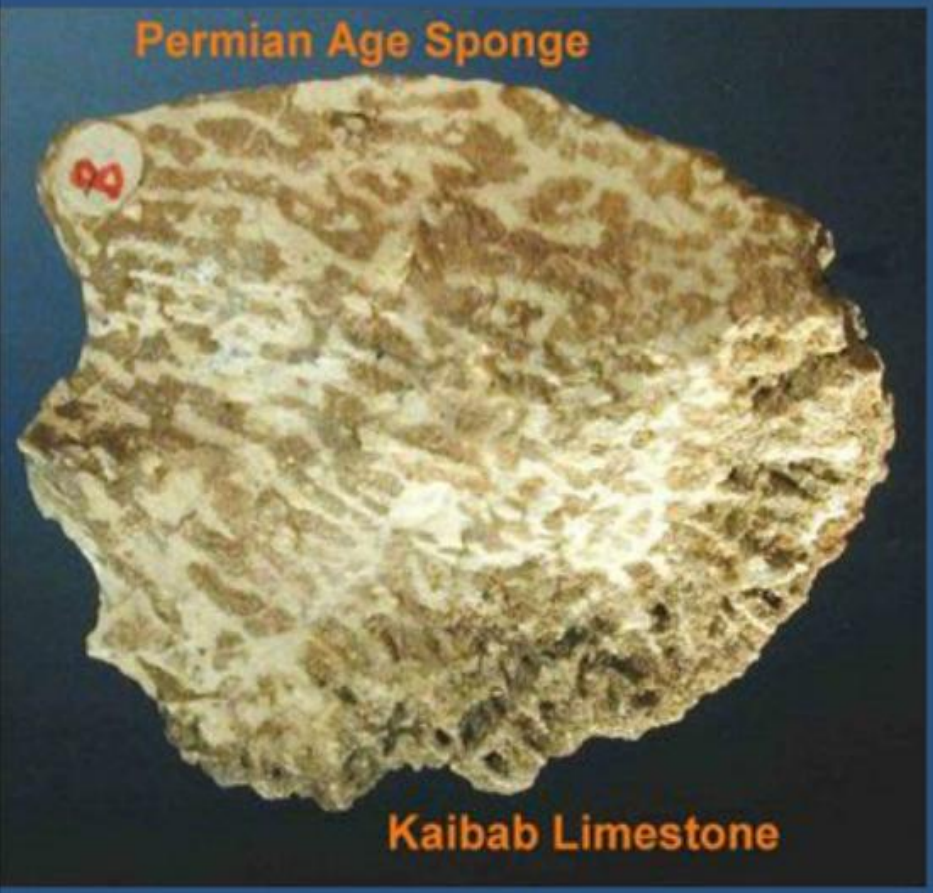

These are examples of internal structures. The sponge fossil on the left has preserved the various canals in which the sponge circulates the water to filter nutrients. On the right the stromatolite displays the layer upon layer of its growth. The stromatolite is a blue green algae that lived in the ocean over 2 billion years ago. (*)

Carbon Film

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As the name implies, a carbon film is flat and black. Carbon films are produced when an organism, normally without any hard parts, is buried and compressed. This compaction drives off the volatiles and leaves behind a carbon (black) residue.

Although there are many examples of carbon films in the fossil record – including worms, fish, and tree limbs, the most abundant fossil type is leaves. (*)

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Carbon Film

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Note that the rock in which the fossil is found is fine grained shale. This is a *low energy environment* that does not have turbulence that would destroy delicate fossils. (*)

The environment of deposition for this sample would be a swamp or lake. (*)

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Carbon Film

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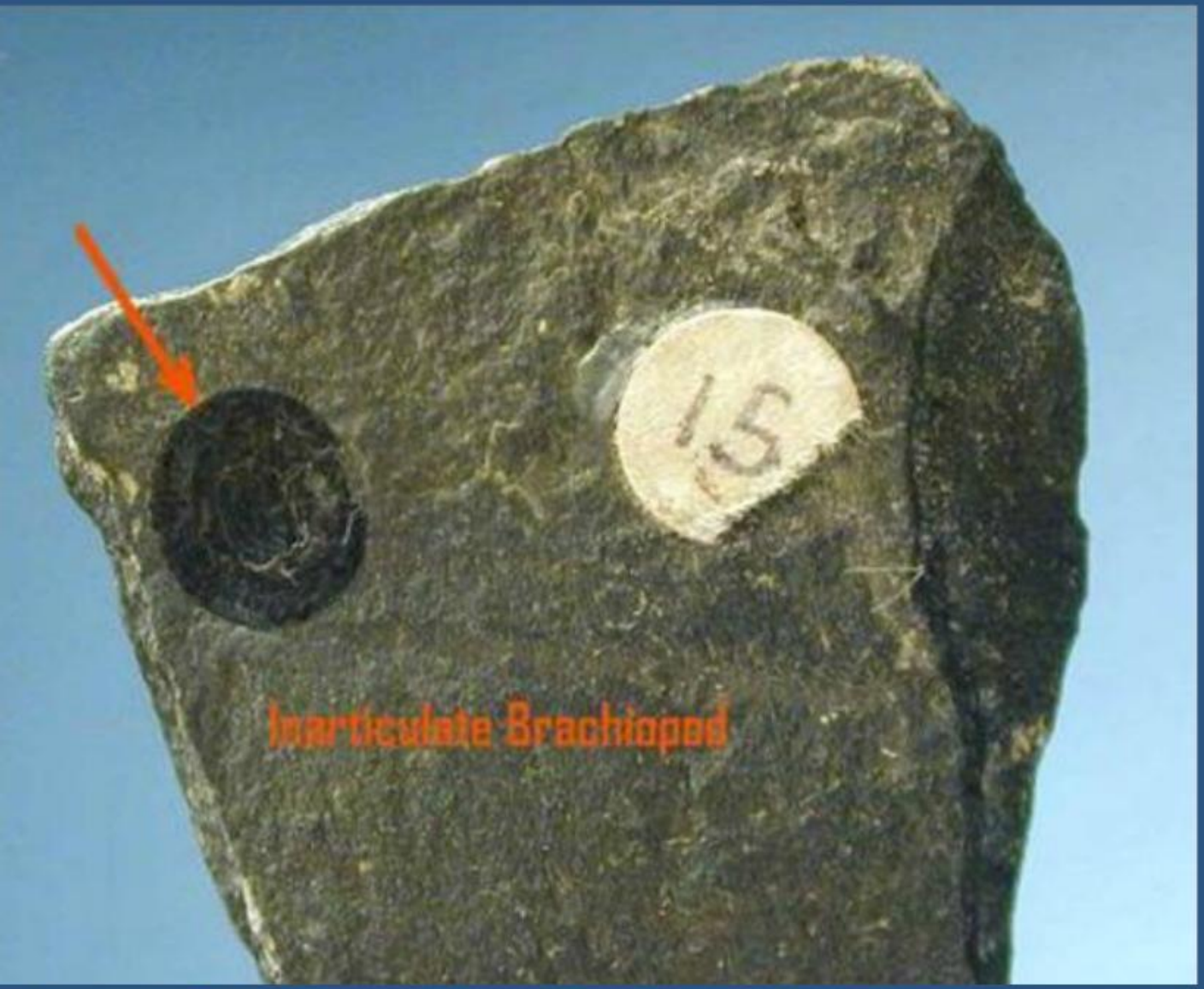

This is definitely a carbon film, just a flat, black spot on this piece of shale. The organism that left this mark was a brachiopod. (*)

Altered Remains of the Organism:

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a- Carbonization

b- Permineralization

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Molds and Casts

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Casts and molds are normally discussed together although they are not quite the same thing. For example, if a dinosaur steps into some soft sand and leaves a footprint, that is an example of a **mold**. If that footprint is then filled in with sand and it becomes lithified, that sandstone is the **cast**. The **cast** is the **filling** and the **mold** is the **impression** (or indentation). (I do want you to distinguish between a cast and a mold.)

Here are some examples. (*)

This is a mold that was made by applying many layers of latex over a trilobite. Once the latex was thick enough it was removed and can now be filled with plaster. (*)

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Molds and Casts

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Here are some examples. (*)

This is a mold that was made by applying many layers of latex over a trilobite. Once the latex was thick enough it was removed and can now be filled with plaster. (*)

After the plaster hardens it can be removed from the mold. (*)

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Molds and Casts

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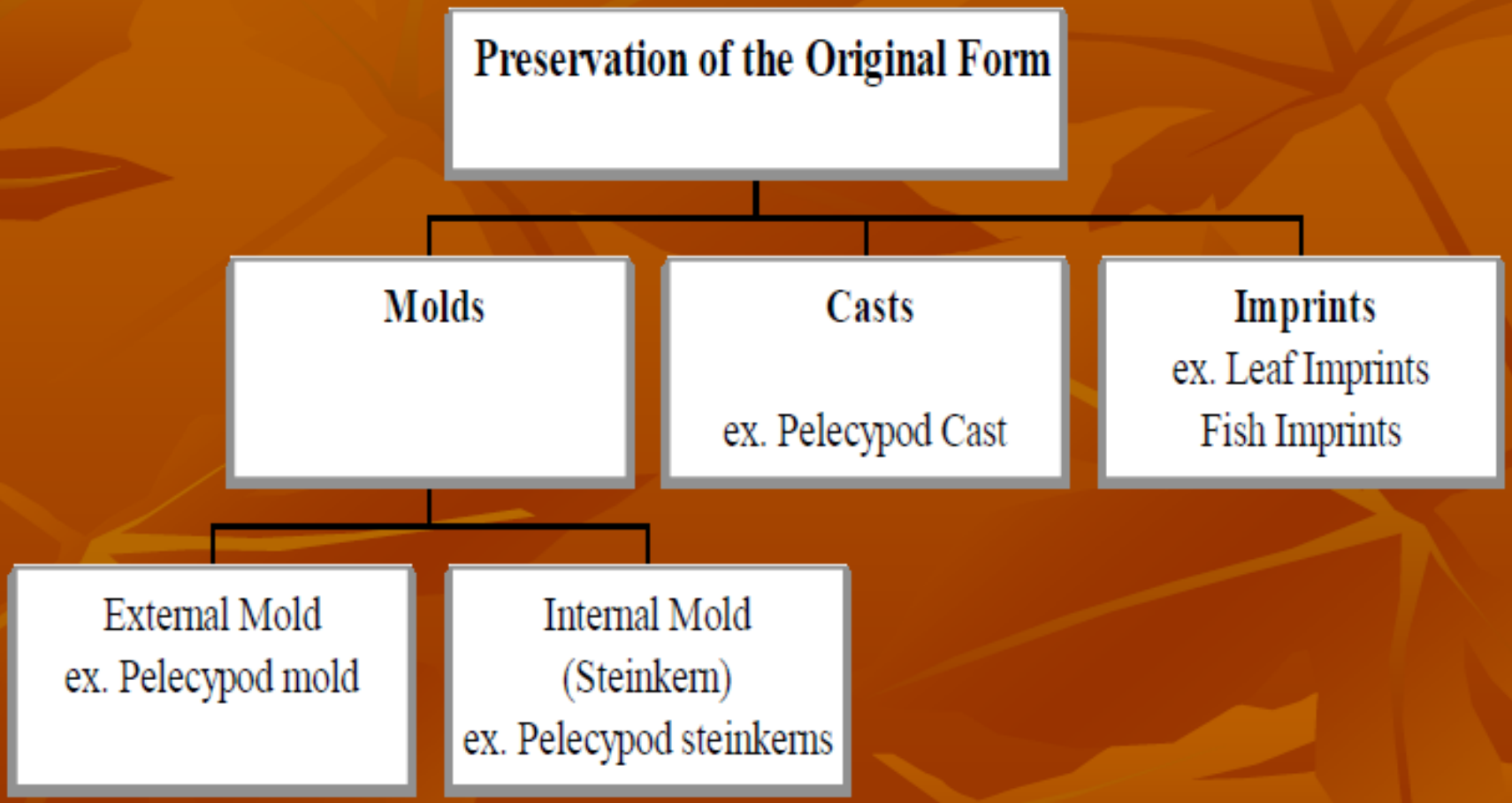
The plaster becomes the **CAST**. In nature, of course, the impression of a plant or animal would be filled with silt, clay, sand or some other natural substance. This filling would become the **cast**. (*)

Preservation of the Original form:



Making Molds and Casts

a. Molds and Casts

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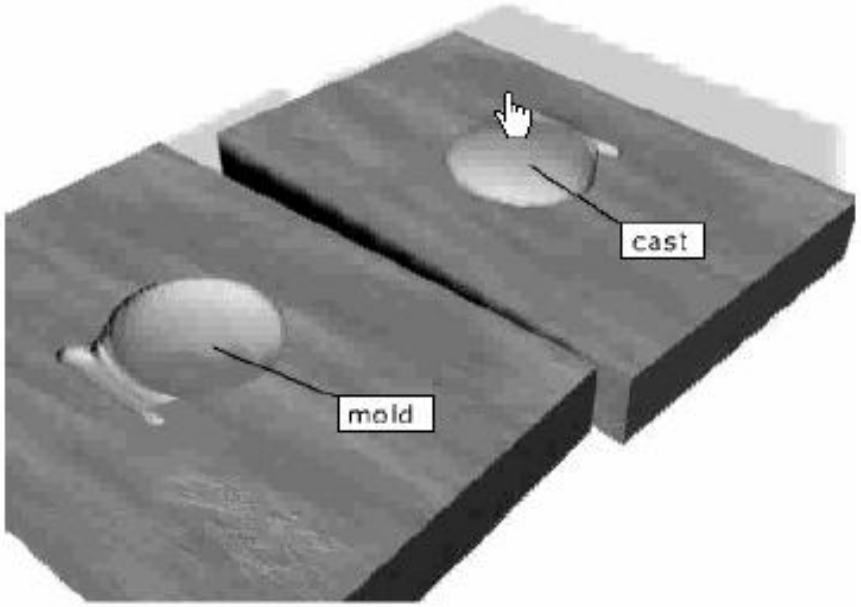

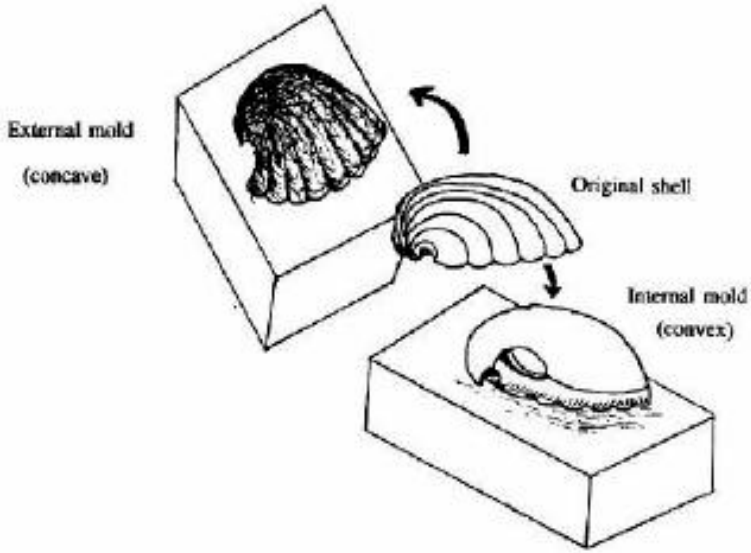

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Trace Fossils

http://www.powershow.com/view/c964f-YjkzM/Paleontology_flash_ppt_presentation

A trace fossil is nothing more than a clue as to what the organism was. For example, footprints give paleontologists some insight on the weight of the animal and its size. The structure of the print can also be used to determine the use of the foot… does it have claws, pads, long toes, short toes or toes at all. Sometimes a walkway is recovered from the rocks. This can reveal clues about the animal's gait or how big it was and how fast it was moving.

Other trace fossils include burrows, coprolites, gastroliths, skin impressions, or even something as trivial as a leaf blowing across a sand dune leaving a trail of its adventure.

Here are some examples. (*)

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Trace Fossils

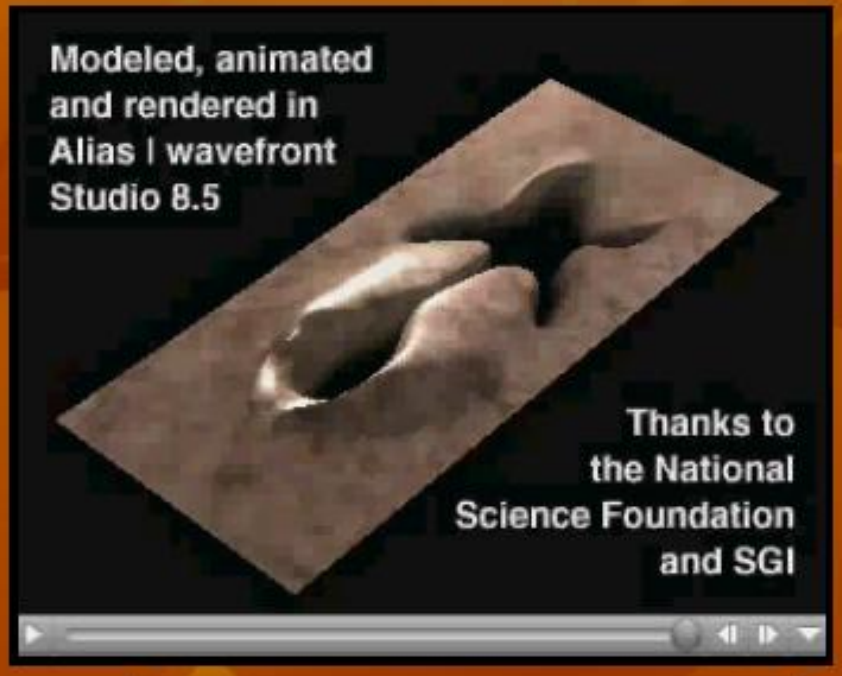
These are tracks left by some bottom feeding animal, maybe a snail. This is probably a record of a grazing pattern. (*)

Preservation of the Original form:

b- Imprints: ex. Leaf Imprints
ex. Fish Imprint

Preservation of tracks of the organism:

a- Foot Prints



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Preservation of tracks of the organism:

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b. Tracks: an impression made by a single foot.

c. Trackway: a number of tracks made during a single trip.

d. Trail: an impression made by an animal without leg.

e. Burrow: a hole or holes an animal dug into loose sediment (like mud).

f. Borings: a hole or holes an animal dug into a hard substrate (like wood or rock).

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Practice Quiz

http://www.powershow.com/view/c964f-YjkzM/Paleontology_flash_ppt_presentation

Here are some samples of various types of fossils. When the image appears, study it and look for clues of the method of fossilization. When you have made your decision, advance to the answer. Remember your choices are limited to these five choices: REPLACEMENT, CAST, MOLD, CARBON FILM or TRACE FOSSIL(*)

(*)

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(*)

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This is an example of replacement. This is a section of a tree trunk from Petrified Forest National Park, AZ. Notice that ***in*** the large trunk there are some tree rings that have been preserved. These are internal structures that indicate replacement. (*)

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Practice Quiz

http://www.powershow.com/view/c964f-YjkzM/Paleontology_flash_ppt_presentation

You are looking at a fossil that has been cut in half.

(*)

This is an example of replacement. This is a fossil nautiloid. Nautiloids were squid like marine animals that produced a shell. As the animal grew it added chambers that accommodated its larger size and it could regulate its buoyancy by pushing gas in or out of the chambers. This specimen has been sawed in half with a diamond saw to show this **internal structure**. (*)

Practice Quiz

(*)

This is an other example of replacement. In fact it is another squid like animal called an ammonite. Here a portion of its outer shell has been worn away to show the intricate structure of its chamber walls. (*)

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Practice Quiz

http://www.powershow.com/view/c964f-YjkzM/Paleontology_flash_ppt_presentation

(*)

This is an example of a carbon film. These leaf fossils accumulated in a swampy area and were then buried by more sediments. The result was that compaction pressures flattened the leaves and drove off all of the material making up the leaf except the carbon. (*)

ENVIRONMENT OF DEPOSITION

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Trilobites

The intricate spines on this trilobite was probably an adaptation for protection. It would have made it difficult for a predator to kill and swallow this critter. (*)

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ENVIRONMENT OF DEPOSITION

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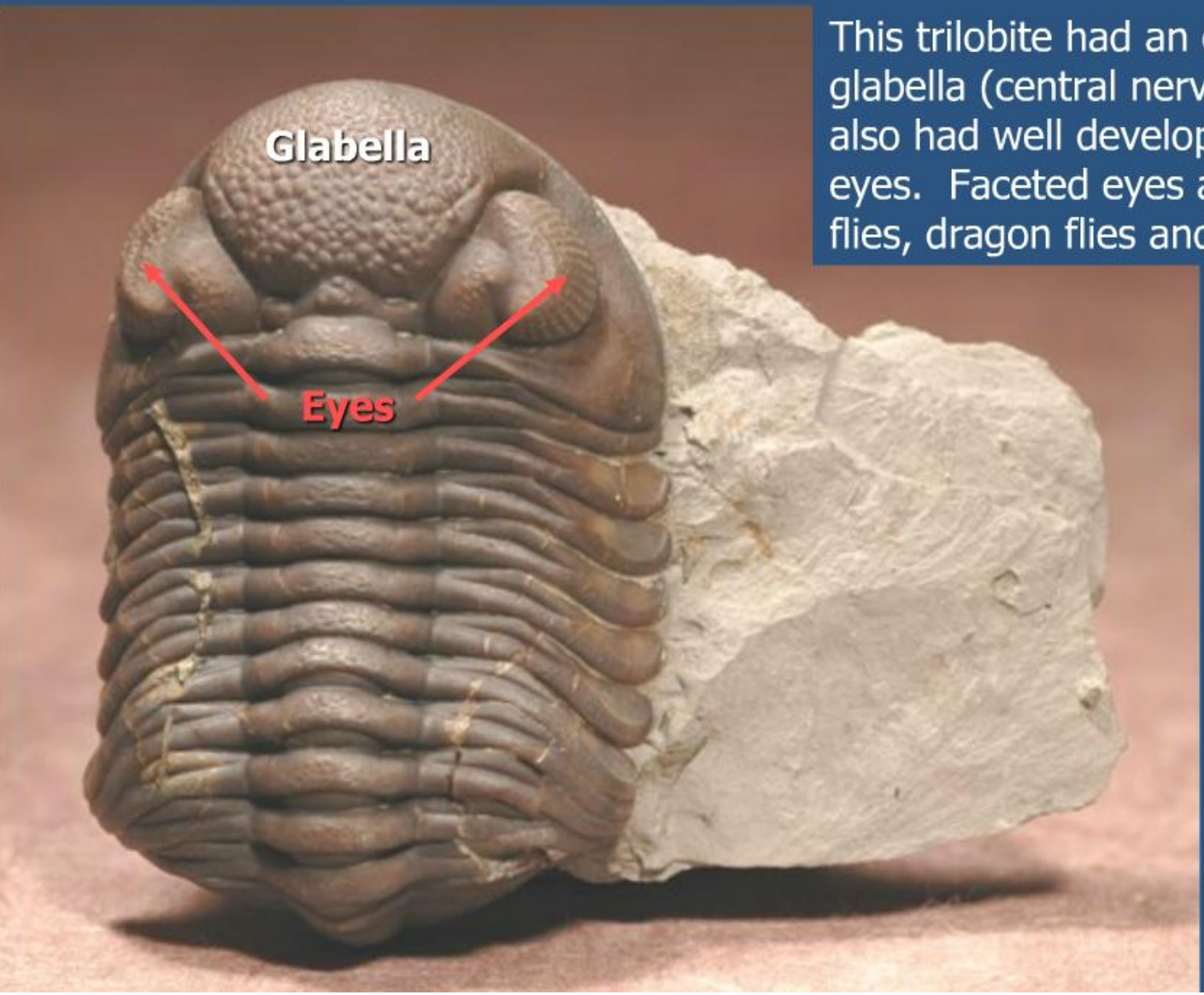
Trilobites



This trilobite had an enlarged glabella (central nervous system). It also had well developed faceted eyes. Faceted eyes are like those on flies, dragon flies and butterflies. (*)

http://www.powershow.com/view/c964f-YjkzM/Paleontology_flash_ppt_presentation

Let's take a look at a few more trilobites. By the way the name *trilobite* refers to the three lobes. The central lobe (where the word "Eyes" is located and a lobe on either side. (*)

ENVIRONMENT OF DEPOSITION

There are other clues to the environment of deposition. (*)

ENVIRONMENT OF DEPOSITION

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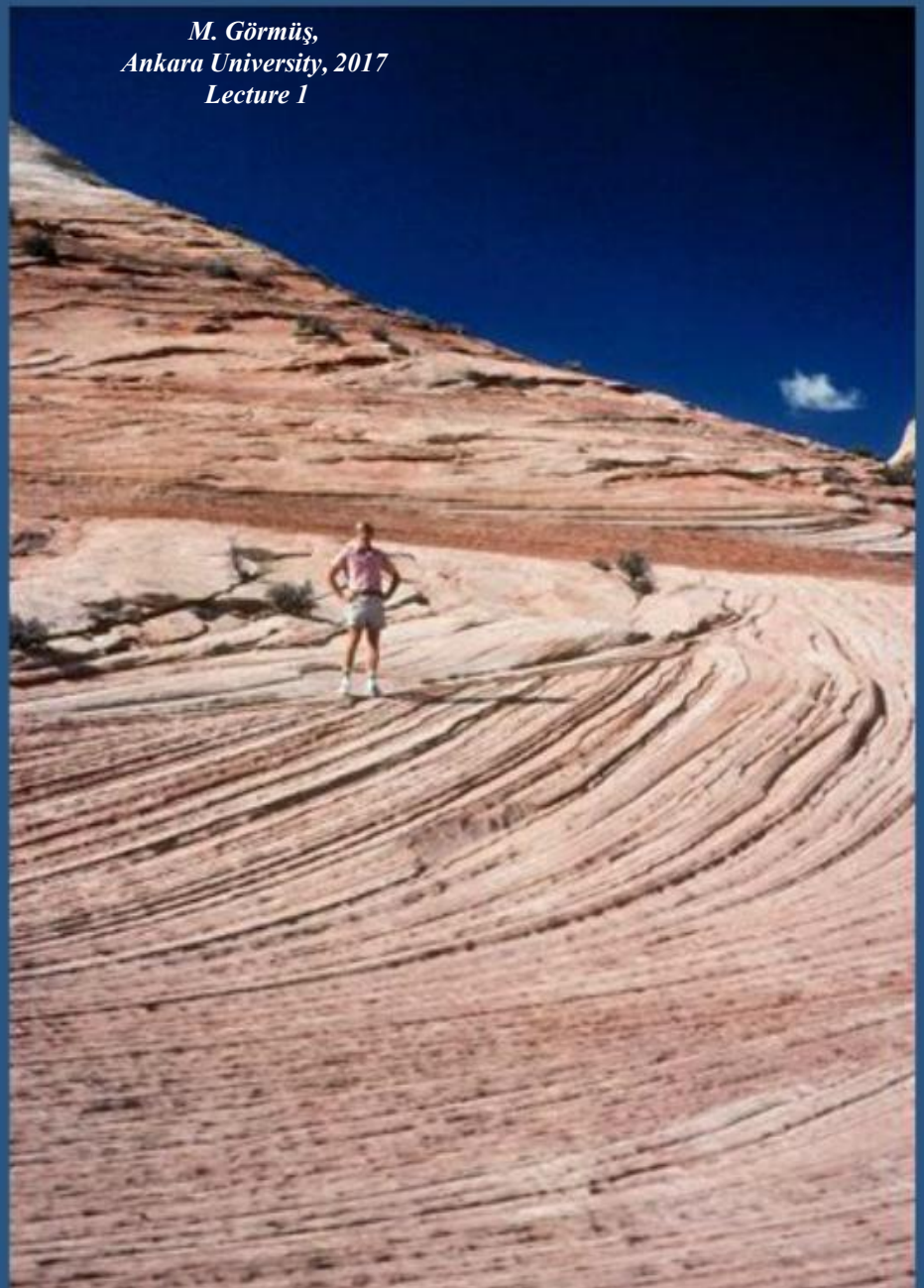
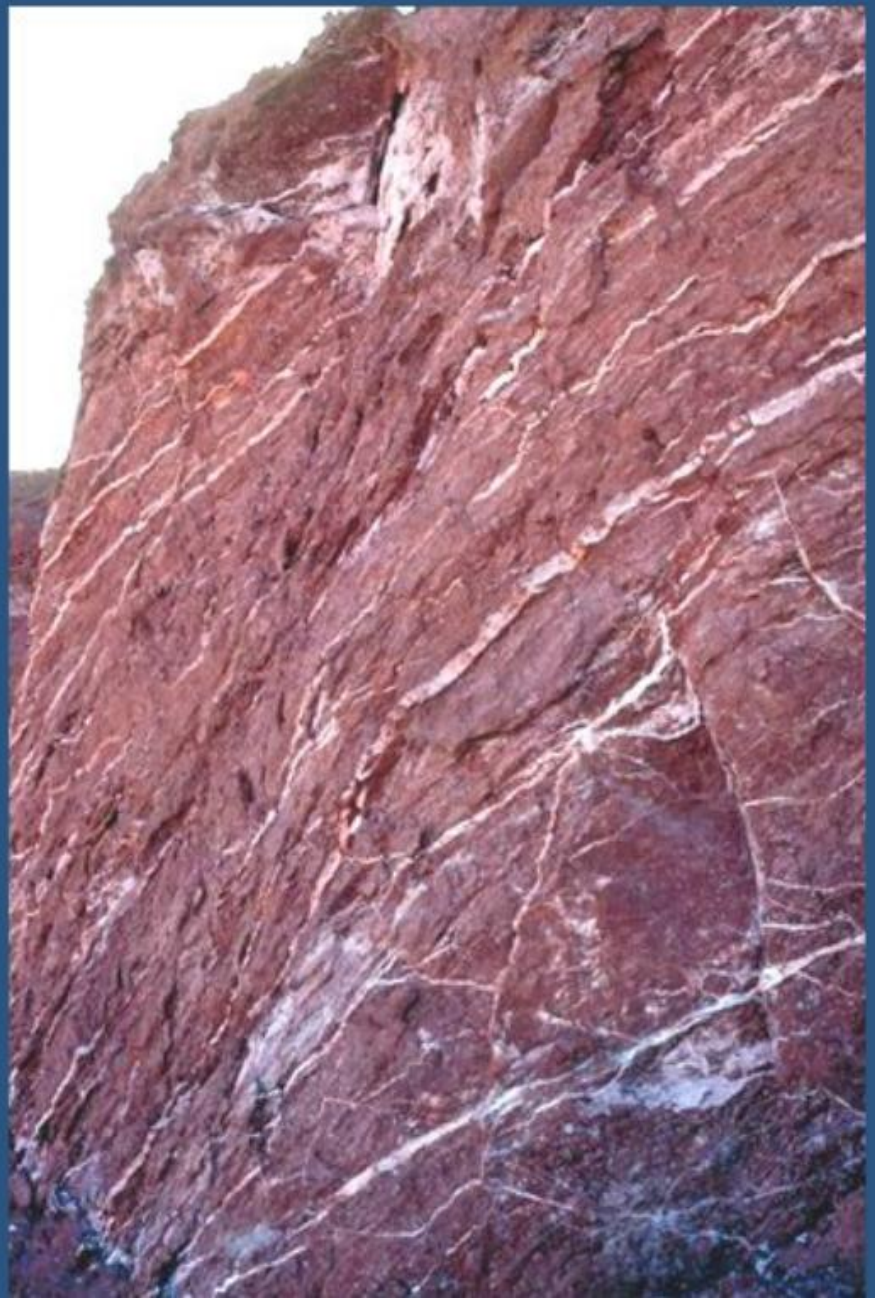


http://www.powershow.com/view/c964f-YjkzM/Paleontology_flash_ppt_presentation

This is cross bedding. It is an indication of a dune environment. (*)

This sandstone is in Zion National Park in southern Utah. It is a formation that was formed when this part of the world was a vast desert. (*)

ENVIRONMENT OF DEPOSITION



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http://www.powershow.com/view/c964f-YjkzM/Paleontology_flash_ppt_presentation

These are gypsum veins in a reddish siltstone. Gypsum is an indication of aridity. These sediments were in an terrestrial environment that was subject to extensive drying. (*)

ENVIRONMENT OF DEPOSITION

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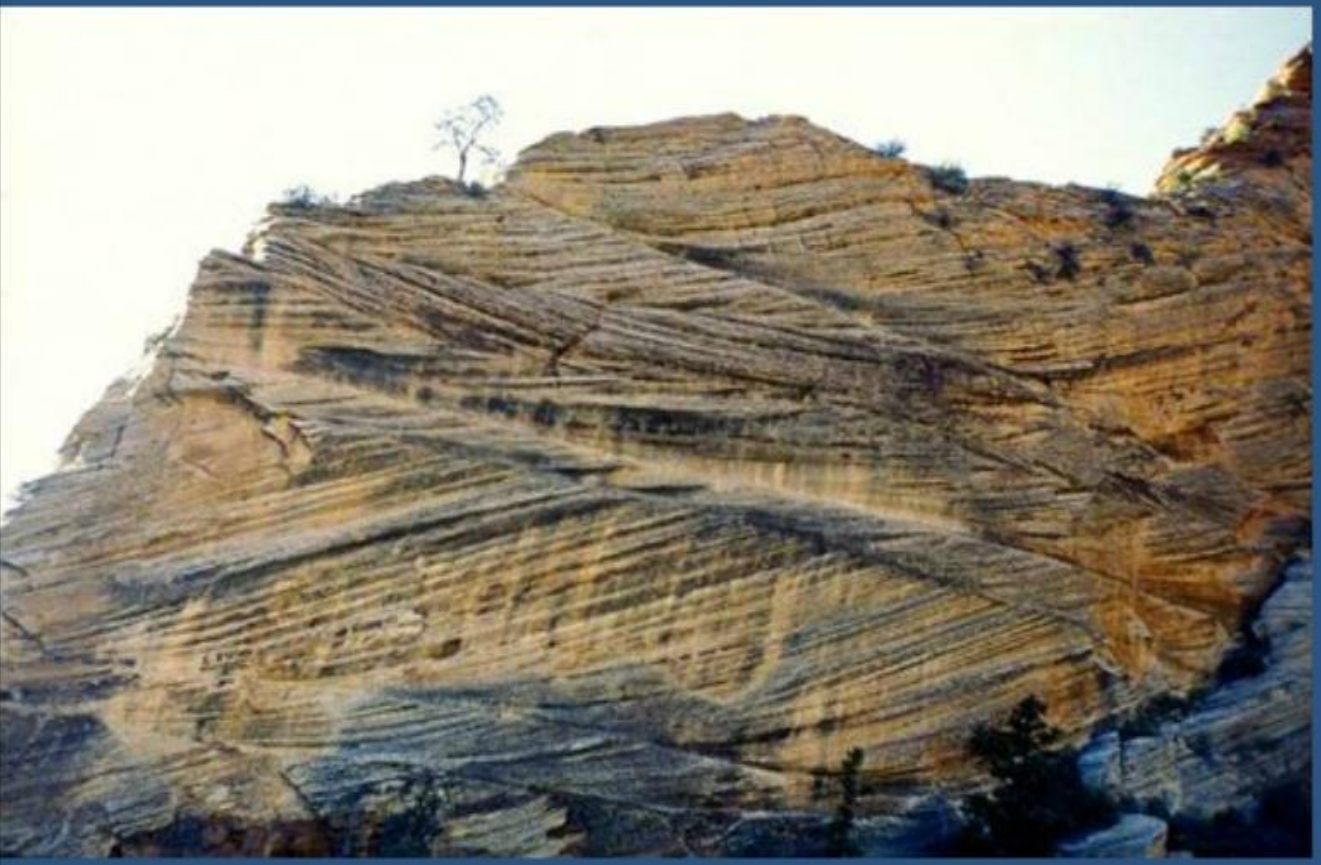
http://www.powershow.com/view/c964f-YjkzM/Paleontology_flash_ppt_presentation

Here is a photograph of Scientist Cliffs in Maryland. What do you think was the environment of deposition ? (*)

This is a beach deposit. (*)

ENVIRONMENT OF DEPOSITION



http://www.powershow.com/view/c964f-YjkzM/Paleontology_flash_ppt_presentation

Here is a photograph taken in Oak Creek Canyon, AZ. What do you think was the environment of deposition ? (*)

This is a dune deposit. (*)

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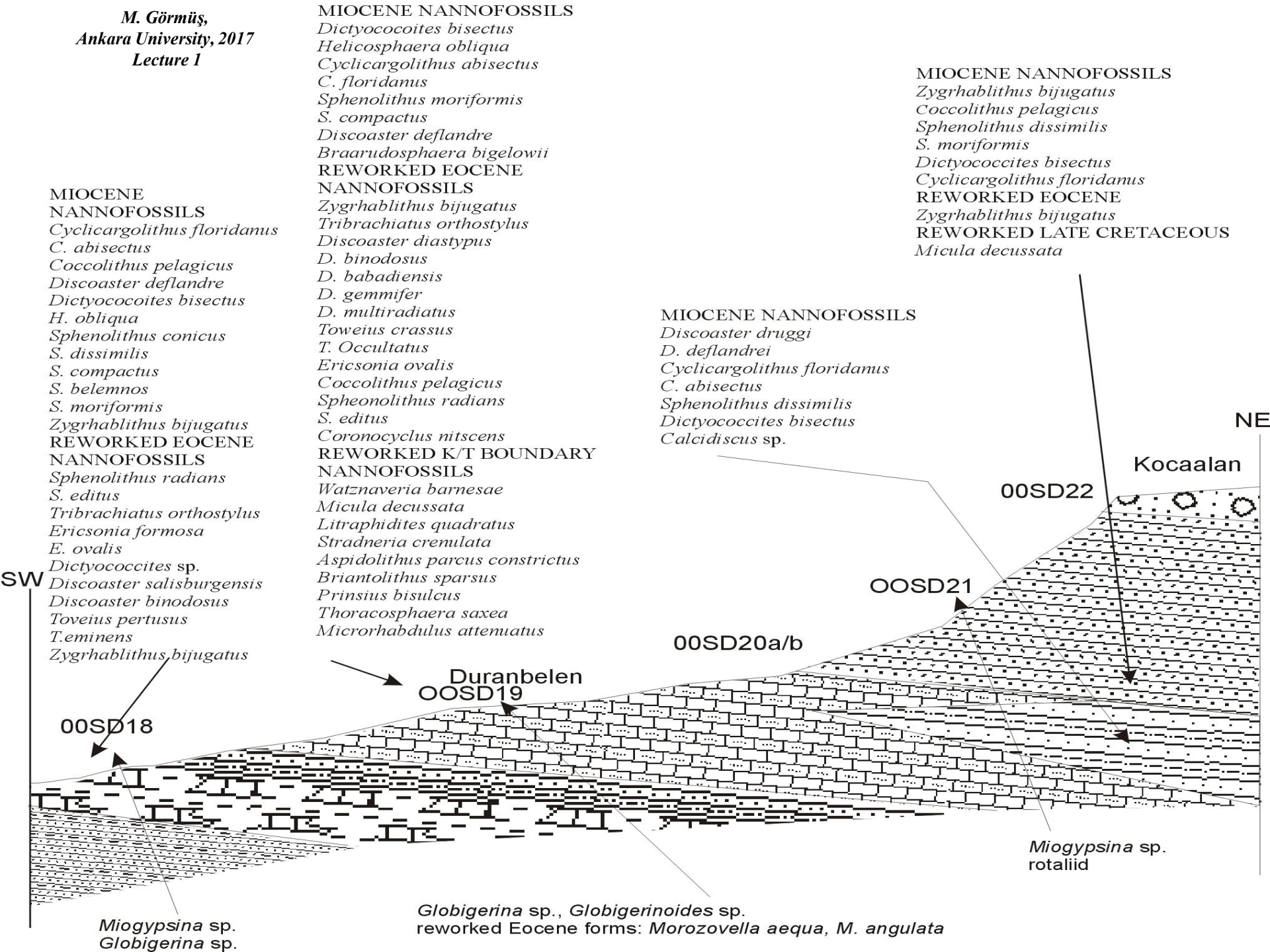
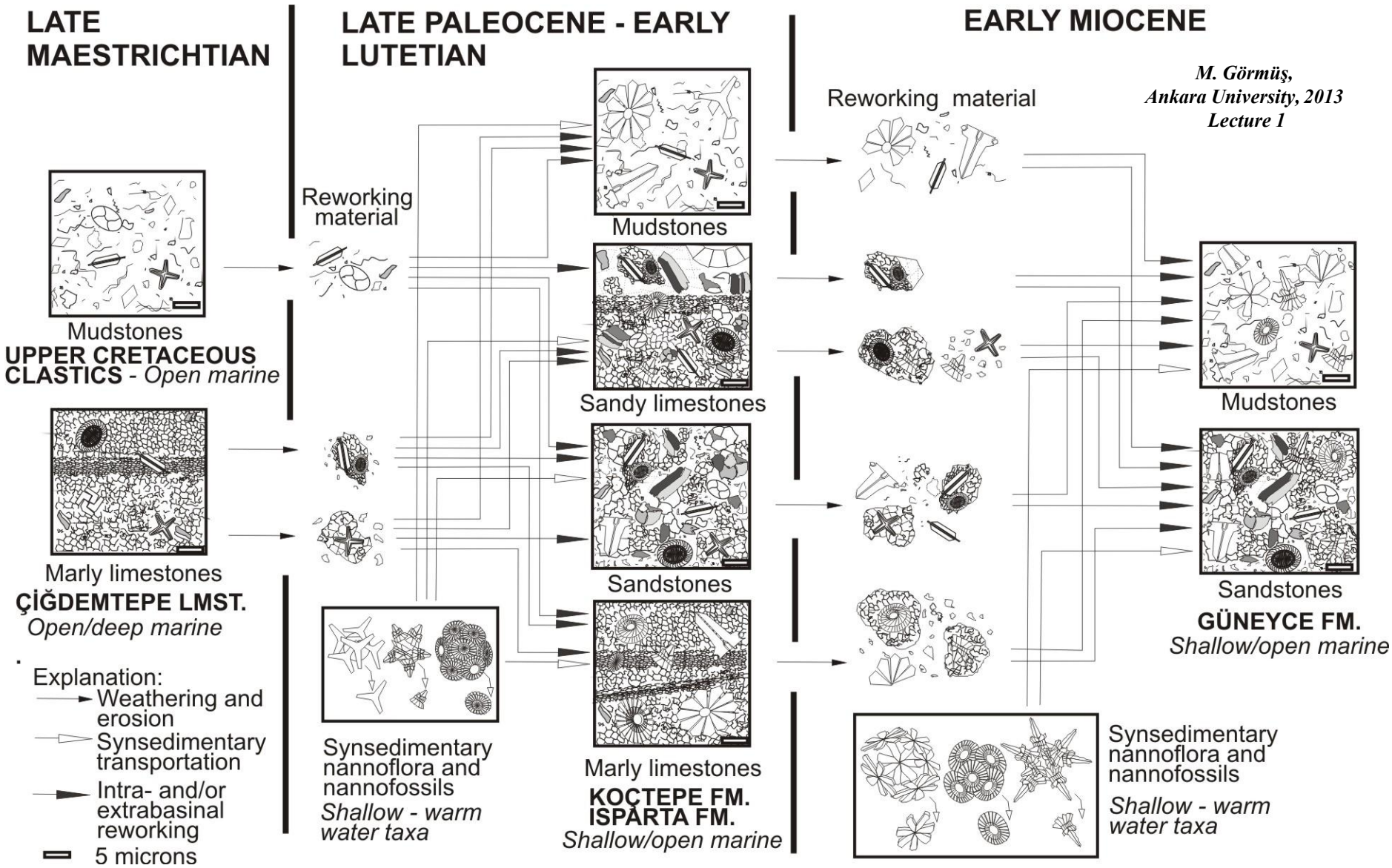
MIOCENE NANNOFOSSILS
Dictyococcoites bisectus
Helicosphaera obliqua
Cyclicargolithus abisectus
C. floridanus
Sphenolithus moriformis
S. compactus
Discoaster deflandre
Braarudosphaera bigelowii
REWORKED EOCENE NANNOFOSSILS
Zygrhablithus bijugatus
Tribrachiatus orthostylus
Discoaster diastypus
D. binodosus
D. babadiensis
D. gemmifer
D. multiradiatus
Toweius crassus
T. Occultatus
Ericsonia ovalis
Coccolithus pelagicus
Spheonolithus radians
S. editus
Coronocyclus nitscens
REWORKED K/T BOUNDARY NANNOFOSSILS
Watznaveria barnesae
Micula decussata
Litraphidites quadratus
Stradneria crenulata
Aspidolithus parcus constrictus
Briantolithus sparsus
Prinsius bisulcus
Thoracosphaera saxea
Microrhabdulus attenuatus

MIOCENE NANNOFOSSILS
Zygrhablithus bijugatus
Coccolithus pelagicus
Sphenolithus dissimilis
S. moriformis
Dictyococcites bisectus
Cyclicargolithus floridanus
REWORKED EOCENE
Zygrhablithus bijugatus
REWORKED LATE CRETACEOUS
Micula decussata

MIOCENE NANNOFOSSILS
Discoaster druggi
D. deflandrei
Cyclicargolithus floridanus
C. abisectus
Sphenolithus dissimilis
Dictyococcites bisectus
Calcidiscus sp.

MIOCENE NANNOFOSSILS
Cyclicargolithus floridanus
C. abisectus
Coccolithus pelagicus
Discoaster deflandre
Dictyococoites bisectus
H. obliqua
Sphenolithus conicus
S. dissimilis
S. compactus
S. belemnos
S. moriformis
Zygrhablithus bijugatus
REWORKED EOCENE NANNOFOSSILS
Sphenolithus radians
S. editus
Tribrachiatus orthostylus
Ericsonia formosa
E. ovalis
Dictyococcites sp.
Discoaster salisburgensis
Discoaster binodosus
Toveius pertusus
T.eminens
Zygrhablithus bijugatus





An example of the Upper Cretaceous-Eocene fossil reworking, Isparta around (Sagular & Görmüş, 2005).

Fossil & fossilization

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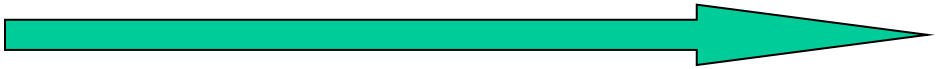
These carbonates (mainly limestones) include rich micro and macrofossils. You can also find the fossils from sedimentary rocks of your home cities.

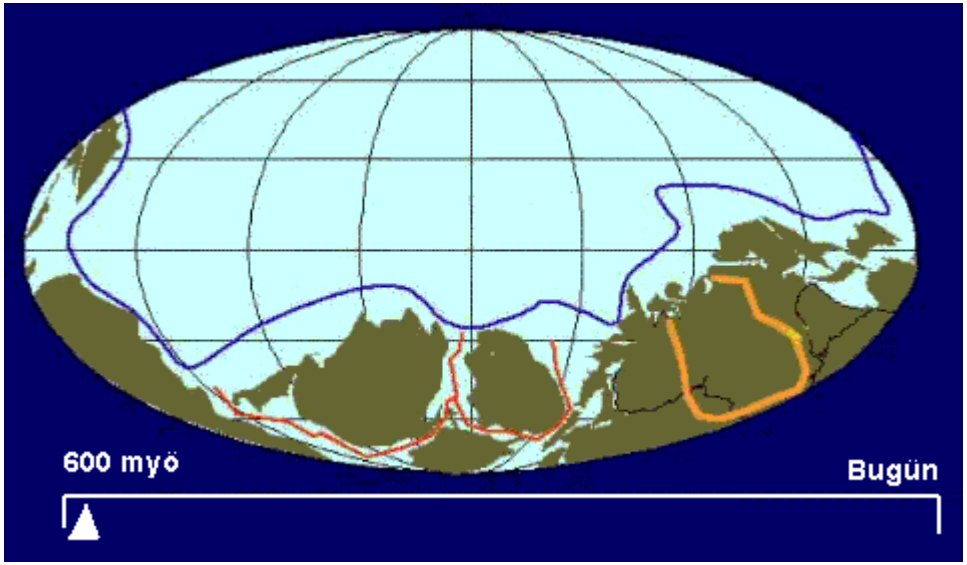
Various sedimentary rocks (i.e. sandstones, silicified rocks, clayey limestones, marls) may also include very rich micro and macro fossils.

time



KAMBRİYEN DÖNEM

http://www.biltek.tubitak.gov.tr/bilgipaket/jeolojik/Fanerozoik/Paleozoik/Kambriyen/index.htm



WWW……

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Geological Time

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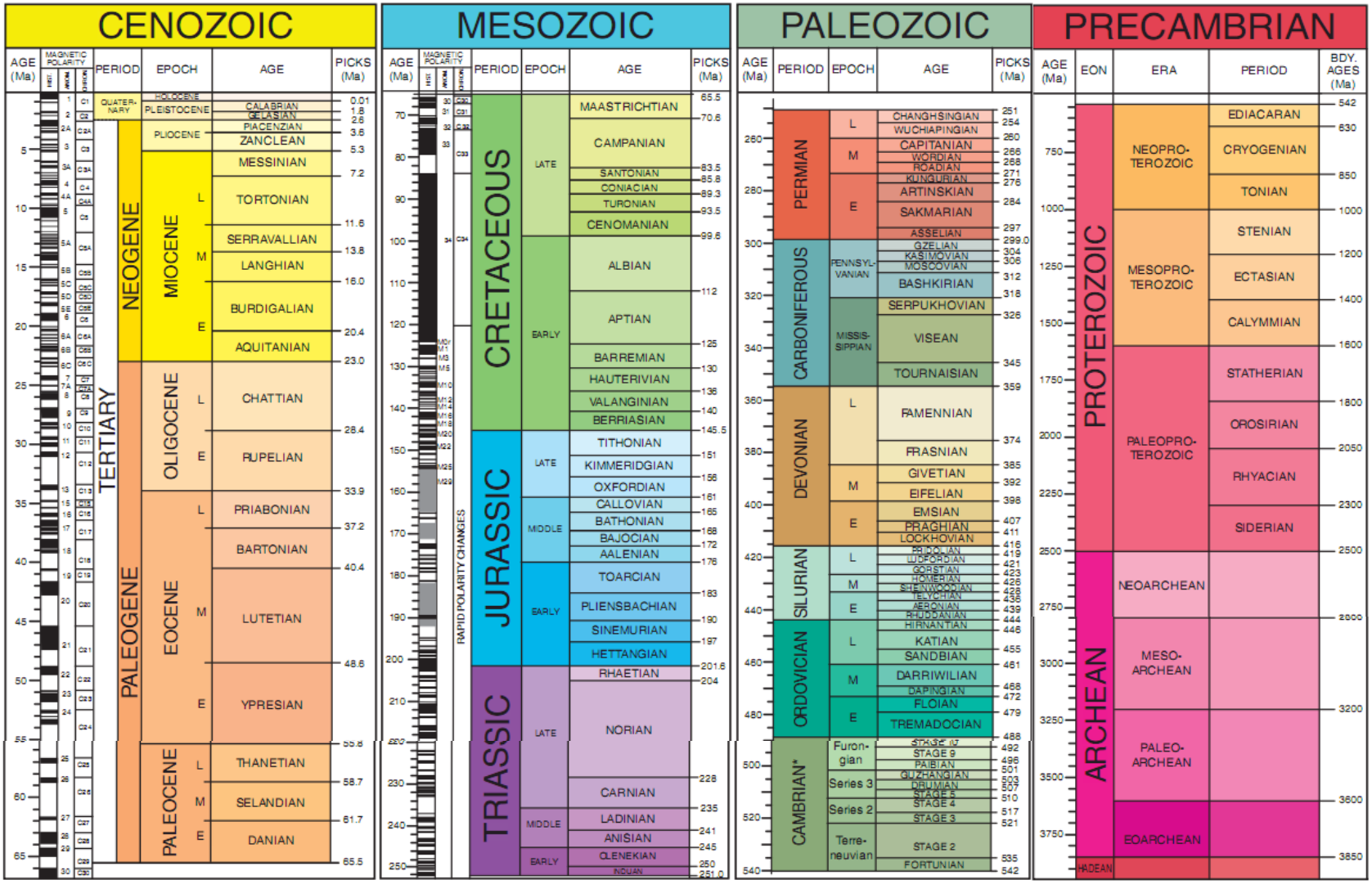
2009 GEOLOGIC TIME SCALE



*International ages have not been fully established. These are current names as reported by the International Commissionon Stratigraphy.

Walker, J.D., and Geissman, J.W., compilers, 2009, Geologic Time Scale: Geological Society of America, doi: 10.1130/2009.CTS004R2C. ©2009 The Geological Society of America.

Sources for nomenclature and ages are primarily from Gradstein, F., Ogg, J., Smith, A., et al., 2004, A Geologic Time Scale 2004: Cambridge University Press, 589 p. Modifications to the Triassic after: Furin, S., Preto, N., Rigo, M., Roghi, G., Gianolla, P., Crowley, J.L., and Bowring, S.A., 2006, High-precison U-Pb zircon age from the Triassic of Italy: Implications for the Triassic time scale and the Carnian origin of calcareous nannoplankton and dinosaurs: Geology, v. 34, p. 1009–1012, doi: 10.1130/G22967A.1; and Kent, D.V., and Olsen, P.E., 2008, Early Jurassic magnetostratigraphy and paleolatitudes from the Hartford continental rift basin (eastern North America): Testing for polarity bias and abrupt polar wander in association with the central Atlantic magmatic province: Journal of Geophysical Research, v. 113, B06105, doi: 10.1029/2007JB005407.

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In geological 2017, the term tertiary has been removed

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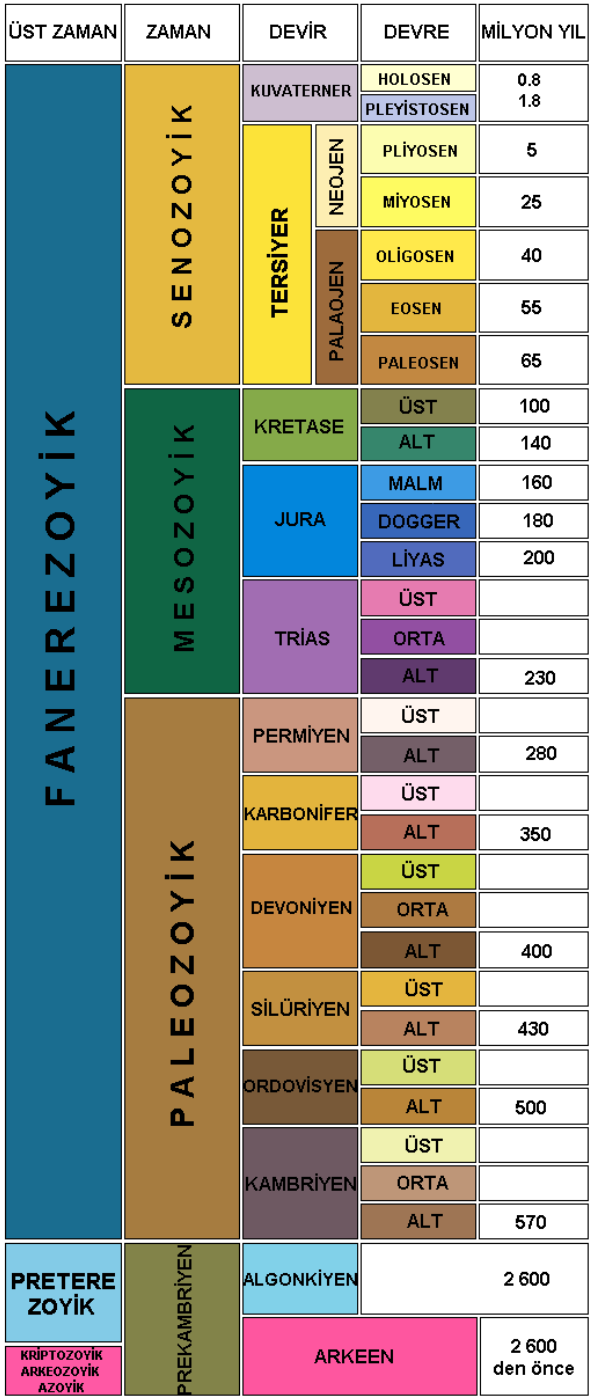

Do not memorize Tertiary,
Learn them in English

Origin of the names for the geological times

The followings have been taken ito consideration for the names of the geologic times.

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1. Development of organisms
   Paleozoic : Ancient (paleo) animal (zoo) time (ic)
   Mesozoic : Meso – zoo –ic
   Senozoyik: Seno – zoo –ic
2. Its best outcrop that was appeared and defined at first time.
   Cambrian: It (Cambria) is a location name in United Kingdom
   Devonian : It (Devonshire) is also a location name in United Kingdom
   Permian: It (Perm) is a location in Russia
   Jurassic : Jura is a location in Alp Mountains betwen Swetzerland and France
3. People group known from the locality
   Ordovician: “Ordovici” people grup in England
   Silürian: “Silur” is also people grup in England
4. Lithological characteristics
   Carboniferous : “Carbon” richness
   Triassic : Three lithologic characteristics
   Cretaceous : “chalk =creta”
5. Other geological time
   Pre-Cambnrian : before Cambrian

http://www.biltek.tubitak.gov.tr/bilgipaket/jeolojik/Fanerozoik/Mezozoik/Kretase/KretaSon.htm

Extinction

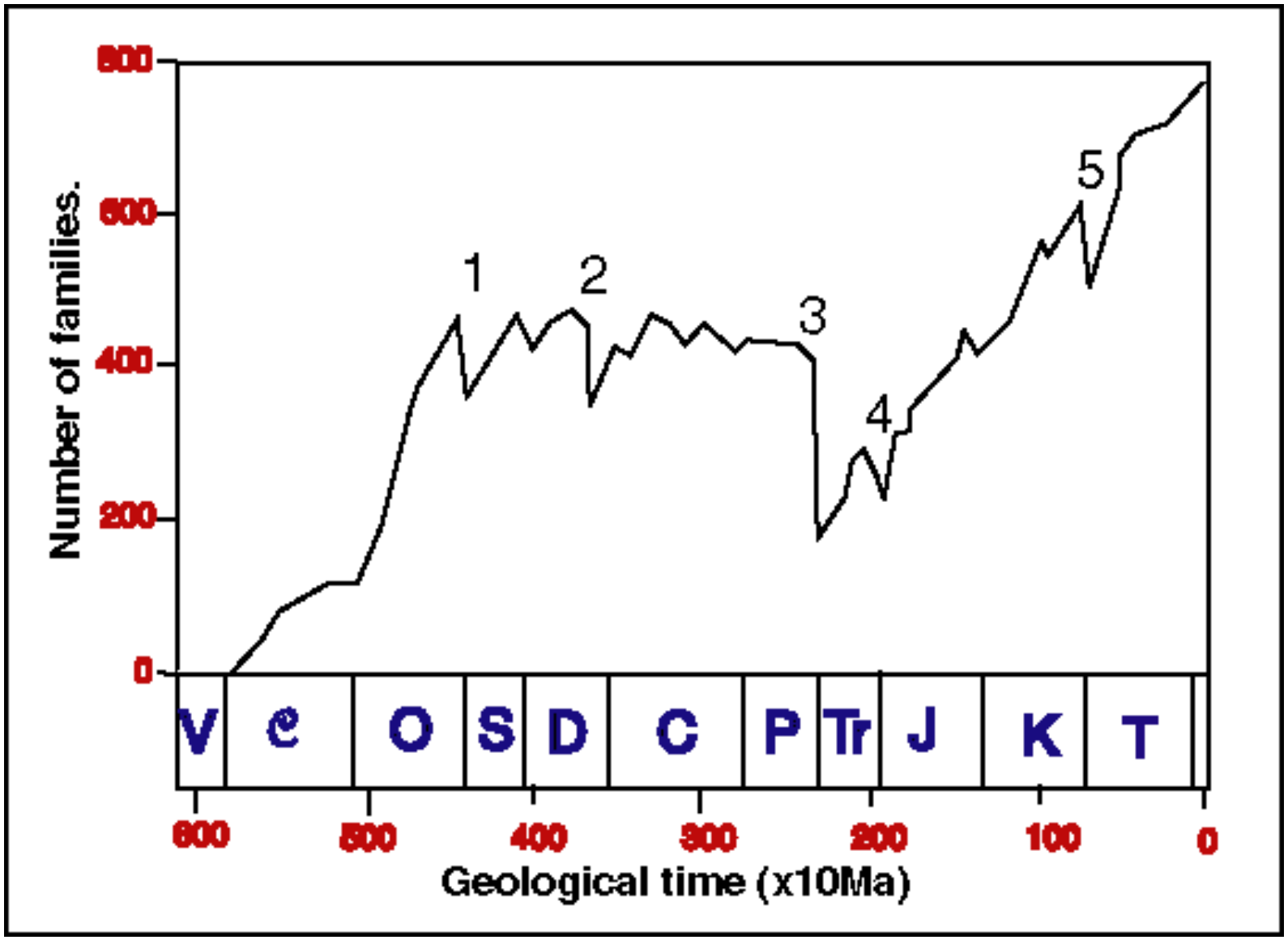
- **Background Extinction**:
  Extinction is occurring all the time. The averate rate of extinction over an extended time period is referred to as the background rate.

- **Mass Extinction**:
  A mass extinction occurs when a large number of taxa go extinct in a geologically rapid interval

  The Big Five are the five universally recognized mass extinctions.
  End Ordivician
  Late Devonian
  Permain-Triassic
  Triassic-Jurassic
  Cretaceous-Tertiary

  We are currently in a period of human driven extinctions that some consider the sixth big event.

Reference: *ftp://ftp.ldeo.columbia.edu/*



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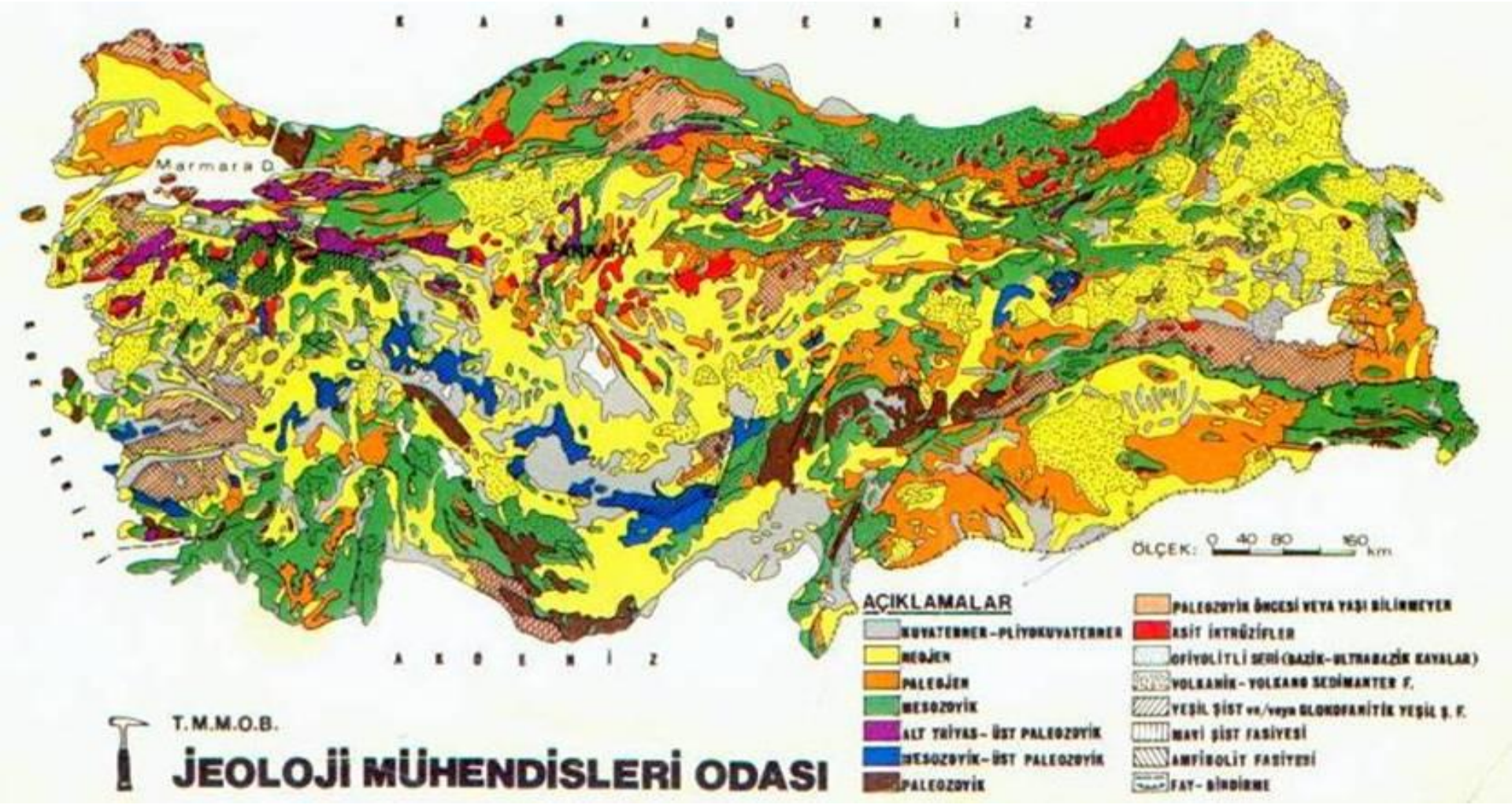

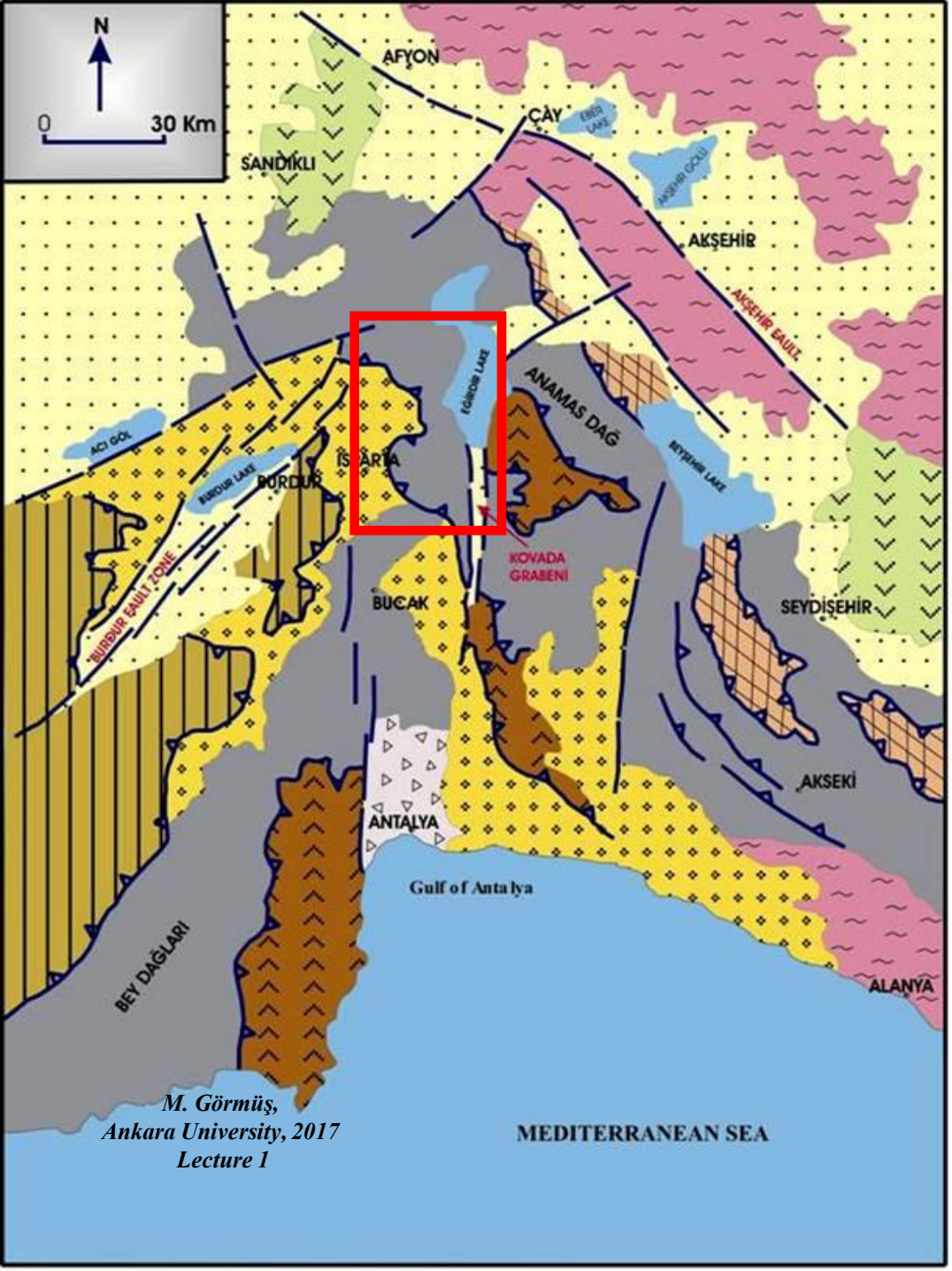

Overthrust

Normal faults

Antalya travertines

Neogene continental volcanics

Neogene continental sediments

Tertiary marine sediments

Beyşehir-Hoyran nappes

Lycian nappes

Antalya nappes

Mesozoic carbonate platforms

Paleozoic metamorphics

(Yağmurlu et al. 1997, 2001; Glover & Robertson, 1998)

Homework 1

Find a geological map from a web site or an article or somewhere, and study and write the colours from the map what they mean.

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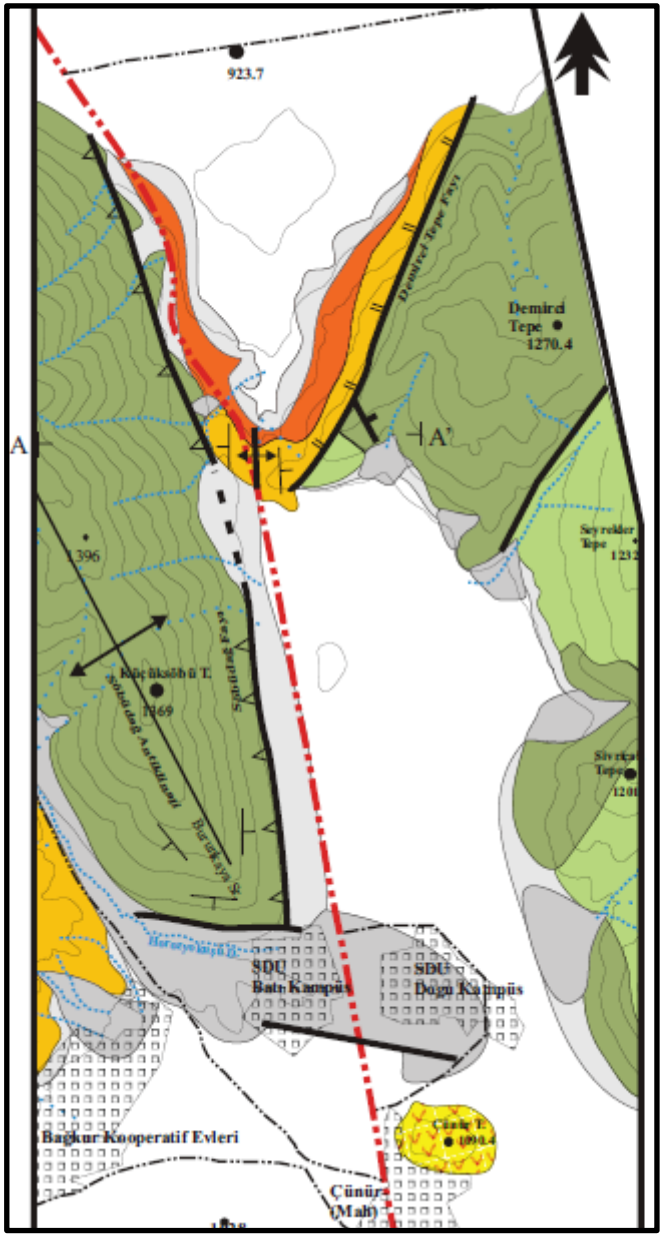
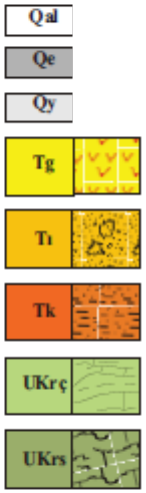
Example





In this geological map,

Q_{al} Quaternary (Q) alluvium ($_{al}$)

Q_e Quaternary (Q) slope deposits ($_e$)

Q_y Quaternary (Q) fan deposits ($_y$)

T_g Tertiary (T), pattern shows volcanics, $_g$ indicates name of the lithodem/lithostratigraphic unit

$T_ı$ Tertiary (T), pattern show clastics, $_ı$ indicates name of the formation, colour shows most probably Eocene

T_k Tertiary (T), pattern show clastics, $_k$ indicates name of the formation, colour shows most probably Paleocene

$UKr_ç$ Upper Cretaceous (UKr), pattern show clayey limestone, $_ç$ indicates name of the formation

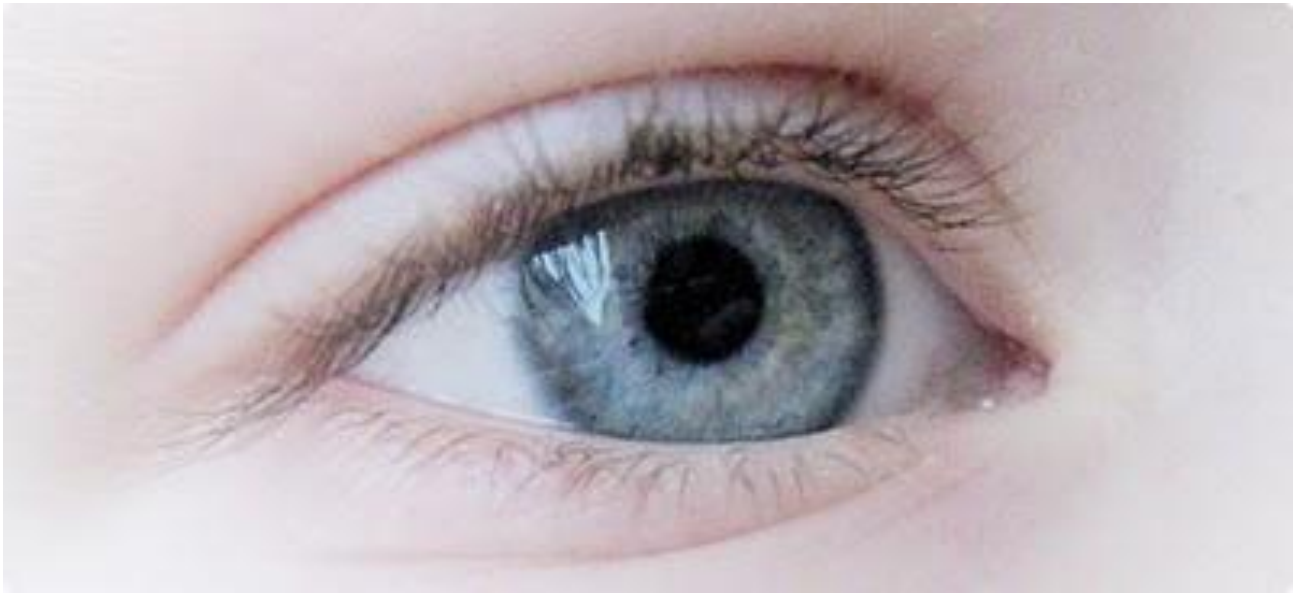
UKr_s Upper Cretaceous (UKr), pattern show limestone, $_s$ indicates name of the formation

Reference:

Görmüş M., Uysal K., Kanbur S., Uysal B., Özdemir A. & Bayır M., 2010. Söbüdağ-Çünür (Isparta) Arasının Jeolojisi. SDUGEO (Online), 1(2), 27-41(www.geo.sdu.edu.tr), ISSN 1309-6656

As a conclusion, in the world you must have

eyes to see



http://dileky.blogcu.com/esas-akil/3726199

Mind to think of

http://www.alabildigine.net/resim/Ne-akil--ne-cesaret-32063333q.aspx

To be succesful, you should have a belief, respect & unity

you need hard working

http://www.izmirkorfez.com/yenileniyoruz/

You see this nature…
but what about others
not to be seen…