Methods of Stratigraphic correlation

Correlation

- Lithostratigraphic correlation - Matching up rock units on the basis of lithology and stratigraphic position.
- Biostratigraphic correlation - Matching up rock units on the basis of fossils they contain.
- Chronostratigraphic correlation - Matching up rock units on the basis of age equivalence, as determined by radioactive dating methods or fossils.

Stratigraphic Units

- Stratigraphic unit. A body of rock beds established as a distinct entity in the classification of the Earth's rocks, based on any of the properties or attributes or combinations thereof that rocks possess.
- a stratotype (type section) is a section of geological strata used as the type for the definition of a unit and which may be used by interested scientists as a reference or type locality.

Stratotypes

- Holostratotype
- 1. Definition, characterization, and description.
- a. Name
- b. Geographic location and geologic setting of the stratotype with an indication of accessibility, maps, and markers, both artificial and natural.
- c. Description of unit at stratotype or type locality.
- d. Regional aspects. Geographic extent; regional variations in thickness, lithostratigraphy, biostratigraphy or other properties; nature of boundaries away from the type; criteria to be used in identifying and extending the unit over the area of its presence.
- e. Geologic age.
- f. Correlation with other units.
- h. References to the literature.
- Accessibility and protection status

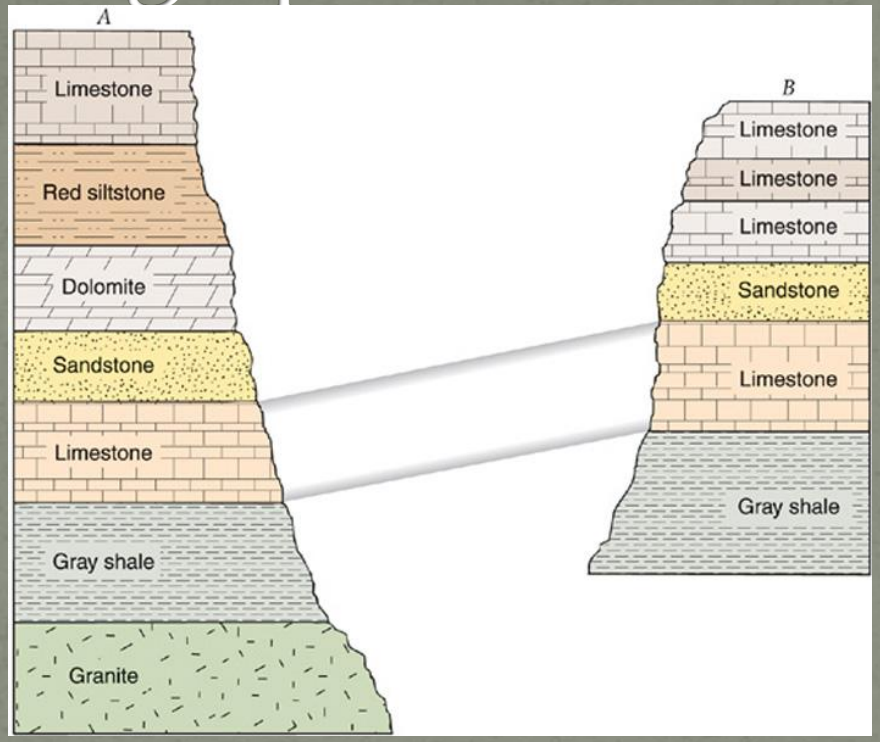
Stratotypes

1. Holostratotype (original)
2. Parastratotype (additional)
3. Lectostratotype (subsequent)
4. Neostratotype (Replacement)
5. Υποστρωματότυπος (reference section)

Lithostratigraphy

- The element of stratigraphy that deals with the description and nomenclature of the rocks of the Earth based on their lithology and their stratigraphic relations.
- The classification of bedded rocks in units on the basis of their lithologic properties and their stratigraphic relations
- Important for the geological study of an area

Lithostratigraphic correlation



Demonstration of lithostratigraphic correlation from one exposure to another.

Lithostratigraphic unit

A body of bedded sedimentary, extrusive igneous, metasedimentary, or metavolcanic rocks distinguished on the basis of lithologic characteristics (texture, color, composition, etc.) and stratigraphic position.

Lithostratigraphic units are the basic units of geologic mapping.

- Lithostratigraphic units are defined and recognized by observable physical features and not by their inferred age, the time span they represent, inferred geologic history, or manner of formation.
- The geographic extent of a lithostratigraphic unit is controlled entirely by the continuity and extent of its diagnostic lithologic features

The smallest lithostratigraphic rock unit is the **bed**.

Lithostratigraphic units

- Supergroup - - two or more groups
- Group - two or more formations
- Formation - primary unit of lithostratigraphy
- Member - named lithologic subdivision of a formation
- Bed - named distinctive layer in a member or formation

Bed

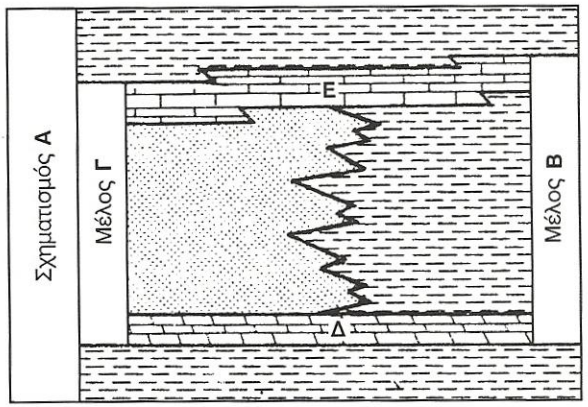
- The smallest formal unit in the hierarchy of sedimentary lithostratigraphic units, e.g. a single stratum lithologically distinguishable from other layers above and below. Customarily only distinctive beds (key beds, marker beds) particularly useful for stratigraphic purposes are given proper names and considered formal lithostratigraphic units.

Formations

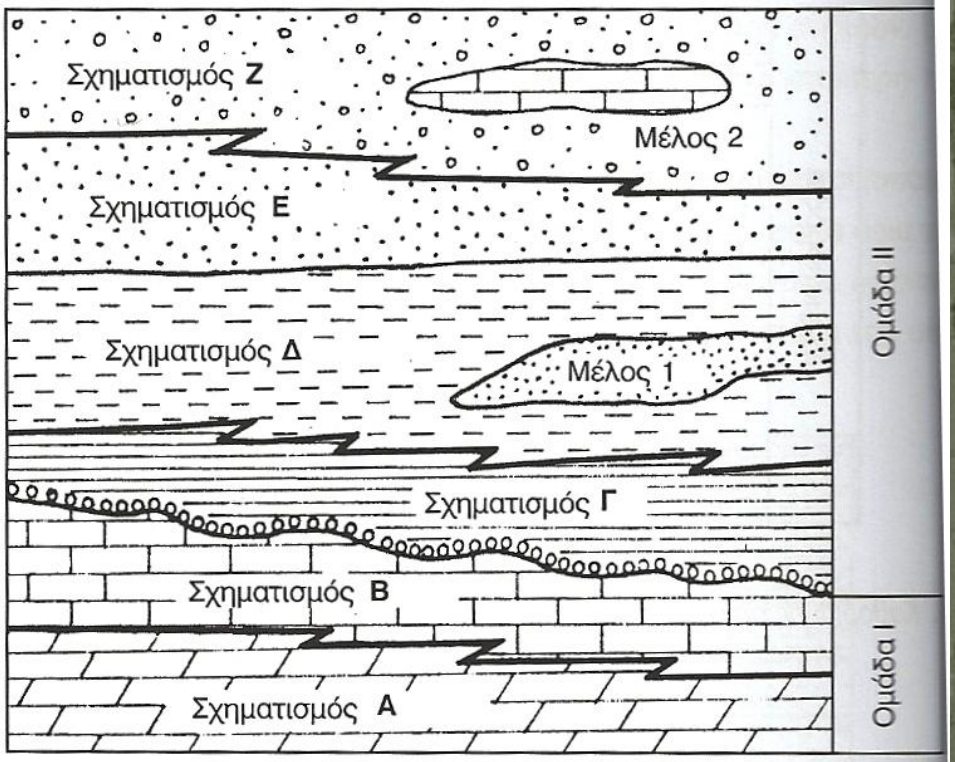
- The primary formal unit of lithostratigraphic classification
- Lithologically homogeneous
- Distinct and different from rock units above and below.
- Traceable from exposure to exposure, and of sufficient thickness to be mappable
- Named for a geographic locality where well exposed.
- The thickness of formations may range from less than a meter to several thousand meters

Member

- The formal lithostratigraphic unit next in rank below a formation
- It possesses lithologic properties distinguishing it from adjacent parts of the formation.
- No fixed standard is required for the extent and thickness of a member.
- A formation need not be divided into members unless a useful purpose is thus served.
- A member may extend from one formation to another.
- Specially shaped forms of members (or of formations) are lenses and tongues.
- A lense is a lens-shaped body of rock of different lithology than the unit that encloses it.
- A tongue is a projecting part of a lithostratigraphic unit extending out beyond its main body.



Σχήμα Γ-4. Καθορισμός ορίων λιθοστρωματογραφικής ενότητας με βάση στρώματα οδ (STRAT. CO



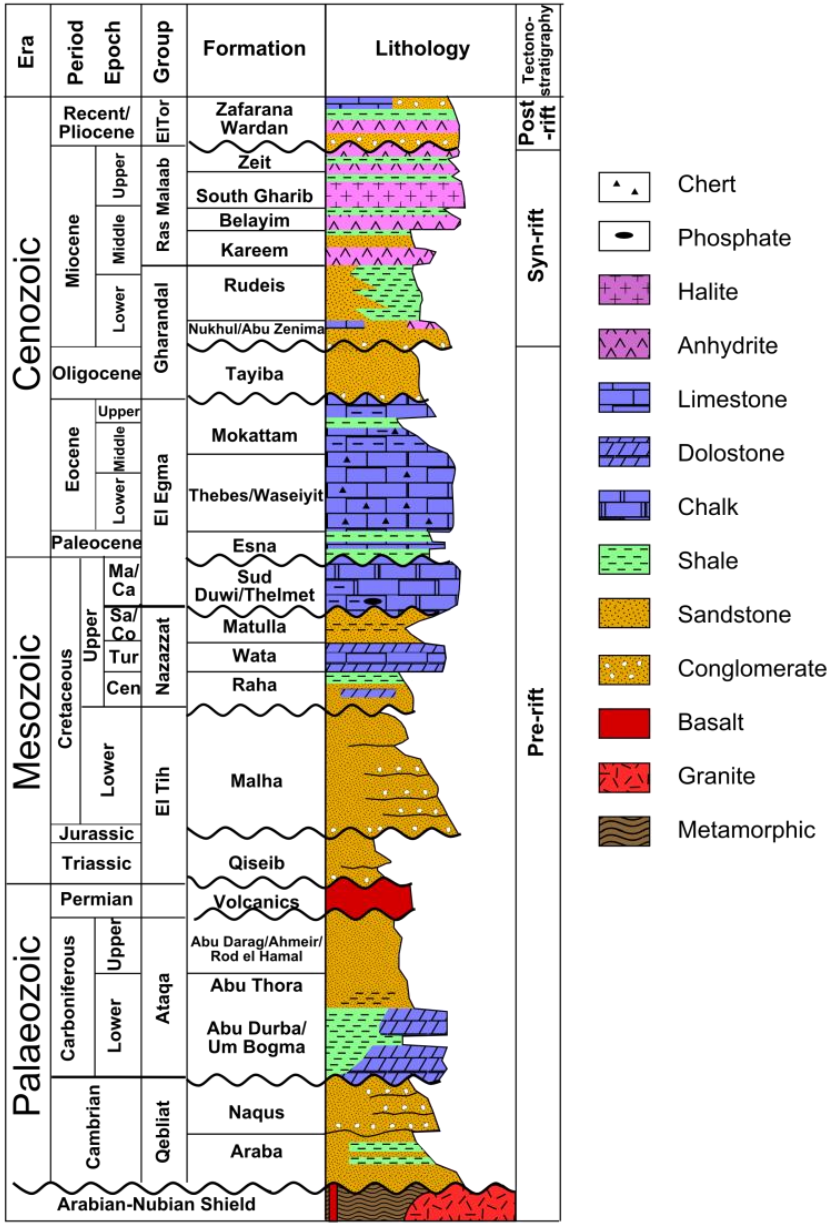
***Σχήμα Γ-5.** Διαχωρισμός μιας ακολουθίας σε λιθοστρωματογραφικές ενότητες*

Group

- **Group.** A succession of two or more contiguous or associated formations with significant and diagnostic lithologic properties in common.
- Formations need not be aggregated into groups unless doing so provides a useful means of simplifying stratigraphic classification in certain regions or certain intervals. Thickness of a stratigraphic succession is not a valid reason for defining a unit as a group rather than a formation. The component formations of a group need not be everywhere the same.
- **Supergroup and subgroup.** The term "supergroup" may be used for several associated groups or for associated groups and formations with significant lithologic properties in common.

Naming of lithostratigraphic units

- The names of most formal stratigraphic units consist of an appropriate geographic name combined with an appropriate term indicating the kind and rank of the unit, e.g. La Luna Formation, except for some terms that were established in the early history of stratigraphy.
- **Geographic component of names of stratigraphic units**
- **Lithologic component of name**


Era
Period
Epoch
Group
Formation
Lithology
Tectono-stratigraphy
Cenozoic
Mesozoic
Palaeozoic
Recent/ Pliocene
Miocene
Upper
Middle
Lower
Oligocene
Eocene
Upper
Middle
Lower
Paleocene
Cretaceous
Upper
Ma/ Ca
Sa/ Co
Tur
Cen
Lower
Jurassic
Triassic
Permian
Carboniferous
Upper
Lower
Cambrian
ElTor
Ras Malaab
Gharandal
El Egma
Nazazzat
El Tih
Ataqa
Qebliat
Zafarana Wardan
Zeit
South Gharib
Belayim
Kareem
Rudeis
Nukhul/Abu Zenima
Tayiba
Mokattam
Thebes/Waseiyit
Esna
Sud Duwi/Thelmet
Matulla
Wata
Raha
Malha
Qiseib
Volcanics
Abu Darag/Ahmeir/ Rod el Hamal
Abu Thora
Abu Durba/ Um Bogma
Naqus
Araba
Arabian-Nubian Shield
Post -rift
Syn-rift
Pre-rift
Chert
Phosphate
Halite
Anhydrite
Limestone
Dolostone
Chalk
Shale
Sandstone
Conglomerate
Basalt
Granite
Metamorphic

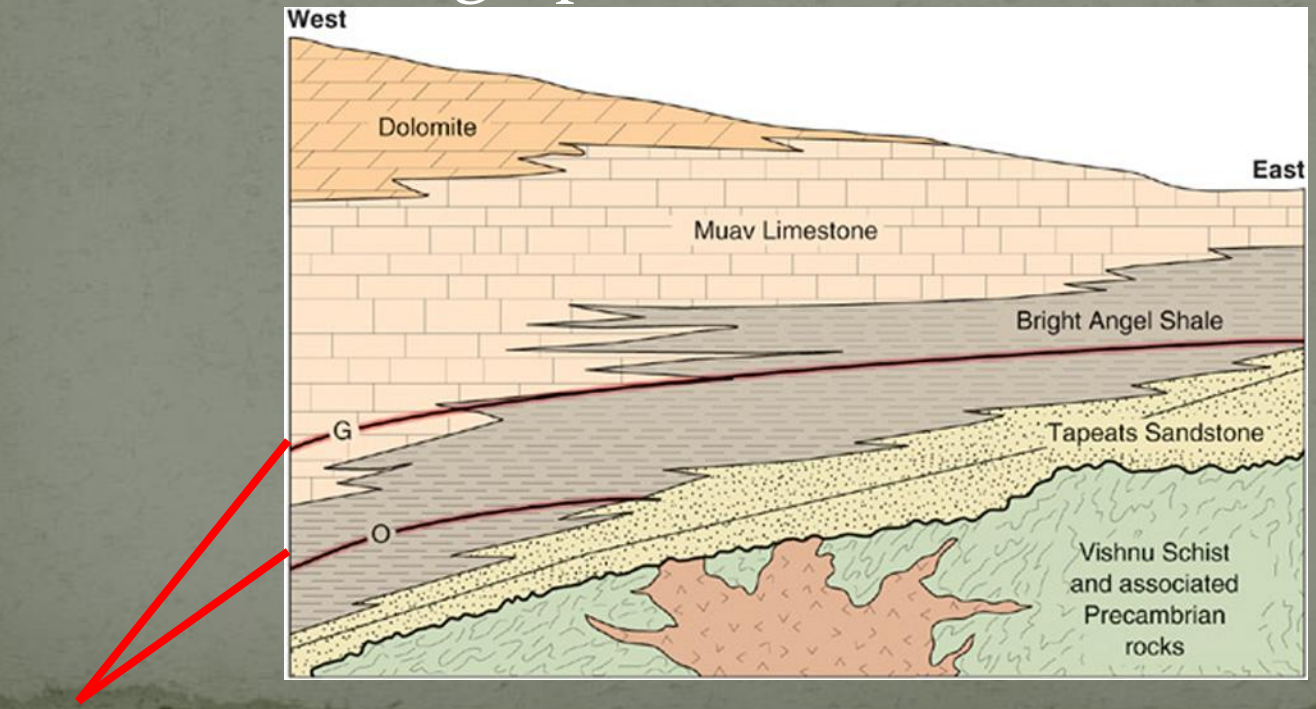
Lithodemes (complexes)

- A lithostratigraphic unit composed of diverse types of any class or classes or rocks (sedimentary, igneous, metamorphic) and characterized by irregularly mixed lithology or by highly complicated structural relations.
- Nonlayered units,

1. Lithodeme
2. Suite
3. Supersuite

Boundaries of lithostratigraphic units

- Boundaries of lithostratigraphic units commonly cut across time surfaces, across the limits of fossil ranges, and across the boundaries of any other kind of stratigraphic units.

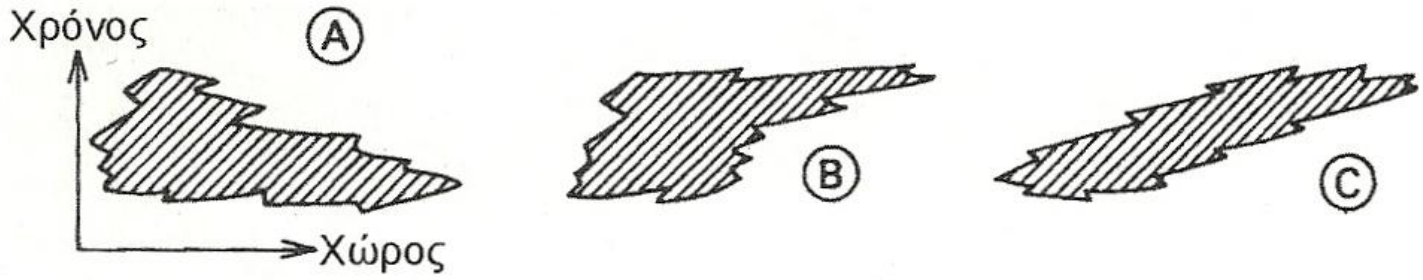


Biostratigraphy

- The element of stratigraphy that deals with the distribution of fossils in the stratigraphic record and the organization of strata into units on the basis of their contained fossils.
- **Biostratigraphic classification.** The systematic subdivision and organization of the stratigraphic section into named units based on their fossil content.

Biostratigraphic units

- A body of bedded sedimentary rocks distinguished on the basis of the fossils it contains
- Biostratigraphic classification. The systematic subdivision and organization of the stratigraphic section into named units based on their fossil content.



Σχ. 23. Τροποποίηση των περιοχών κατανομής της πανίδας στη διάρκεια του χρόνου.
A: με περιορισμό.
B: με εξάπλωση.
C: με μετατόπιση.

- Organisms vary in geographic extent, and represented time span.
- They migrate particularly when environmental conditions change, adjusting their geographical ranges..
- Therefore biostratigraphic correlation is not always correlation in time.

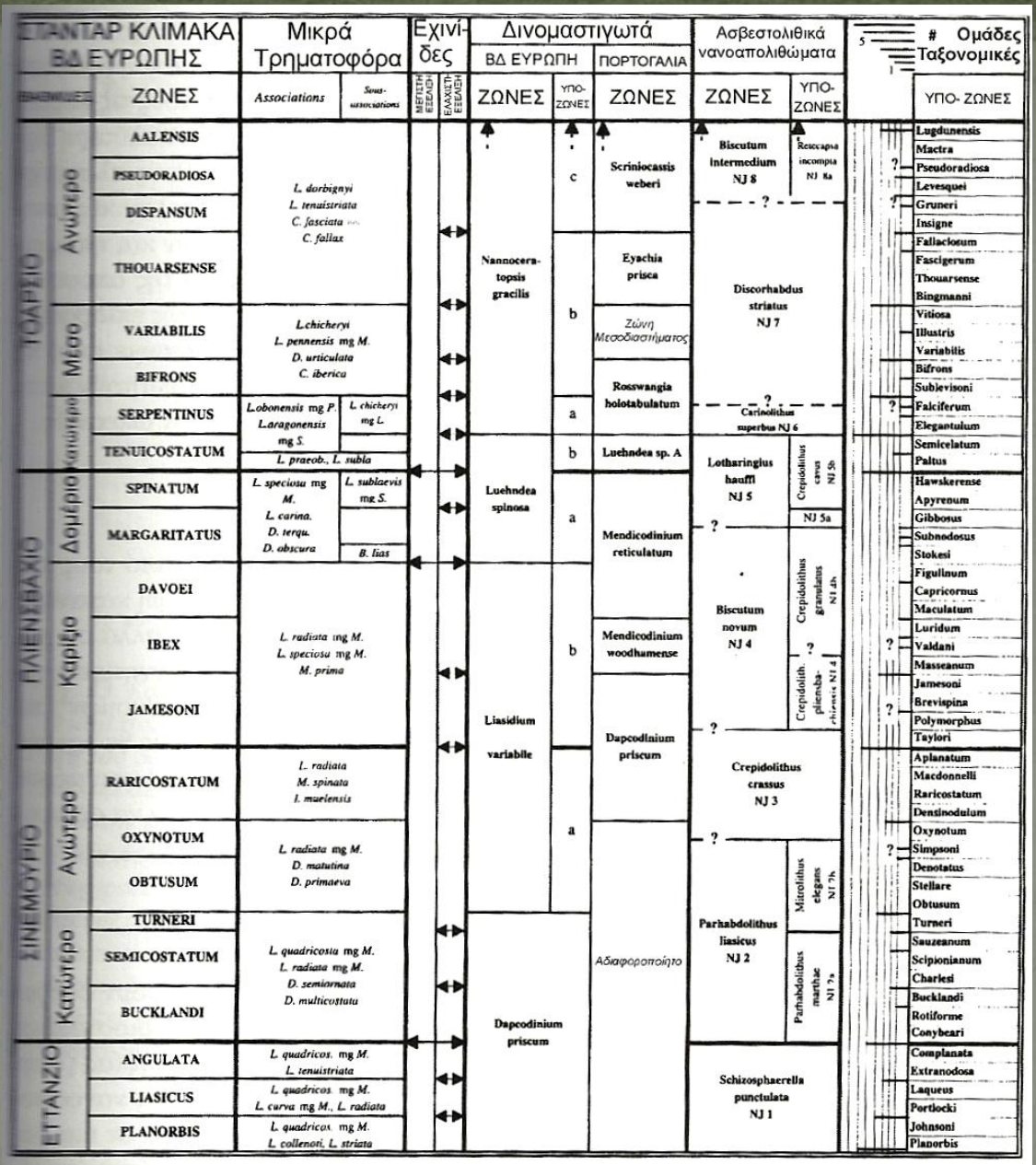
Biostratigraphic units

- Based on:
- All fossil species
- Only one taxon
- A specific species abundance
- Specific morphological features
- Evolutionary Stages of certain taxa lineages
- Accumulations of species characterizing a known stratigraphic range

Biostratigraphic zone (Biozone).

- The basic unit
- A general term for any kind of biostratigraphic unit regardless of thickness or geographic extent. Biozones vary greatly in thickness, geographic extent, and represented time span.

- A bed or group of beds that are characterised by one or more taxa from it is named after



Σχ. 32Β. Σύγκριση της κλίμακας των στάνταρ υποζωνών με αμμωνίτες του Κατωτέρου Ιουρασικού με τις «παράλληλες κλίμακες» που προέρχονται από μικρά τρηματοφόρα, δινομαστιγωτά (Riding & Thomas, 1992, Davis, 1985), ασβεστολιθικά νανοαπολιθώματα (Bown et al., 1988) και τον πίνακα κατανομής των εχινοδέρμων.

Biostratigraphic units

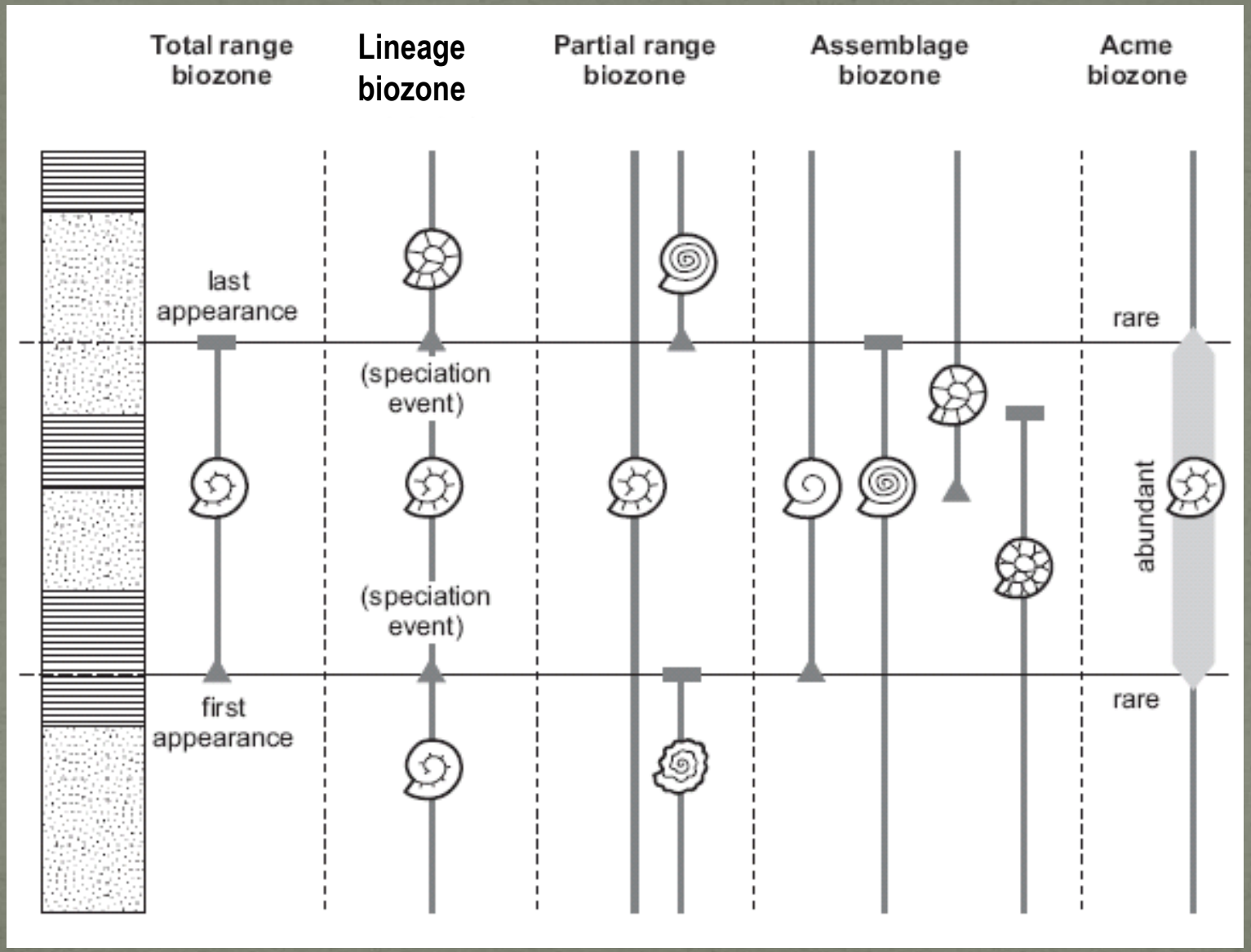
- **Zonule**
- **Subbiozone (Subzone).** A subdivision of a biozone.
- **Biozone**
- **Superbiozone (Superzone).** A grouping of two or more biozones with related biostratigraphic attributes.

- **Barren intervals.** Stratigraphic intervals with no fossils common in the stratigraphic section.

Kinds of biozones

- Five kinds of biozones are in common use:

1. range zones, The body of strata representing the known stratigraphic and geographic range of occurrence of a particular taxon or combination of two taxa of any rank. **taxon-range zones and concurrent-range zones**.
2. interval zones, The body of fossiliferous strata between two specified biohorizons. Such a zone is not itself necessarily the range zone of a taxon or concurrence of taxa; it is defined and identified only on the basis of its bounding biohorizons
3. lineage zones. The body of strata containing specimens representing a specific segment of an evolutionary lineage
4. assemblage zones, The body of strata characterized by an assemblage of three or more fossil taxa that, taken together, distinguishes it in biostratigraphic character from adjacent strata
5. abundance zones, The body of strata in which the abundance of a particular taxon or specified group of taxa is significantly greater than is usual in the adjacent parts of the section.


Total range biozone
Lineage biozone
Partial range biozone
Assemblage biozone
Acme biozone
last appearance
first appearance
(speciation event)
(speciation event)
rare
abundant
rare

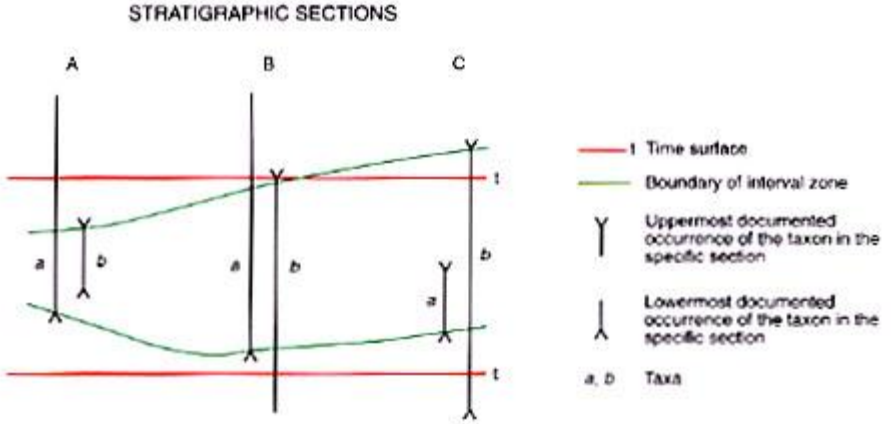


Figure 3: Interval Zone. In this example, the lower limit of the zone is the lowermost known occurrence of taxon *a*, and the upper limit is the highest known occurrence of taxon *b*. The zone extends laterally as far as both of the defining biohorizons can be recognized.

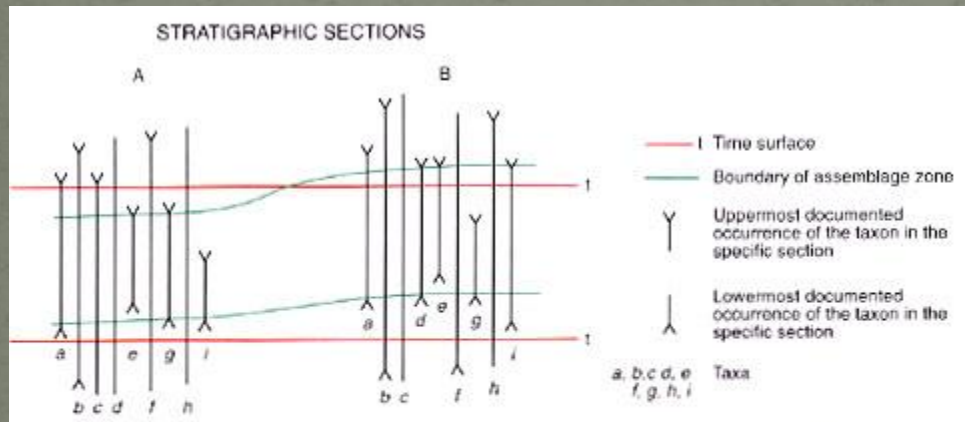


Figure 6: Assemblage Zone. In this example, the assemblage diagnostic of the zone includes nine taxa with diverse stratigraphic ranges. For this assemblage zone to be useful, it may be necessary to provide some explicit description of its boundaries: for example, the lower boundary can be said to be placed at the lowermost occurrence of taxa *a* and *g* and the upper boundary at the highest occurrence of taxon *e*. Most of the taxa of the assemblage characteristic of the zone should, however, be present.

Naming Biostratigraphic Units

- The formal name of a biostratigraphic unit should be formed from the names of one, or no more than two, appropriate fossils combined with the appropriate term for the kind of unit in question. The function of a name is to provide a unique designation for the biozone. Thus, any taxon in the characteristic assemblage of a biozone may serve as name-bearer as long as it is not already employed. (abundance biozone of *Bolivina,* taxon range biozone of *Globerina brevis)*
- Codification of biostratigraphic zones by certain letter and number combinations reflecting taxa and specific geochronological time periods (NJ1 = Nanofossil Jurassic 1)