University Of Basrah

College of Science

Department of Geology

STRATIGRAPHY

Lectures Notes for Third-Class Undergraduate Students

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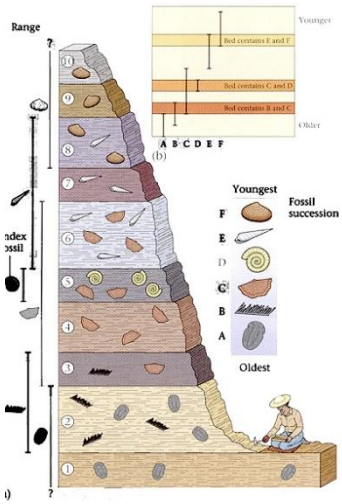
Chapter Three

Categories and ranks of stratigraphic units

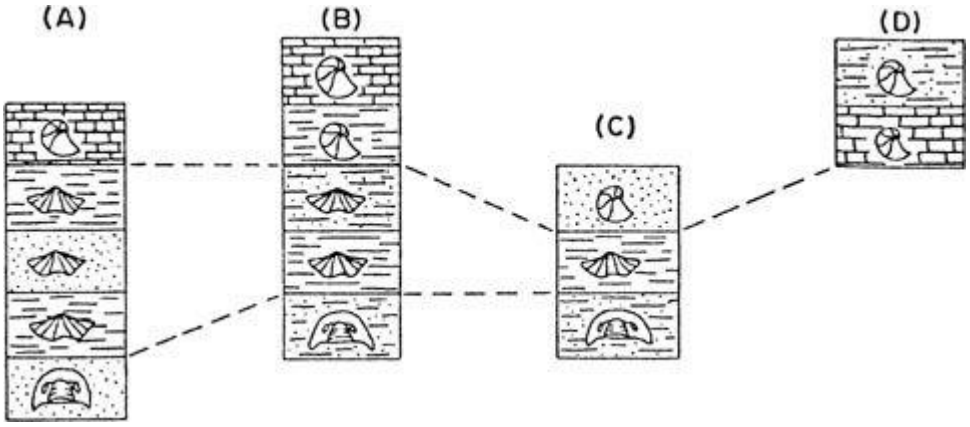
Biostratigraphy



Biostratigraphy: is the classification of bodies of rock or rock material into biostratigraphic units based on their contained fossils.

Good biostratigraphy requires:

- Common fossils
- Good taxonomy
- Accurate location of these fossils in carefully measured sections. This requires:
- The vertical changes in fossils can be noted at one place and convenient boundaries chosen.
- These changes and boundaries must be recognized at other places.



Kinds of Biostratigraphic Units (Fossil Zones)

Zones: are based on the vertical ranges of individual species or assemblages of species in section.

Biozone: is the fundamental biostratigraphic unit.

There are five specific kinds of biozones, these are:

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1- Range Biozone

2- Interval Biozone

3- Lineage Biozone

4- Assemblage Biozone

5- Abundance Biozone

Note// These five kinds of biozones are not hierarchically interrelated.

1- Range Zone (*taxon range zone)*

Range Biozone: is a body of rock representing the known stratigraphic and geographic range of occurrence of any selected element or elements of the chosen fossil taxon, or taxa, present in the rock record.

There are two kinds of range biozones:

A. **A taxon-range biozone**: is a body of rock representing the known stratigraphic and geographic range of a chosen taxon.
B. **A concurrent-range biozone**: is a body of rock including the concurrent, coincident, or overlapping part of the ranges of two specified taxa.

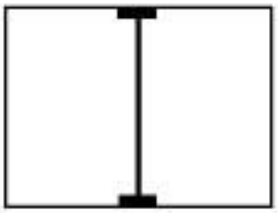
2- Interval Zone

An interval biozone: is a body of rock between two specified biostratigraphic surfaces (biohorizons).

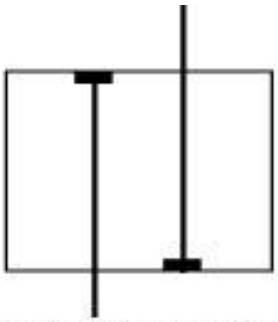
The features on which biohorizons are commonly based include lowest occurrences, highest occurrences, distinctive occurrences, or changes in the character of individual taxa (e.g., changes in the direction of coiling in foraminifera or in number of septa in corals).

3- Lineage Biozone

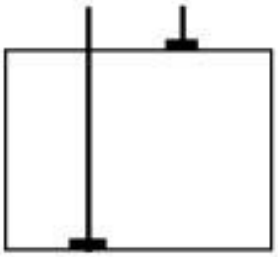
A lineage biozone is a body of rock containing species representing a specific segment of an evolutionary lineage.



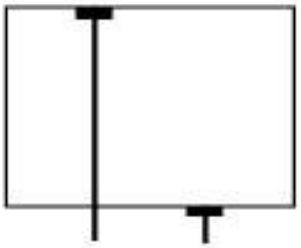
A.--Taxon-range Biozone (based on the range of a taxon).



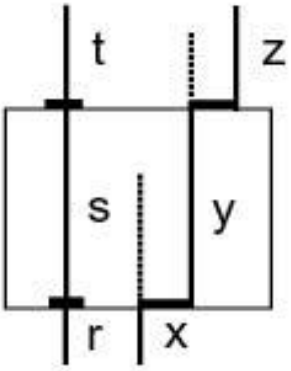
B.--Concurrent-range Biozone (based on range of concurrent occurrences of two taxa).



C.--Interval Biozone (based on lowest occurrences).

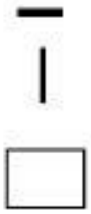


D.--Interval Biozone (based on highest occurrences).



E.--Lineage Biozone (based on successive species in a segment of an evolutionary lineage).

EXPLANATION



Lower and upper range of taxon

Vertical range of taxon

Biozone boundaries: lower, upper, lateral

r,s,t
x,y,z

Taxa

4- Assemblage Biozone

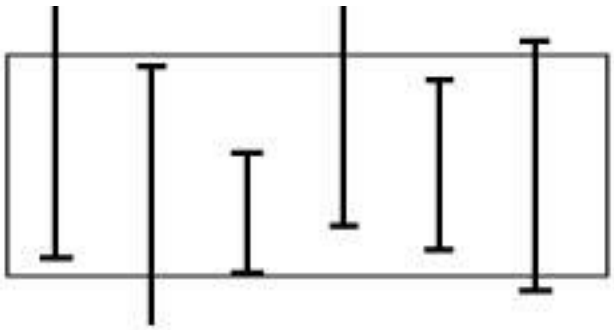
An assemblage biozone is a body of rock characterized by a unique association of three or more taxa, the association of which distinguishes it in biostratigraphic character from adjacent strata.

An assemblage biozone may be based on a single taxonomic group, for example, trilobites, or on more than one group, such as acritarchs and chitinozoans.

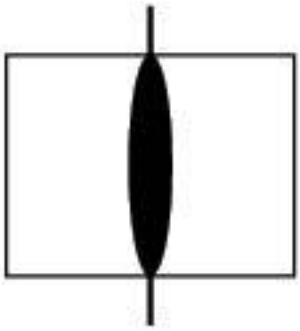
5- Abundance Biozone

An abundance biozone is a body of rock in which the abundance of a particular taxon or specified group of taxa is significantly greater than in adjacent parts of the section.

Abundance zones may be of limited, local utility because abundances of taxa in the geologic record are largely controlled by paleoecology, taphonomy, and diagenesis. The only unequivocal way to identify a particular abundance zone is to trace it laterally.



A.--Assemblage Biozone (based on the overlapping ranges of an assemblage of co-occurring taxa).

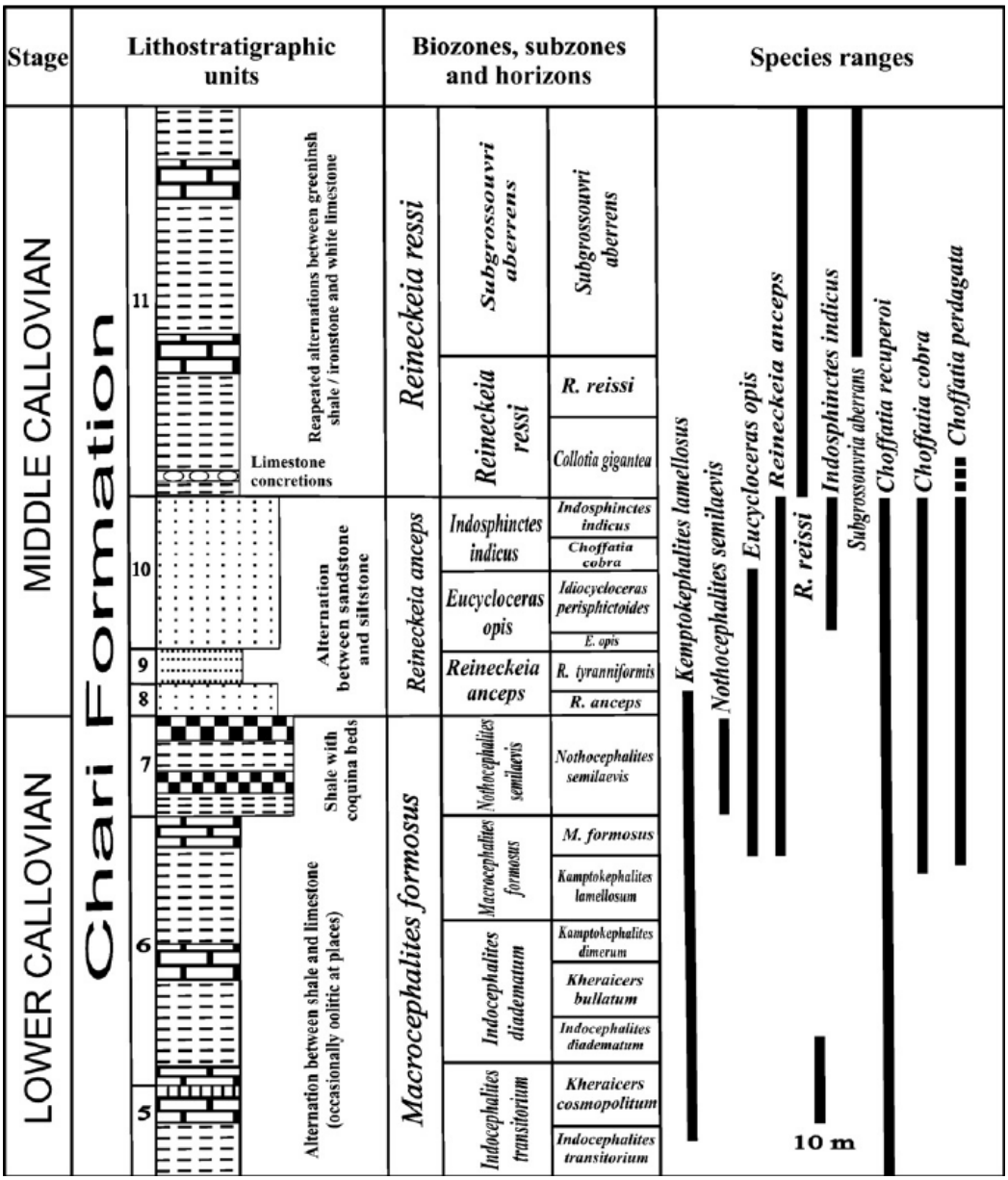


B.--Abundance Biozone (thickened line denotes range of increased abundance of the taxon).

Boundaries (Biohorizones)

The boundaries of a biozone are drawn at surfaces that mark the lowest occurrence, highest occurrence, limit, increase in abundance, or decrease in abundance of one or more components of the fauna or flora.

Note// the base or top of one kind of biozone may not, or need not, coincide with the base or top of another kind of biozone.



STRATIGRAPHIC COLUMN OF JUMARA SECTION ILLUSTRATING BIOSTRATIGRAPHY AND VERTICAL DISTRIBUTION OF CHOFFATIA AND OTHER IMPORTANT AMMONITE TAXA. BIOZONATION IS MODIFIED AFTER JANA ET AL. (2000, 2005)

Name of Biozone

The name of a biozone consists of the name of one or more distinctive taxa or parataxa (for trace fossils) found in the biozone, followed by the word ‘‘Biozone.’’

(e.g., Turborotalia cerrozaulensis Biozone or Cyrtograptus lundgreni-Testograptus testis Biozone).

The name of the species whose lowest occurrence defines the base of the zone is the most common choice for the biozone name.

Note// names of the nominate taxa, and hence the names of the biozones, conform to the rules of the international codes of zoological or botanical nomenclature or, in the case of trace fossils, internationally accepted standard practice.

Good Zone Fossils

Any fossil group can be used for zoning. But since the aim is to recognize the smallest time intervals over the widest area, zone fossils should ideally have the following characteristics:

1- A relatively wide paleogeographic range, usually marking wide ecological tolerances.

2- Limited vertical time range of species.

3- Easily recognized changes of taxonomic features on the skeleton.

4- Floating, swimming, or flying forms.

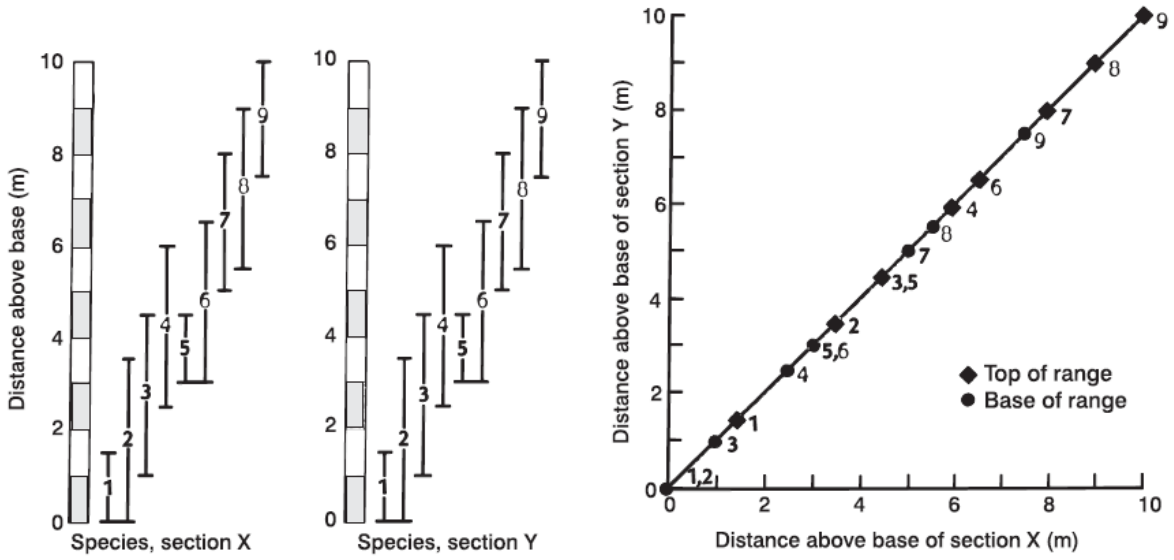
5- Capable to being preserved.

6- Relatively abundant.

Graphic correlation with fossils

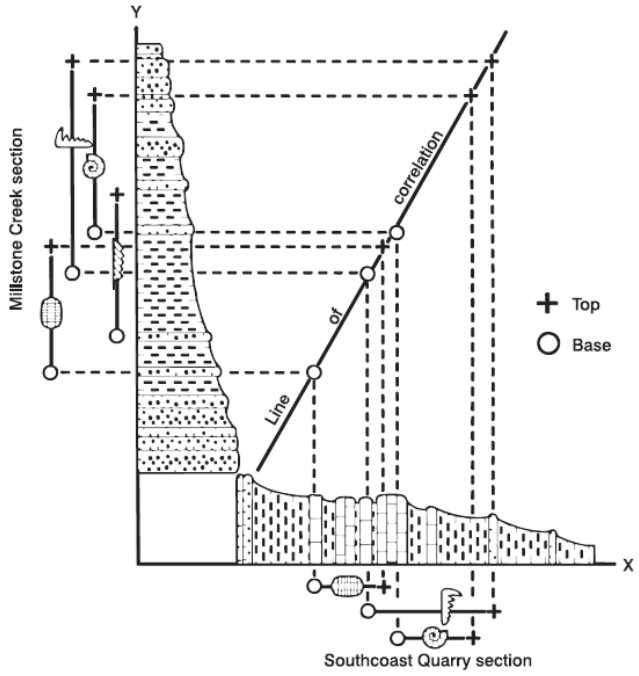
Alan Shaw’s (1964) methods

Perfect 45˚correlation line: - If the two sections have the same rang of fossil species - the section must have accumulated at the same rate.



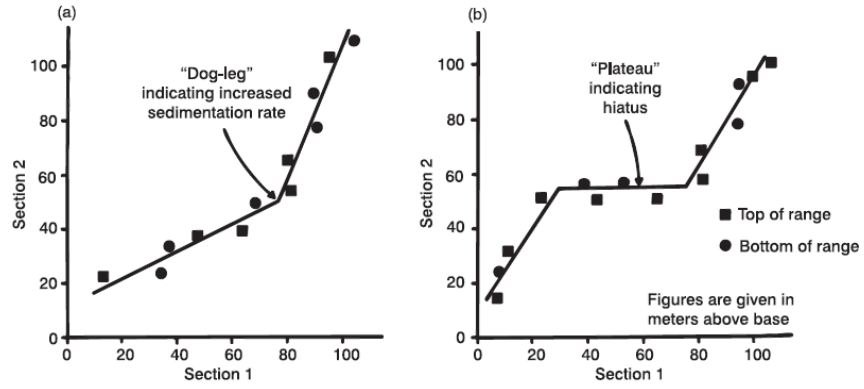
BASE AND TOPS OF RANGES PLOTON A STRIGHT LINE AT 45° CORRELATION IN TWO IDENTICAL SECTIONS (PROTHERO, 1990 IN BROOKFILED, 2004)

Gentler or steeper correlation lines show that: - Constant accumulation rates but different in the two sections. - allow evaluation if relative rates of sedimentation for the sections.



RANGE PLOTS FOR TWO SECTIONS WITH CONSTANT BUT DIFFERENT SEDIMENTATION RATES (PIERCE, 1995 IN BOOKFIELD, 2004).

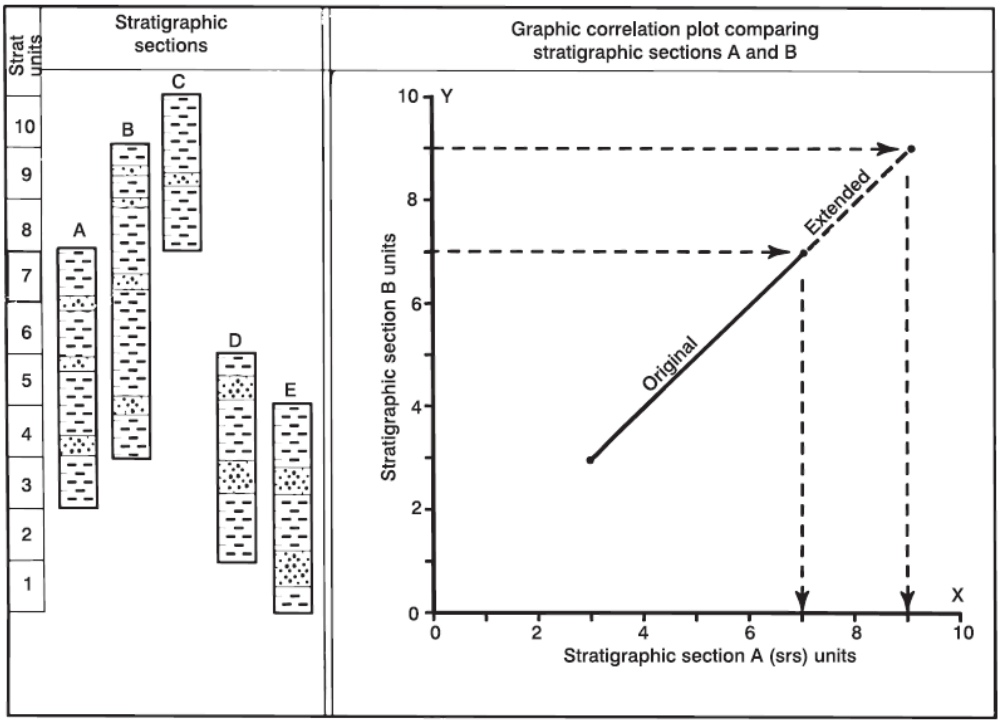
Dog- leg: indicates: - A change in relative accumulation rates. - A flat section indicates no accumulation (or erosion) in one section, and a diastem or unconformity.



(A) CHANGE IN SEDIMNTATION RATE AND (B) DIASTEM OR UNCONFORMITY IN ONE SECTION (DOYLE, 1996 IN BROOKFIELD, 2004).

Composite Standard Section

A synthesis of many sections



COMPOSITE STANDARD SECTION (CARNEY AND PIERCE, 1995 IN BROOKFIELD, 2004).

References

This lecture is based on the following references:

Brookfield, M.F.,2004. Principles of Stratigraphy. Blackwell Publishing, 340P.

North American Stratigraphic Code. , 2005. AAPG Bulletin, v. 89, no. 11, pp. 1547–1591.