

GLY 102

# Introduction to Geology II

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## **Course Description**

This Course makes use of the principles and techniques of geology to reconstruct and understand the geological history of Earth. It focuses on evolution of organism , their distribution, classification, occurrence and uses as fossil for relative dating of rocks.

The course also explains the use of stratigraphy, structural geology and paleontology to tell the sequence of rock formation and the timing of other events observed on rocks during different time periods in the geological timescale. Account of historical geologists will also be thought.

## **Learning Objectives**

By the end of this Course and after answering tutorial questions and assignments, students should be able to understand:

- The historical development of the field of geology
- The development of the basic geologic principles employed by historical geologists.
- The evolution of the geologic time scale
- The history of the Earth from its inception to the present

# Course Contents

WEEK	TOPIC
1	Theory of Evolution of Organism
2	Theory of Evolution of Organism
3	Distribution and Classification of Major Fossil Groups
4	Distribution and Classification of Major Fossil Groups
5	Uses of Fossil
6	Principles of Historical Geology -Earth's History
7	Global Dating of the Rock Record
8	First Continuous Assessment
9	Global Dating of the Rock Record
10	Unconformity
11	The Founders of Historical Geology
12	Second Continuous Assessment
13	Water Cycle/Hydrologic Cycle
14	Water Cycle/Hydrologic Cycle
15	Revision
16	Examination
17	Examination

## Additional Textbooks

- Understanding Earth Sixth Edition Edition by John Grotzinger (Author), Thomas H. Jordan
- Principles of Geology: (Classic Reprint) Paperback – June 15, 2012 by Charles Lyell.
- System History - Text 3RD EDITION by Steven M. Stanley. W.H. Freeman, 2009

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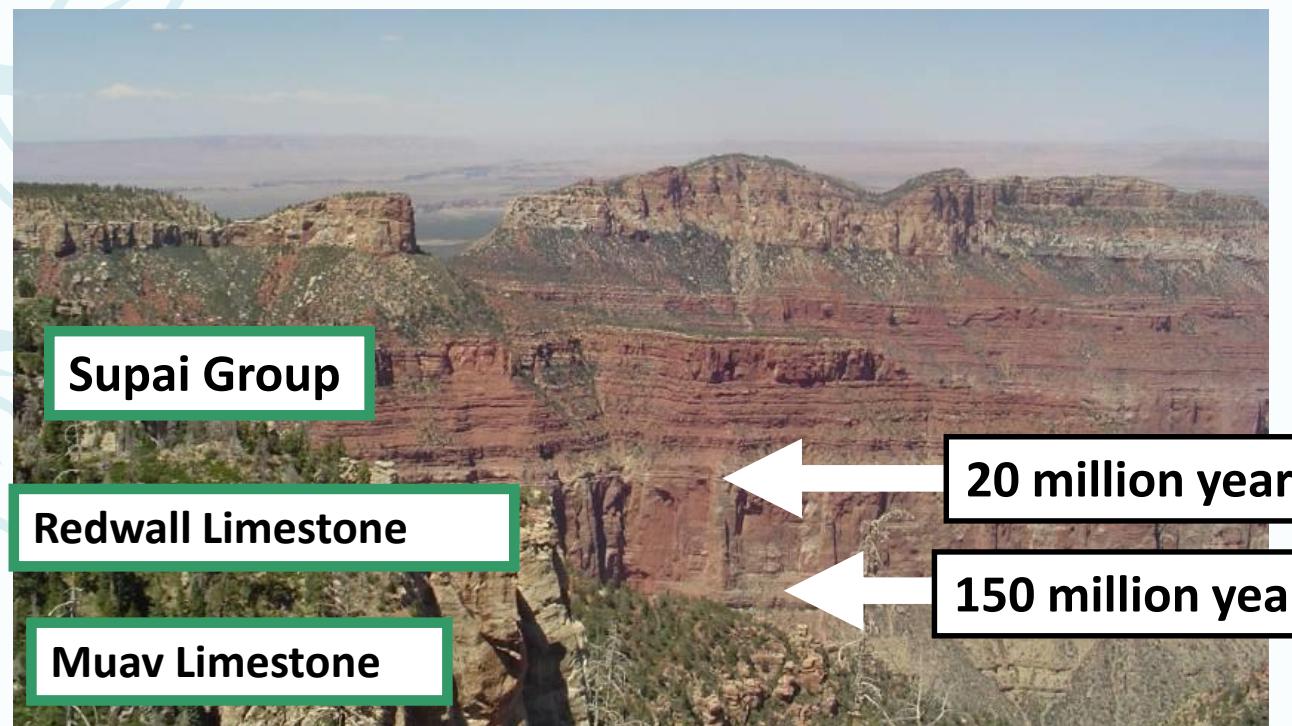
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# UNCONFORMITY

## Disconformity

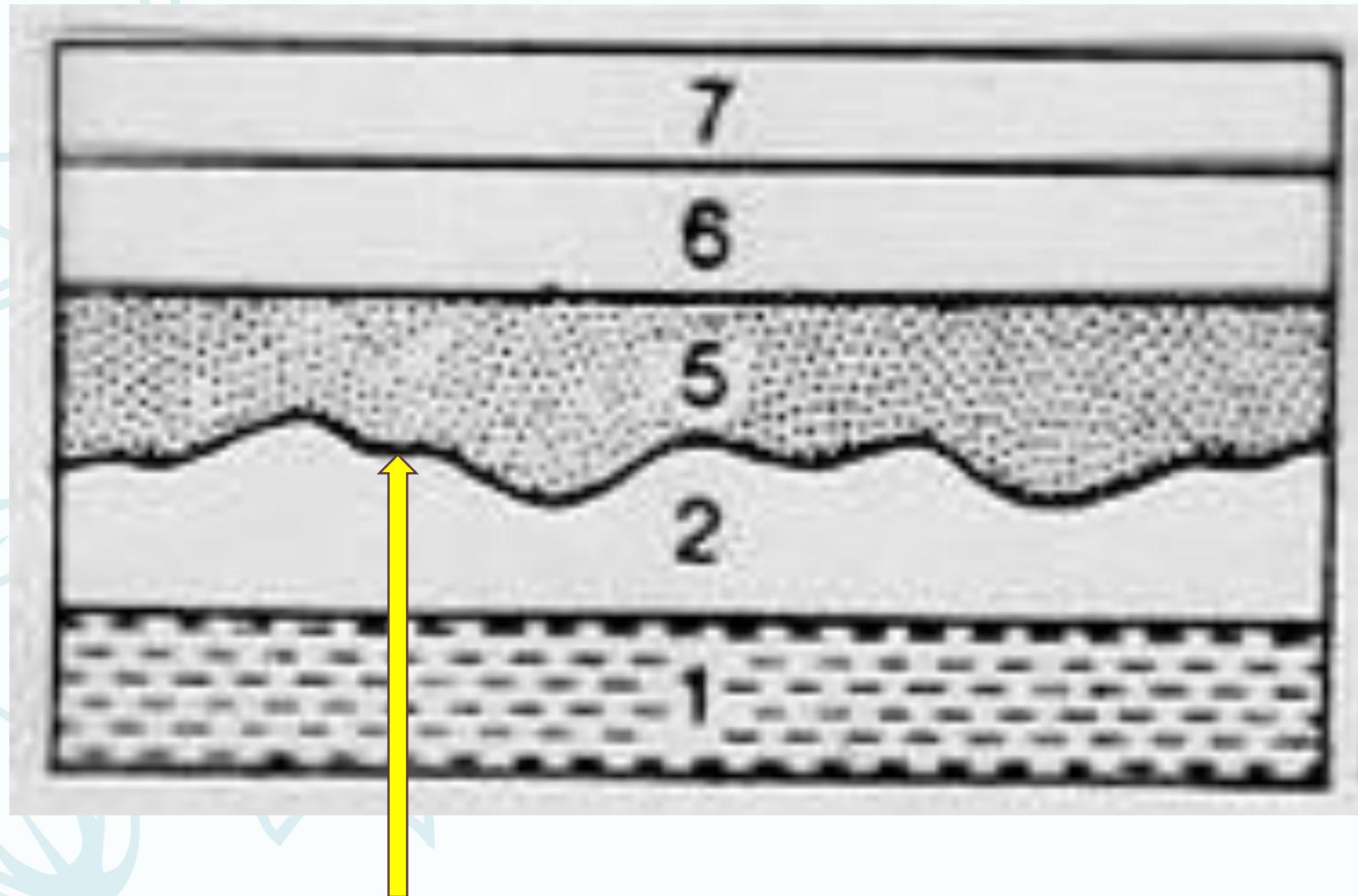
Rocks in a nearly horizontal fashion were eroded and an erosional profile remains covered by subsequent sedimentary deposition. Shows that there was a period of erosion and then renewed deposition in nearly horizontal layers. Most difficult to recognize because the units are nearly horizontal and only a small discontinuous layer can be observed (rubble zone or soil profile).



# UNCONFORMITY

## Disconformity

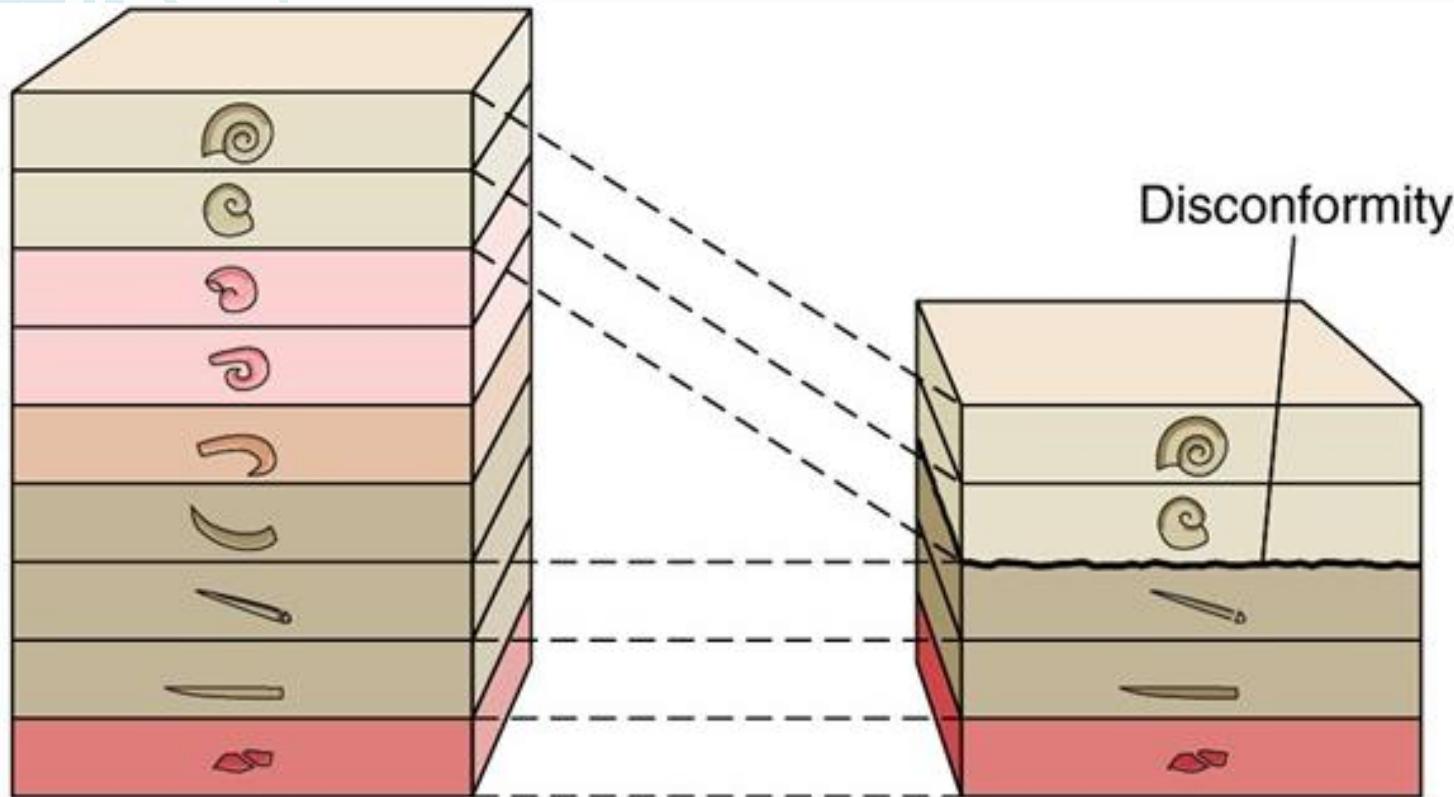
Sediments on sediments (same orientation) with obvious erosion



# UNCONFORMITY

## Disconformity

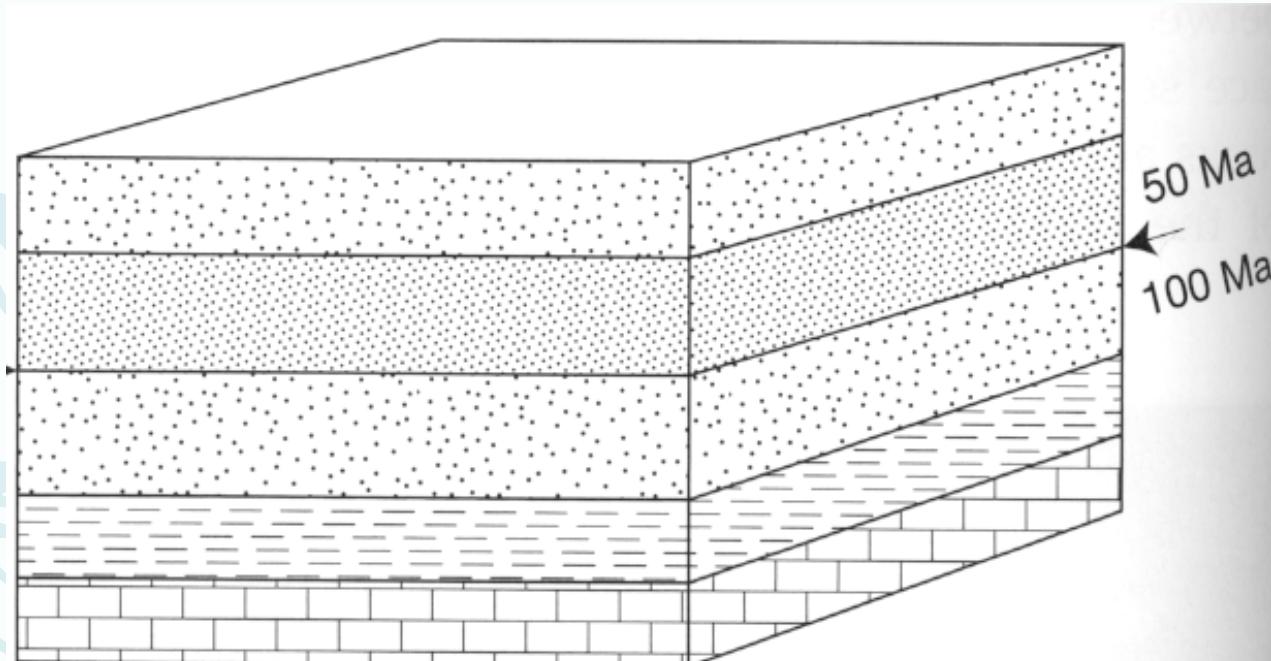
Strata below and above the unconformity are parallel but marked by a visible, irregular or bumpy *erosional surface*. The erosional surface makes disconformity easy to recognize than paraconformity.



# UNCONFORMITY

## Paraconformity

A paraconformity is a hidden unconformity where the beds below and above the unconformity are parallel and no erosional contact or other physical evidence is obvious. The contact is indistinguishable from typical bedding plane. Common identification methods are (1) abrupt faunal changes or absence of faunal zones; (2) missing strata



(Boggs, p. 456)

# UNCONFORMITY

## Angular Unconformity

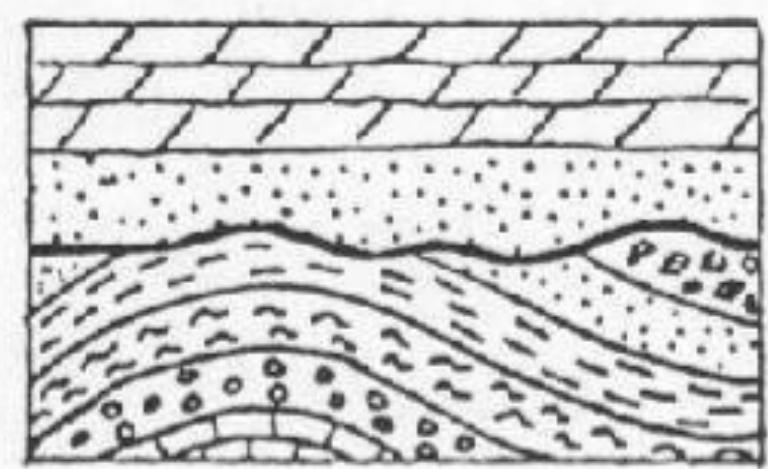
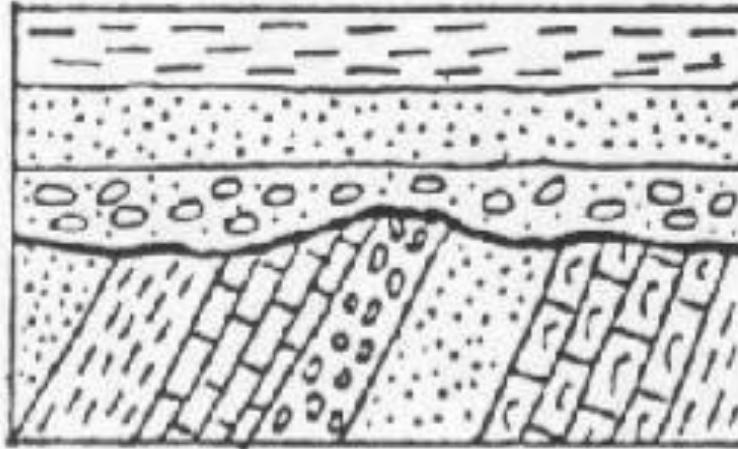
Rocks above and below unconformity have different orientations. Shows that there was a period of deformation, followed by erosion, and then renewed deposition. Easiest of the three types to recognize because the units are at an angle truncated with the units above them.



# UNCONFORMITY

## Angular Unconformity

This is sediments on sediments with different orientations



# UNCONFORMITY

## Angular Unconformity



# UNCONFORMITY

## Nonconformity

This is when sediments overlay a crystalline igneous or metamorphic rock.

### Uplift, Erosion, Deposition

Erosional Surface

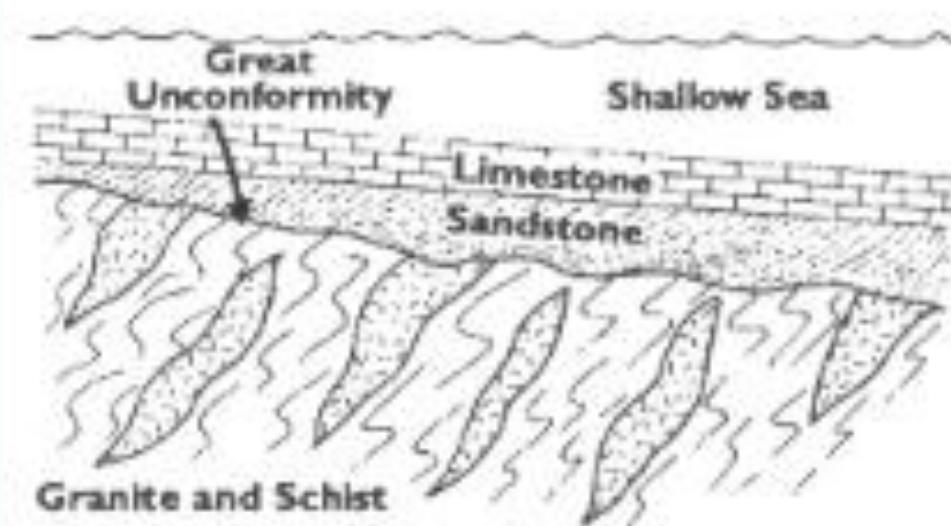


Great  
Unconformity

Shallow Sea

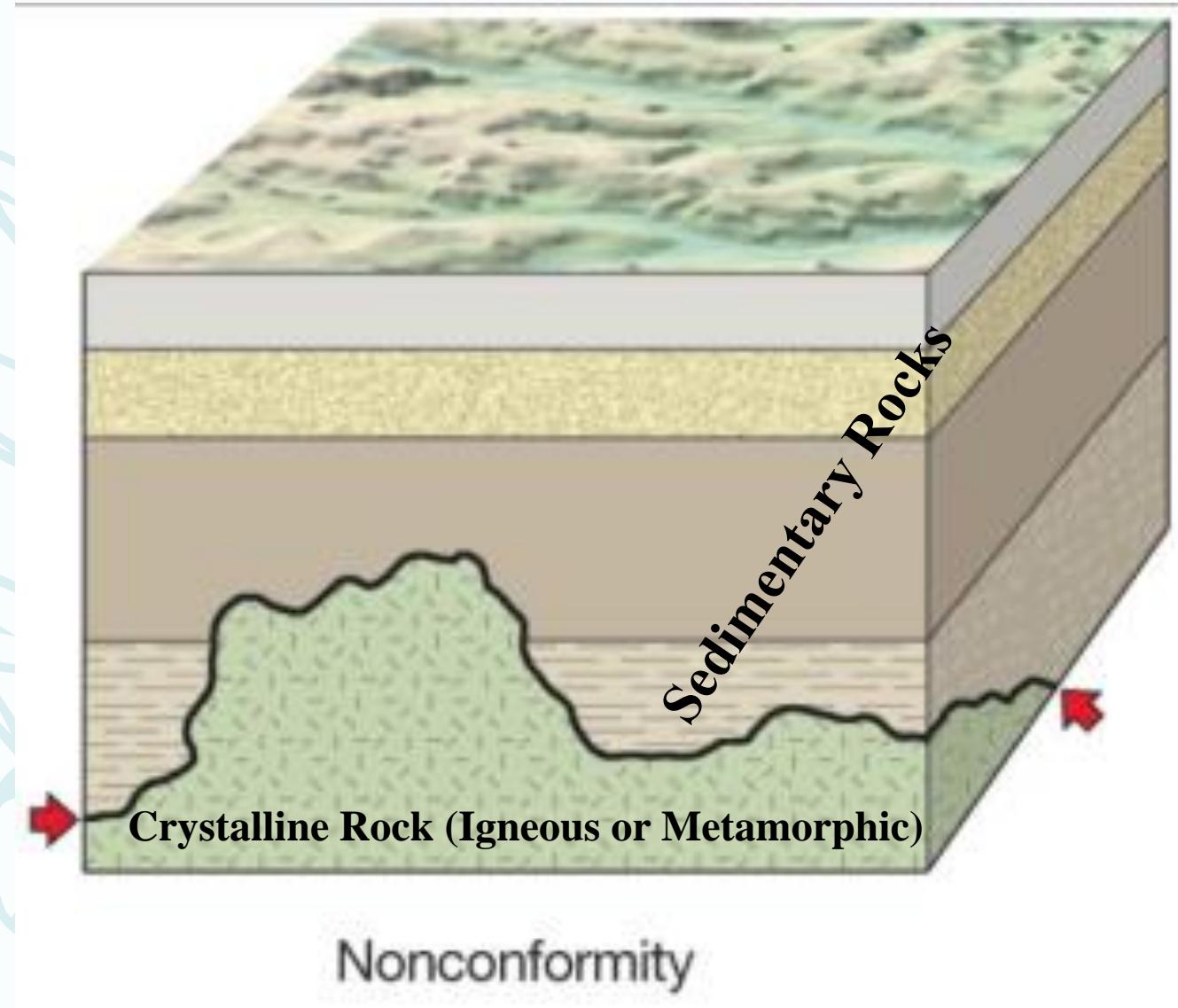
Limestone  
Sandstone

Granite and Schist

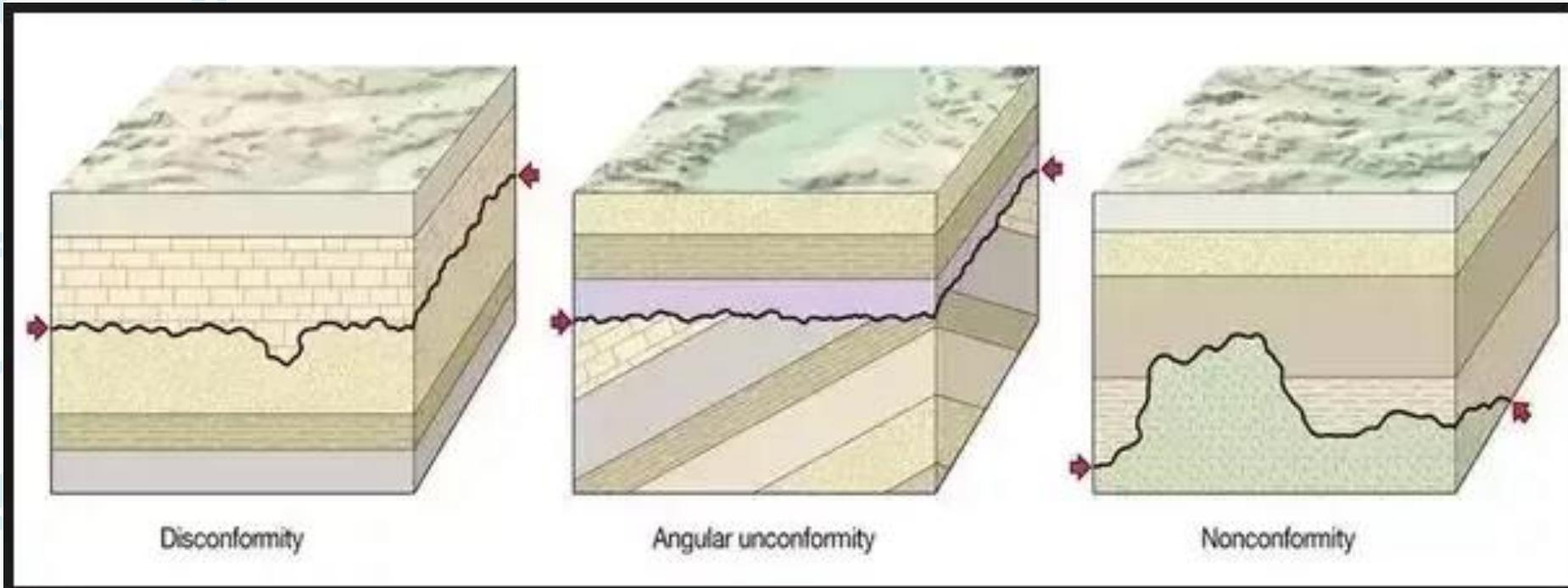


# UNCONFORMITY

## Nonconformity



# UNCONFORMITIES



# UNCONFORMITIES

## Criteria for Identification

1. Stratigraphic Evidence
  - Seismic reflection terminations (onlap, toplap or truncation)
  - Bed truncation observed in detailed well log cross sections
  - Missing biostratigraphic horizons
  - Missing facies in a sequence i.e. abrupt change from fluvial facies to marine facies
  - Evidence of widespread channeling of platforms or shelves
  - Abrupt vertical geochemical changes such as stable isotopes
2. Individual Well Evidence
  - Dipmeter changes
  - GR log changes in response to increased uranium concentration at exposure surfaces
  - Vertical breaks in thermal maturity profiles (i.e. abrupt vertical change in vitrinite reflection values)
  - Changes in lithology as seen in cores that indicate subaerial exposure or nondeposition, as evidenced by the following:
    - Paleosols and weathered horizons

# UNCONFORMITIES

## Criteria for Identification – cont'd

- Hematitic grain coatings or dissolution textures unrelated to burial diagenesis
- Clam-bored hardgrounds such as Toredo borings
- Thin lag deposits of bone, phosphate or shell hash
- Fluid inclusion evidence for atmospheric gases (e.g. argon, helium)

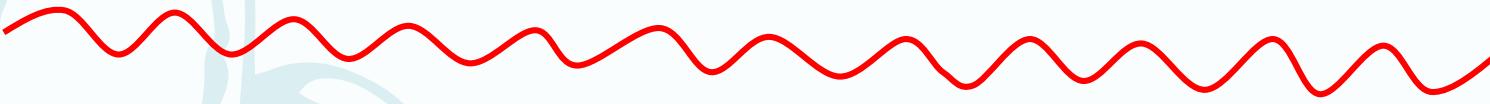
### 3. Outcrop Evidence

- Regional changes in bed orientation (dips) above and below a given stratigraphic contact
- Obvious evidence of erosion mappable across several kms on an outcrop
- Layered sedimentary rocks on deformed basement rocks

*Adapted from AAPG Treatise of Petroleum Geology, Exploring for Oil and Gas Traps.*

# UNCONFORMITIES

## Representation



## Depositional Sequence

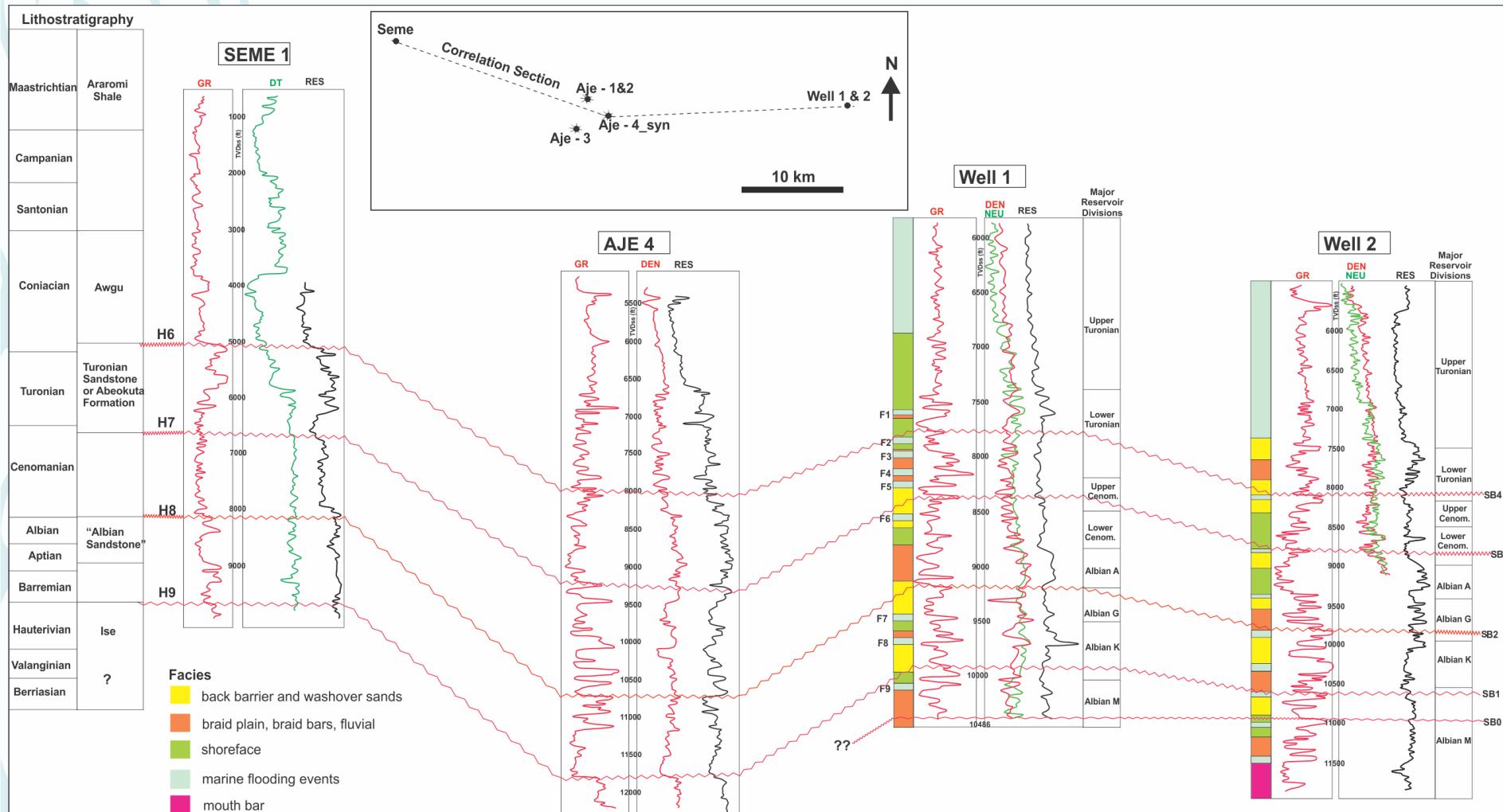


## Depositional Sequence



# UNCONFORMITIES

## Correlation Surfaces



Correlation using unconformities in the Dahomey Basin (Jonathan et al., 2017)

# UNCONFORMITIES

## Stratigraphic Traps

