Bedding Uncomformities

Bedding or stratification

- Stratigraphy studies bedded rocks
- Sedimentary, metasedimentary metamorphic rocks and volcanoclastic rocks
- The Bed is the basic unit of bedding
- Each Bed a homogenous body differentiating from the others in terms of composition, texture (size, shape, sorting, arrangement of grains) , colour, hardness, diagenesis, structure
- **Stratification** (= layering or **bedding**) is the most obvious feature of sedimentary rocks. The layers (or beds or strata) are visible because of differences in the color, texture, or composition of adjacent beds.

Bed (stratum)

- Confined between two contacts, bedding planes, bed floor and bed roof
- Contacts sharp or gradual
- Based on their thickness strata separated into Beds (>1cm) and Laminae (<1cm)

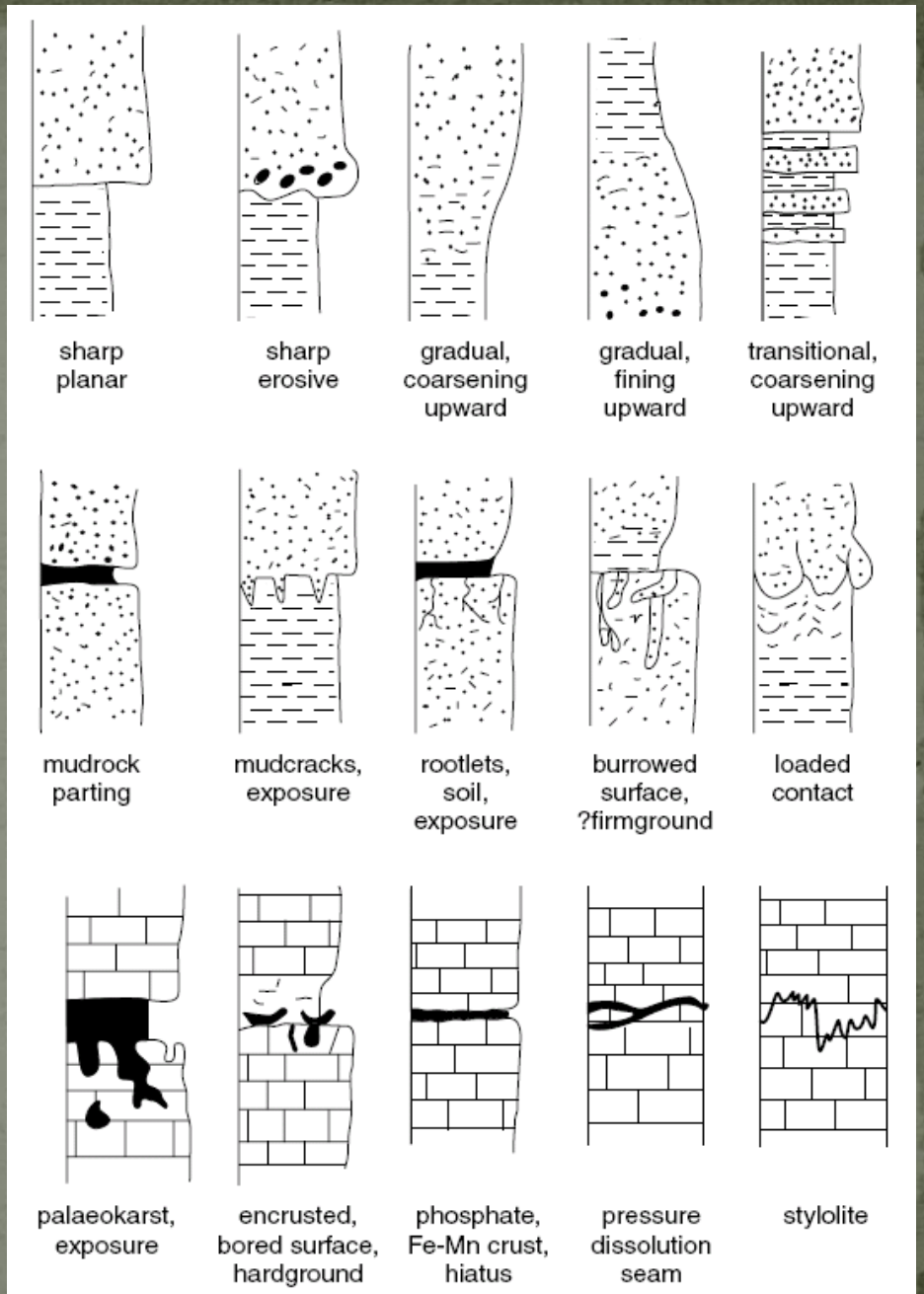
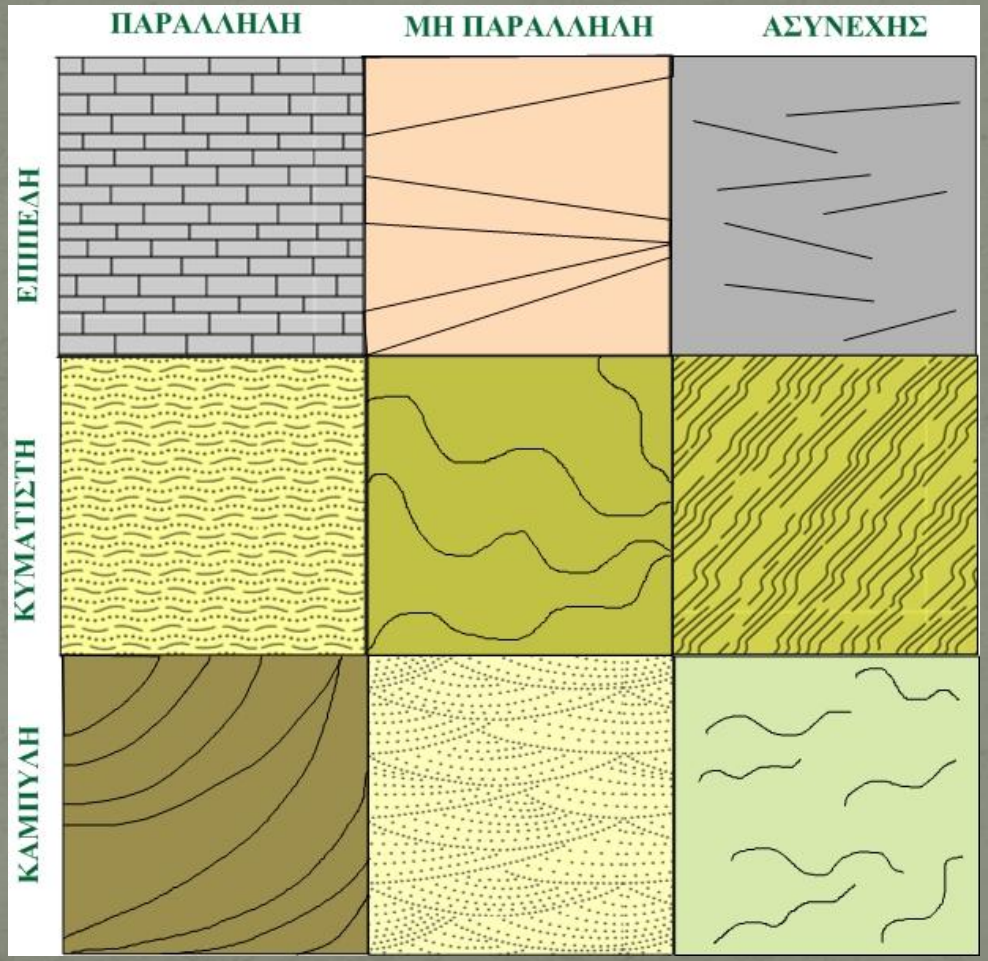


Figure 5.5 *Bedding planes and bed contacts: the range of possibilities.*

Strata

	type	thickness
Beds	Very thick bedded	>100 cm
	Thick bedded	30-100 cm
	Medium bedded	10-30 cm
	Thin bedded	3-10 cm
	Very thin bedded	1-3 cm
Laminae	laminated	0,3-1 cm
	Thinly laminated	<0,3 cm

Types of bedding



Διαφορετικοί τύποι στρώσης

Kinds of bedding

- Graded Bedding
- Annual Bedding
- Cyclic Bedding or Cyclothem
- Parallel Bedding
- Cross-bedding or cross-stratification
- Compact Bedding

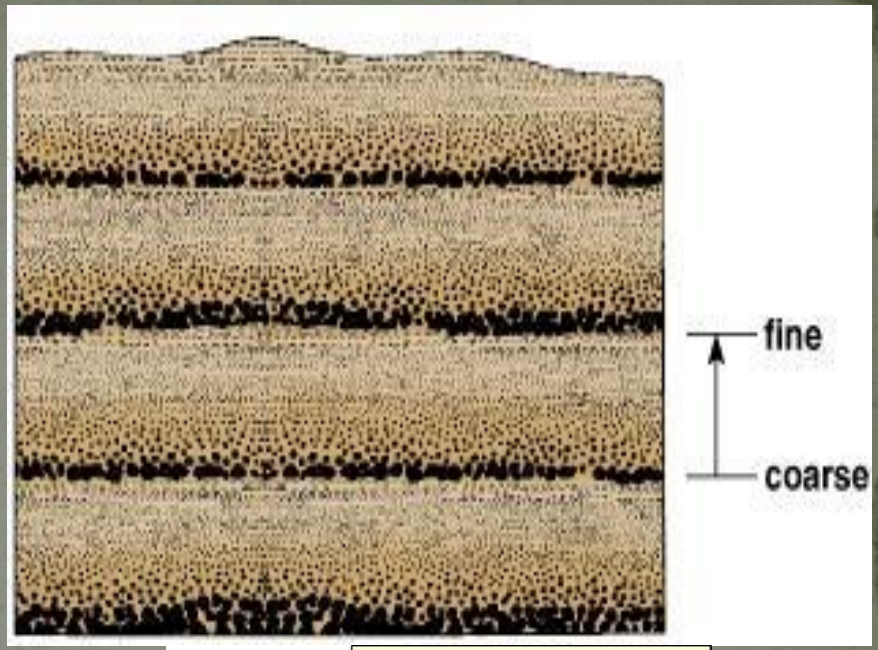
Graded Bedding

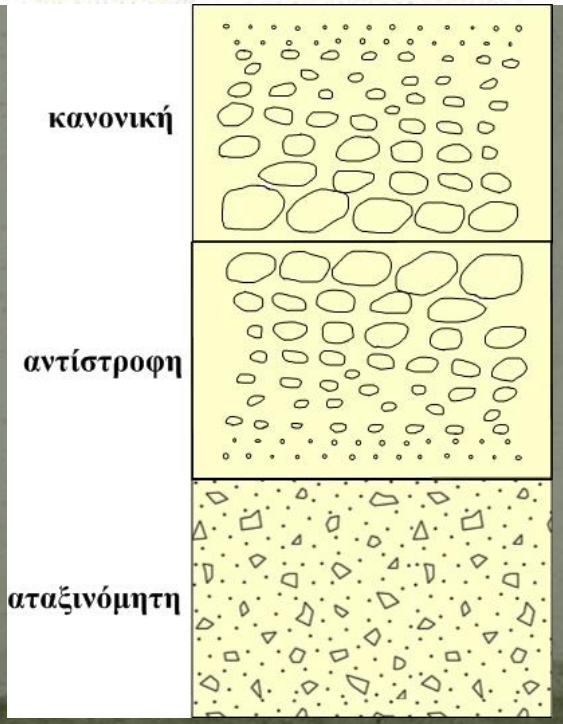
- The grain size in a graded bed is coarser at the bottom and finer at the top.
- Graded bedding results when a sediment-laden current (such as a turbidity current) begins to slow down.
- Three types:

  Normal grain sorting (gradual decrease in energy)

  Normal grain sorting with fine grains scattered throughout the mass (e.g. Turbidites)

  Reverse grain sorting (gradual increase in energy)





Annual Bedding

- Annually recurring and rhythmic bedding
- Alternating coarse-grained – fine-grained sediments
- Each pair corresponds to one year
- Coarse-grained and usually dark-colored - winter deposits
- Fine-grained and usually light-colored - summer deposits

Cyclic Bedding or Cyclothem

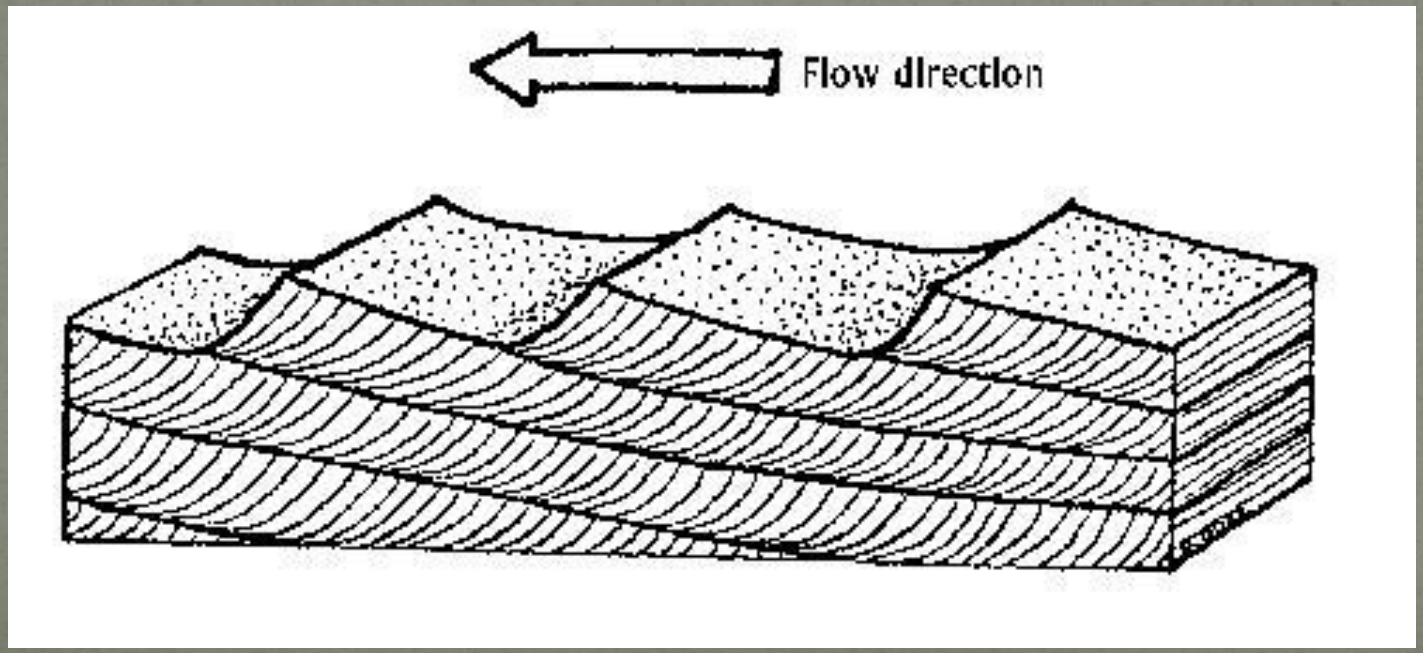
Large-scale repeating bedding with the same bed sequences

Parallel Bedding

- Rhythmic bedding with laminal parallel beds
- Formation in a calm environment Rhythmic or seasonal conditions of feeding, flow,
- Rhythmites

Cross-bedding or cross-stratification

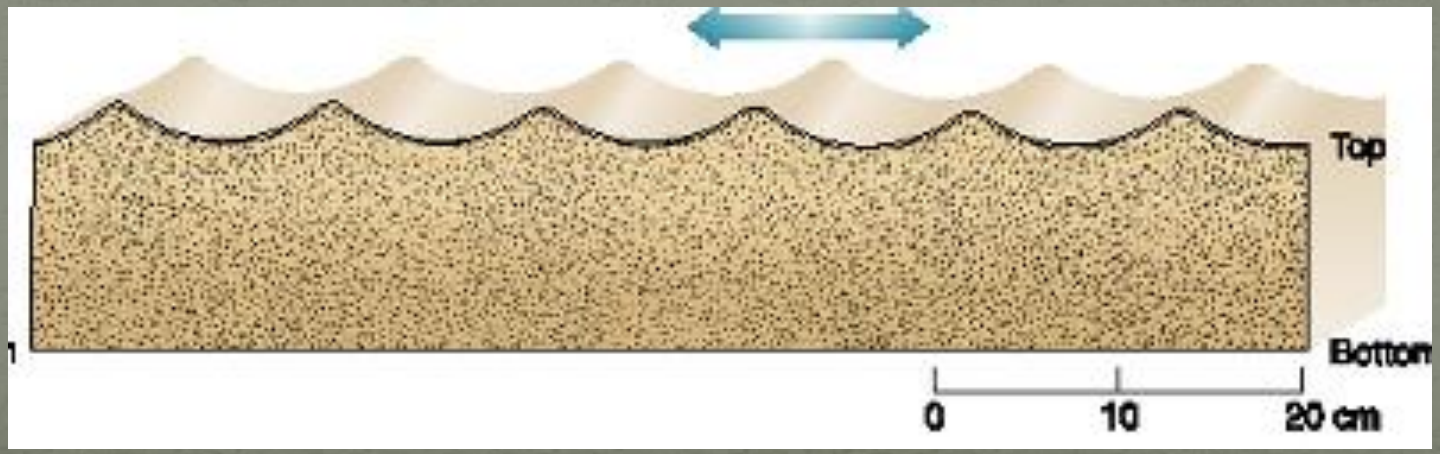
An arrangement of beds or laminations in which one set of layers is inclined relative to the others.



Ripple marks

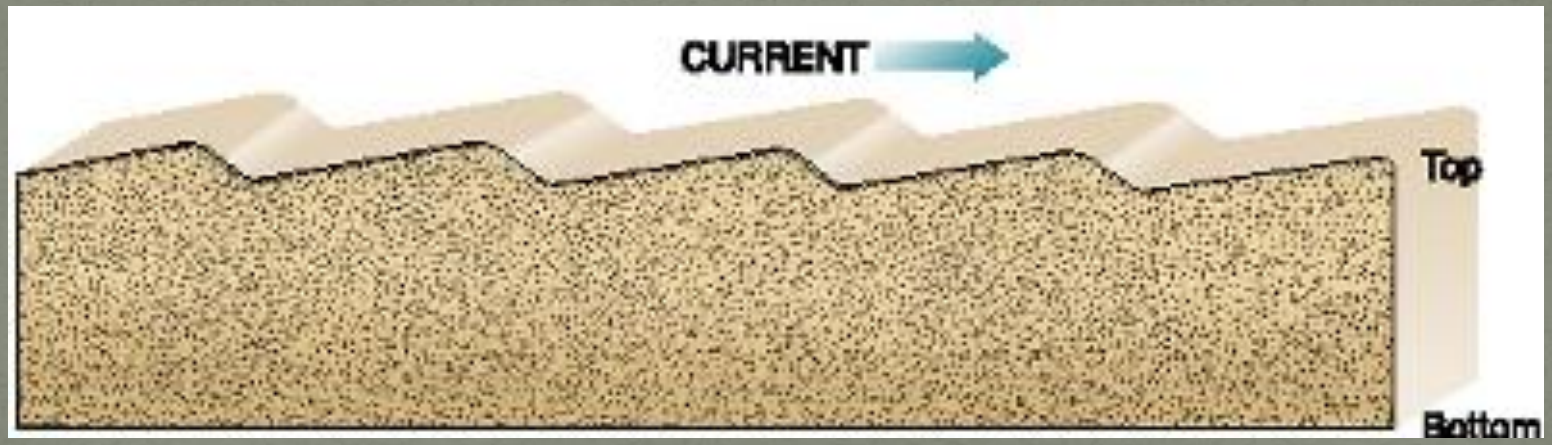
Undulations of the sediment surface produced as wind or water moves across sand.

- **Symmetric ripple marks** are produced by waves

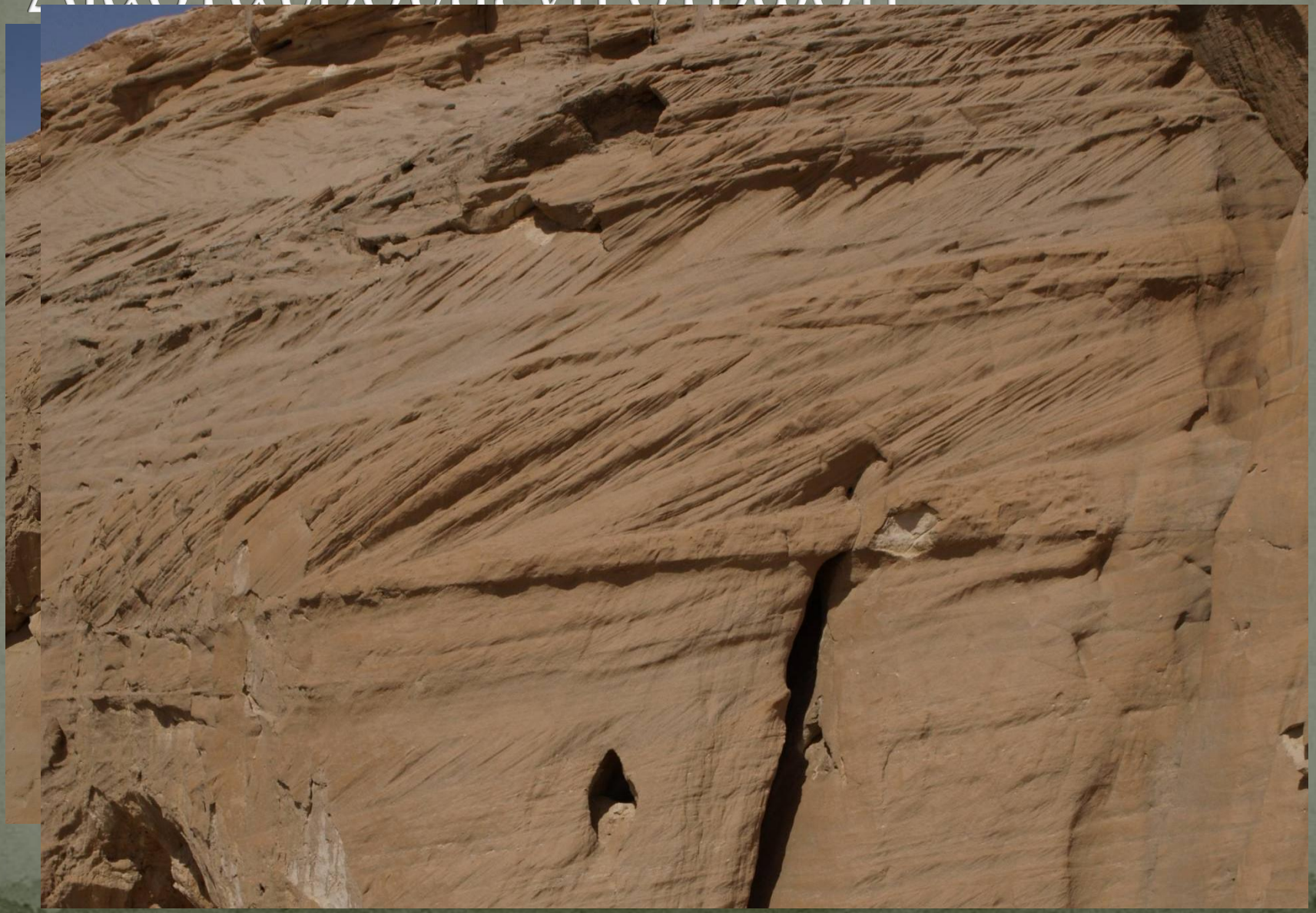


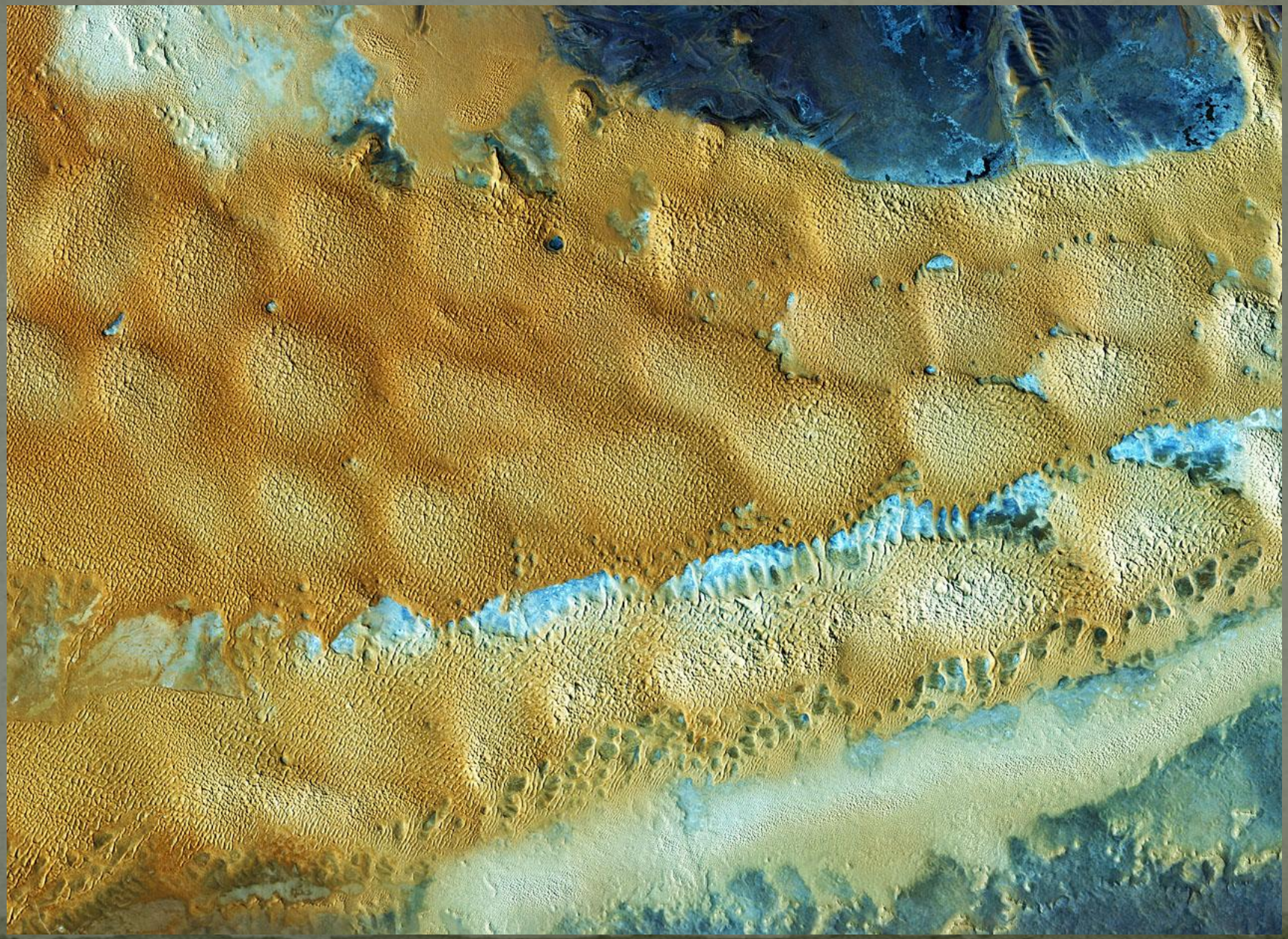
Ripple marks

Asymmetric ripples form in unidirectional currents (such as in streams or rivers).

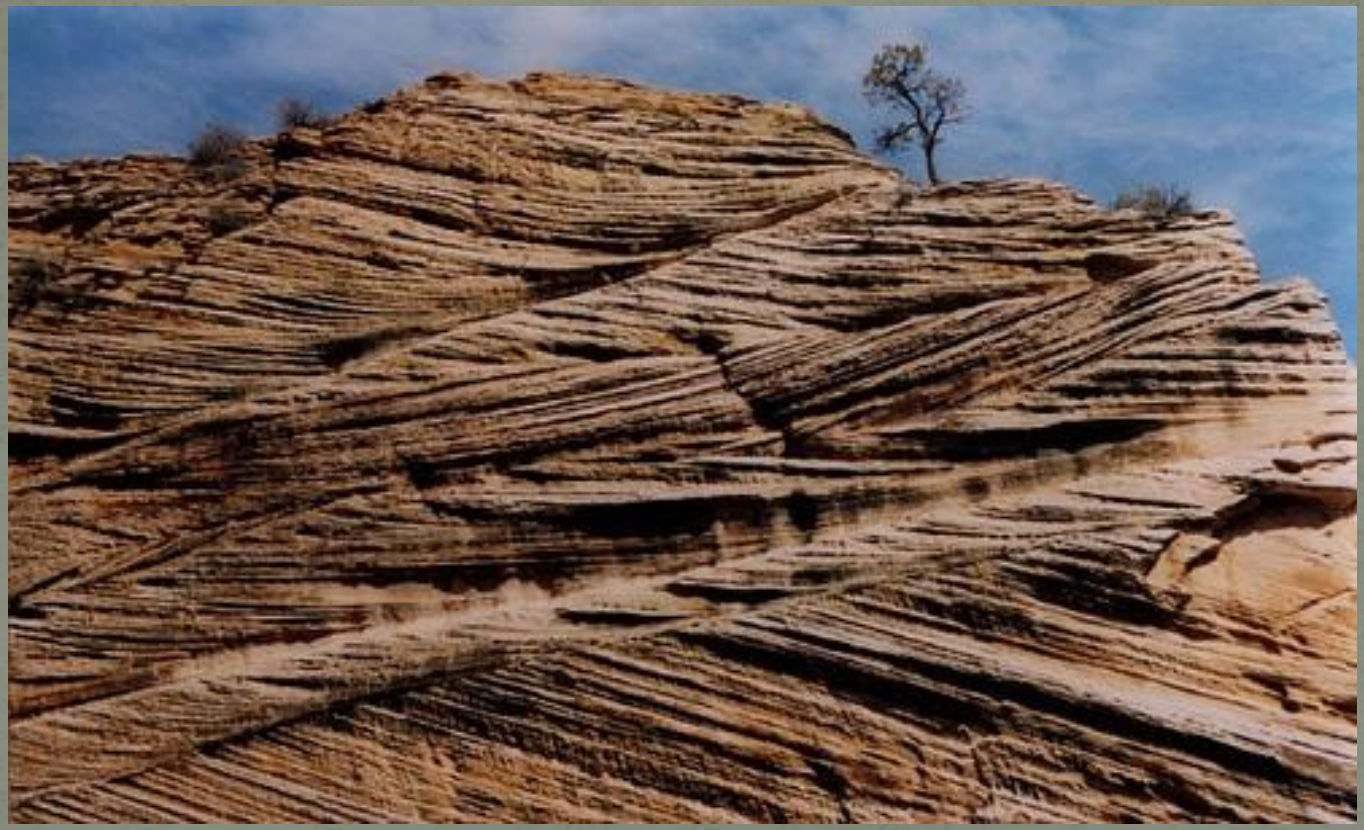


Διασταυρούμενη στρώση





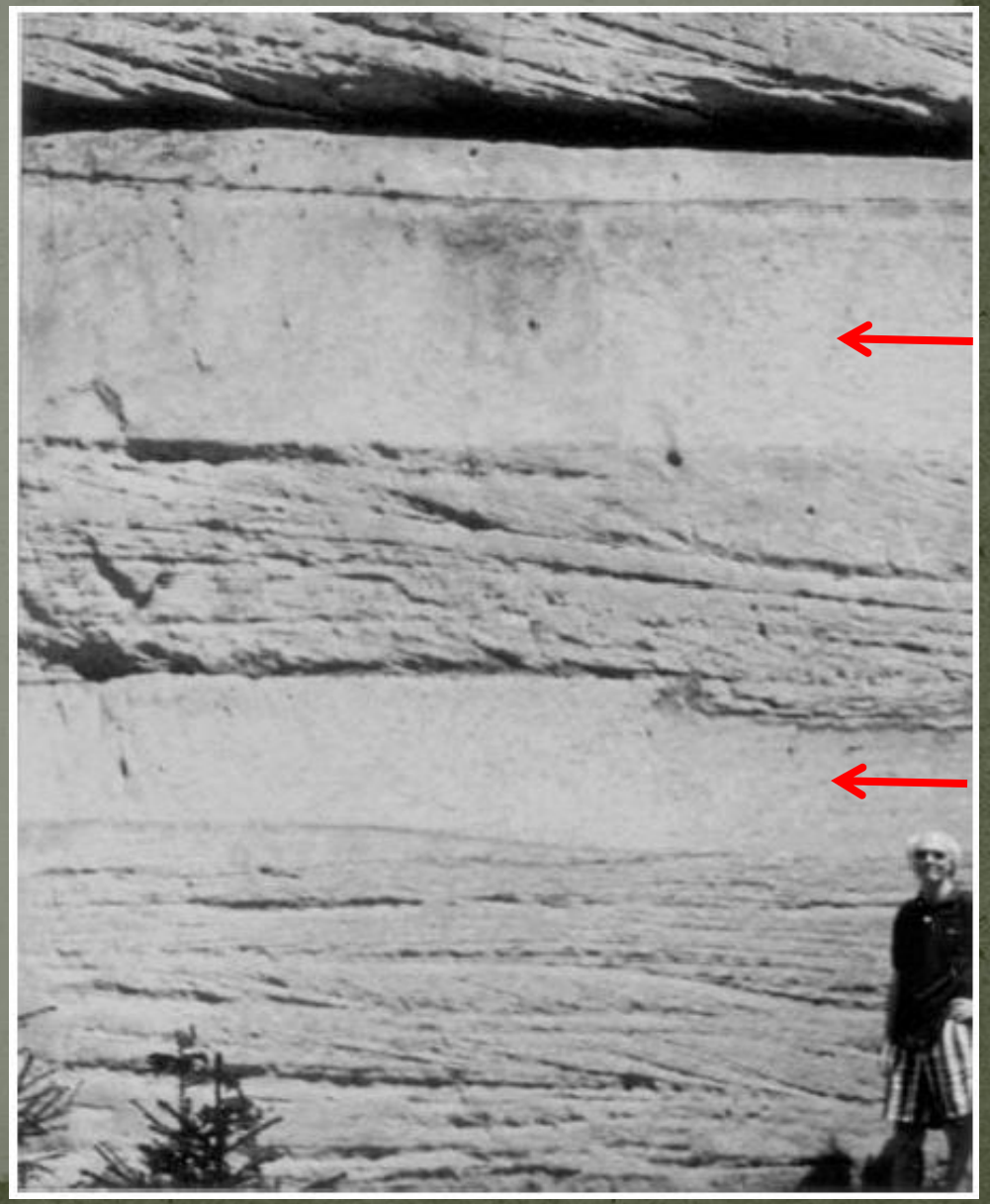
Διασταυρούμενη στρώση 2



Διασταυρούμενη στρώση στο Navajo sandstone

Compact Bedding

- Bedding without internal structure
- Due to rapid deposition of fine-grained materials in a calm environment
- Due to recrystallization
- Due to bioturbation



Criteria of superimposition

What happens when we do not have an undisturbed sequence but modified, even inverted, layers?

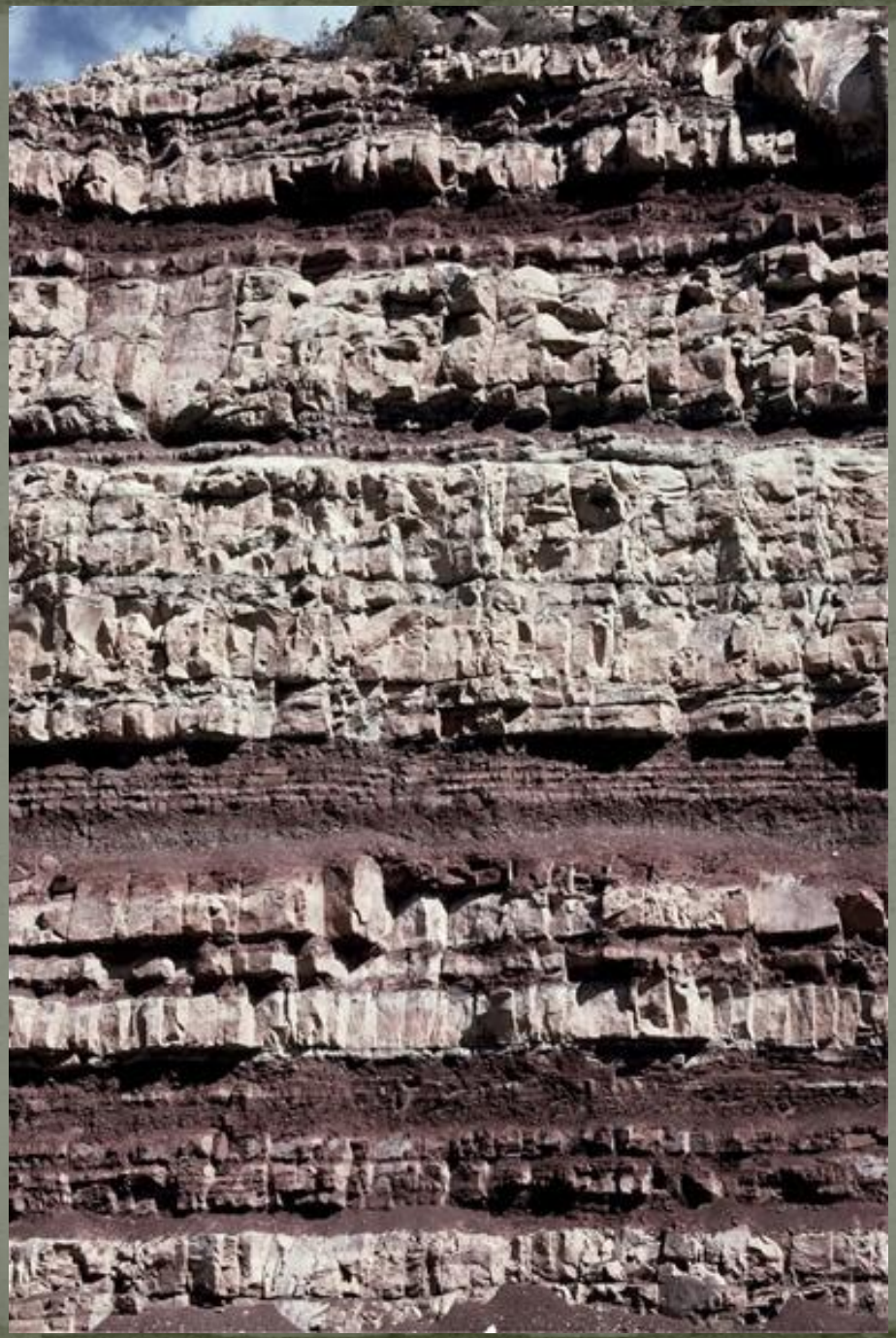
Using criteria to find the correct position of layers

- Stratigraphic
- Tectonic

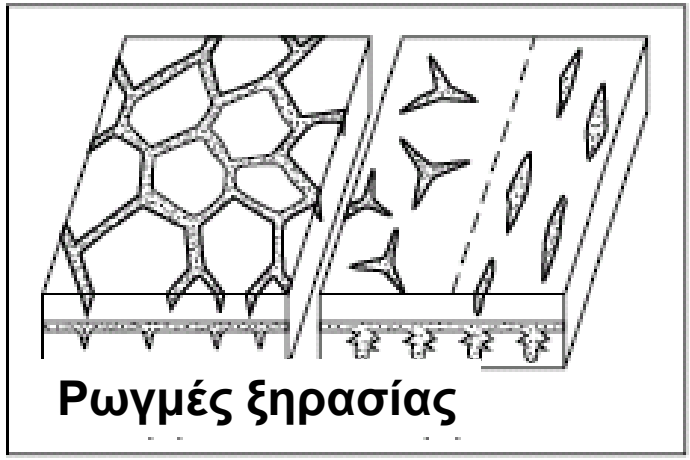
Stratigraphic Criteria

1. Local sequence
2. Graded bedding
3. Cross-bedding
4. Discontinuity
5. Fossils
6. Small stratigraphic structures

1. Trace fossils, 2. Dessication cracks,
3. Ripple marks, 4. Graded bedding



Ιχνοαπολιθώματα



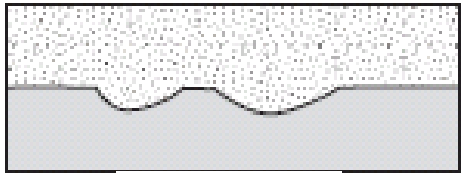
Ρωγμές ξηρασίας

Γεωειδή σε απολιθώματα

Διασταυρούμενη στρώση

Ρωγμές ξηρασίας

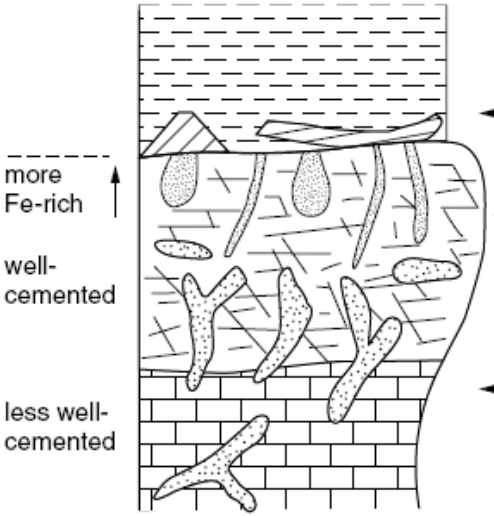
Κυρτά κελύφη



Γεώδη κελυφών

Ιχνοαπολιθώματα

Ίχνη κίνησης



Απ

Ασυνέχειες

Stratigraphic section

- The graphical representation of lithological, and structural components such as thickness, fossil content, of a certain sequence in a certain position
- Basic element and foundation of any geological study
- Data collected from:

1. Natural sections
2. Artificial sections
3. Drillings
4. Geophysical tomographies

Artificial section

Drillings


0.00m
1.00m
2.00m
3.00m
4.00m
5.00m
6.00m
7.00m
8.00m
9.00m
10.00m
11.00m
12.00m
13.00m
14.00m
15.00m
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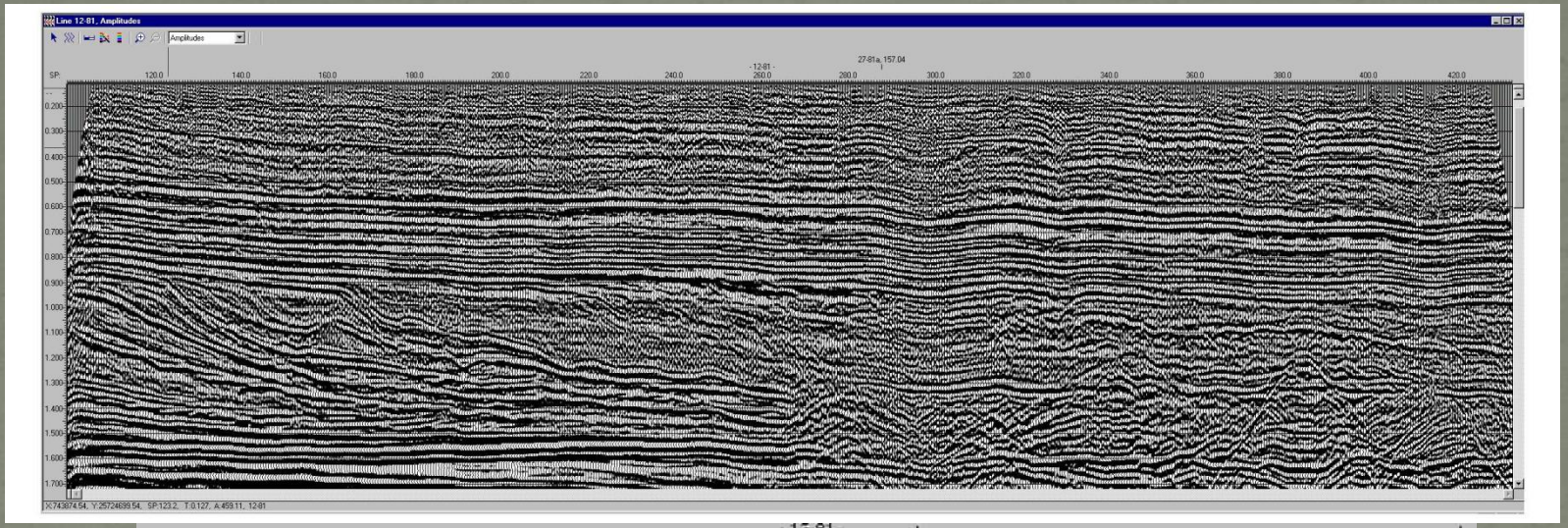
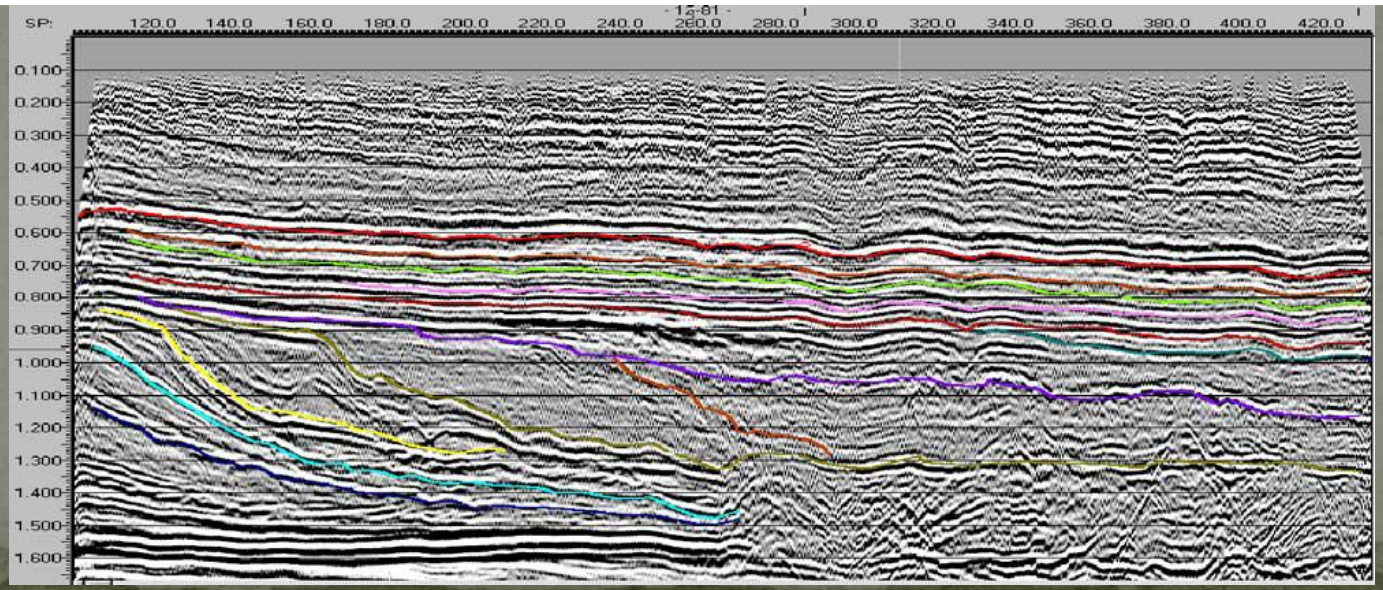
29.00m
30.00m
30.30m


Eijkelkamp

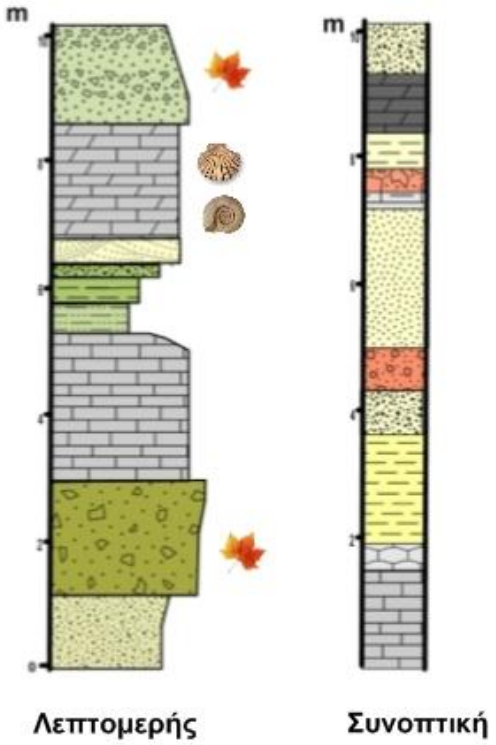

Eijkelkamp

Geophysical tomographies





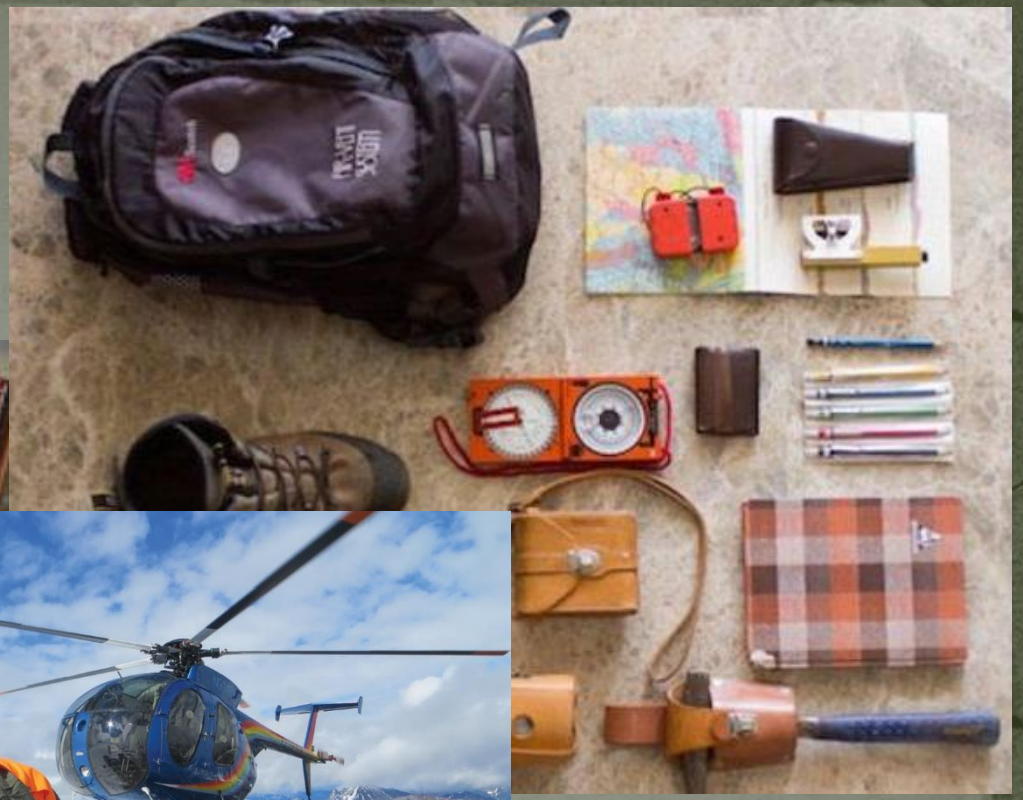
Detailed – Brief Stratigraphic collumn



In the detailed stratigraphic column, the variations in grain size are depicted as well as the transition from one layer to another, in contrast to the brief one in which the changes in the sediments are shown by the different symbolism and the transitions are not clear.

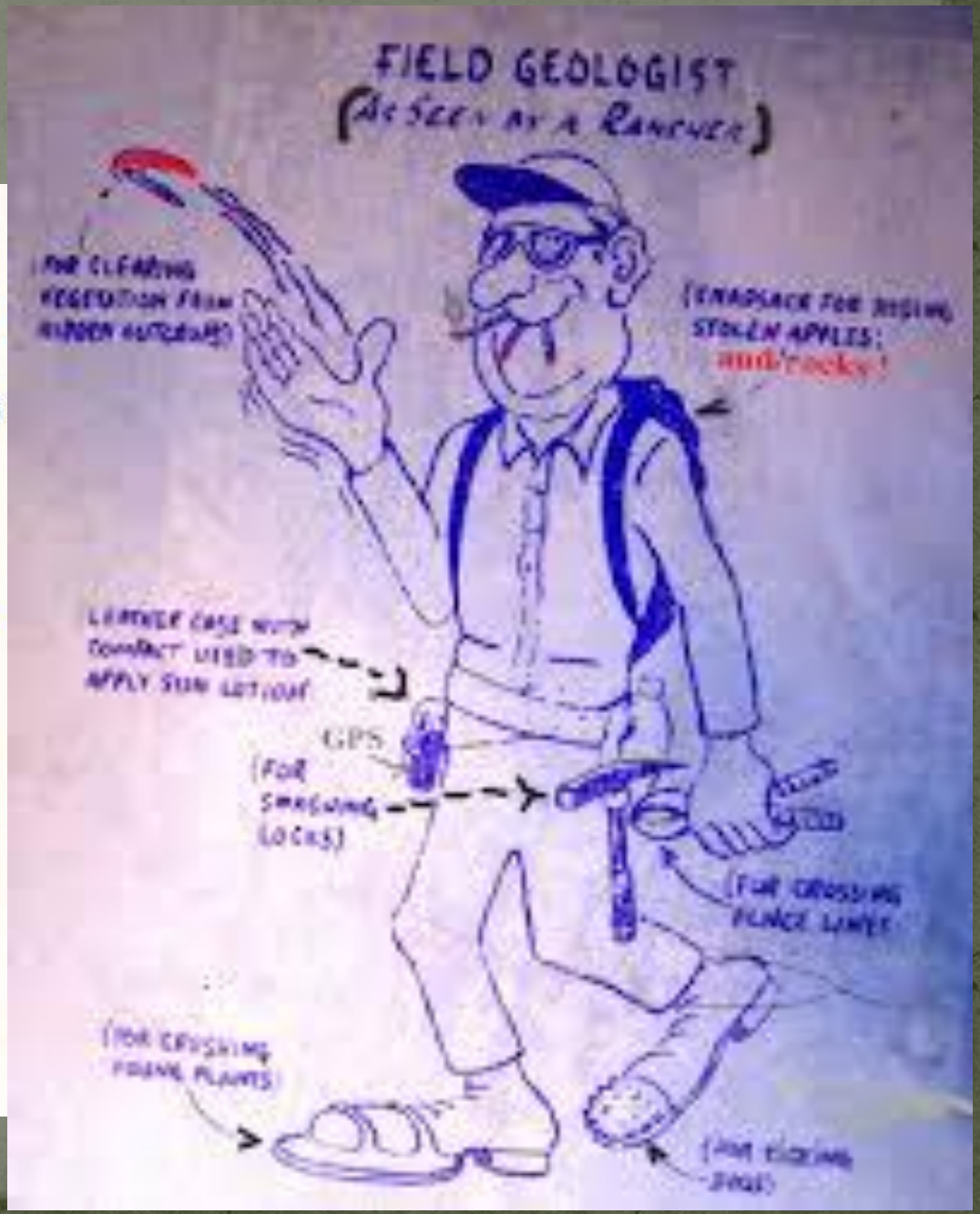
Construction of a stratigraphic section

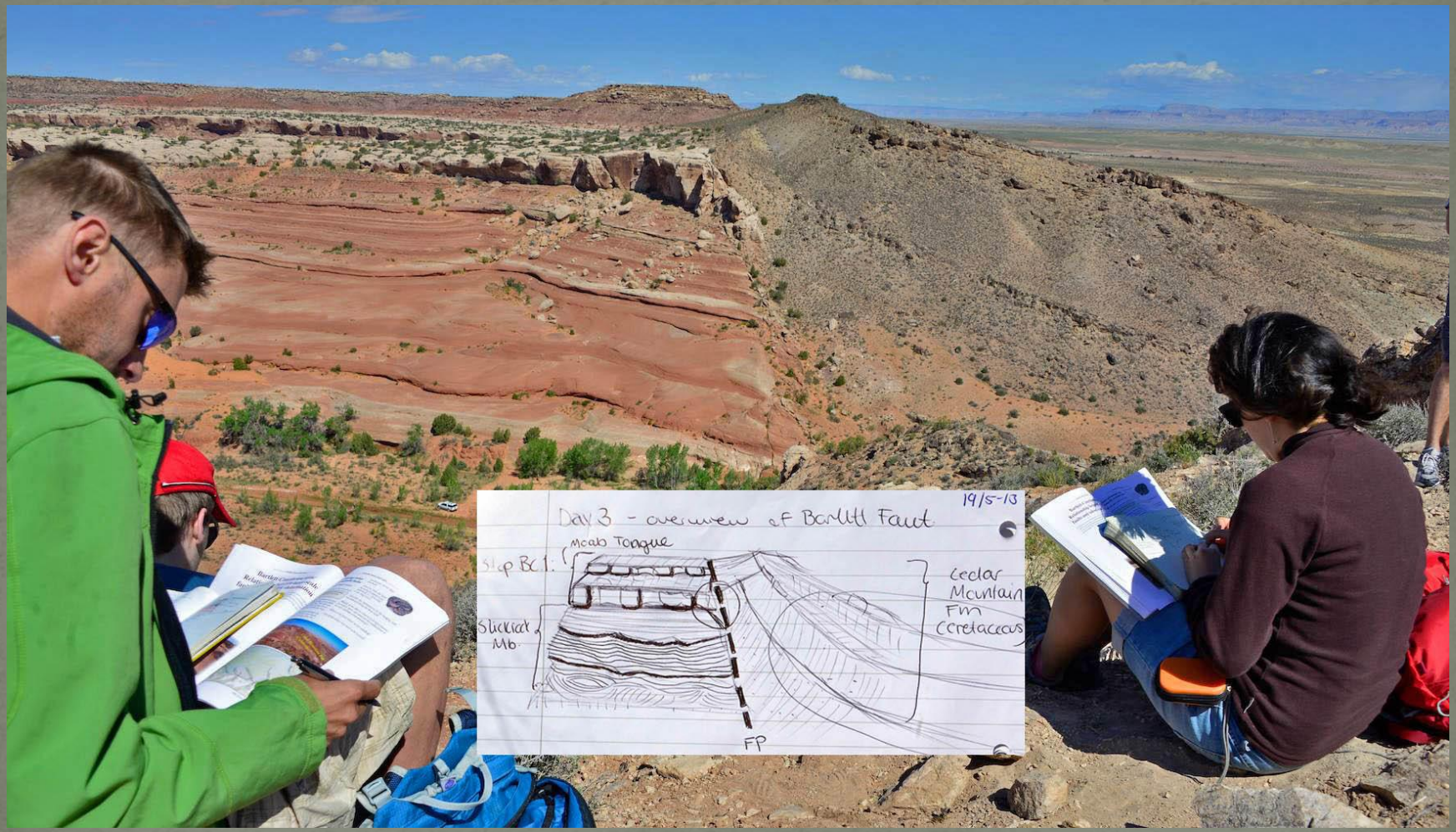
1. Field stage
2. Laboratory stage
3. Stratigraphic section construction



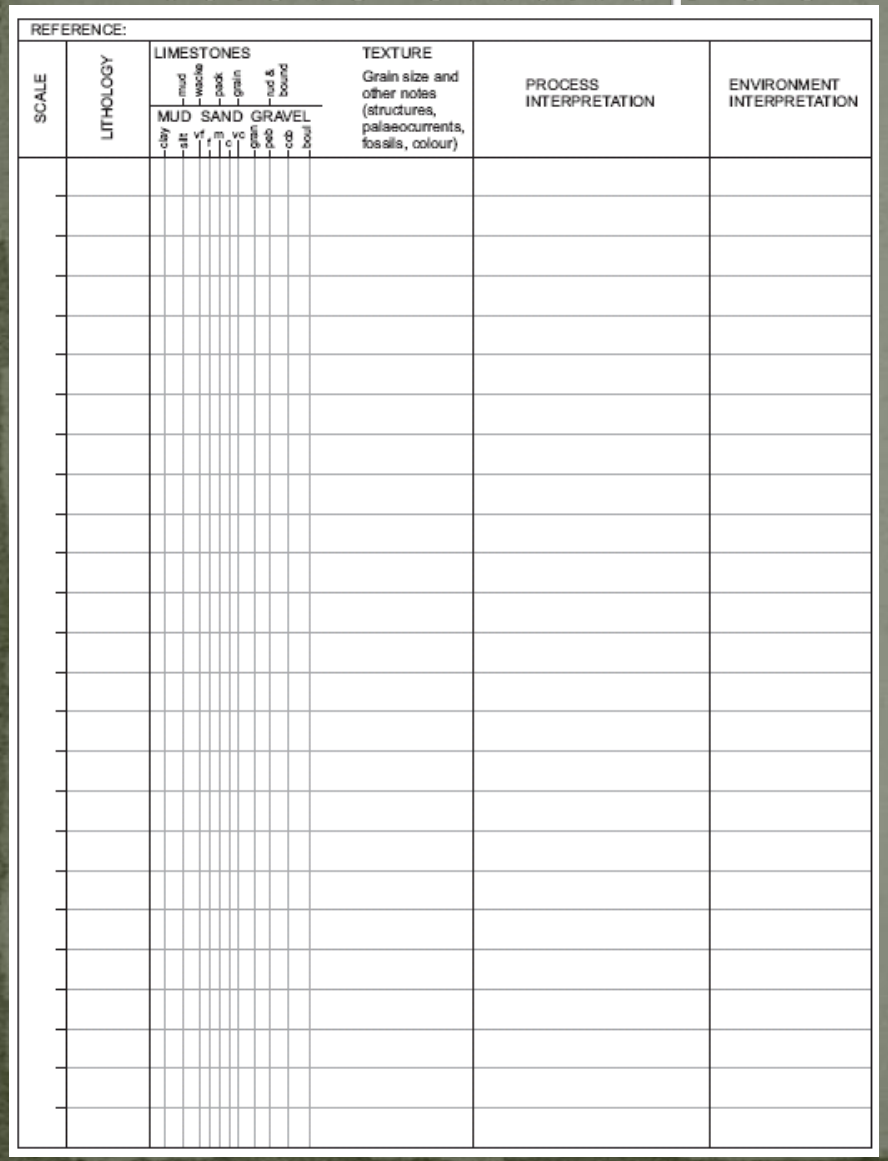

Israel

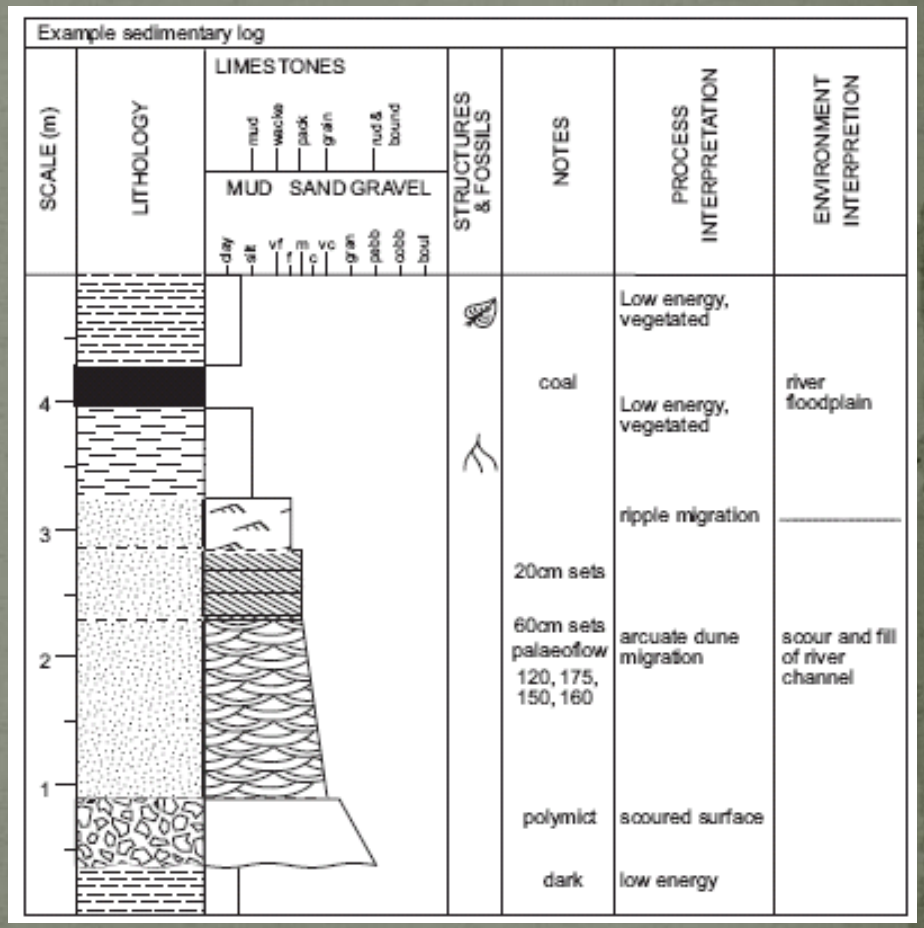
Wot the well-dressed 'ologist is wearing this summer




19/5-13
Day 3 - overview of Bartlett Fault
Moab Tongue
Slickrock Mb
Cedar Mountain Fm Cretaceous
FP

Στάδιο υπαίθρου





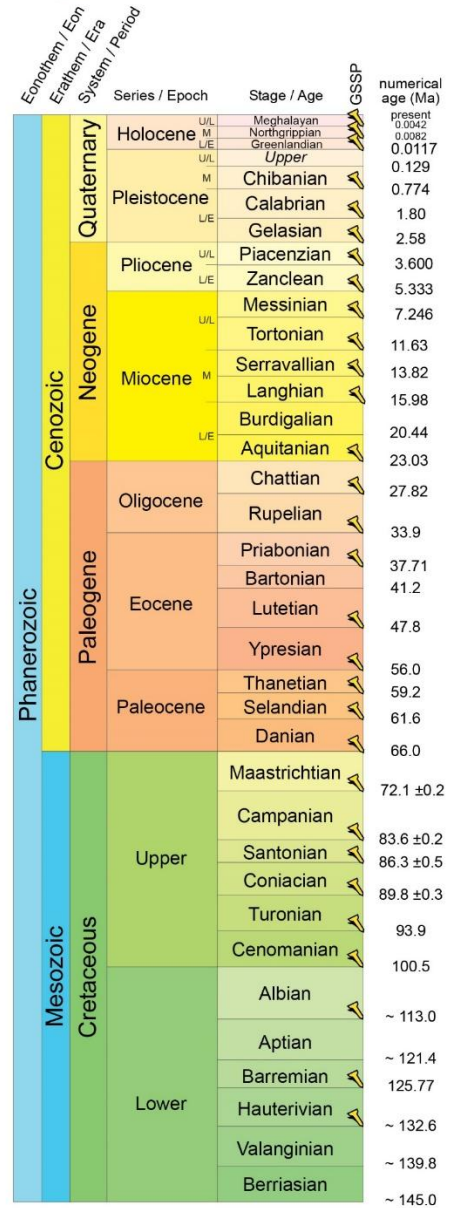
INTERNATIONAL CHRONOSTRATIGRAPHIC CHART

IUGS

www.stratigraphy.org

International Commission on Stratigraphy

v 2023/06



Units of all ranks are in the process of being defined by Global Boundary Stratotype Section and Points (GSSP) for their lower boundaries, including those of the Archean and Proterozoic, long defined by Global Standard Stratigraphic Ages (GSSA). Italic fonts indicate informal units and placeholders for unnamed units. Versioned charts and detailed information on ratified GSSPs are available at the website http://www.stratigraphy.org. The URL to this chart is found below.

Numerical ages are subject to revision and do not define units in the Phanerozoic and the Ediacaran; only GSSPs do. For boundaries in the Phanerozoic without ratified GSSPs or without constrained numerical ages, an approximate numerical age (~) is provided.

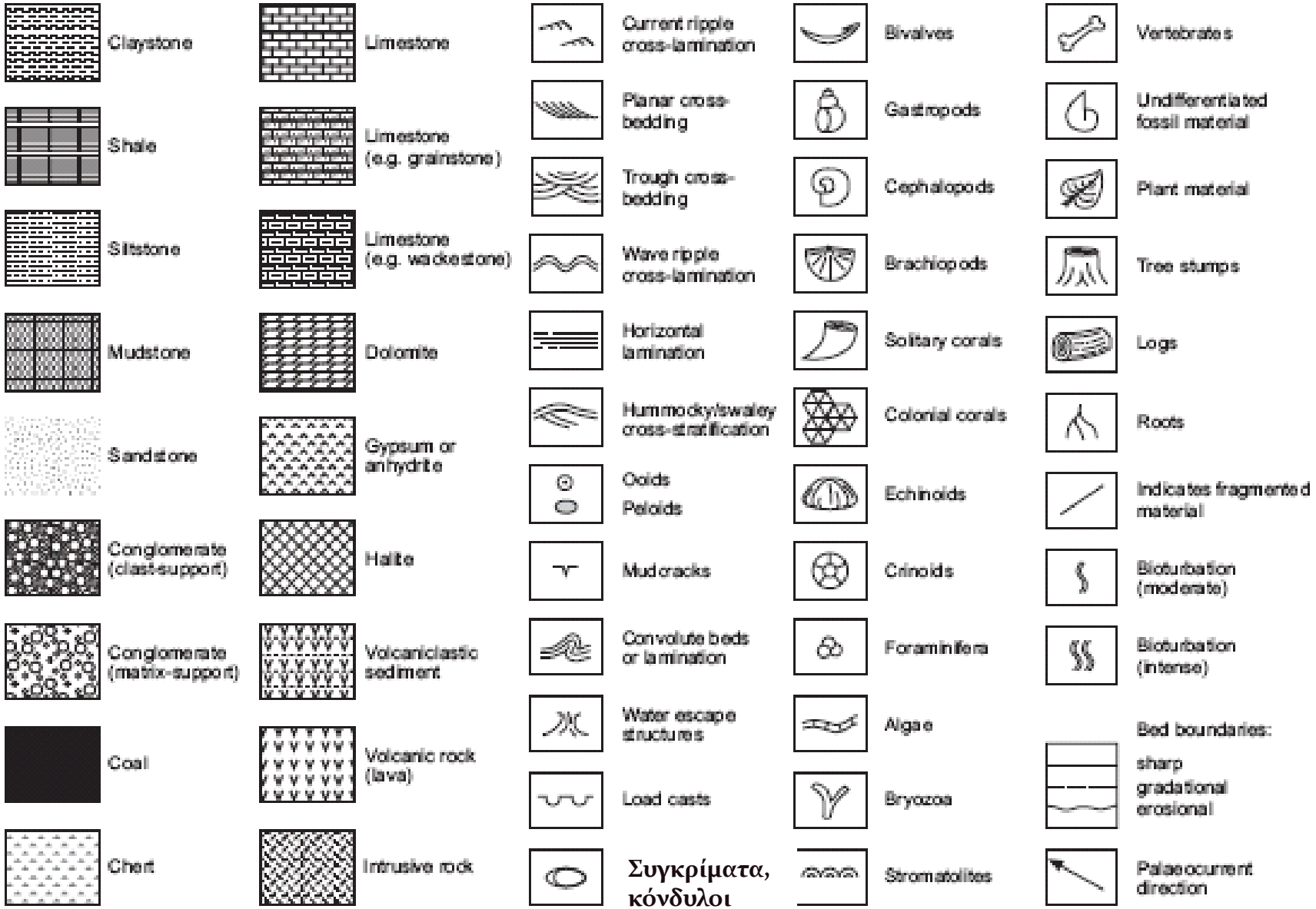
Ratified Subseries/Subepochs are abbreviated as U/L (Upper/Late), M (Middle) and L/E (Lower/Early). Numerical ages for all systems except Quaternary, upper Paleogene, Cretaceous, Jurassic, Triassic, Permian, Cambrian and Precambrian are taken from 'A Geologic Time Scale 2012' by Gradstein et al. (2012), those for the Quaternary, upper Paleogene, Cretaceous, Jurassic, Triassic, Permian, Cambrian and Precambrian were provided by the relevant ICS subcommissions.

Colouring follows the Commission for the Geological Map of the World (www.ccgm.org)

Chart drafted by K.M. Cohen, D.A.T. Harper, P.L. Gibbard, N. Car

To cite: Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fan, J.-X. (2013; updated) The ICS International Chronostratigraphic Chart. Episodes 36: 199-204.

URL: http://www.stratigraphy.org/ICSchart/ChronostratChart2023-06.pdf


Claystone
Shale
Siltstone
Mudstone
Sandstone
Conglomerate (clast-support)
Conglomerate (matrix-support)
Coal
Chert
Limestone
Limestone (e.g. grainstone)
Limestone (e.g. wackestone)
Dolomite
Gypsum or anhydrite
Halite
Volcaniclastic sediment
Volcanic rock (lava)
Intrusive rock
Current ripple cross-lamination
Planar cross-bedding
Trough cross-bedding
Wave ripple cross-lamination
Horizontal lamination
Hummocky/swaley cross-stratification
Ooids
Peloids
Mudcracks
Convolute beds or lamination
Water escape structures
Load casts
Συγκρίματα, κόνδυλοι
Bivalves
Gastropods
Cephalopods
Brachiopods
Solitary corals
Colonial corals
Echinoids
Crinoids
Foraminifera
Algae
Bryozoa
Stromatolites
Vertebrates
Undifferentiated fossil material
Plant material
Tree stumps
Logs
Roots
Indicates fragmented material
Bioturbation (moderate)
Bioturbation (intense)
Bed boundaries:
sharp
gradational
erosional
Palaeocurrent direction

Completeness of rock record

- The rock record is the set of rocks that have been deposited (sedimentary record) or formed in a specific area or across the planet.
- The record is always incomplete and discontinuous
- Why?

Incomplete rock record

- It is most often interrupted by countless Discontinuities, Unconformities or diastemas
- Rocks are destroyed by various exogenous and endogenous processes
- The deposition or formation of rocks is often interrupted by such processes
- Such temporary and short interruptions are found, as we said earlier, on each layer surface.
- The elements that the rocks contain in these interruptions are also part of Stratigraphy and a very important contribution to understanding the history of our planet.

Discontinuities

Any change/interaption in the lithological continuity or coherence of a layer.

Two types

1. Stratigraphic
2. Tectonic

Stratigraphic Discontinuities

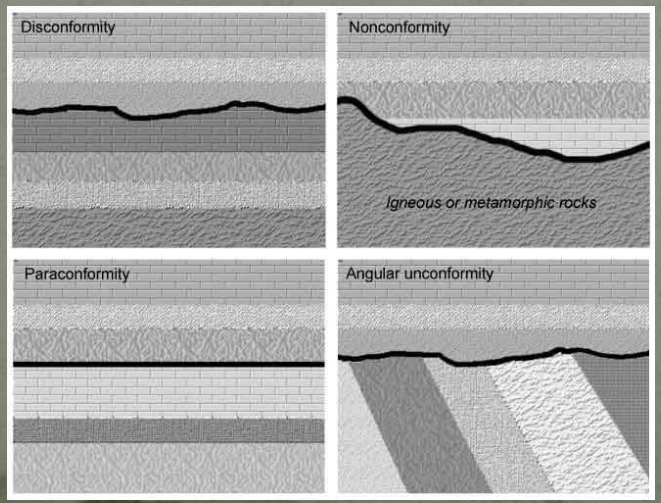
A. Bed contacts

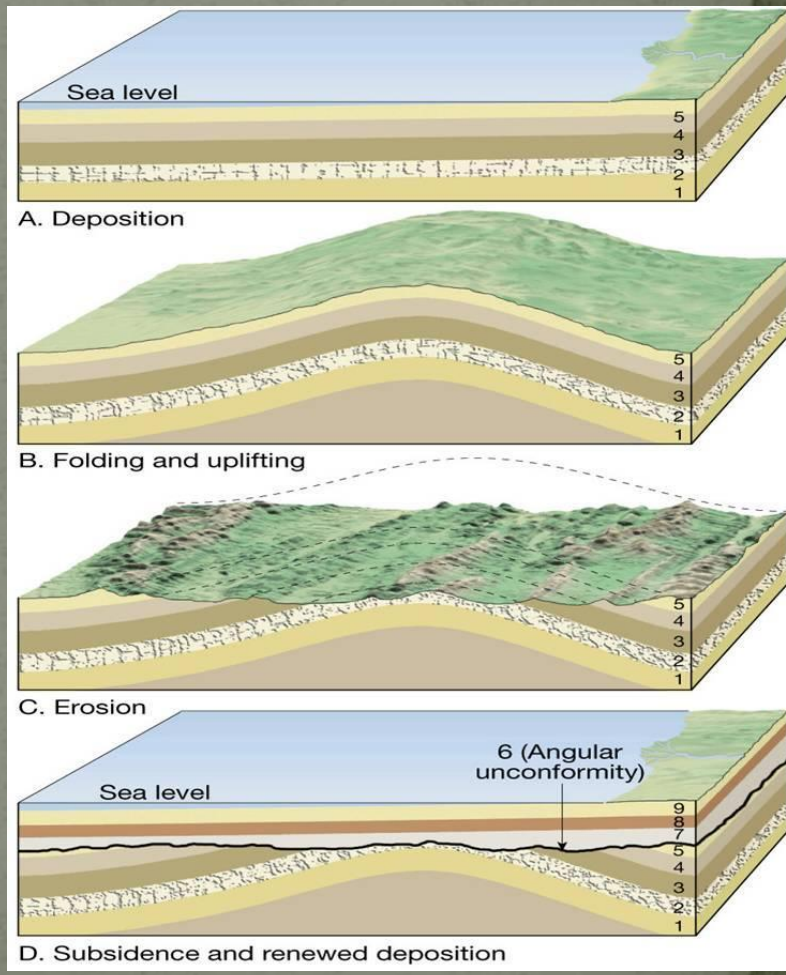
B. Unconformities
C. Diastems

Unconformities

«the stop of sedimentation for a significant time period»

1. Nonconformity
2. Angular conformity
3. Disconformity
4. Paraconformity





Angular conformity

Γωνιώδης ασυμφωνία

Nonconformity

Συνεχής ασυμφωνία

Disconformity

Διαβρωσιγενής ασυμφωνία

Paraconformity

Παρα- ασυμφωνία

diastema

Πρωτογενείς ασυμφωνίες στο Grand Canyon

Diastema

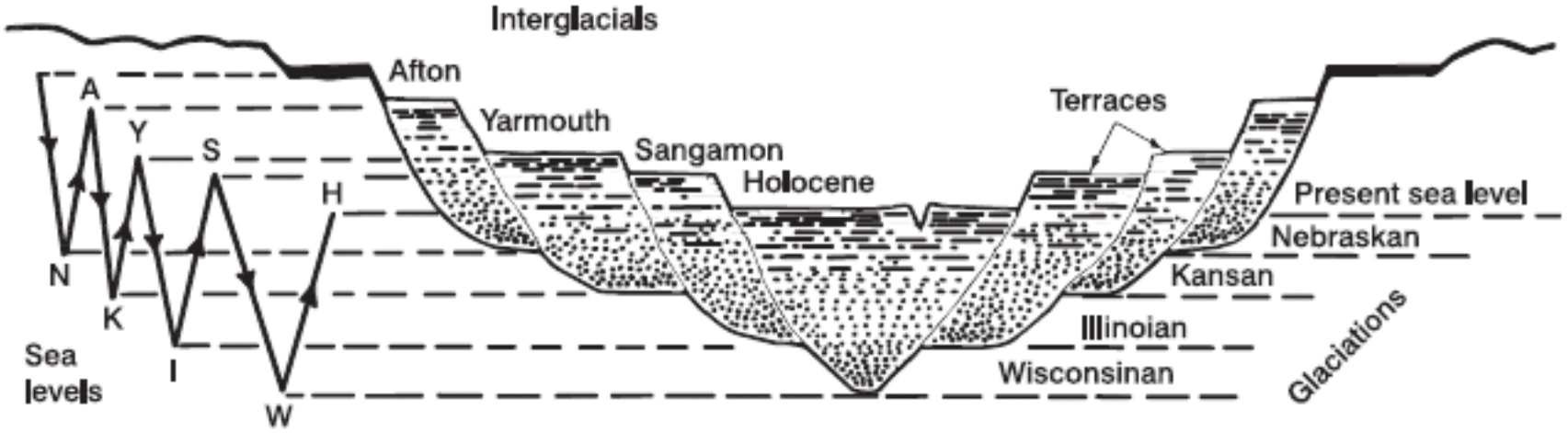
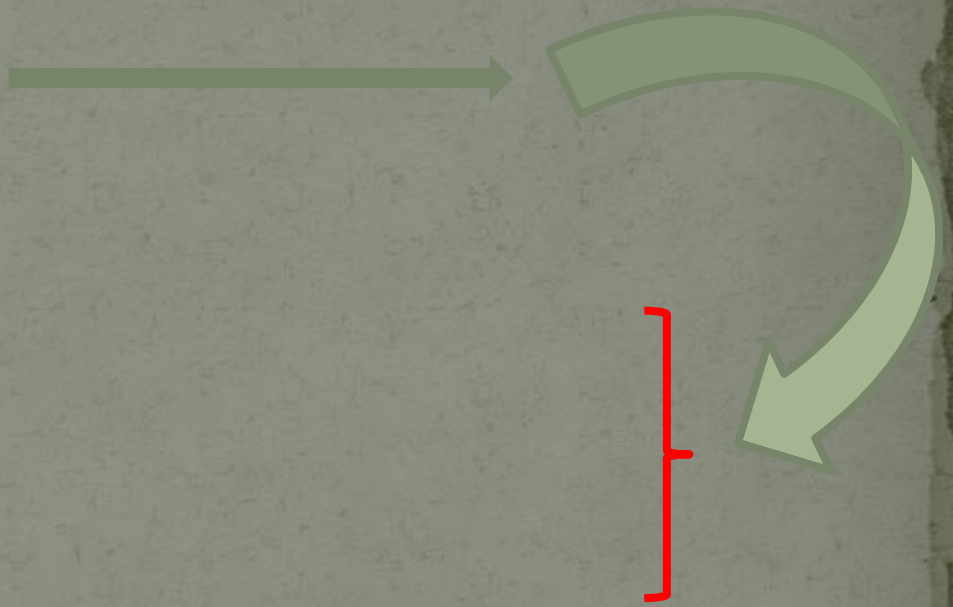


Fig. 5.13 Interglacial terraces and glacial valley cutting, lower Mississippi River, USA (from Strahler 1971, fig. 41.18).

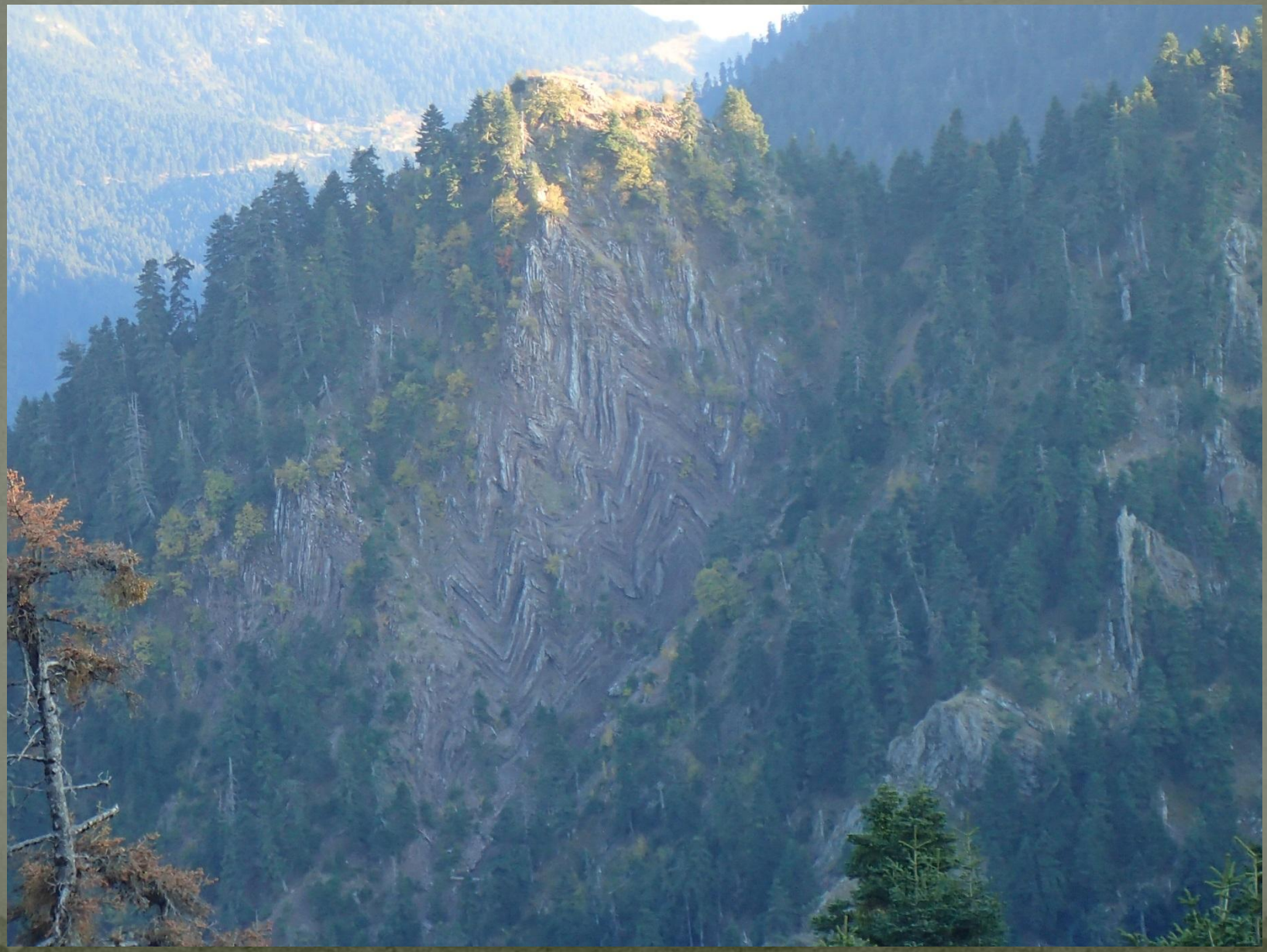
Tectonic Discontinuities

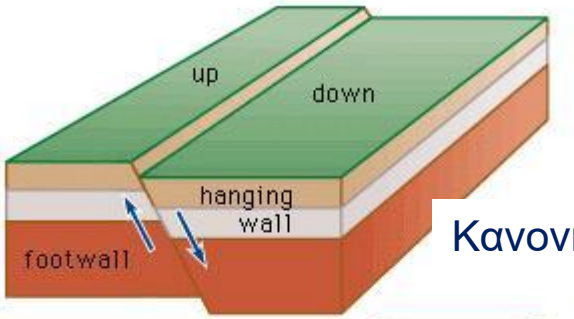
1. faults
   - normal
   - reverse
   - strike slip

2. high angle thrusts
3. low angle thrusts

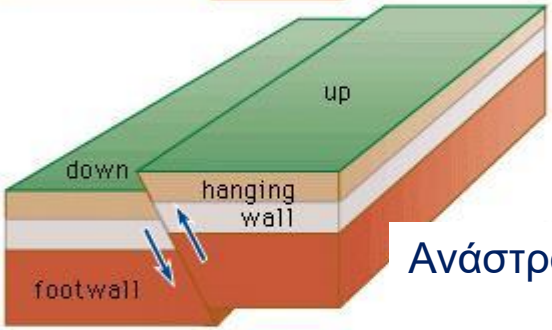


thrusted sheets and nappes

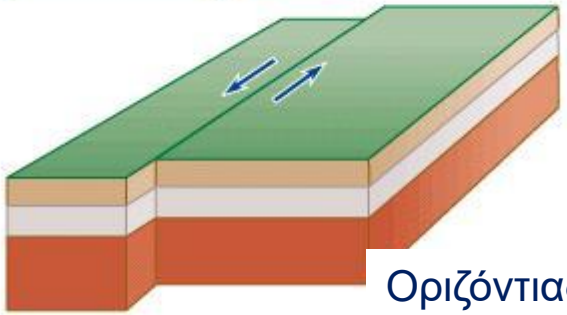




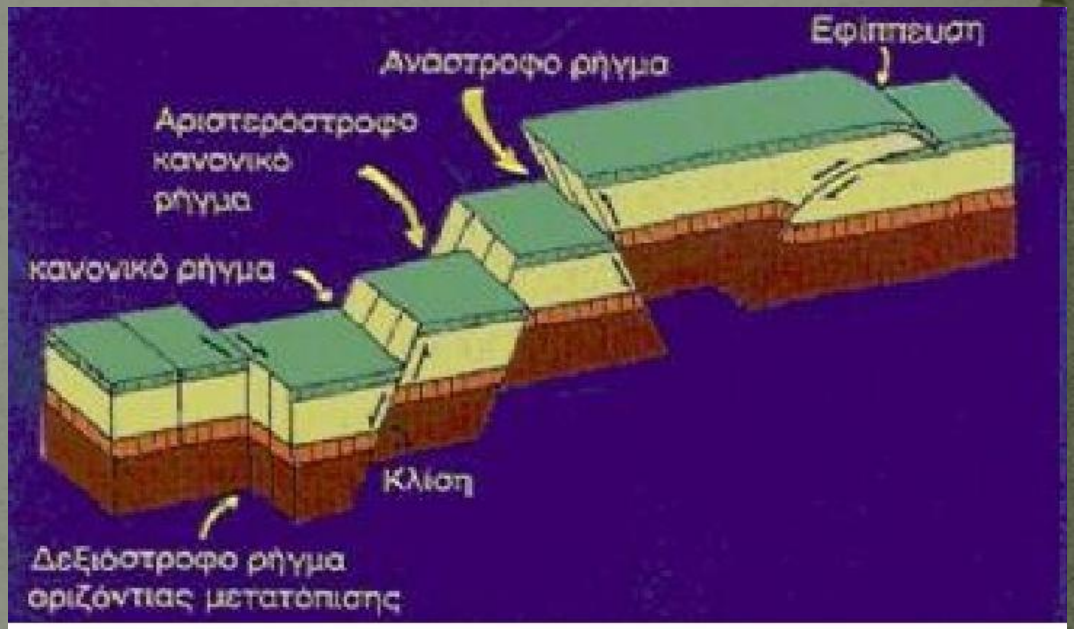
Κανονικό



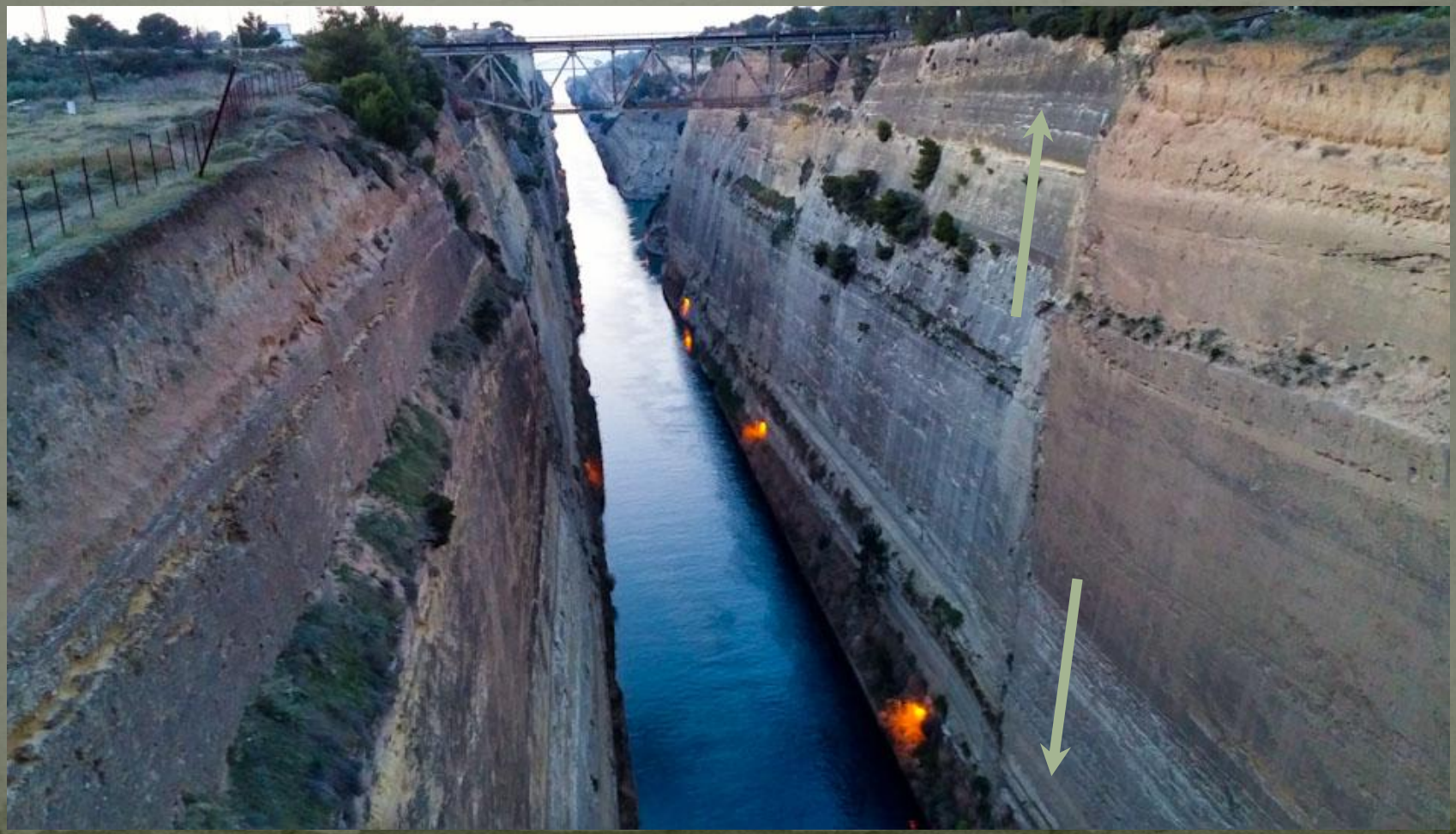
Ανάστροφο

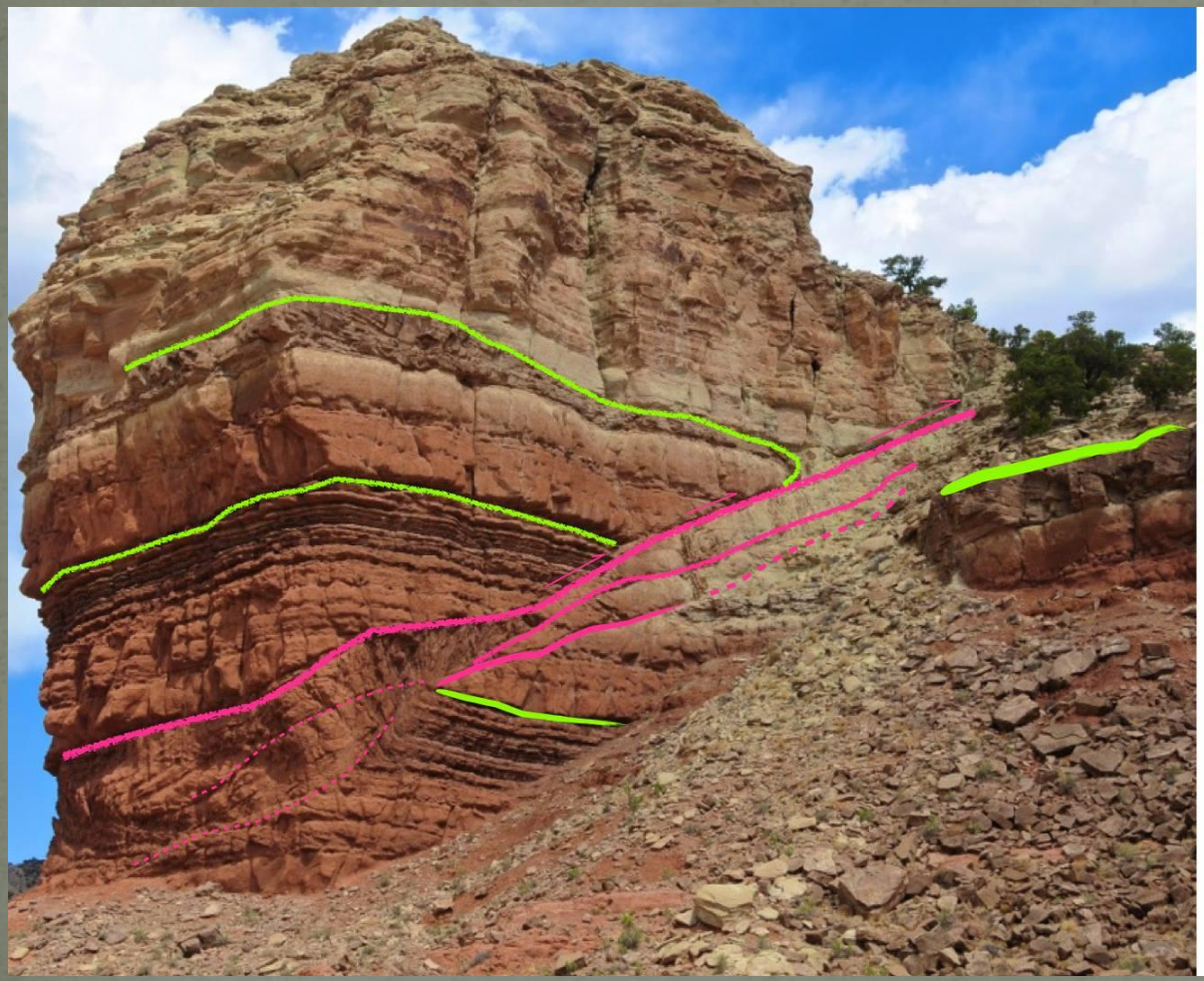


Οριζόντιας μετατόπισης



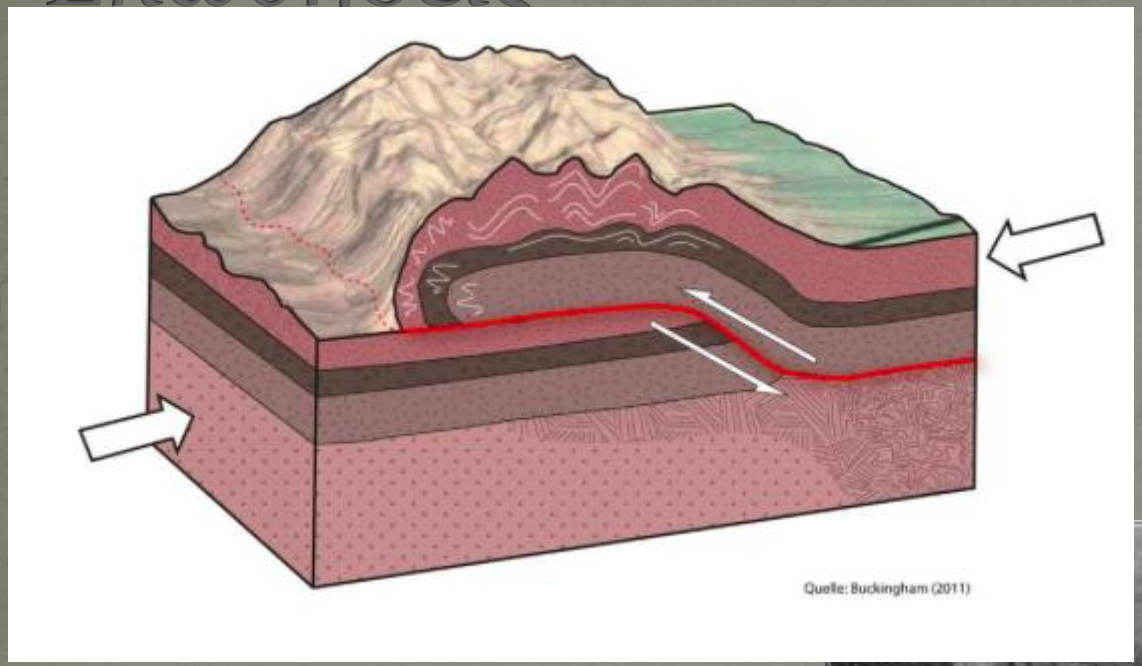
Ρήγμα: διάρρηξη (σπάσιμο) στο φλοιό της γης.
Υπάρχουν τρία είδη ρηγμάτων: 1. Κανονικά ρήγματα, 2. Ανάστροφα ρήγματα, 3. Ρήγματα οριζόντιας μετατόπισης.

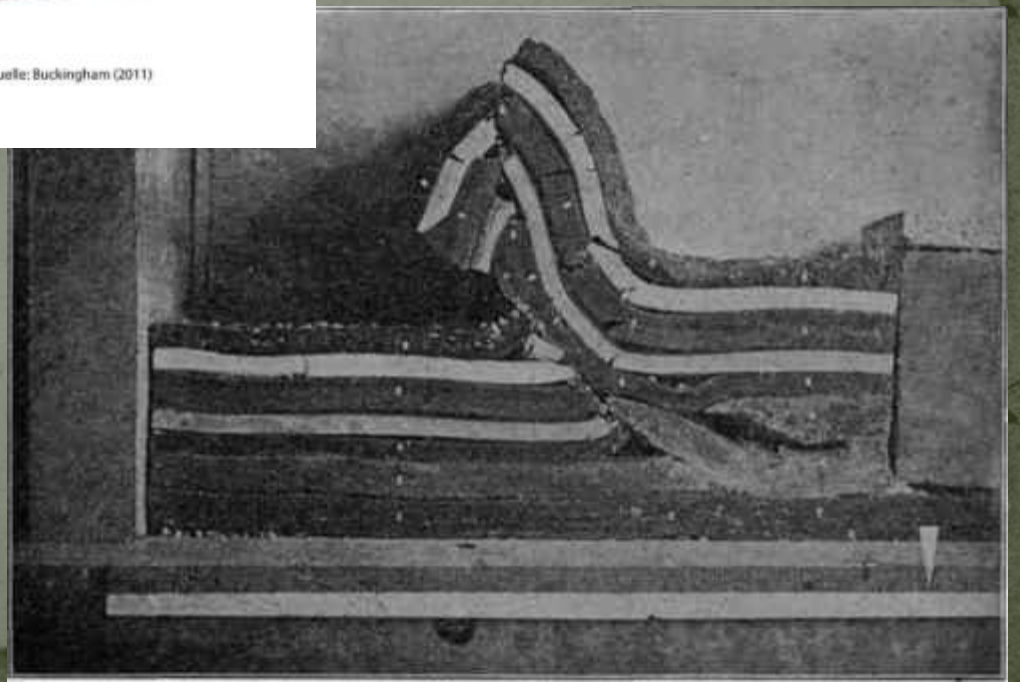




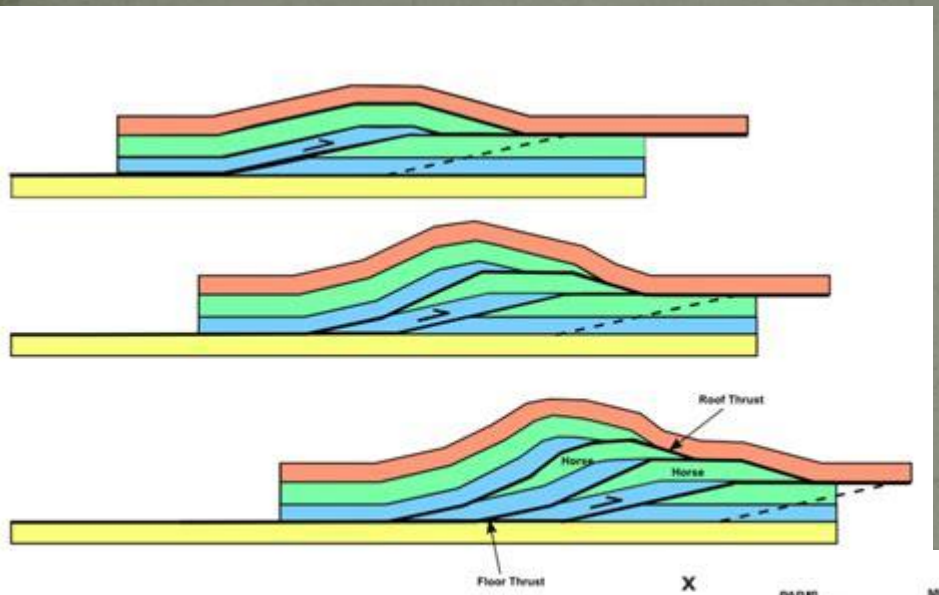
an interpretation
of the
Reverse Fault
(fault zone) at
Cedar Mountain,
Utah, USA.

Επωθήσεις





Thrusts



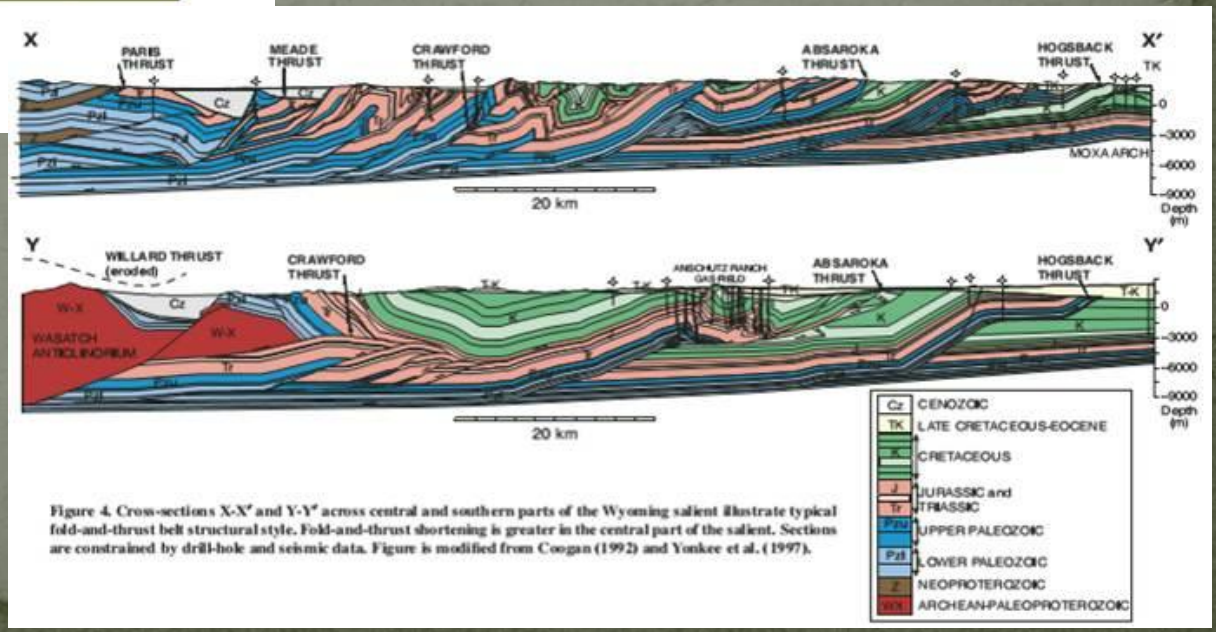


Figure 4. Cross-sections X-X′ and Y-Y′ across central and southern parts of the Wyoming salient illustrate typical fold-and-thrust belt structural style. Fold-and-thrust shortening is greater in the central part of the salient. Sections are constrained by drill-hole and seismic data. Figure is modified from Coogan (1992) and Yonkee et al. (1997).

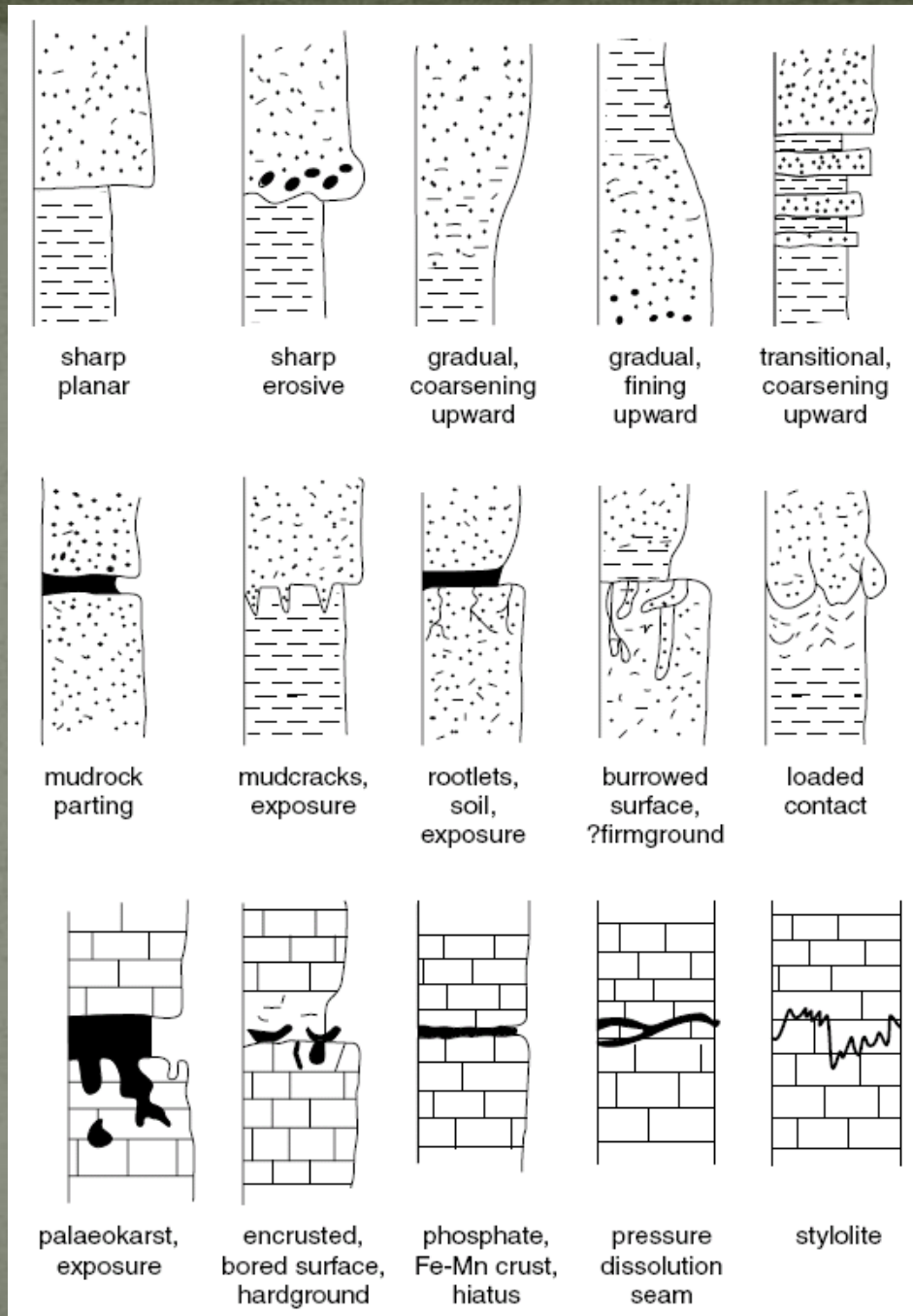


Figure 5.5 *Bedding planes and bed contacts: the range of possibilities.*