



# **STRATIGRAPHY**

Petroleum Geoengineering MSc course  
2023/24. 1. Semester

MFFTT710005

COURSE COMMUNICATION FOLDER

**Institute of Exploration Geosciences**

**Course Title: Stratigraphy**

**Credits: 3**

Type (lec. / sem. / lab. / consult.) and Number of Contact Hours per Week:**lec.2, sem. 1**

**Neptun code:** MFFTT710005

**Type of Assessment** (exam. / pr. mark. / other):**exam**

one field and one cameral exercise each. The field exercise is to be presented in groups, in ppt-format and orally based on one of the two field surveys during the semester. The indoor exercise is the complex evaluation of a geological map with special attention to unconformities and characterization of the sequences of geological cycles between them. These exercises give 40%, while the exam gives other 60% of the grade of the course.

**Grading limits:**

>90%: excellent,

75-90%: good,

60-75%: medium,

45-60%: satisfactory,

<45%: unsatisfactory.

Position in Curriculum (which semester):**first**

Pre-requisites (*if any*):

**Course Description:**

**Acquired store of learning:**

Study goals:The student will learn how to use stratigraphy (including stratigraphic contradictions) in petroleum geology as basic information for structural modelling.

Course content:Principles of stratigraphy. Types of bedding. Relationship between different rock bodies. Unconformity types. Age-determination of rocks. Stratigraphical correlation: fundamentals of bio-, litho-, chemo-, cyclo-, magneto-, seismo-, chrono- and sequence stratigraphy. Geological time scale and stratotypes. Basin analysis: synthesis of different stratigraphic and other methods; its role in petroleum exploration and production with case studies. Stratigraphy and evolution of Hungarian basins.

Education method:Lectures with powerpoint presentation, cameral evaluation of a geological map with the construction of a geological cross-section, two field surveys, one day each.

**Competencies to evolve:**

T1, T4, T5, T8, T12, K5, K7

The 3-5 most important compulsory, or recommended **literature** (textbook, book) **resources:**

- Brookfield, M. (2006): Principles of Stratigraphy. 340 p., Blackwell Publishing, ISBN 1-4051-1164-X.
- Boggs S. Jr. (2006): Principles of sedimentology and stratigraphy. 4th Edition. 662 p., Pearson Prentice Hall, ISBN: 0131547283.
- Allen P. A & Allen J.R. (2013): Basin Analysis. Principles and Application to Petroleum Play Assessment. 3rd. Edition, 642 p., Wiley & Sons, ISBN 978-0-470-67377-5.
- Veeken P.P. (2007): Seismic Stratigraphy, Basin Analysis and Reservoir Characterisation. Handbook of Geophysical Exploration: Seismic Exploration. **37**, 523 p., Elsevier, ISBN: 0080453112.
- Haas J. (ed., 2013): Geology of Hungary. Regional Geology Reviews. 244 p., Springer, ISBN: 978-3-642-21909-2.

**Responsible Instructor**(*name, position, scientific degree*):

**György Less Dr., professor, DSc**

**Norbert Zajzon Dr. habil., associate professor, PhD**

**Zoltán Püspöki Dr. habil., senior research fellow, PhD (Hungarian Geological Survey)**

**Thematics of lectures:**

Thursday, 11:00 – 13:00

<i>Date</i>	<i>Lectures</i>
2020.09.14.	Technical break because of the late arrival of foreigner students
2020.09.21.	Principles of stratigraphy. Types of bedding
2020.09.28.	Relationship between different rock bodies. Unconformity types
2020.10.05.	Chronostratigraphy: age-determination of rocks. Geological time scale and stratotypes
2020.10.12.	Fundamentals of biostratigraphy. Most important fossils in determining age and facies I.
2020.10.19.	Most important fossils in determining age and facies II
2020.10.26.	Fundamentals of radiometric age-determination and fission-track dating
2020.11.02.	Rectoral break
2020.11.09.	Magnetostratigraphy. Chemostratigraphy. Cyclostratigraphy
2020.11.16.	Sequence stratigraphy I.
2020.11.23.	Sequence stratigraphy II.
2020.11.30.	Inter-semester rating classroom task. Presentation on the field-trips
2020.12.07.	Integration of different stratigraphical methods: stratigraphical correlation
2020.12.14.	Basin analysis: synthesis of stratigraphic and other methods; its role in petroleum exploration and production with case studies

## Thematics of practices

Two field surveys, one day each: in the N part of the Bükk Mts.

1. field-trip (one full day, 2020. 10.06): Miskolc – Csanyik Valley – Ómassa – Bálvány – Kapu-bérc – Ördög-oldal – Csikorgó – Szentlélek – Három-kút, rock gate – Csókás – Lillafüred – Miskolc
2. field-trip (one full day, 2020. 10.20.): Miskolc – Hollós-tető – Répáshuta, Bánya-hegy – Hereg-rét – Lök-völgy– Szarvaskő– Tardos quarry – Nagyvisnyó, Mihalovits quarry – Nagyvisnyó, 1. railway cut – Dédestapolcsány – Nekézseny, Strázsa-hegy – Csernely – Dédestapolcsány, vineyards – Sajólászlófalva – Miskolc

## **Tasks for inter-semester rating**

**Choose the correct answer (2 points each)**

1. When the Incised Valley was infilled? During
  - a) TST
  - b) LST
  - c) HST
  - d) SMST
  
2. The Highstand Systems Tracts was formed during
  - a) Rapid rise of relative sea level,
  - b) Rapid fall of relative sea level
  - c) Still stand
  - d) Late rise and early fall of relative sea level
  
3. The Transgressive Systems Tracts was formed
  - e) Rapid rise of relative sea level
  - f) Rapid fall of relative sea level
  - g) Still stand
  - h) Late rise and early fall of relative sea level
  
4. The duration of a typical 3<sup>rd</sup> order sequences are
  - a) 50-100 million years
  - b) 10-50 million years
  - c) 1-3 million years
  - d) 100,000 – 500,000 years
  
5. The parasequences are bounded by
  - a) Unconformities
  - b) Unconformities and their correlative concordant surfaces
  - c) Flooding surfaces
  - d) Erosional truncations

## **II. True or false? (2 points each)**

**Onlap** - Lateral termination of strata onto unconformity or non-depositional surface at the base of a sequence or systems tracts.

True

False

**Downlap** – Upward and generally landward termination of strata at the base of relatively horizontal shallow marine carbonates or coastal/deltaic siliciclastics.

True

False

**Carbonates** are AUTOCHTHONOUS– ‘created’ in situ

True

False

**Siliciclastics** are ALLOCHTHONOUS (transported)

- True  False

**Sigmoidal** – Stratal geometry produced by combined progradation and aggradation. Clinoforn or inclined surfaces may terminate basinward (downlap), but extend updip into shelfal stratal patterns.

- True  False

**Siliciclastics** tend to dominate lowstand systems tract and carbonates dominate transgressive/highstand systems tract.

- True  False

**Bayline** – The line of approximate demarcation between slope and basin environments

- True  False

**Transgression = retrogradation** (relative sea level rise outpaces sediment supply and the shoreline moves landward)

- True  False

**Regression of shoreline** – Facies migrate basinward direction

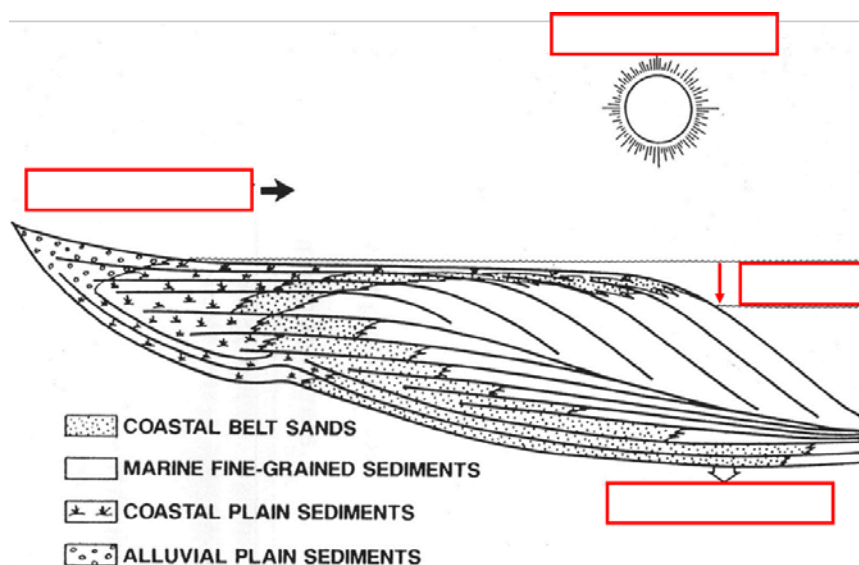
- True  False

**Walter’s law** – In a vertical succession (e.g. core) where facies gradationally pass into one another, they must have been deposited in laterally adjacent environments.

- True  False

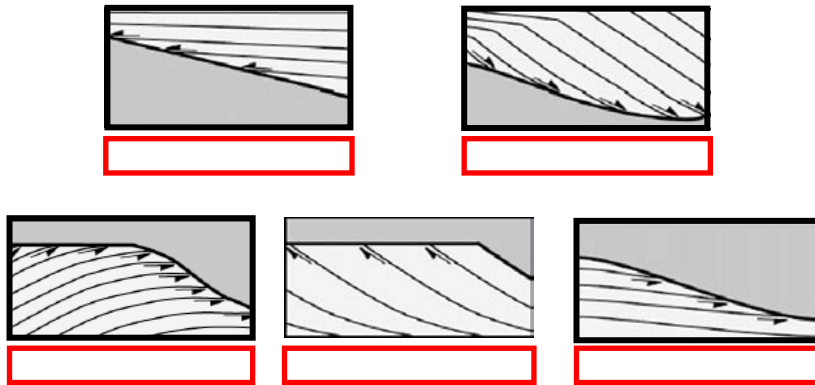
### III. Complete the figures

Identify and write into the red boxes the major controls on the sedimentary rock record, highlighted by yellow (4 points) **(sediment supply, climate, eustasy, tectonic subsidence)**

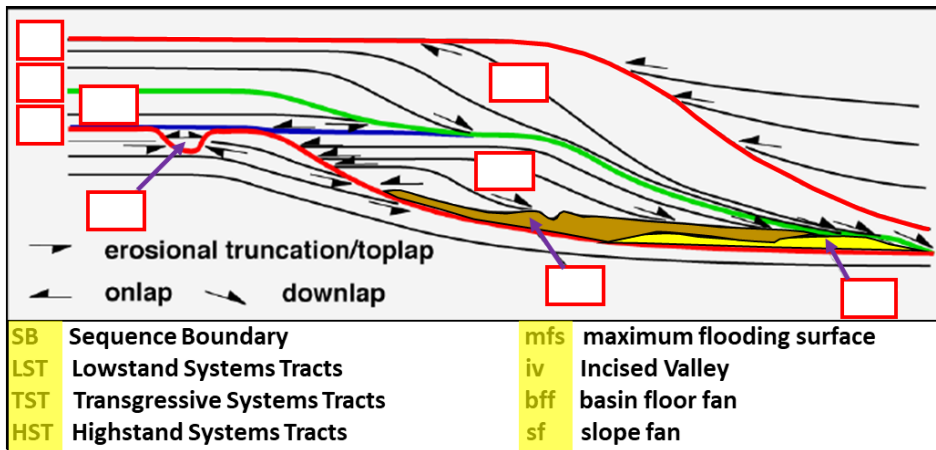


Identify and write into the red boxes the reflection terminations, highlighted by yellow 5 points)

**(onlap, toplap, erosional truncation, downlap, apparent truncation)**

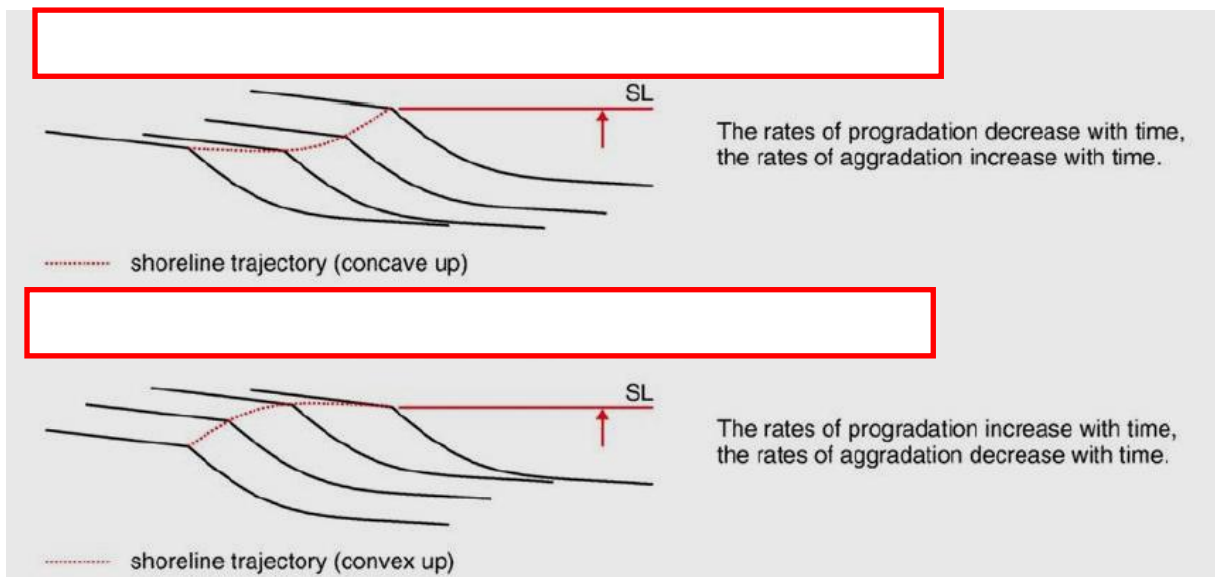


Identify and write into the red boxes the following terms, highlighted by yellow (9 points)



Identify and write into the red boxes stratal stacking patterns, highlighted by yellow (2 points)

Lowstand normal progradation (LST), Highstand normal progradation (HST)



## **Questions for exam**

1. The subject of stratigraphy, stratigraphic categorization and nomenclature
  1. Lithostratigraphy, Steno's rule and exceptions
  1. Bedding types, lateral termination of beds
  1. Grouping beds into formation, Walter's law
  1. Termination of formations, unconformity types
  1. Methods of lithostratigraphical correlation
  1. Biostratigraphy, Dollo's rule, main features (including way of life) of good age-determining fossils
  1. Principles of biozonation, limitations, biozone types
  1. Correlation of biozones and stratotypes
  1. Principles, limitations and main types of radiometric dating
  1. Fission track dating and limitations
  1. Principles of magnetostratigraphy, limitations
  1. Principles and main types of chemostratigraphy
  
2. Event stratigraphy and main rare events in the history of Earth
  2. Evolution of flora from beginning to recent
  2. Fauna of the Paleozoic
  2. Evolution of vertebrates from beginning to recent
  2. Main geotectonic events and paleogeography of the Paleozoic
  2. Climate of the Pre-Cambrian and Paleozoic
  2. Climate of the Mesozoic and Cenozoic
  2. Main geotectonic events and paleogeography of the Mesozoic and Cenozoic
  2. Life of the Pre-Cambrian
  2. Evolution of Earth's atmosphere in the last 4500 million years
  2. Fauna of the Mesozoic
  2. Fauna of the Cenozoic
  2. The Earth's Crust of the Pre-Cambrian

Miskolc, August 31, 2023.

Dr. György Less  
professor