MISKOLCI EGYETEM

MŰSZAKI FÖLD- ÉS KÖRNYEZETTUDOMÁNYI KAR

SEDIMENTOLOGY

(*Earth Sciences Engineering MSc*)

2024/25 II. semester

MFFAT720030

COURSE COMMUNICATION FOLDER

University of Miskolc
Faculty of Earth and Environmental Sciences and Engineering
Institute of Exploration Geosciences

Course datasheet

Course Title: Sedimentology **Instructor:** Dr. Velledits Felicitász, associate professor	**Code:** MFFAT720030 **Responsible department/institute: Institute of Exploration Geosciences**
Position in curriculum (which semester): 2	**Pre-requisites (if any):** MFFAT710005
No. of contact hours per week (lecture + seminar): 1+1	**Type of Assessment (examination/ practical mark / other):** practical mark
Credits: 2	**Course:** full time

Study goals To acquaint students with the most important sediments like sand, silt, clay, carbontes, evaporites, cherts etc. and the processes that result in their formation.
To get to know the main types of sedimentary rocks: 1.The siliciclastic sedimentary rocks. 2. Organic sedimentary rocks: carbonates, coal, oil shale. 3. Evaporites (halite, gypsum). 4. Chemical sedimentary (chert, jaspilite).
At the end of the course they have to be able to interpret the ancient environmental conditions in sediment source areas and depositional sites, based on constituents, textures, structures, and fossil content of the deposits. They have to differentiate between continental, littoral, and marine deposits of the geologic record.
Compatencies to evolve**:**
Knowledge**:**

skills:

T01 Differentiates the processes described by the general and specific theories required for the practicising of the fields of earth science engineering, categorizes the internal connections between geological processes, and designs the planning and interpretation procedures.
T02 Combines the technical and scientific knowledge required for the high-level integration in earth sciences engineering disciplines, among others in numerical methods, technical physics and their contexts.
T03 Categorizes the components of the raw material extraction sector, the technologies used for the extraction and preparation of mineral raw materials, as well as the scope of geo-environmental tasks, their external socio-economic environment and regulatory system.

ability

K01 Applies general and specific scientific theories pf applied earth sciences, systematizes them, solves independent engineering tasks (mainly complex geological prospecting, final report summarizing exploration results, geological-geophysical parts of environmental impact assessments).
K02 Composes presentations and written documents in Hungarian or in a foreign language.

autonomy and responsibility:

F01 Plans the work independently, and rules on to lead workgroups.

Course Description:

1. The place of sedimentology in earth sciences. The main stages in the development of sedimentology.
2. The main groups of sedimentary rocks: (siliciclastic) rocks, biogenic rocks, rocks formed by chemical precipitation, organic sediments, volcanic rocks.
3. Major aspects of rock description (composition, rock, sedimentary structures, fossils) Processes of sedimentation (stagnation, transport, settling / precipitation, diagenesis) The main laws: Steno's laws, aktualismus, Walter's law.
4. Carbonate rocks. Introduction: What are carbonate rocks? Carbonate minerals. Factors affecting carbonate formation.
5. Main sedimentation environments: Wilson's facies belts, their main rock and microfacial types. The main constituents of carbonate rocks. Changes in carbonate-producing groups of organisms during the history of the earth.
6. Classification of carbonate rocks. Pore types. Diagenesis: marine, fresh water, deep burial.
7. Carbonate platform types. Carbonate reservoirs. Comparison of carbonate and silicicastic rocks.
8. Main characteristic of silicicalstic rocks: sorting, sfericity, roundness. Cementation of siliciclastic rocks.
9. Origine, transport, sedimentotation and diagenesis of siliciclastic rocks. Classification of siliciclastic rocks.
10. Sedimentary environments of siliciclastic rocks. Alluvial fans, eolitic and fluviatile facies (sediments of meandering and braided rivers).
11. Coastal sediments, siliciclastic self seas.
12. Delta (river, wave, tidal dominated, Gilbert, coarse-grained and fan-delta). Deep sea fans.
13. Evaporites, manganese ores. Precipitation: radiolarit, chert, diatomite.
14. Fossil energy sources. Coal: lignite, brown coal, anthracite, graphite. Uranium sedimentology. Hydrocarbons: petroleum, natural gas, oil shale, tar sands

Assessment:

two written exam: Midterm exam, and Final exam. In both exam must be reached 50%.

Grading scale:

% value	Grade
80 -100%	5 (excellent)
80 – 70%	4 (good)
70 - 60%	3 (satisfactory)
60 - 50%	2 (pass)
0 - 50%	1 (failed)

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Compulsory or recommended literature resources:

Balogh Kálmán (ed.) Szedimentológia I-III,
Hartai Éva: Változó Föld
Harold G. Reading 1996, 2006: Sedimentary Environments: Processes, Facies and Stratigraphy, Wiley, London, p.704
Asquith & Gibson: Basic well log analysis for geologists, AAPG, Methods in exploration series
Serra, 1985: Sedimentary environments from wireline logs. Schlumberger p.211
Gerhard Einsele 2000: Sedimentary Basins: Evolution, Facies, and Sediment Budget, p. 792
Mike R. Leeder, 2011: Sedimentology and Sedimentary Basins: From Turbulence to Tectonics. John Wiley & Sons, p. 784
P. A. Allen, J.R., 1990: Allen Basin Analysis: Principles and Applications. Wiley, p.451
Andrew D. Miall, 1990: Principles of sedimentary basin analysis. Springer-Verlag, - 668 oldal
Emiliano Mutti, 1992:Turbidite sandstones. Agip, Istituto di geologia, Università di Parma, - 275 oldal

Other Faculty Member(s) Involved in Teaching, if any (name, position, scientific degree): Dr. Juhász Györgyi

Syllabus of the semester

Thursday, 8:00 – 10:00 (Carbonate sedimentology)

2025.02.13. The place of sedimentology in earth sciences. The main groups of sedimentary rocks: (siliciclastic) rocks, biogenic rocks, rocks formed by chemical precipitation, organic sediments, volcanic rocks.

2025.02.19. Major aspects of rock description (composition, rock, sedimentary structures, fossils) Processes of sedimentation (stagnation, transport, settling / precipitation, diagenesis) The main laws: Steno's laws, aktualismus, Walter's law.

2025.02.26. Carbonate rocks. Introduction: What are carbonate rocks? Carbonate minerals. Factors affecting carbonate formation.

2025.03.05. Main sedimentation environments: Wilson's facies belts, their main rock and microfacial types. The main constituents of carbonate rocks. Changes in carbonate-producing groups of organisms during the history of the earth.

2025.03.12. Classification of carbonate rocks. Pore types. Diagenesis: marine, fresh water, deep burial

2025.03.19. Carbonate platform types. Carbonate reservoirs. Comparison of carbonate and silicicastic rocks

20253.03.26. Midterm exam

Monday, 9:00 – 12:00 (Siliciclastic sedimentology)

2025.02.10.Main characteristic of silicicalstic rocks: sorting, sfericity, roundness. Cementation of siliciclastic rocks.

2025.02.17. Test. Origine, transport, sedimentotation and diagenesis of siliciclastic rocks. Classification of siliciclastic rocks

2025.02.24. Sedimentary environments of siliciclastic rocks. Alluvial fans, eolitic and fluviatile facies (sediments of meandering and braided rivers).

2025.03.03. Coastal sediments, siliciclastic self seas.

2025.03.10. Delta (river, wave, tidal dominated, Gilbert, coarse-grained and fan-delta).

2025.03.17. Deep sea fans.

2025.03.24. Evaporites, manganese ores. Precipitation: radiolarit, chert, diatomite. Fossil energy sources. Coal: lignite, brown coal, anthracite, graphite. Uranium sedimentology.

2025.03.31. End term exam

Midterm exam

1. What are the main sedimentary rock groups?

Siliciclastic rocks, biogenic rocks, chemical precipitations, organic sediments, volcanic rocks.
(max: 10)

2. What is Steno's law?

It is the law of superposition. It states that in undeformed stratigraphic sequences, the oldest strata will be at the bottom of the sequence. This is important to stratigraphic dating, which assumes that the law of superposition holds true and that an object cannot be older than the materials of which it is composed.
(max: 10)

3. What is Walter's law?

Walther's law states that any vertical progression of facies is the result of a succession of depositional environments that are laterally juxtaposed to each other.
(max: 10)

4 What kind of processes are summerised under the term diagenesis?

The physical, chemical or biological **alteration of sediment**s into sedimentary rock at low temperatures and pressures.
After deposition, sediments are compacted as they are buried beneath successive layers of sediment and different solutions circulate in the sediments. From this solution different minerals can precipitate, which cement the grains of sediment.
Grains of sediment, rock fragments and fossils can be replaced by other minerals during diagenesis. Porosity mainly decreases during diagenesis, except in rare cases such as dissolution of minerals and dolomitization.
(max: 10)

5 What are the controls on carbonate deposition?

Marine environment: 90% of the carbonates were deposited in.
Animals need light and warm temperatures.
Most carbonates are produced in the upper 20m of the water column.
Shallow tropic, subtropic seas between 30N, and 30S and deep see bottom.
Salinity 32-40‰.
Water temperature: 25C.
Minimal siliciclastic pollution.
(max: 10)

6. What is the difference between matrix and cement?

Matrix is primary. It is relative finer grained sized sedimentary particles in between coarse grained particles.
Cement is secondary. It is the binding material between the grains, it is precipitated from moving solutions, can be siliceous or carbonate.
(max: 10)

7. Describe the main features of eolianite?

Are wind transported coastal dunes adjacent to high-energy beaches in warm climates.
It consists of well sorted, cross stratified clastic limestones.
Grains are ooids, pellets, skeletal fragments, sometimes quartz grains also appear.
Cross stratification.
Geometry: elongate bodies of carbonate grainstones paralel to the strandline.
Associated facies: interfingers with beach and nearshore sands, evaporites. May underline lagoonal deposits or chaliche.
Composition: sand sized skeletal fragments, ooids, pellets.

Grainsize, sorting: well sorted: fine-medium grain without the gravel sized constituents.
Early-stage cements: vadose,: meniscus, pendant droplets.
Evidence of subaerial depositon: paleosols.
Subaerial crusts (chaliche layers), karst featues.
(max: 10)

8. What is grapestone?
Grapestones are composite grains with an irregular shape that resembles a bunch of grapes. Sand-sized grains cemented together shortly after deposition.
(max: 10)

9. What is characteristics of the pelagic rocks?
Presence of planctonic foraminifers, coccoliths, pteropods, diatoms, radiolaria.
Condensed sections deposited at slow rates or are intercalated with numerous hiatuses.
Presence of multiple hardground horizons that mark submarine lithification events associated with hiatuses.
Fine grained, well bedded sediments of great lateral extent and with gradual lateral facies changes.
Presence of fecal pellets, small scale lamination or cm to meter thick bedding rhythms.
Large scale bedding feautes are typically absent, or rare.
Some burrow assembles dominated by groups such as Zoophycos, Skolithos, Thalassinoides
(max: 10)

10. What is characteristic of the sedimentation of an atoll?
Asymmetric facies distribution, and the reefs are situated on the windward side
(max: 10)