

COURSE DESCRIPTION

Isotope Geology

Academic year 2026-2027

1. Programme-related data

1.1. Higher Education Institution	Babeş-Bolyai University
1.2. Faculty	Faculty of Biology and Geology
1.3. Doctoral School	Theoretical and Applied Geology
1.4. Field of study	Geology
1.5. Level of study	Doctorate

2. Course-related data

2.1. Course title	Isotope Geology	Course code	SDG04		
2.2. Course coordinator	Prof. univ. dr. Bogdan P. Onac				
2.3. Seminar coordinator	Prof. univ. dr. Bogdan P. Onac				
2.4. Year of study		2.5. Semester		2.6. Type of assessment	Exam
2.7. Course status	Optional	2.8. Course type	Specialisation subject		

3. Total estimated time (hours per semester of teaching activities)

3.1. Number of hours per week	4	of which: 3.2. course	2	3.3. seminar/ laboratory/ project	2
3.4. Total of hours in the curriculum	48	of which: 3.5. course	24	3.6. seminar/ laboratory	24
Time allocation for individual study (IS) and self-taught activities (ST)					hours
Learning from textbooks, course materials, bibliography, and notes (IS)					60
Additional research in the library, on subject-specific electronic platforms, and on-site					70
Preparing seminars/ laboratories/ projects, assignments, reports, portfolios, and essays					46
Tutoring (professional guidance)					10
Examinations					4
Other activities: two-way communication with the course coordinator					12
3.7. Total hours of individual study (IS) and self-taught activities (ST)				202	
3.8. Total hours per semester				250	
3.9. Number of credits				10	

4. Prerequisites (where applicable)

4.1. curriculum-related	Sedimentary rocks and General geochemistry courses
4.2 skills-related	

5. Specific conditions (where applicable)

5.1. course-related	
5.2. seminar/laboratory-related	

6. Subject-specific learning outcomes

Knowledge
1. Understand principles of stable and radiogenic isotopes.
2. Learn how isotopes trace geological and environmental processes.
3. Apply isotopic dating methods to determine ages of rocks and minerals.

4. Use isotopes to reconstruct past climates and environments.
5. Study water sources and groundwater flow using isotopes.
6. Become familiar with methods for measuring isotope ratios.
7. Interpret isotope data in geological studies.
8. Understand the role of isotopes in Earth history and climate research.
Skills
1. Analyse stable and radiogenic isotope datasets from geological samples.
2. Apply isotope fractionation principles to natural systems.
3. Interpret isotopic signatures to reconstruct geological processes.
4. Evaluate and apply radiometric dating methods.
5. Integrate isotope data with geological and environmental datasets.
6. Critically assess isotope geochemistry literature.
7. Design research questions using isotope approaches.
8. Present and discuss isotope data and interpretations clearly.
Responsibility and autonomy
1. Work independently in analysing and interpreting isotope data.
2. Take responsibility for accurate data interpretation and reporting.
3. Apply critical thinking in evaluating isotope datasets.
4. Manage independent research tasks related to isotope studies.
5. Make informed scientific decisions based on isotope evidence.
6. Demonstrate scientific integrity in data handling and reporting.
7. Collaborate effectively in research and laboratory settings.
8. Communicate results clearly and professionally.

7. Contents

7.1. Course	Teaching and learning methods	Remarks ¹
Introduction to isotope geology	Oral presentations combined with guided discussion and student questions	2 ore
Stable isotope principles and fractionation	Lectures with interactive explanations and problem-solving exercise	2
Radiogenic isotopes and geochronology	Oral presentations supported by data interpretation examples	4
Analytical methods in isotope geology	Lectures with demonstrations of analytical techniques and instrument workflows	4
Interpretation of isotope data	Guided exercises and group discussions on real datasets	2
Isotopes in hydrology and environmental studies	Lecture followed by case studies and student-led discussions	4

¹ For example, organisational aspects, recommendations for students, specific aspects relating to the course/seminar, such as inviting experts in the field, etc.

Isotopes in paleoclimate and paleoenvironmental reconstruction	Lectures combined with analysis of published datasets	4
Applications of isotope geology in Earth Sciences	Student presentations and critical discussion of research papers	2
Bibliography		
<p>Onac, B.P. 2004. <i>Clepsidrele geologie. Introducere în geocronologia izotopică</i>. Ed. Presa Univ. Clujeană, Cluj-Napoca, 176 p.</p> <p>Sharp, Z. 2017. <i>Principles of stable isotope geochemistry</i>. Pearson/Prentice Hall, Upper Saddle River, 445 p.</p> <p>Văсарu, V., Cosma, C. 1998. <i>Geocronologie nucleară. Metode de datare prin fenomene nucleare naturale</i>. Ed. Dacia, Cluj-Napoca, 349 p.</p> <p>White, W.M. 2015. <i>Isotopic geochemistry</i>. Wiley, 478 p. (digital)</p> <p>https://isoplotr.geoaltay.eu</p> <p>https://c14.arch.ox.ac.uk/oxcal.html</p> <p>https://wateriso.utah.edu/waterisotopes/</p>		
7.2. Seminar/ laboratory		
	Teaching and learning methods	Remarks
Sample preparation for isotope analysis (cleaning, grinding, weighing)	Demonstration followed by supervised hands-on practice and discussion of best laboratory practices	2
Introduction to stable isotope instrumentation (Picarro overview)	Instrument demonstration with guided explanation of analytical workflow and student questions	4
Introduction to radiogenic isotope instrumentation (Nu plasma)	Instrument demonstration with guided explanation of analytical workflow and student questions	4
Calibration and standards in isotope measurements	Guided laboratory exercise using reference materials and discussion of data quality and precision	4
Processing and interpretation of isotope data	Computer-based exercises with instructor guidance and group discussion of results	4
Case study: isotope applications in hydrology or paleoclimate	Multi-lab project combining data analysis, student collaboration, and presentation of results	6
Bibliography		

8. Evaluation

Type of activity	8.1 Evaluation criteria ²	8.2 Evaluation methods ³	8.3 Percentage in the final grade
8.4. Course	Understanding of isotope geochemistry principles and terminology	Ongoing: short quizzes and participation in discussions; Final: written exam	30%
	Ability to interpret isotope data and apply concepts to geological problems	Ongoing: problem-solving exercises and case-study discussions; Final: data interpretation questions in the final exam	40%
8.5. Seminar/ laboratory	Ability to apply laboratory procedures and analytical methods correctly	Ongoing: instructor observation during lab work and lab performance checks; Final: laboratory practical evaluation	10%
	Ability to analyze, interpret, and communicate isotope data	Lab assignments and data analysis exercises; Final: laboratory report or short project presentation	20%
8.6 Minimum standard for passing Minimum grade of 5 on the final exam Minimum grade of 5 on the continuous (ongoing) assessments.			

² The evaluation criteria must directly reflect the learning outcomes targeted at the level of the degree programme respectively at the level of the subject. More specifically, the learning outcomes set out in the expected learning outcomes are assessed.

³ Both final evaluation methods and ongoing evaluation strategies should be established.

9. SDG labels (Sustainable Development Goals)⁴

		 Sustainable Development Generic Label						
1 FĂRĂ SĂRĂCIE 	2 FOAMETE 'ZERO' 	3 SĂNĂTATE ȘI BUNĂSTĂRE 	4 EDUCATIE DE CALITATE 	5 EGALITATE DE GEN 	6 APĂ CURATĂ ȘI SĂNĂTATE 	7 ENERGIE CURATĂ ȘI LA PREȚURI ACCESIBILE 	8 MUNCĂ DECENTĂ ȘI CREȘTERE ECONOMICĂ 	9 INDUSTRIE, INOVAȚIE ȘI INFRASTRUCTURĂ 
								
10 INEGALITĂȚI REDUSE 	11 ORAȘE ȘI COMUNITĂȚI DURABILE 	12 CONSUM ȘI PRODUCȚIE RESPONSABILE 	13 ACȚIUNE CLIMATICĂ 	14 VIAȚĂ ACVATICĂ 	15 VIAȚĂ TERESTRĂ 	16 PACE, JUSTIȚIE ȘI INSTITUȚII EFICIENTE 	17 PARTENERIATE PENTRU REALIZAREA OBIECTIVELOR 	No label applies
								

Date of entry:

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Signature of course coordinator

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Signature of seminar coordinator

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Date of approval in the department:

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Signature of the head of department

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⁴ Select a single label which, according to the [Implementation of SDG labels in the academic process](#), best matches the subject. If the subject addresses sustainable development in a generic manner (i.e. by presenting/introducing the general framework of sustainable development, etc.), then the Sustainable Development generic label may be applied. If none of the labels describe the subject, select the last option: "No label applies."