UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze della Terra e del Mare
ACADEMIC YEAR	2024/2025
MASTER'S DEGREE (MSC)	GEORISKS AND GEORESOURCES
SUBJECT	ISOTOPE GEOCHEMISTRY
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	21015-Attività formative affini o integrative
CODE	16881
SCIENTIFIC SECTOR(S)	GEO/08
HEAD PROFESSOR(S)	NOGUEIRA LAGES JOAO PEDRO — Ricercatore a tempo determinato — Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**NOGUEIRA LAGES JOAO PEDRO** Monday 11:00 13:00 Wednesday 11:00 13:00

DOCENTE: Prof. JOAO PEDRO NOGUEIRA LAGES

PREREQUISITES	Chemistry, geochemistry, physics, mathematics, mineralogy, petrology
LEARNING OUTCOMES	Acquisition of advanced tools for the evaluation of the geochemical characteristics of a natural system through the use of isotope ratios of selected elements. Knowledge of state-of-the-art methodologies and tools for high-precision measurements of natural materials for their isotopic characterization. Critical analysis of geochemical studies, their methodology, results and implications for the understanding of natural systems. Ability to identify and access state-of-the-art work through the consultation of scientific publications specific to the sector of Isotopic Geochemistry. Ability to understand the main processes that influence isotopic fractionation and its broader implications on geochemical cycles and the evolution of the Earth. Analysis of the radioactive decay process for geochronological purposes and in source studies. Ability to use the specific language of this particular discipline. Communication and synthesis skills to communicate scientific results from peer-reviewed studies, analytical methodologies and theoretical concepts related to the field of isotopic geochemistry.
ASSESSMENT METHODS	In-class presentations. Oral exam, with questions regarding theoretical concepts of isotope geochemistry and interpretation of figures describing the application of different isotope systems in geosciences. Written exam of 7 to 10 numerical exercises on applying isotope geochemistry concepts in the geosciences. Compensatory tools and dispensatory measures will be guaranteed by the Disability and Neurodiversity Center - University of Palermo (Ce.N.Dis.) to students with disabilities and neurodiversity, based on specific needs and in implementation of current legislation.
EDUCATIONAL OBJECTIVES	Recognise the isotope behavior during the main geological phenomena. The causes of the isotopic fractionation and radioactive decay. As the isotope fractionation is influenced by the temperature and chemistry of the system. The study of isotopic ratios of radiogenic elements for discrimination of magma sources.
TEACHING METHODS	In-person lectures, numerical exercises, and laboratory.
SUGGESTED BIBLIOGRAPHY	ALLEGRE, C.J. (2008) - ISOTOPE GEOLOGY. Cambridge University Press. Hoefs J. (2012) - Stable Isotope Geochemistry. Springer WHITE, W, M. (2023) ISOTOPE GEOCHEMISTRY. Wiley (2nd edition, 2023), ISBN: 978-1-119-72994-5

SYLLABUS

Hrs	Frontal teaching
2	Isotopes and radioactivity: the atomic nucleus
4	The principles of radioactive dating
4	Radiometric dating methods
2	Cosmogenic isotopes
1	Carbon-14 dating
4	Radiogenic isotope geochemistry: strontium isotope geochemistry and strontium–neodymium isotopic coupling
1	Radiometric dating methods: rich systems and solutions to the problem of the open system
2	Radiometric dating methods: poor systems and the radiometric isotopic correlation diagram
2	Radiogenic isotope geochemistry: the continental crust–mantle system and the early history of the Earth
2	The mass spectrometer: principles, components and limitations
2	Stable isotope geochemistry: modes of isotope fractionation
1	Stable isotope geochemistry: the isotope cycle of water
1	Stable isotope geochemistry: oxygen isotopes in igneous processes
2	Stable isotope geochimistry: sulfur, carbon, and nitrogen isotopes and biological fractionation
4	Isotope geology and dynamic systems analysis

Hrs	Practice
2	The principles of radioactive dating
2	Radiometric dating methods
1	Carbon-14 dating
2	Radiogenic isotope geochemistry: strontium isotope geochemistry and Strontium–neodymium isotopic coupling
1	Radiometric dating methods: rich systems and solutions to the problem of the open system
1	Radiometric dating methods: poor systems and the radiometric isotopic correlation diagram
2	Radiogenic isotope geochemistry: the continental crust–mantle system and the early history of the Earth
1	Stable isotope geochemistry: modes of isotope fractionation
1	Stable isotope geochemistry: oxygen isotopes in igneous processes
1	Stable isotope geochimistry: sulfur, carbon, and nitrogen isotopes and biological fractionation

Hrs	Practice
2	Isotope geology and dynamic systems analysis

Hrs	Workshops
2	Stable isotope lab: sample preparation, analytical procedures and data treatment (oxygen and carbon)
2	Stable isotope laboratory: sample preparation, analytical procedures and data treatment (sulfur)