



# UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze della Terra e del Mare		
ACADEMIC YEAR	2020/2021		
MASTER'S DEGREE (MSC)	GEORISK AND GEORESOURCES		
SUBJECT	VOLCANIC ACTIVITY SURVEILLANCE		
TYPE OF EDUCATIONAL ACTIVITY	C		
AMBIT	21015-Attività formative affini o integrative		
CODE	19834		
SCIENTIFIC SECTOR(S)	GEO/08		
HEAD PROFESSOR(S)	CALABRESE SERGIO	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)			
CREDITS	6		
INDIVIDUAL STUDY (Hrs)	86		
COURSE ACTIVITY (Hrs)	64		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	2° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	<b>CALABRESE SERGIO</b> Tuesday 10:00 13:00 Via Archirafi 36, terzo piano, stanza III-8 Thursday 10:00 13:00 Via Archirafi 36, terzo piano, stanza III-8		

DOCENTE: Prof. SERGIO CALABRESE

<b>PREREQUISITES</b>	Basic background on Earth Sciences; Basic principles of physics and chemistry of the Earth; Geochemistry and Volcanology.
<b>LEARNING OUTCOMES</b>	Aim of the course is to supply a robust knowledge and skills concerning the theoretical and experimental aspects of monitoring of active volcanoes. Starting from chemical-physics laws ruling the magmatic degassing, the necessary tools to evaluate the most correct geochemical parameters will be treated. Looking at real cases and considering a set of geochemical tracers, the course aims to give to students the correct skills to evaluate the hazard level of a particular volcano in a particular moment.
<b>ASSESSMENT METHODS</b>	Oral exam with practical exercises focused and geochemical data processing; evaluation of a written report focused on discussion of data processed during the course. The test will ascertain: (i) the adoption of an appropriate technical language, (ii) a critical and independent reasoning, (iii) ability to make connections between various topics of the course.
<b>EDUCATIONAL OBJECTIVES</b>	The aim of the course is to give a robust knowledge and skills concerning the theoretical and experimental aspects of geochemical and geophysical monitoring of active volcanoes, finalized to the comprehension of eruptive dynamics, to the definition of the main geophysical and geochemical parameters that are crucial for volcanic surveillance. In particular, the course aims to give to students the correct skills on modern geophysical techniques using analysis of discrete and continuous signals acquired by integrated geochemical networks (UV cameras, MultiGas stations, etc.). Acquisition of theoretical and practical backgrounds, on modern geochemical monitoring techniques of active volcanoes. Laboratory and field activities activity.
<b>TEACHING METHODS</b>	Frontal lessons and practical exercises on processing of geochemical data; Educational laboratories aimed at understanding the principle of data acquisition and processing in volcanic environment using modern geochemical instruments and software; working table; laboratory and field activities.
<b>SUGGESTED BIBLIOGRAPHY</b>	Volatiles in Magmas. Volume 30. Michael R. Carroll and John R. Holloway, editors 1994, i-xviii + 517 pages. ISBN 0-939950-36-7; ISBN13 978-0-939950-36-2 - <a href="http://www.minsocam.org/MSA/RIM/rim30.html">http://www.minsocam.org/MSA/RIM/rim30.html</a> The Encyclopedia of Volcanoes. ISBN 978-0-12-385938-9. - <a href="https://www.sciencedirect.com/book/9780123859389/the-encyclopedia-ofvolcanoes#book-info">https://www.sciencedirect.com/book/9780123859389/the-encyclopedia-ofvolcanoes#book-info</a> R. Scarpa, R. I. Tilling, Monitoring and Mitigation of Volcano Hazards. Springer Sigurdsson H. ed. 2000, Encyclopedia of Volcanoes. Academic Press - <a href="https://www.springer.com/gb/book/9783642800894">https://www.springer.com/gb/book/9783642800894</a> Recent scientific articles on geochemical monitoring of active volcanoes will be provided.

## SYLLABUS

Hrs	Frontal teaching
2	presentation and Introduction to the course; anonymous test
3	Volcanic risk, hazard and surveillance / monitoring concepts - Approaches to volcanic monitoring: geophysics, geochemistry, geodesic, petrology. Pre and sineructive monitoring. Continuous and discreet monitoring, in situ and remote monitoring.
3	Effects of volcanic activity on the environment and human health
6	"Theoretical principles The geochemical approach and the general principles: the release of fluids from magmas, drying processes, decompression and crystallization. Notes on the thermodynamics of degassing processes, concepts of gas fugacity, chemical and isotopic equilibrium. Processes of chemical and chemical fractionation. isotopic - Migration of fluids and evidence of outgassing: volcanic plume, fumaroles, gases diffused from the soil, hydrothermal fluids and dissolved gases. "
6	"Applications Identification of the magmatic component, contamination of superficial / atmospheric fluids, mixing of magmatic and hydrothermal and superficial fluids, interactions with thermal aquifers, use of isotopic markers - Estimates of the exhaustion pressure of magmas with larger and inert species, geothermometry and geobarometry and redox conditions with reactive volatile species, use of isotopic systems (C, S) - Budget of magmatic birds, fluid / magma ratios and volumes of degassing magma "
5	"Introduction to geophysical monitoring and general principles. Basic information on the main geophysical disciplines such as seismology, soil deformations and geodesy, infrasound and thermal analysis. Case studies"
3	"Surveillance and monitoring activities in the context of memoranda of understanding with the Department of Civil Protection. H24 operating rooms: their operation and purpose."
4	Instrumental geochemical and geophysical monitoring networks: water and gas, atmospheric deposition, permanent and mobile seismic networks, infrasonic arrays, permanent and mobile GPS networks, clinometric networks. The main Italian and foreign volcanic monitoring networks
Hrs	Workshops
14	Depending on weather conditions, volcanic activity, availability of means of transport and financial availability of the CDS, Field Activities: Excursion and educational exercises in Vulcano and / or Etna, with demonstration of the use of geochemical instrumentation in the countryside. In the absence of resources, the activity will be held in the DiSTeM laboratories

Hrs	Workshops
4	Educational laboratory on the use of instrumentation for volcanic monitoring. Geochemical data processing and statistical analysis through spreadsheets. Construction of graphs for the representation of geochemical data and realization of process curves through calculation codes. Laboratory analysis experience
14	346/5000 Depending on weather conditions, volcanic activity, availability of means of transport and financial availability of the CDS, Field Activities: Excursion and educational exercises in Vulcano and / or Etna, with demonstration of the use of geochemical instrumentation in the countryside. In the absence of resources, the activity will be held in the DiSTeM laboratories