



# UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze della Terra e del Mare		
ACADEMIC YEAR	2019/2020		
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)	94		
COURSE ACTIVITY (Hrs)	56		
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>	Knowledge of principles of Earth dynamics; knowledge of chemistry and physics; basic knowledges of 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. midterm evaluation. 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>	<p>- 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></p> <p>- The Encyclopedia of Volcanoes. ISBN 978-0-12-385938-9. - <a href="https://www.sciencedirect.com/book/9780123859389/the-encyclopedia-of-volcanoes#book-info">https://www.sciencedirect.com/book/9780123859389/the-encyclopedia-of-volcanoes#book-info</a></p> <p>- 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></p> <p>- Recent scientific articles on geochemical monitoring of active volcanoes will be provided.</p>

## SYLLABUS

Hrs	Frontal teaching
2	presentation and introduction; anonymous entrance exam
3	Volcanic risk, hazard, and volcanic surveillance/monitoring. Volcanic monitoring approaches: geophysics, geochemistry, geodetic, petrology. Pre- and syneruptive monitoring. Discrete and continuous monitoring. Remote monitoring and "in-situ" monitoring.
3	Effects of volcanic activity on environment and human health
6	"Theoretical principles. Geochemical approach and general principles: magmatic fluid release, exsolution, decompression and crystallization. Principles of thermodynamics and degassing processes; fugacity concept, chemical and isotopic equilibrium. Chemical and isotopic fractionation. Fluid migration and degassing evidence: volcanic plumes, fumaroles, soil gas, hydrothermal fluids and dissolved gas."
6	"Measurement techniques. Extensive and intensive measurements, volatile concentration and fluxes, in situ and remote sampling techniques, issues e limitations. Measurements of chemical and isotopic parameters on fumaroles and water, flux and concentration measurements on volcanic plumes, diffuse soil flux measurements. Geochemical prospecting. Permanent stations. Continuous sampling. Atmospheric depositions and biomonitoring techniques. study cases example and applications"
3	"Applications: identification of the magmatic component, shallow/meteoric fluid contamination, magmatic/hydrothermal/meteoric fluid mixing and interaction with thermal aquifers. Isotopic markers. Exsolution pressure estimates on magma with reference on major and inert species. Geothermometry, geobarometry, redox condition with reactive volatile species. Use of isotopical systems (C, S). Budget of magmatic volatiles. Magma/fluid ratio. Degassing Magma volume estimates."
4	Introduction to geophysical monitoring and basic principles. Introduction on main geophysical disciplines, such as seismology, ground deformation, infrasound, thermal remote sensing, etc. Study case.

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Hrs	Frontal teaching
2	"Surveillance and monitoring activities in the framework of cooperation between scientific community and Civil Protection Agencies. Volcanic observatories: how do they work and which is their aim."
3	Instrumental networks for geochemical and geophysical monitoring: volcanic fluids, atmospheric deposition; permanent and temporary seismic networks, infrasonic arrays, GPS networks, tiltmeters networks. The main italian and foreign networks of volcanic monitoring
Hrs	Workshops
6	Laboratory on the use of volcano monitoring instrumentation. Geochemical data processing and statistical analysis using spreadsheet software (Excel). Table and graphics design for geochemical data visualization. Curve fitting using spreadsheet software (Excel). Experience of laboratory analyses of volcanic fluids.
18	"Field work (pending on availability of resources): Excursion to vulcano and /or Etna , with a demonstration of the use of geochemical instrumentations. In the absence of the required resources, the demonstration will be held in the DiSTeM laboratories"