

SCHOOL OF ADVANCED STUDIES- 2014 PhD Research topics	
Area of Studies	SCIENCE AND TECHNOLOGY

Curriculum:	PHYSICAL AND CHEMICAL PROCESSES IN EARTH SYSTEMS
<p>Supervisors: Prof. Emanuele Tondi , Dr. Claudio Di Celma With stipend Research financed by grants: www.reachproject.com E. Tondi and C. Di Celma Info: emanuele.tondi@unicam.it, claudio.dicelma@unicam.it</p>	<p>Research Topic n. 1: Sedimentological and stratigraphic characterisation of sedimentary rocks and their relationship with failure modes and fracture distribution</p> <p>Reservoir quality is usually very variable due to the high degree of heterogeneities, most of which are below conventional seismic resolution but may have a major impact on fluid behaviour during production. As a result, exploration and development involve high costs and, at the same time, high risks. Gaining a good knowledge of the role played by all the structural and stratigraphic key features encountered in a reservoir is therefore critical to mitigating both costs and risks. One method to more accurately interpret, and predict, the architecture of reservoir heterogeneities present in subsurface fields is through the study of appropriate outcrop analogues.</p> <p>Furthermore, the storage and migration of geofluids in rocks is strongly influenced by “fracturing” or, better, by the presence and characteristics of bedding, joints, veins, stilolites and fault zones. The different deformation processes and their capacity of increasing or inhibiting hydraulic conductivity in rocks, are controlled by the physical-mechanical properties of the rocks, and are the result of different sedimentation environments, diagenesis and alteration state.</p> <p>This PhD project aims to explore the relationships existing between compositional, depositional, and diagenetical rock features and the physical-mechanical properties of the sedimentary rocks and, as a consequence, the different failure modes and fracture distributions in sedimentary rocks.</p>
<p>Supervisors: Dr. Gabriele Giuli, Prof. Eleonora Paris Stipend currently not available Research financed by grants: G.Giuli – E. Paris Info: gabriele.giuli@unicam.it, eleonora.paris@unicam.it</p>	<p>Research Topic n. 2: The role of transition elements in silicate glasses and melts: Synthesis, structural characterization, technological applications</p> <p>This project proposes integrated experimental and theoretical research concerning interactions between sulfur and transition elements in silicate melts and glasses. The topic is of fundamental importance to understand the behavior of S in magmas and to better understand the formation of metal sulfide ore deposits. Also, the behavior of sulfur and transition elements is of interest for glass materials with major technological application, including production of colored glass and vitreous isolation of nuclear wastes. For this research proposal we will address questions about S-transition metal interactions using state-of-the-art experimental and theoretical methods. The project is organized in specific tasks to be accomplished, with provision for feed-back between experiment, spectroscopic</p>

	analysis and theory as the project progresses.
<p>Supervisor: prof. Antonio Schettino With stipend Research financed by grants: PRIN, A. Schettino info: antonio.schettino@unicam.it</p>	<p>Research topic n. 3: Plate Kinematics & Mantle Dynamics of the Red Sea Region</p> <p>This research program has the objective of constructing a new plate kinematics model for the Red Sea region since the early Miocene and to combine the plate motions with an upper mantle circulation model. This research requires the analysis of magnetic and gravity data using potential fields techniques, and to acquire skills in the field of mantle dynamics modelling. The student should have a strong background in geophysics and be willing to explore both the kinematics of tectonic plates and the physics of Earth' interior.</p>
<p>Supervisors: Prof. Eleonora Paris, Dr. Chiara Invernizzi Without stipend info: eleonora.paris@unicam.it or chiara.invernizzi@unicam.it website: www.unicam.it/geologia/unicamearth/index.htm</p>	<p>Research Topic n. 4: Research on teaching and learning processes in Earth Sciences education (UNICAMearth project)</p> <p>This PhD project aims at the development of new approaches to teaching and learning Earth Sciences in the Italian schools. In particular, innovative teaching tools and models, inquiry-based science education (IBSE) <u>approach</u>, project and problem based <u>learning</u> (PBL) and flipped classroom education are well considered. The program is especially dedicated (but not reserved) to high school Science teachers, willing to explore new ways to approach Earth Sciences and investigate the integration of contributions to the learning process coming from the school science curriculum, the university research and the museum activities. The final aim is, in fact, to find new strategies to address perceived problems in Earth Sciences teaching and to increase the engagement of young people on geosciences topics, from the use of natural resources to climate change, from the understanding of Earth interior and planetary evolution to the natural hazards. The project is a collaboration between the Geology group and the Science Museum at UNICAM (UNICAMearth Group, see us at the website).</p> <p>The PhD students will also have the possibility to carry out joint research projects with University of Campinas (Brazil), co-supervisor prof. R. Greco (Instituto de Geociências – Unicamp), greco@ige.unicamp.br, http://www.unicamp.br/unicamp/a-unicamp</p>

<p>Supervisor: Dr. Antonio Schettino Without stipend Research financed by grants: A. Schettino Info: antonio.schettino@unicam.it</p>	<p>Research Topic n. 5: Mantle Dynamics</p> <p>This research program has the objective of constructing a new upper mantle circulation model, which incorporates the possibility of accelerated states for the lithosphere, driven by asthenosphere currents. The student should have a strong background in physics or mathematics and be willing to explore the physics of Earth' interior.</p>
<p>Supervisors: Prof. Michael Carroll, Prof Antonio Speranza Without stipend Research financed by grants: M. Carroll, FAR 2013 UNICAM Info: michael.carroll@unicam.it</p>	<p>Research Topic n. 6: Volcanoes and Climate</p> <p>Some volcanic eruptions can inject large amounts of sulphuric gases in the stratosphere. These gases convert to sulphate aerosols and cause non-uniform perturbations of the radiative balance of the Earth (Carroll and Holloway, 1994, Carroll et al. 1987, 1988). Significant climatic effects, from global to regional scale, may persist for years after the single volcanic episodes. Global climate model simulations can be used to better understand the potential effects of volcanic eruptions on the global and regional climate systems. Moreover, due to the strong environmental effect of large eruption on climate change, a model will be elaborated concerning the duration and strength of the environmental effect due to volcanic sulphur loading into the troposphere and stratosphere. Thus, in the aim of making sufficiently reliable models on the effect of volcanic emission on climate, our research project will focus on exploring the potential role of parameters different from surface temperature in assessing the performance of numerical models in modelling volcanic impact and refining the computation of "volcanic forcing". This may be combined with new experimental and theoretical studies concerning melt-vapor partitioning of S in different magma systems, (depending on interests of the candidate).</p>
<p>Supervisor: Dr. Marco Materazzi Without stipend Research financed by grants: G. Pambianchi - M. Materazzi Info: marco.materazzi@unicam.it gilberto.pambianchi@unicam.it</p>	<p>Research Topic n. 7: The groundwater reservoirs of the central-southern Apennine; geometry, capacity and protection</p> <p>The project aims at studying the major hydrogeological structures present in the central-southern Apennine, including both mountain aquifers and those of the floodplains. Mountain aquifers involve the major springs, both "punctual" (often located along the slopes and in the higher portion the reliefs), and "linear" (along the valley floors), the latter fueling the fluvial discharge of the main rivers of the region. The aquifers of the floodplains, hosted within the recent and present alluvial deposits of the main regional rivers, also contribute to fluvial discharge and consist of mono and multi-layered aquifers.</p> <p>The three-year project aims at studying the geometric, dynamic and quantitative characters of those hydrogeological structures, many of which home of the main exploitation works of the region for drinking water purposes. Particular care will be devoted to the definition of the vulnerability degree to pollution and to the investigations to be implemented for water resources protection and preservation.</p>

<p>Supervisor: Prof. Gilberto Pambianchi Without stipend Research financed by grants: G. Pambianchi – M. Materazzi Info: gilberto.pambianchi@unicam.it marco.materazzi@unicam.it</p>	<p>Research Topic n. 8: Geoarchaeological studies and landscape evolution since the Bronze Age along the Adriatic side of central Italy</p> <p>In central-southern Marche, relevant archaeological testimonies, ranging from the Iron Age till the Middle Age, are present. The detail of geomorphologic research is focused on these sites, distributed in different and representative morphological situations located between the Apennines and the Adriatic Sea. Only some small sites are well preserved, and therefore enjoyable; many other, even though recognizable, were abandoned and spoiled by time, by men and, often, by natural catastrophes (earthquakes and floods).</p> <p>The research using geomorphological and geoarchaeological methods (aerial photographs, remote sensing, geophysical surveys, paleopedology and stratigraphy...) aims at reconstructing:</p> <p>a) landscape before the establishment of the archaeological site (past geomorphic evolution); b) landscape during and after the establishment of the site (recent geomorphologic evolution); c) present landscape (active geomorphic evolution);</p> <p>The results will allow to have a representative framework of the geomorphological heritage which will be an unique cultural heritage together with archaeological finds also in line with the recommendations of the European Landscape Convention.</p>
<p>Supervisors: Prof. Piero Farabollini, Prof. Gilberto Pambianchi, Prof. Emanuele Tondi Without stipend Research financed by grants: P. Farabollini, G. Pambianchi, E. Tondi Info: piero.farabollini@unicam.it, gilberto.pambianchi@unicam.it, emanuele.tondi@unicam.it</p>	<p>Research Topic n. 9: Geomorphology and active crustal deformations in the uplifting foothills of the Umbria-Marche Apennines (Italy)</p> <p>The foothills of the Umbria-Marche Apennines are characterized by a diffuse both shallow (<15 km) and relatively deep (15–25 km) small-magnitude earthquakes. The focal mechanisms are of mixed kinematics, with normal, strike-slip, or reverse-faulting mechanisms, suggesting that the tectonic regime is not uniform and, consequently, not well established in this region. Moreover, outcropping lithologies are not suitable to preserve pervasive evidence of low- to medium-magnitude tectonic deformations. In this contest, considering that some historical earthquakes with MCS intensities up to IX occurred (such as Camerino 1799, Senigallia 1930, Offida 1943, Ancona 1972), the problem arises of how to identify seismic sources able to generate damaging earthquakes in this densely populated region of central Italy.</p> <p>Morphotectonic analyses can be valuable tools in reconstructing neotectonic events, even where evidence for deformation is unclear in present-day landforms; particularly, also considering their cost-effectiveness, useful tools are geomorphometric assessments from remote sensing and 3D modeling.</p> <p>This project is aimed at applying a quantitative geomorphological approach, consisting of stream-channel parameters evaluations combined with the dataset of stream incision rates derived by the quantitative analysis of fluvial terraces staircases, in order to recognize areas affected by low tectonic activity. This study can also be useful for siting, develop and monitoring human activities (i.e. gas</p>

	underground sequestration and/or storage).
<p>Supervisor: Prof. Michael Carroll Currently without stipend Research financed by grants (PRIN): M. Carroll Info: michael.carroll@unicam.it</p>	<p>Research Topic n. 10: Kinetics of crystallization in silicic magmas</p> <p>Experimental and theoretical data are needed to define time scales for magmatic processes (residence, ascent, eruption), at Stromboli volcano and with possible application to other basaltic systems. To obtain information on the dynamics of the system from the textural variations observed, we need quantitative data on the rates of nucleation (J) and growth (G) for crystal composition, pressure and temperature of interest. The project involves experimental and theoretical studies of the mechanisms and the growth rates of minerals in magmas, by carrying out experiments at high temperature and pressure to determine the parameters which controls the growth/nucleation rates. The PhD student will carry out the research in collaboration with the Universita' di Pisa (prof. Armienti, project PRIN). The student will perform the experiments in Camerino, but may also spend time in the labs at INGV (Roma) and Orleans (France) and possible periods at the Osservatorio Vesuviano and Stromboli..</p>
<p>Supervisor: Prof. Emanuele Tondi With stipend Research financed by grants: Eureka Project</p>	<p>Research Topic n. 11: Valutazione e riduzione del rischio sismico dei beni culturali: verifica e confronto tra normativa in vigore in Italia e Turchia</p>