

DOCTORAL STUDENTS' YEARBOOK XLI CYCLE



Academic Year 2025-2026

DOCTORAL STUDENT PROFILE · XLI CYCLE



Francesco Pio Cocco

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SUPERVISOR Francesco Carotenuto	CO-SUPERVISOR(S) Saverio Bartolini Lucenti, UNIFI
PROJECT TITLE Paleobiology for the study of faunal crises, from the deep past to the near future	

PROJECT SYNOPSIS

The project focuses on implementing new techniques for reconstructing species' geographic ranges. While Species Distribution Models (SDMs) have been the scientific standard for decades, they possess inherent limitations by focusing solely on species occurrences and the climatic conditions at those specific points. To overcome this, the project aims to:

- 1) Account for morphological data alongside geographic data, treating it as an adaptation to the climate within a species' habitat;
- 2) Include prey availability as a driver for the extinction and vulnerability of iconic predators;
- 3) Incorporate present and past occurrence data to predict future responses to climate change in extant species.

The methods include:

- 1) Utilization of Bayesian statistics.
- 2) Implementation of Machine Learning algorithms.
- 3) Use of geometric morphometrics techniques.

The project's expected outcomes are then: 1-2 papers on *L. pardinus*, 1 paper on *S. harrisii*, 1 paper on the faunal transition from Triassic archosaur-dominated communities to dinosaur-dominated ones, and 1 paper on *Megantereon* sp.

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Luca Dell'Anno

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SUPERVISOR Stefano Albanese	CO-SUPERVISOR(S) Salvatore Dominech, UNINA
PROJECT TITLE Development of advanced methods for processing environmental geochemical data for modeling diffuse contamination processes and source discrimination	

PROJECT SYNOPSIS

The research focuses on developing advanced geochemical data processing methods to model diffuse contamination and discriminate pollutant sources in the Solofra-Montoro area. The primary scientific targets are to define background values, identify source points, and develop innovative methods for geochemical data processing and groundwater modeling, analyzing contamination evolution and interconnections between surface and basal aquifers. The project follows an "Environmental Supply Chain" approach, integrating multivariate statistical analyses (PCA, Cluster, and Discriminant Analysis) with GIS-based spatial processing. Tools such as QGIS, R, ModFlow, and ModelMuse will be used to reconstruct contaminant paths and develop 3D predictive models. Expected results include the assessment of pollutant dispersion and the definition of intervention priorities for public health protection. The project will deliver a validated data-processing framework, fine-tuned through field monitoring and industrial collaboration with Ce.R.I.S..

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Alessia Di Costanzo

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SUPERVISOR Pasquale Raia	CO-SUPERVISOR(S) Carmela Serio, UNINA
PROJECT TITLE AI implementation of cultural heritage legacy protection. The Museum Ignazio Cerio Case Study.	

PROJECT SYNOPSIS

The project aims to develop an artificial intelligence-based pipeline for the digital reconstruction and restoration of fossil specimens, using the collections of the Ignazio Cerio Museum as a case study. Fossils are often incomplete or damaged, limiting their inclusion in morphological analyses and resulting in the loss of scientific information. The goal is to design an automated method capable of reconstructing the 3D morphology of fossils, correcting deformations and estimating missing anatomical parts while preserving biological integrity. A convolutional neural network (CNN) will be developed and trained on 3D datasets to learn anatomical relationships and generate plausible reconstructions. Variational Autoencoders (VAE) and Generative Adversarial Networks (GAN) will support optimization, enabling the model to produce realistic details through comparison with authentic samples. Geometric morphometrics will be integrated to analyze shape variation and validate model reliability. Expected results include a pipeline for automated restoration and tools for paleontological research and digital heritage preservation.

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Hongchuan Hu

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SUPERVISOR Maurizio Fedi	CO-SUPERVISOR(S) Giovanni Florio, UNINA
PROJECT TITLE Structurally Constrained multi-physics inversion in complex settings from potential fields data and subsurface images	

PROJECT SYNOPSIS

Sequential multi-physics inversion is developed for complex geological settings, coupling different geophysical datasets through cross-gradient constraints to reduce non-uniqueness and enhance structural consistency. The project integrates seismic, gravity, and magnetic data, introducing geophysical structural constraints for potential field inversion. Applications focus on fault-fold basins and CO₂ geological storage, aiming to improve subsurface characterization and uncertainty assessment.

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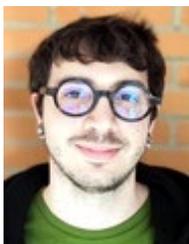
Davide Emanuele Marfella

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SUPERVISOR Jacopo Selva	CO-SUPERVISOR(S) --
PROJECT TITLE Multi-hazard model for volcanic islands	

PROJECT SYNOPSIS

The project's objectives are to develop a model that simplifies the quantification of multiple hazards on volcanic islands and to apply this model in these contexts, taking into account the interactions between both eruptive and non-eruptive phenomena and appropriately addressing any data gaps. The method we intend to use involves the development of a simplified multi-hazard model, which includes the selection of hazards, their interactions, and their spatial and temporal correlations; the selection of hazards and relationships relevant to the Ischia case study and/or volcanic islands in general; the development of baseline models for individual hazards (simulating all phenomena and their temporal occurrences in probabilistic terms); and the generation of multi-hazard and/or multi-risk studies for Ischia, the Canary Islands, the Azores, or the Aeolian Islands. The expected results are the production of several hazard maps for Ischia, a multi-hazard model and its application in Ischia and in another case study (Canary Islands, Azores Islands or Aeolian Islands), potentially supporting multi-hazard urban planning and emergency management.

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Manuel Matarozzi

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SUPERVISOR Pier Paolo Gennaro Bruno	CO-SUPERVISOR(S) Giovanni de Alteriis, CNR; Mauro Antonio Di Vito, INGV; Luigi Improta, INGV; Marco Sacchi, CNR
PROJECT TITLE Reprocessing and integration of exploration seismic data for the geological and structural characterization of the Campi Flegrei caldera	

PROJECT SYNOPSIS

This project aims to reassess legacy active seismic data acquired by Agip-Eni, OGS, CNR and other public and private institutions in the Campi Flegrei area, both offshore and onshore. The objective is to produce an updated reconstruction of the geological and structural framework of the caldera through advanced seismic processing and interpretation techniques. The application of modern seismic workflows to these datasets will allow the extraction of new structural details and correlations, enabling a refined characterization of the subsurface structural framework of the caldera and improved constraints on the geodynamic processes driving Campi Flegrei volcanism. The results of this study are expected to provide robust information to support volcanic risk assessment and management in this strategic and densely populated region, where the ongoing unrest of the Campi Flegrei caldera represents a major scientific and societal challenge.

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Linda Morvillo

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SUPERVISOR Pasquale Raia	CO-SUPERVISOR(S) Marina Melchionna, UNINA
PROJECT TITLE Development of artificial intelligence methods for geometric morphometrics	

PROJECT SYNOPSIS

This project aims to develop advanced artificial intelligence frameworks to enhance Geometric Morphometric (GM) techniques by integrating high-resolution 3D imaging with deep learning architectures. The two main goals of the project are the creation of automated systems for 3D shape reconstruction via landmarks and semi-landmarks, and the development of machine-learning-based models to predict soft-tissue craniofacial morphology from skeletal remains. Initial activities will focus on extensive data sampling and gaining expertise in neural networks, specifically CNN, GAN, and PointNet algorithms. Graph Neural Networks will be integrated to improve 3D mesh reconstruction, being expected to overcome the limitations of traditional GM approaches. These deep learning tools will be used to model the complex relationship between cranial features and their corresponding soft tissues. The expected outcome consists in the development of innovative AI-driven tools that provide more accurate and efficient alternatives to current methodologies. We expect this project may have also significant implications for forensic identification, paleoanthropological reconstruction, and medical applications.

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Alberto de Vito Piscicelli

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SUPERVISOR Carlo Donadio	CO-SUPERVISOR(S) Francesco Carotenuto, UNINA; Luca Lämmle, UNICAMP (Brasile)
PROJECT TITLE Novel outside-the-box study on transitional environments for the conservation of geomorphic systems	

PROJECT SYNOPSIS

The project proposes a study of transitional environments in the Mediterranean basin aimed at analyzing their geomorphological and environmental evolution, assessing the combined effects of climate change and anthropogenic pressures on coastal systems. The research involves a comparative analysis of two study areas, used as case studies to reconstruct the evolution of coastal erosion and compare dynamics across different geographical contexts, including the effects of climate change. An innovative aspect of the research lies in the integration of biological and geomorphological indicators to analyze phenomena such as pollutant dispersal, biodiversity loss, erosion, and alterations in the physico-chemical balance of marine ecosystems. The study will employ geophysical surveys for seabed mapping, topographic surveys, and ROV investigations for the direct observation of seabed facies. Among the expected outcomes is the development of geobiothematic maps integrating physical, chemical, and biological data with future climate projections, aimed at improving the understanding of coastal processes and supporting environmental management and the mitigation of erosion and pollution.

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Gilda Russo

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SUPERVISOR Alberto De Bonis	CO-SUPERVISOR(S) Maria Verde, UNINA
PROJECT TITLE Ancient ceramic production and raw materials in the Bay of Naples area	

PROJECT SYNOPSIS

The PhD project develops an integrated archaeometric–geological model of ceramic production in the Bay of Naples, linking clay resources, technological choices and vessel function beyond typology. In a geologically diverse and archaeologically dense landscape, ceramic manufacture and raw-material circulation are documented from Greek to Roman times and beyond. The research aims to identify exploited clay resources and their technological potential and compositional signature using PLM, XRPD, SEM-EDS, XRF, grain-size analysis, rheological properties, and isotopes. It will investigate paste preparation, tempering agents, and firing conditions through mineralogical and microstructural evidence, supported by experimental replicas tested for physical properties to relate raw-material behaviour to performance and use. Sampling of clay deposits will be conducted through geological surveys and targeted coring to collect clays buried within historical layers, providing reference materials for provenance and diachronic change. The project will reconstruct the raw material procurement and production systems and distinguish local from non-local inputs over time.

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Carlo Scirocco

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SUPERVISOR Alessandra Ascione	CO-SUPERVISOR(S) Ettore Valente, UNINA
PROJECT TITLE Unravelling the spatio-temporal distribution of surface uplift in active orogens: New data from the southern Apennines (Italy) and Chilean Andes – 30S	

PROJECT SYNOPSIS

The investigation is focused on the reconstruction of the spatial distribution of vertical motions through a morphostratigraphical analysis constrained by dating of fluvial and marine terraces along two selected transects spanning from the coast to the orogenic divide. The selected transects, although being characterised by major differences in terms of both geological processes and large-scale morphometry, share a common feature that is comparable coastal uplift since the late Quaternary. The comparison of geomorphological features in the transects will highlight the contribution of parameters, such as local relief or/and surface uplift inside the mountain belts on the dynamics and evolution of river systems. A morphometry analysis of DEMs at different scales is carried out by GIS and MATLAB integrates the morphostratigraphical analysis of fluvial and marine terraces. Age constraints will be obtained by various techniques. The results will allow the estimation of fluvial incision rates, that will contribute to assess the spatial distribution of uplift inside each transect, and to compare the style of uplift in the investigated mountain range sectors.

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Kamyar Tamizkar

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SUPERVISOR David Iacopini	CO-SUPERVISOR(S) Maria Filomena Loreto, CNR-Bologna
PROJECT TITLE Seismic facies and petrophysical properties of the Messinian deposits in the Tyrrhenian Sea (IODP Exp. 402)	

PROJECT SYNOPSIS

The project aims to achieve a multiscale characterization of Messinian evaporitic deposits in the Tyrrhenian Basin in order to better understand the Messinian Salinity Crisis (MSC). The study focuses on the analysis of seismic facies and their correlation with petrophysical properties. It reconstructs depositional environments, including the two main Messinian depositional cycles and their transition to the Pliocene deepening phase. The research will also investigate salt tectonics and its relationship with extensional tectonics in the main Tyrrhenian basins, and evaluate the sealing capacity of evaporitic units with respect to seal bypass structures. The seismic stratigraphic reconstruction will be compared with existing studies from the Sicily basins, the Apennine chain, and the western Tyrrhenian Sea. MethodsThe research integrates deep-penetration seismic datasets (CROP, MEDOC, MS) with high-resolution Sparker data, calibrated with physical and geochemical data from IODP Expedition 402, ODP Leg 107, and DSDP Leg 13. The methodology includes 2D/3D seismic interpretation, forward seismic modelling using NORSAR, and gravity anomaly modelling to constrain deep geological structures

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Daniele Valvo

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SUPERVISOR Vincenzo Allocca	CO-SUPERVISOR(S) Carlo Donadio, UNINA; Pantaleone De Vita, UNINA; Silvio Coda, UNIPEGASO
PROJECT TITLE Modeling the Response of Major Karst Aquifers of the Southern Apennines to Short- and Long-Term Pluviometric Variability	

PROJECT SYNOPSIS

This PhD project, in collaboration with GORI (Gestione Ottimale Risorse Idriche), aims to model the recharge dynamics of major karst aquifers in southern Italy by integrating field data and numerical approaches. It evaluates aquifer responses to short- and long-term climate variability to support sustainable groundwater management in a changing climate, while ensuring a continuous freshwater supply for local populations who depend on these vital resources for their survival and economic activities.