

PRE-DOCTORAL CONTRACT OPPORTUNITY IN VOLCANOLOGY

PIF2024- From past eruptions to future hazards. An interdisciplinary volcanological investigation of central Turkish Anatolian active VOLcanoes (TURVO) -PID2023-147255NB-I00

PhD supervisor: Dr. Xavier de Bolós

Co-PhD supervisor: Dr. Pablo Tierz

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A predoctoral contract is available within the framework of the TURVO project, focusing on the volcanological study of the composite volcano Erciyes in the Central Anatolian Volcanic Province (CAVP) in Turkey. The geological record of this volcano indicates past explosive activity characterized by the violent emission of large quantities of pyroclasts and gases, presenting significant hazards. The proposed PhD project aims to understand the explosive activity of Erciyes and quantify the hazards of potential future eruptions, as well as their possible impact on Europe and the Eastern Mediterranean.

The predoctoral student (Predoc) will participate in a comprehensive training program within the TURVO project, collaborating with an international team of researchers. The Predoc's tasks will include participating in field campaigns in the CAVP, where the predoc will gain knowledge in volcanic stratigraphy and receive training in the collection, processing, and interpretation of geological field data. The Predoc will be trained in using basic analytical techniques for tephra analysis and subsequent correlation, to conduct spatial analyses of volcanic deposits. The Predoc will also apply numerical simulations of ash dispersion using specialized software. Furthermore, the predoc will learn physical and statistical modeling for probabilistic hazard analysis applied to the Erciyes volcano. Additionally, the position includes two research stays with TURVO team members in Italy and/or the UK.

GEO3BCN-CSIC is dedicated to training future Earth Science researchers, consistently supervising an annual average of 5 highly qualified PhD theses over the past years. With a proven record of successful graduate career development, GEO3BCN-CSIC, along with its strong national and international collaborations, offers an excellent research environment. The training offered will be completed by CSIC course portfolio since the postgraduate and Specialization Department at CSIC organizes events about career development. The proposed PhD project, focusing on understanding past explosive activity at Erciyes volcano and quantifying future eruption hazards, complements the TURVO project and enriches both initiatives. Supervisor will be Dr. Xavier de Bolós and Dr. Pablo Tierz, members of the Applied Volcanology Team at GEO3BCN-CSIC, experts in field-based volcanology and volcanic hazard assessment, respectively. The suggested work plan, from which at least 3 JCR publications will be derived, is the following:

Task 1: Bibliographic review and field-campaign planning:

(1.1) Genesis, evolution, structure and known eruptive history at Erciyes volcano. (1.2) Geochemistry of igneous rocks, including pre- and syn-eruptive conditions, at intraplate volcanic systems, in CAVP and elsewhere. (1.3) Use of event trees in the context of quantifying volcanic hazard. (1.4) Planning of sites to visit in the first field campaign.

Task 2: Field-data collection, processing and interpretation:

(2.1) Field work: description and measurements of volcanic deposits at selected outcrops, logging of relevant eruptive units, sampling. (2.2) Lab work: grain-size analyses, componentry analyses, morphological particle analyses (e.g. with SEM), sample preparation for geochemical analyses (whole-rock and mineral compositions). (2.3) Initial stratigraphic correlation between eruptive units, spatial analysis of thicknesses to derive isopach and isopleth maps.

Task 3: Chemical fingerprint to correlate tephra deposits:

(3.1) Analyses of whole-rock, matrix and general mineral compositions (e.g. applying EPMA). (3.2) Detailed analyses of mineral compositions (with LA-ICP-MS). (3.3) Enhanced correlations between eruptive units based on the results from the geochemical analyses. Possibility to have an internship at Sapienza University in Italy and/or at the University of Oxford in UK.

Task 4: Inversion modeling of eruption source parameters:

(4.1) HPC environment and model configuration using PARFIT and FALL3D (4.2) Range model estimation. The observational uncertainties must be quantified with a proper procedure (e.g., clustering analysis). (4.3) Ensemble-based estimation using the FALL3D model, and observations will be assimilated to obtain a complete gridded dataset of tephra-fallout deposit thickness. The reconstructed deposit will be validated using suitable metrics and an independent dataset of observations.

Task 5: Development of a Bayesian Event Tree for Erciyes volcano:

(5.1) Dynamic integration of newly derived geological and geochemical data for an improved understanding of Erciyes volcano. (5.2) Exploration of plausible structures of Bayesian Event Trees for Erciyes. (5.3) Parameterization of selected BET structure using TURVO's new datasets, including data-driven sets of analog volcanoes derived from PyVOLCANS tool.

Task 6: Ph.D. Dissertation writing and defense:

At least three papers as lead-author are foreseen after completing Tasks 1-5. These are envisaged to be submitted for publication in JCR journals.

Given that TURVO seeks strong collaboration among all team members, it is also expected that the PhD candidate will participate in other project tasks, with the aim of getting to know other methodologies, aside from those directly related to his/her PhD Thesis. This may result in additional publications, fostering the acquisition of a comprehensive skill set, including data compilation, processing, interpretation, and statistical modeling for probabilistic volcanic hazard analyses with uncertainty quantification.

Overall, the PhD candidate will acquire a full set of skills including: (i) Data compilation and storage; (ii) Collecting, processing and interpretation of geological, geochemical and hazard-related data; (iii) Physical and numerical modeling; and (vi) Statistical modeling for probabilistic volcanic hazard analyses, including uncertainty quantification.

Upon completion of the PhD thesis, we envision a successful research or professional career for the candidate. The Applied Volcanology Team sustains robust collaborations with various universities, research institutions, and global geothermal companies at national and international level. This ongoing engagement allows us to align our research with their priorities, contributing to advancements in Earth Science challenges. Significantly, there is a growing interest among companies in methodologies that integrate geological and modeling approaches. Additionally, the consistent involvement of international researchers at our research center serves as a valuable element for continuous education and professional development.

Job details:

- Duration: 4 years (2025-2028)
- Location: Geoscience Barcelona (GEO3BCN), Consejo Superior de Investigaciones Científicas (CSIC), Barcelona.
- Doctoral program: Doctoral program in Earth Sciences, Faculty of Earth Sciences, University of Barcelona, Catalonia, Spain.
<https://web.ub.edu/en/web/estudis/w/phd-hdk09?researchMonitoringPlan>

Job requirements:

- Degree: **Geology or Physics**.
- Preferred Experience: Field geology in volcanic terrains. Physical and statistical modeling including uncertainty quantification. Numerical modeling. Previous experiences in volcano-stratigraphy, geological mapping, and GIS tools will also be valued.

- Language: English is required. Catalan or Spanish is not required but is expected to be learned over the 4 years.
- Evaluation: **CV and Motivation letter** (1 page in English, Catalan or Spanish) (submit to xbolos@geo3bcn.csic.es)

Required documentation at the time of application:

All candidates must submit their formal application and the required documentation to the official CSIC portal once the call opens, likely around Autumn (date not yet confirmed). Starting August 1, 2024, candidates can submit their CV and motivation letter to xbolos@geo3bcn.csic.es to start the evaluation process.

- Academic transcript and other curricular merits
- Scholarships and courses abroad
- Age: Be at least eighteen years old and not exceed the maximum compulsory retirement age.
- Doctorate Status: Must not possess a PhD degree.
- Disciplinary Record: Must not have been dismissed through disciplinary proceedings from any administration service.
- Contract Declarations: Declare any previous contracts of the same type that have been held.
- Doctoral Program: Must have pre-admission, admission, or enrollment in the Doctoral program in Earth Sciences of UB.

Foreign Applicants

- Degree: Hold a university degree of at least 300 ECTS credits or a university master's degree, or equivalent, that allows admission or pre-admission to a doctoral program before the contract.
 - If the degree is in a language other than Spanish or English, a simple translation to Spanish or English, signed by the applicant, must be provided.
 - Must also provide accreditation of holding the corresponding certificate of equivalence or, failing that, having initiated the equivalence procedure before the contract formalization. If the applicant has the degree homologation credential at the time of application, this document can be provided instead of the equivalence.
 - It is strongly recommended to undergo the equivalence procedure rather than homologation.

RESUMEN EN CASTELLANO:**OFERTA DE CONTRATO PREDOCTORAL EN VOLCANOLOGÍA**

PIF2024- De erupciones pasadas a peligros futuros. Una investigación volcanológica interdisciplinaria de los volcanes activos en la Anatolia Central de Turquía -PID2023-147255NB-I00

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Se ofrece un contrato predoctoral en el marco del proyecto TURVO, enfocado en la investigación volcanológica del volcán compuesto Erciyes en la Provincia Volcánica de Anatolia Central (PVAC) en Turquía. El registro geológico de este volcán indica actividad explosiva en el pasado con la emisión violenta de grandes cantidades de piroclastos y gases, un fenómeno altamente peligroso. El proyecto de doctorado propuesto se centrará en entender la actividad explosiva del Erciyes y cuantificar los peligros de futuras erupciones, así como su potencial impacto en Europa y el este Mediterráneo. El personal predoctoral (predoc) participará en un plan de formación integral dentro del proyecto TURVO, colaborando con un equipo internacional de investigadores. Las tareas del predoc incluirán la participación en campañas de campo en el PVAC, donde aprenderá conceptos de estratigrafía volcánica y se capacitará en la recopilación, procesamiento e interpretación de datos geológicos de campo. El predoc aprenderá el uso de técnicas analíticas básicas para el análisis de tefras y su posterior correlación con el fin de realizar análisis espaciales de los depósitos volcánicos. También aplicará simulaciones numéricas de dispersión de ceniza mediante software especializados. Finalmente, el predoc aprenderá modelización física y estadística para análisis probabilísticos de peligrosidad aplicados al volcán Erciyes. Además, realizará dos estancias de investigación con miembros del equipo TURVO en Italia y/o UK.