



Postdoctoral researcher in oil exploration with Remote Sensing at UNICAMP - Brazil

This position is part of the project “Multi-scale applications of data and methods of hyperspectral remote sensing and LIDAR for studies of Pre-Salt rocks and their analogues” (*Aplicações multi-escala de dados e métodos de sensoriamento remoto hiperespectral e LIDAR para estudos de rochas do Pré-Sal e seus análogos*), funded by the Petrobrás oil company. This project aims to test multi-scale hyperspectral sensing and LIDAR (Light Detection And Ranging) methods in the study of Pre-Salt rocks under field and laboratory conditions and several possible analogues from remotely piloted aircraft. The project is divided into a set of “Work Packages” (WP) that delimits it between the phases of methodological developments in frontier technologies and applications in the study of source rocks and oil reservoirs in the Pre-Salt basins and their continental analogues. The study areas comprise reservoir rocks analogous to the Pre-Salt in the interior basins of North/Northeast Brazil and in the Neuquén basin (Argentina).

The Neuquén Basin, located in west-central Argentina, contains Late Triassic to early Cenozoic sediments that were deposited in a retro-arc tectonic setting. Shales deposited in the deep-water marine environment of the Los Molles (Middle Jurassic) and Vaca Muerta (Upper Jurassic-Early Cretaceous) Formations contain characteristics similar to the black shales found in Brazil. Conventional oil and gas exploration in the sandstone layers is already taking place in the basin. The potential for exploration of hydrocarbons in unconventional reservoirs in the shales has already been recognized by some companies. Therefore, these formations will be studied here as analogues of the Pre-Salt source rocks.

In this WP, hyperspectral data will be collected at different scales (field and laboratory) in the study areas, aiming to evaluate the effectiveness and operability of the developed methodology. The collected data will be analyzed and the results will be compared to the reference attributes of the source rocks and reservoir that make up the formations of the Pre-Salt basins. These data will also be integrated and compared with traditional analysis methods (e.g. petrographic characterization, SEM-EDS, x-ray diffraction (XRD), x-ray fluorescence (FRX)). The analysis of outcrops and samples collected by HySpex hyperspectral imaging cameras (VNIR-SWIR) will be used to identify the mineralogical and organic composition. Data acquisition in the outcrops of the Los Molles and Vaca Muerta Formations will be carried out with hyperspectral cameras fixed to a drone. The samples collected will be analyzed with the same cameras coupled to a lab rack (fixed structure) that allows their use in a punctual way (over a certain area or point of the sample), or as a scanner, generating hyperspectral images of the samples with high spectral and spatial resolution.

From the processing and spectral analysis of the acquired images, qualitative and quantitative information will be extracted that will allow to carry out the spectral characterization of the lithotypes and facies of each sample/outcrop, as well as to establish mineralogical relationships. The results with classification algorithms will allow



estimating the percentage of mineral components of the rocks, as well as identifying signs and/or traces of hydrocarbons, in case they occur in the analyzed samples. This step will also include the creation of a spectral library that can be used in future studies in Brazilian basins.

Specifically, the post-doctorate candidate will deal with the field and laboratory work, and with the writing of scientific publications related to the Neuquén Basin area. Also, the candidate is expected to organize and lead the field campaigns: flight lines, field sampling design, field mapping, authorizations for foreign UAV pilots and UAV operation authorization in ANAC Argentina, etc.

The position will be held at the Geosciences Institute of the University of Campinas (UNICAMP), Brazil. The successful candidate will join a team of post-docs and graduate students, who work with Prof. Carlos Roberto de Souza Filho and Prof. Diego Fernando Ducart at UNICAMP on the project. The candidate should also collaborate with other research laboratories. Depending on the needs, the candidate might be involved in other activities of the team (laboratory measurements, field campaigns, etc.).

Requirements for applicants:

- Experience in the central-west Argentina geology, preferably of the Neuquén Basin;
- Ability to learn about sensor systems for laboratory and field use;
- Ability to conduct fieldwork in challenging conditions;
- Ability in writing scientific publications in international PEER-review journals;
- Knowledge in oil exploration, and also remote sensing, image processing, multi- and hyperspectral imagery (drone, airborne, satellite) would be appreciated, but not exclusive.

Required documents:

- CV with academic training, publications, and professional experiences
- Cover letter
- Contact of two references
- Short description of research interests and plans for the position

Duration: 12 months (with the possibility to extend for at least 2 more years, depending on performance).

Salary: R\$ 7,373.10 (about US\$ 1,450 per month, tax-free)



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To obtain more information about this position, please contact **Prof. Carlos Roberto de Souza Filho** (beto@unicamp.br) and/or **Prof. Diego Fernando Ducart** (dducart@unicamp.br).