



University of Genova

Department of Earth, Environmental  
and Life Sciences

Doctorate Course in Earth and  
Environmental Science and  
Technology

Earth Science Curriculum

Università degli Studi di Genova



Dottorato in Scienze e Tecnologie  
per l'Ambiente e il Territorio

Research Theme n. 1

Titolo:

**Individuazione e caratterizzazione di strutture legate a cicli sismici in rocce oceaniche esumate**

Title: **Finding and characterising the record of seismic cycles in exhumed oceanic rocks**

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*Program description including the formation program abroad*

Within subduction complexes and orogenic belts, metamorphic oceanic units show a variety of geometries, ranging from near-continuous Km-scale bodies, with an original stratigraphy of the oceanic lithosphere still recognizable, to highly sliced and disrupted terrains where the oceanic lithologies have a poor lateral continuity (e.g.; mélanges and chaotic rock units). The processes and factors driving these variable arrangements may occur at different structural levels within, for example, the interface between the subducting and the upper plate, and they have yet to be clearly defined. Among the main factors we can include the presence and properties of syntectonic fluids, the rheological contrasts and mechanisms of mixing, the strain-rate and its partitioning, and the P-T-t of deformations. Within these tectonic complexes, well-known structures related to seismic deformations have been described so far and their complex rheological behaviour makes them a privileged site where to explore the nucleation of slow-slip-events and tremors.

Tectonic mélanges and orogenic complexes with metamorphic oceanic remnants are therefore good candidates for the study of seismic cycles and transient, episodic ruptures at different structural levels.

The PhD candidate will address the above open questions applying a multiscale and interdisciplinary approach, including detailed field mapping and 3D structural modeling of the study areas and integrated microstructural and petrological investigations (e.g.: SEM, EPMA, EBSD LA-ICP-MS, XCT scan).

Potential target areas for the field study are within the Italian Western Alps (e.g.; Voltri and Monviso massifs).

This research will be carried out in the framework of PRIN/MUR, CARG and PNRR projects that encompass multidisciplinary research groups with expertise in either structural geology and mineralogical/petrology/geochemistry.

*Collaboration and abroad experiences:*

- Sorbonne Université, Institut des Sciences de la Terre de Paris

- Universität Bern, Institut für Geologie - Switzerland  
- University of Washington, Department of Earth and Space Science

Financial support: PRIN/MUR funds available

Tutor's publications (max 3)

**Federico L.**, Crispini L., Scarsi M., Capponi G., Piazza M. (2021). Late orogenic tectonics in the Ligurian Alps (Italy): constraints from syntectonic sedimentary deposits at the top of an exhumed plate interface. JOURNAL OF MAPS, p. 1-12, ISSN: 1744-5647, doi: 10.1080/17445647.2021.2012535

**Locatelli M.**, Verlaquet A., Agard P., Pettke T., **Federico L.** (2019). Fluid Pulses During Stepwise Brecciation at Intermediate Subduction Depths (Monviso Eclogites, W. Alps): First Internally Then Externally Sourced. GEOCHEMISTRY, GEOPHYSICS, GEOSYSTEMS, vol. 20 (11), p. 5285-5318, ISSN: 1525-2027, doi: 10.1029/2019GC008549

**Locatelli M.**, Crispini L., Mariani E., Capponi G., Scarsi M., **Federico L.** (2024). Seismic faulting and CO<sub>2</sub>-rich fluid interactions: Evidence from carbonate spherulitic grains in ultramafic fault damage zones. JOURNAL OF STRUCTURAL GEOLOGY, vol. 180, p. 1-18, ISSN: 0191-8141, doi: 10.1016/j.jsg.2024.105058