UNIVERSITÀ DI PAVIA
DIPARTIMENTO DI SCIENZE DELLA TERRA E DELL'AMBIENTE
DOTTORATO DI RICERCA IN SCIENZE DELLA TERRA E DELL'AMBIENTE

FORM PER PROGETTI BANDO DOTTORATO

1. Project title

Apatite as a mineralogical tool in Raman elastic geobarometry

2. Proposer

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3. Research Unit

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4. Key words
(Max. 5 – at least 2)

Apatite – Raman Spectroscopy – elastic geobarometry – chemistry – metamorphic processes

5. Abstract
(Max.1.500 characters with spaces)

Apatite is a common accessory mineral used in geochronology to provide cooling and exhumation ages for rocks. However, these methods do not provide the pressure (P) and temperature (T) conditions under which apatite is formed. This PhD project will develop the use of apatite inclusions in garnet as an elastic geothermobarometry tool for to bridge this gap. Elastic barometry is already calibrated and widely utilised for quartz, zircon, rutile, and omphacite inclusions in garnet. But apatite, a significantly more widespread inclusion in metamorphic garnets, still lacks precise calibrations. The technique measures residual pressure (P_{inc}) non-destructively via Raman spectroscopy and single-crystal X-ray diffraction to determine entrapment conditions using the equations of state of the host and the inclusion. The research project is divided in five work packages: 1) chemical-structural characterisation of natural apatite (EMPA/XRD); 2) Raman experiments at HP and HT to study the vibrational dynamics of the bare phase at non-ambient condition; 3) XRD measurements at HP and HT to derive consistent Equations of State (EoS); and 4) ab initio simulations to evaluate the inclusion strain states under different stress conditions; 5) this set of data and experiments will allow calibration of the elastic geobarometry technique and the reconstruction of P-T-t paths of metamorphic rocks from apatite inclusions in garnet.