DEPThS: Field-based summer school on subduction forearc dynamics

SECOND EDITION (2022)

Subduction zones are of primary importance for understanding the interactions between the Earth's surface and the deep levels of the planet and assessing the potential implications for the climate. The second edition of the international Summer School "DEPThS" aims to analyze the dynamics of subduction forearcs through a highly multidisciplinary approach, with particular emphasis on exhumation processes and the deep carbon cycle. The course is aimed primarily at PhD students in the various fields of Earth Sciences. It includes one day of classroom lectures in Milan and four days of field lessons based on geological observations along key transects across the Western Alps, one of the best-studied fossil subduction zones on Earth. Lectures will integrate petrological, tectonic, and stratigraphic evidence along the analyzed transects with the results of recent geophysical experiments on the deep tectonic structure of the Alps. Lectures will be held by geologists, petrologists, and seismologists from University of Milano-Bicocca, ISTerre Grenoble, University of Torino, and Syracuse University NY, who will interact all together with the students both in the classroom and in the field while hiking and discussing in front of intellectually stimulating outcrops in the breathtaking alpine landscape.

SCIENTIFIC COMMITTEE:

Marco G. Malusà (University of Milano-Bicocca), **Stéphane Guillot** (CNRS - ISTerre Grenoble), **Anne Paul** (ISTerre Grenoble), **Simona Ferrando** (University of Torino), **Chiara Groppo** (University of Torino)

PERIOD: from Friday 1 July to Tuesday 5 July 2022

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PLACE AND TEACHING METHOD:

- 1 July: Classroom lectures at the University of Milano-Bicocca, Milan, Italy
- 2-5 July: Lessons in the field in various locations in the Italian Western Alps (Aosta, Varaita, Po and Bormida valleys).

ECTS: 3 (8 hours of classroom lectures, 20 hours of activity in the field)

NUMBER OF PARTICIPANTS: Twenty places are available. Priority will be given to PhD students. In case of availability, participation will also be open to early career scientists. Candidates will be selected based on the relevance of their doctoral project with the contents and multidisciplinary nature of the course, also considering the need to ensure equal representation of gender and nationality.

REGISTRATION FEE: The registration fee is 300 euro. Bus travel within different course locations, accommodation, breakfasts, and packed lunches from the evening of 1st July to the afternoon of 5th July are included. The fee also covers for a social dinner the 3rd of July. It does not include transport costs to reach Milan and health insurance for non-EU participants.

REQUESTED DOCUMENTS TO BE UPLOADED IN THE APPLICATION FORM:
CV, ID card or passport, motivation letter

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THE LECTURERS:

Marco G. Malusà is a geologist at the University of Milano-Bicocca whose main research emphasis is the tectonic evolution and exhumation processes of orogenic belts and associated detrital fluxes to sedimentary basins. His research integrates thermochronology with field geology (sedimentology, stratigraphy, structural geology) and geophysics. He took part to the CIFALPS and CIFALPS2 seismic experiments across the Western Alps.

Anne Paul is a structural seismologist at ISTerre Grenoble. Her main research interest is the geodynamics of the continental lithosphere in regions of active continental collision (Alps, Anatolia, Zagros, Pyrenees, Andes, Tibet). Her main tool is seismic tomography from data of temporary seismic arrays. She is co-PI of the CIFALPS and CIFALPS2 seismic experiments across the Western Alps.

Simona Ferrando is a petrologist at the University of Torino. Her research activities mainly focus on metamorphic petrology and fluid-rock interactions and on the application of Raman spectroscopy to Earth Sciences. Study areas include extensional and compressional tectonic settings such as the Western Alps, Sulu, Himalaya, Greenland, and the Ethiopian plateau.

Suzanne Baldwin is Thonis Family Professor of Earth and Environmental Sciences at Syracuse University NY. She uses thermochronology and petrology to investigate lithospheric plate boundary processes. Study areas include eastern Papua New Guinea, Antarctica, Barbados and Greece.

Chiara Groppo is a petrologist at the University of Torino. She applies phase petrology modelling to investigate the P-T evolution of metamorphic terranes and to clarify the processes of carbon production, transfer, fixation and outgassing in non-volcanic, tectonically active areas. Study areas include the Western Alps, Himalaya, and Karakorum.

Alberto Resentini is a geologist whose main research emphasis is the provenance of synorogenic detrital fluxes in sedimentary basins. His research integrates sedimentary petrography, detrital geo/thermochronology and field geology.

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LOGISTICS: Transport by bus/minibus during the four days of field work. Dinner and overnight in hotels or mountain huts located in villages and small towns in the Western Alps, where attendees can find a range of different dining options (the dinner of the 3rd of July is included in the participation fee). Field lessons will take place in a mountain environment at altitudes ranging from a few hundred meters to about 2500 meters above sea level (appropriate equipment required: hiking boots, warm clothes, waterproof jacket, mountain backpack).

courtesy Parco del Monviso

COVID-19 RESTRICTIONS: All the activities will be held in accordance with the Covid-19 pandemic containment measures and requirements in force on the Italian territory. Participants must have a Green Pass. Non-EU participants must have health insurance for the entire duration of the course and must inquire about any restrictions on access to Italy.

FOR FURTHER INFORMATION, CONTACT: marco.malusa@unimib.it

DETAILED PLAN

Friday 1 July (Milan, Piazza della Scienza, University of Milano-Bicocca, Room U2-07)

h 8:30-9:00 *Registration*

h 9:00-9:15 *Welcome and opening of the course by the President of the Doctoral School and the Director of the Department of Earth and Environmental Sciences*

h 9:15-9:30 *Presentation of the lecturers and the program of the Summer School*

h 9:30-10:00 *Short presentation of the participants (1 minute and a half + 1 slide each)*

h 10:00-10:45 ***Lecture 1 (Marco G. Malusà):***
The Alpine fossil subduction zone and the geological records of exhumation

h 10:45-11:00 *Questions/Discussion*

h 11:00-11:30 *Coffee Break*

h 11:30-12:15 ***Lecture 2 (Simona Ferrando):***
Metamorphic petrology and carbon evolution in the subduction forearc

h 12:15-12:30 *Questions/Discussion*

h 12:30-13:30 *Lunch Break*

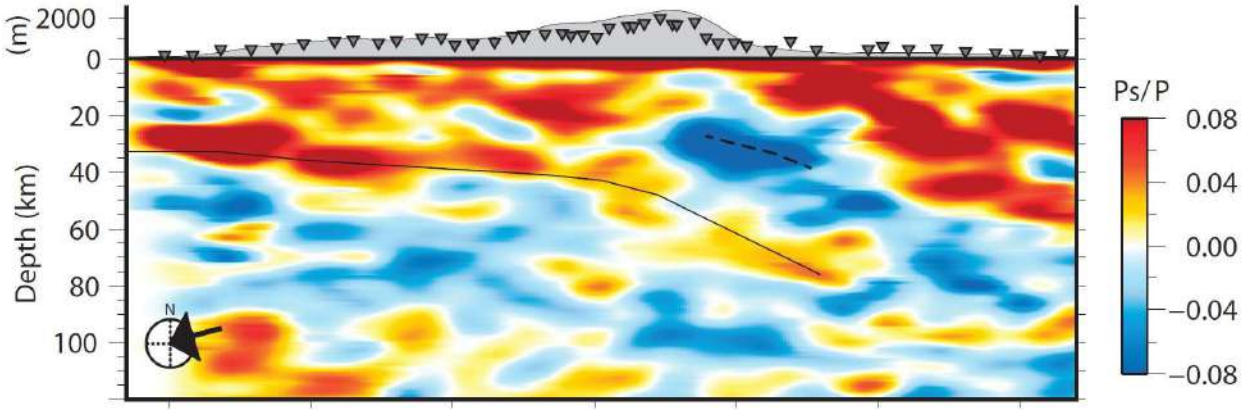
h 13:30-14:15 ***Lecture 3 (Anne Paul): The deep structure revealed by geophysical experiments***

h 14:15-14:30 *Questions/Discussion*

h 14:30-15:15 ***Lecture 4 (Suzanne Baldwin): The Papua New Guinea modern analogue (online)***

h 15:15-15:30 *Questions/Discussion*

h 15:30 Transfer by bus to upper Aosta Valley, evening lecture and overnight stay



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Saturday 2 July: A transect along the CIFALPS2 profile: the lower plate and tectonic relationships within the subduction wedge

h 8:30-10:30 *Mont-Blanc Massif and Frontal Pennine Fault*

h 11:00-13:00 *The frontal greenschist- and blueschist-facies units of the subduction wedge*

h 14:00-17:30 *The Gran Paradiso eclogitic dome and its metaophiolitic envelope*

h 17:30 Transfer by bus to lower Aosta Valley, evening lecture and overnight stay

Sunday 3 July: The upper plate and the Dora-Maira Unit along the CIFALPS profile

h 8:30-11:00 *Sesia-Lanzo unit and the Cretaceous wedge*

h 11:00-12:00 *The upper-plate lower crust*

h 12:30-14:30 Transfer by bus to lower Varaita Valley

h 14:30-18:00 *The Dora-Maira eclogitic dome*

h 18:00 Transfer by bus to upper Po Valley, evening lecture and overnight stay

Monday 4 July: The Viso metaophiolites along the CIFALPS profile

h 8:00 Transfer by minibus to Pian del Re - upper Po Valley

h 9:30-15:00 *A journey across the Viso metaophiolites*

h 15:00 Transfer by bus to Bormida Valley, evening lecture and overnight stay

Tuesday 5 July: Sediments atop the eclogitic dome: Voltri-Valosio and the overlying Tertiary Piedmont Basin succession along the CIFALPS 2 profile

h 8:30-10:00 *Valosio unit*

h 10:00-12:00 *Molare Fm and overview of the Voltri Unit*

h 12:30-13:30 *The Oligocene sedimentary succession*

h 13:30-14:30 *The Voltri peridotite*

h 14:30-16:00 *Oligocene fossil corals on the Voltri Unit*

h 16:00 Return by bus to Milano Centrale railway station (expected arrival at 18:30)

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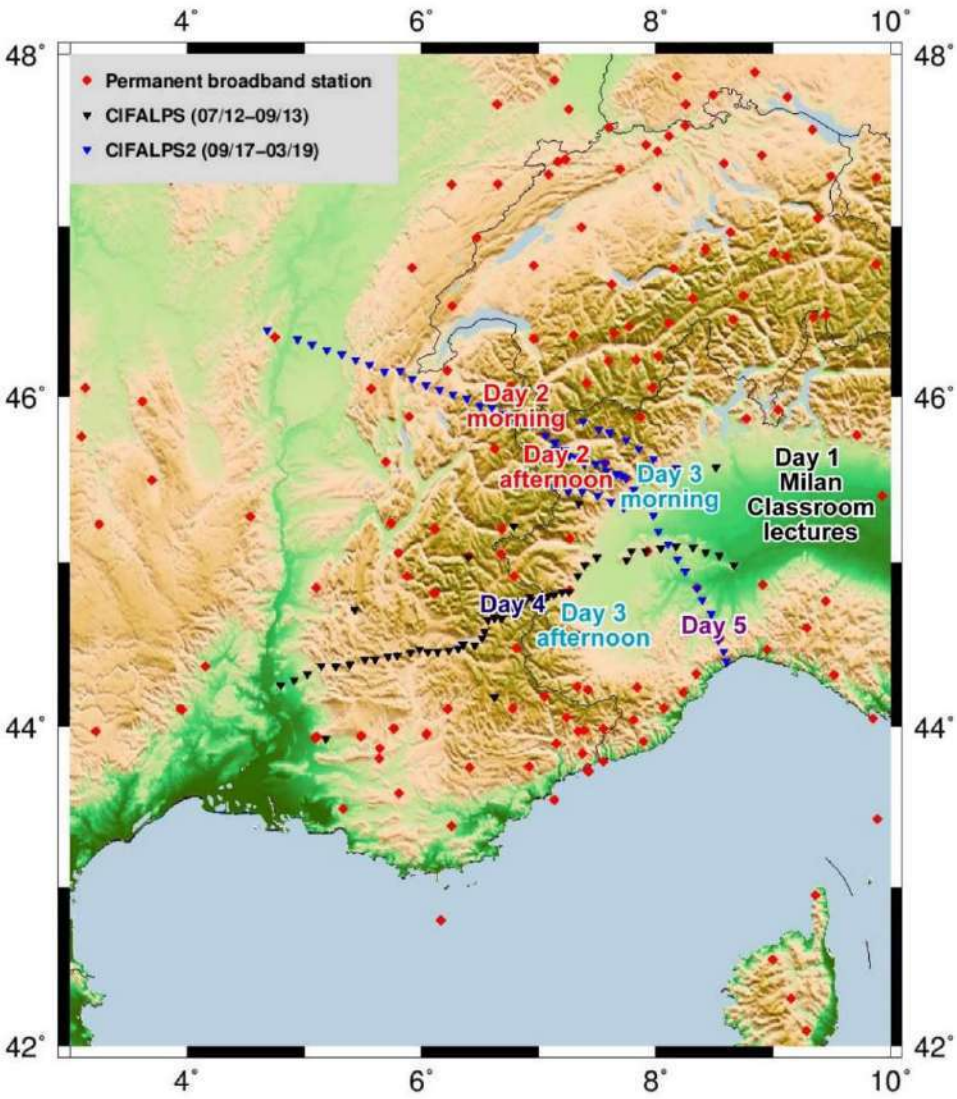

SUGGESTED PRELIMINARY READINGS:

Malusà et al. (2015) Contrasting styles of (U) HP rock exhumation along the Cenozoic Adria-Europe plate boundary (Western Alps, Calabria, Corsica). Geochemistry, Geophysics, Geosystems 16(6), 1786-1824. https://doi.org/10.1002/2015GC005767

Malusà et al. (2021) The Deep Structure of the Alps Based on the CIFALPS Seismic Experiment: A Synthesis. Geochemistry, Geophysics, Geosystems, 22(3), 1-42, e2020GC009466, https://doi.org/10.1029/2020GC009466