

# CURRICULUM VITAE

## Leonardo Del Sole

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### EDUCATION

- 01 November 2017 – 21 May 2021  
**Ph.D.** in STRUCTURAL GEOLOGY (SSD: GEO/03). University of Bologna, Bologna, Italy. Thesis: *Fracture Networks Development, Fluid Flow, and Diagenetic Processes in Sandstones and Carbonate Rocks*. This project uses a multidisciplinary approach (fieldwork, analytical methods, modeling) that involves structural geology, fracture mechanics, sedimentary petrology, and geochemistry to address issues relating to the interaction among fracture and fault networks development, fluid flow, host rock properties, and diagenetic processes in porous sandstones and carbonate rocks. Supervisor: Prof. Marco Antonellini.
- 08 October 2015 – 25 October 2017  
**Second cycle-master's degree** in FIELD AND NATURAL RESOURCES GEOLOGY (CLASS LM-74), University of Roma Tre, Roma, Italy. Final mark: 110/110 e Lode (magna cum laude). Thesis: *Tectonic evolution of the Rennick Fault (North Victoria Land, Antarctica) through the analysis of fault-related fractures of analogues: the case of the Val Roveto Fault (Central Apennines, Italy)*. Supervisor: Prof. Francesco Salvini. Co-Supervisor: Dr. Paola Cianfarra.
- 27 September 2012 – 22 July 2015  
**First cycle-bachelor's degree** in GEOLOGICAL SCIENCES (CLASS L-34), University of Bologna, Bologna, Italy. Final mark: 110/110 e Lode (magna cum laude). Thesis: *Description of fluid flow and deformation sequence in the Monte Venere Formation (Northern Apennines, Italy)*. Supervisor: Prof. Marco Antonellini.

### RESEARCH EXPERIENCE / INTERNSHIPS / JOB EXPERIENCE

- April 2021  
**Technical collaborator.** Collaboration in the monitoring of water points (spring, well, piezometer, watercourse) located in the project area related to the quadrupling of the railway line Fortezza – Verona. Responsibilities: Collection of physical (flow rate, water table depth) and water quality (e.g. pH, ORP, conductivity, dissolved oxygen, temp.) parameters of water points along the *Valle Isarco* (South Tyrol, Italy).
- 16 April 2019 – 19 July 2019  
**Internship** at the University of Montpellier - Geosciences Montpellier, Montpellier, France. Cementation of deformation bands in porous sandstones. Achieved during the Ph.D. Supervisor: Prof. Roger Soliva. Co-Supervisor: Dr. Gregory Ballas.
- 75 hours curricular internship at the GeoQuTe Lab at the University of Rome Tre. It focused on the analysis of structural data collected in North Victoria Land (Antarctica), with focus on the inversion of kinematic data (Monte Carlo method), by use of the *Daisy3 software*, with the aim to determine the paleo-stress field responsible for the observed deformation in a fault zone. Achieved during the M.S (A.A. 2016-17). Supervisors: Prof. Francesco Salvini and Dr. Paola Cianfarra.
- 96 hours curricular internship at the Institute of Marine Sciences - National Research Council, ISMAR-CNR, Bologna, Italy. It focused on some of the most common exploration methods employed in marine geology and geophysics: analysis and interpretation of magnetic susceptibility data (core sample) and seismic reflection profiles (SeisPrho). Achieved during the B.S (A.A. 2014-15). Supervisors: Dr. Alina Polonia and Dr. Luca Gasperini.

### RESEARCH INTERESTS

My general fields of interest include Structural Geology & Tectonics, Fracture networks characterization, Fault zone analysis, Petrophysics, Rock mechanics, Fluid/Fault interaction, Structural Diagenesis, and fault zone hydrogeology. Recently, my work has been focused on the interaction between deformation, fluid flow, and diagenesis in sandstone and carbonate rocks by means of a multidisciplinary approach, involving structural geology, fracture and fault mechanics, geochemistry, and sedimentary petrology.

### PUBLICATIONS (Peer reviewed journal articles)

- **Del Sole, L.,** Antonellini, M., Soliva, R., Ballas, G., Balsamo, F., Viola, G. (2020). Structural control on fluid flow and shallow diagenesis: insights from calcite cementation along deformation bands in porous sandstones, *Solid Earth*, 11(6), 2169-2195, <https://doi.org/10.5194/se-11-2169-2020>.
- **Del Sole, L.,** Antonellini, M., Calafato, A. (2020). Characterization of sub-seismic resolution structural diagenetic heterogeneities in porous sandstones: Combining Ground-Penetrating Radar profiles with geomechanical and petrophysical *in situ* measurements (Northern Apennines, Italy). *Marine and Petroleum Geology*, 117, 104375. <https://doi.org/10.1016/j.marpetgeo.2020.104375>.
- Antonellini, M., **Del Sole, L.,** Mollema, P. N. (2020). Chert nodules in pelagic limestones as paleo-stress indicators: a 3D geomechanical analysis. *Journal of Structural Geology*, 132, 103979. <https://doi.org/10.1016/j.jsg.2020.103979>.
- **Del Sole, L.,** Antonellini, M. (2019). Microstructural, petrophysical, and mechanical properties of compactive shear bands associated to calcite cement concretions in arkose sandstone. *Journal of Structural Geology*, 126, 51-68. <https://doi.org/10.1016/j.jsg.2019.05.007>.
- Antonellini, M., Mollema, P. N., **Del Sole, L.** (2018). Reply to Comment by Trincherro et al. on "Application of analytical diffusion models to outcrop observations: Implications for mass transport by fluid flow through fractures". *Water Resources Research*, 54(11), 9706-9707. <https://doi.org/10.1029/2018WR023312>.
- Antonellini, M., Mollema, P. N., **Del Sole, L.** (2017). Application of analytical diffusion models to outcrop observations: Implications for mass transport by fluid flow through fractures. *Water Resources Research*, 53(7), 5545-5566. <https://doi.org/10.1002/2016WR019864>.

### PUBLISHED ABSTRACTS (\*oral presentation)

- **Del Sole, L.,** Calafato, A., Antonellini, M. (2020, May). Combining Ground-Penetrating Radar profiles with geomechanical and petrophysical *in situ* measurements to characterize sub-seismic resolution structural and diagenetic heterogeneities in porous

- sandstones (Northern Apennines, Italy). In *EGU General Assembly Conference Abstracts* – GRA. ID: EGU2020-3118.
- **Del Sole, L.**, Antonellini, M. (2019, April). Strengthening effect of compactive shear bands and associated carbonate nodules in arkose sandstone: a natural analog of composite multilayer. In *EGU General Assembly Conference Abstracts* – GRA. ID: EGU2019-6134.
  - **Del Sole, L.\***, Antonellini, M. (2018, September). Calcite-cement precipitation mediated by cataclastic shear bands in arkosic sand: petrophysical and mechanical considerations (abs.): SGI-SIMP Congress – “Geosciences for the environment, natural hazards and cultural heritage” – September 12-14, 2018, Catania, Italy. (p. 165).

## **OTHER CONTRIBUTIONS**

**Del Sole, L.**, Antonellini, M. 2020. Compactive shear bands. In: Mukherjee, S. (Ed) Atlas of Structural Geology, 2<sup>nd</sup> Edition. Elsevier, pp. 115–118. ISBN: 978-0-12-816802-8. <https://doi.org/10.1016/B978-0-12-816802-8.09995-9>.

## **AWARDS**

2020 “Stephen E. Laubach Structural Diagenesis Research Award” (\$4,000.00) awarded from the Geological Society of America (GSA). <https://community.geosociety.org/sedimentarygeologydiv/awards/laubach>.

## **GRANTS/SCHOLARSHIP**

“MARCO POLO Program” Student Support scholarship (€3,450.00) from the Alma Mater Studiorum – University of Bologna for abroad research period (Geosciences Montpellier - France, April 2019–July 2019).

## **REVIEWER ACTIVITY**

1 review for the *Journal of Petroleum Science and Engineering* (Elsevier).

## **MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS**

- European Geoscience Union (EGU)
- Società Geologica Italiana (SGI)

## **POST GRADUATE COURSES**

[1] Online short course on “The structure and growth of fault zones” held by Dr. Giovanni Camanni (DiSTAR, University of Naples Federico II, Italy). 11-12-13 May 2020 [12 hours lectures]. [2] Short Course on “Selling Science to politicians and publics - communicating technical science to non-technical audiences” held by Prof. Ian Stewart (Plymouth University, UK) at the University of Bologna, Italy, February 25, 2019 [6 hours lectures]. [3] Short Course on “Thermometry, chronometry, barometry and fluid geochemistry in sedimentary basins” held by Dr. Marta Gasparrini (GeoResources Department, IFP Energies Nouvelles, FRANCE) at the University of Rome III, Italy, September 17-21, 2018 [27 hours lectures]. [4] “Statistics: theory and application (R software)” held by Dr. Alessio Boattini and Dr. Andrea Lucchetti (Univ. Bologna, Italy), June 25-29, 2018 [30 hours lectures and exercise + final exam]. [5] Volcanology Ph.D. Field course: Campi Flegrei and Vesuvio (Naples, Italy)” held by Dr. Federico Lucchi (Univ. Bologna, Italy), May 9-11, 2018 [3 days field-trip]. [6] Short course “Subduction: Dynamics and Tectonics” held by Professor Leigh Royden (MIT), January 19-20, 2017, University of Rome Tre, Rome, Italy [16 hours lectures]. [7] VIII Volcanology School - AIV, December 7-12, 2015, Bolsena, Italy [15 hours lectures, 20 hours field-work].

## **TECHNICAL SKILLS**

Computational knowledge O.S.: MacOS, Windows.

Business Software: Microsoft Office package, LaTeX (basic knowledge).

Graphic Software: Inkscape, Adobe Illustrator, Agisoft PhotoScan/Metashape (basic knowledge).

Scientific Software: GIS, Daisy3, StereoNet, ImageJ, R, MATLAB (basic knowledge), MODFLOW (basic knowledge).

## **PERSONAL SKILLS**

I personally consider that my greatest skill is the adaptation capacity and troubleshooting besides a natural willingness to discover and learn about new scientific instruments and techniques. I am a perseverant, goal-oriented and self-motivated person willingly to learn and improve. I am comfortable working in fast-paced environments with strict deadlines. Ultimately, all the experiences and diverse work environments previously exposed gave me ability to autonomously produce quantitative analysis of geological data and have helped me to understand the need for a multidisciplinary point of view and a multiscale approach in solving geological-related problems.

## **OTHER INFORMATION**

Languages: Italian (mother tongue), English (fluent), Spanish (very fluent).

Driving Licence: A; B

## **Bologna, 21 May 2021**

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