



PhD Marco A. Lopez-Sanchez

Short bio: I am a postdoctoral researcher at [Géosciences Montpellier - CNRS](#) in France. I hold a *PhD* in Geology from the University of Oviedo in Spain. In the past, I combined jobs outside the academy as a geology teacher and freelance geologist with postdoctoral training in [Sergio Llana-Fúnez](#) research group. At the beginning of 2018, I joined the *Manteau et Interfaces* research group in Montpellier under the direction of [Andréa Tommasi](#), where my research focuses on the characterisation of microstructure and texture during deformation and annealing using in-situ monitoring and SEM-EBSD. Although in the past I worked mainly with quartz-feldspathic rocks, the materials I currently work with are olivine, ice, and magnesium.

My research interests include different aspects of geodynamic processes from the microscopic to the orogenic scale and exploring the physical properties of Earth materials (mineral physics). My primary interests include characterization of rock microstructure/texture through EBSD and image analysis, rock deformation and rheology, crustal-scale shear zones, crustal strength modelling, and understanding strain localization in nature. Other interests are the evolution of ancient orogens, the interaction between rock deformation, fluids and metamorphism, and the establishment of the absolute time at which deformation processes occur. I also enjoy programming for data analysis and other cool [things](#).

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Personal details

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On the web

Personal website: <https://marcoalopez.github.io/>

CV (pdf): [Resume pdf](#)

Orcid-ID: <http://orcid.org/0000-0002-0261-9267>

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Google scholar: [scholar.google](#)

Publons / Research-ID: [A-4290-2015](#)

Github page: <https://github.com/marcoalopez>

At Géosciences Montpellier: [link](#)

Outreach: <https://medium.com/@marcoalopez>

Education

Jul 2013 - *PhD* in Geology, *cum laude* honours, [Department of Geology](#), [Univ. of Oviedo](#).

Advisor: Sergio Llana-Fúnez. Co-advisors: Profs. Alberto Marcos and Francisco J. Martínez

Thesis: *Análisis tectónico de la Falla de Vivero (Galicia, NW of Spain)*

Sep 2007 - DEA (Masters of Science - *M.Sc.*) in Geology, Department of Geology, University of Oviedo. Project advisor: Prof. A. Marcos

Jan 2006 - Bachelor of Science (*B.Sc.*) in Geology, Department of Geology, University of Oviedo.

Research

Appointments (only academic related)

2018 - present - Postdoctoral researcher, Géosciences Montpellier & CNRS, Université de Montpellier

2015 - 2017 - Postdoctoral researcher, Dpto. de Geología, Universidad de Oviedo

2007 - 2013 - *PhD candidate*, Departamento de Geología, Universidad de Oviedo

Fellowships/Awards

2017 - Postdoctoral fellowship [Clarín-COFUND](#) (Marie Skłodowska-Curie Actions 7th FW) (2 years)

2017 - [Marie Skłodowska-Curie Actions Seal of Excellence Award with the research project proposal IDEA](#)

2016 - Early Career Scientist's Travel Award for EGU General Assembly 2016

2007 - Predoctoral fellowship in the Severo Ochoa Program (FICYT, Principality of Asturias, Spain) (4 years)

Scientific activities as visitor researcher

2019 - **Grenoble (France)**. Duration: 1.5 months. Experimental ice deformation (creep) using digital image correlation methods at [Institut des Géosciences de l'Environnement](#) under the supervision of [Maurine Montagnat](#).

2018 - **Saint-Étienne (France)**. Duration: 1 week. High temperature experimental deformation of magnesium alloys in a channel-die compression rig at [École des Mines de Saint-Étienne](#) (collab. R. Quey).

Publications

In review or available as a pre-print

Lopez-Sanchez MA. *Which average, how many grains, and how to estimate robust confidence intervals in unimodal grain size populations* Submitted to JSG in December 2019

Lopez-Sanchez MA, Tommasi A, Barou F, and Quey R. *Dislocation-driven static recrystallization in AZ31B magnesium alloy imaged by quasi-in-situ EBSD experiments*. Submitted MSEA in November 2019.

Published or in press (citable) peer-reviewed publications

2019

[PDF-08](#) **Lopez-Sanchez MA**, García-Sansegunido J, and Martínez, FJ (2019) The significance of early Permian and early Carboniferous U-Pb zircon ages in the Bossòts and Lys-Caillaouas granitoids (Pyrenean Axial Zone). *Geological Journal* **54**: 2048-2063 <https://doi.org/10.1002/gj.3283>

2018

[PDF-07](#) **Lopez-Sanchez MA** (2018) GrainSizeTools: a Python script for grain size analysis and paleopiezometry based on grain size. *Journal of Open Source Software* **3**(30): 863, <https://doi.org/10.21105/joss.00863>

[PDF-06](#) **Lopez-Sanchez MA** and Llana-Fúnez S (2018) A cavitation-seal mechanism for ultramylonite formation in quartzfeldspathic rocks within the semi-brittle field (Vivero fault, NW Spain). *Tectonophysics* **745**: 132-153 <https://doi.org/10.1016/j.tecto.2018.07.026>

2016

[PDF-05](#) **Lopez-Sanchez MA** and Llana-Fúnez S (2016) An extension of the Saltykov method to quantify 3D grain size distributions in mylonites *Journal of Structural Geology* **93**: 149-161; <https://doi.org/10.1016/j.jsg.2016.10.008>

[PDF-04](#) **Lopez-Sanchez MA**, Aleinikoff J, Marcos A, Martínez FJ, and Llana-Fúnez S. (2016) An example of low Th/U zircon overgrowths of magmatic origin in a late orogenic variscan intrusive: the San Ciprián Massif (NW Spain). *Journal of the Geological Society* **173**: 282-291; <https://doi.org/10.1144/jgs2015-071>

2015

[PDF-03](#) **Lopez-Sanchez MA** and Llana-Fúnez S (2015) An evaluation of different measures of dynamically recrystallized grain size for paleopiezometry or paleowattmetry studies. *Solid Earth* **6**: 475-495, Special issue: Deformation mechanisms and ductile strain localization in the lithosphere; <https://doi.org/10.5194/se-6-475-2015>

[PDF-02](#) **Lopez-Sanchez MA**, Marcos A, Martínez FJ, Llana-Fúnez S, and Iriondo A (2015) Setting new constraints on the age of crustal-scale normal fault (Vivero Fault): Implications for the evolution of Variscan orogeny in the Iberian Massif. *International Journal of Earth Sciences* **104**(4): 927-962; <https://doi.org/10.1007/s00531-014-1119-1>

[PDF-01](#) **Lopez-Sanchez MA**, Iriondo A, Marcos A, and Martínez FJ (2015) A U-Pb zircon age (479±5 Ma) from the uppermost layers of the Ollo de Sapo Fm near Viveiro (NW Spain): implications for the duration of rifting-related Cambro-Ordovician volcanism in Iberia. *Geological Magazine* **152**(2): 341-350; <https://doi.org/10.1017/S0016756814000272>

Others

López-Sánchez MA (2007) Estudio geológico de la Falla de Vivero y estructuras asociadas en la región de Guntín (Lugo, NO de la Península Ibérica). *Trabajos de Geología* **27**: 97-157 [link](#)

Field Trip guides

[FT1](#) - Marcos A, Bastida F, Aller J, Fernández FJ, Llana-Fúnez S and **Lopez-Sanchez MA** (2011) DRT post-conference Fieldtrip Guide: West Asturian Leonese Zone, Cabo Ortegal, Malpica-Lamego Line. *Deformation, Rheology and Tectonics (DRT - Oviedo) meeting* 42 pp + map.

Meeting proceedings

- 2019 - **Lopez-Sanchez MA**, Tommasi A, Barou, F and Quey R. In-situ annealing EBSD experiments in magnesium alloy AZ31B with variable deformation microstructures (Oral). *GRD meeting (Grenoble, France)*
- 2019 - **Lopez-Sanchez MA**. Which measure of central tendency is most appropriate in grain size studies? (Poster). *Deformation mechanisms, Rheology and Tectonics (DRT) 2019 (Tübingen, Germany)*
- 2019 - **Lopez-Sanchez MA**, Tommasi A, Barou, F and Quey R. EBSD in-situ annealing experiments on magnesium alloy (AZ31): how dislocations and interfaces affect recrystallization and final grain size (Oral). *Deformation mechanisms, Rheology and Tectonics (DRT) 2019 (Tübingen, Germany)*
- 2019 - Cárdenes V, **Lopez-Sanchez MA**, Barou, F, Olona, J and Llana-Fúnez S. Seismic anisotropy in fine-grained slates from NW Spain (Poster). *Deformation mechanisms, Rheology and Tectonics (DRT) 2019 (Tübingen, Germany)*
- 2019 - **Lopez-Sanchez MA**, Tommasi A, Barou, F and Quey R. Preliminary results on magnesium (AZ31) in situ annealing experiments in the SEM-EBSD (poster). *Final CREEP workshop (Les Houches - France)*
- 2017 - Llana-Fúnez S, Alonso JL, Caldera N and **Lopez-Sanchez MA**. Fault rocks at the base of the Somiedo Nappe (Variscan Orogen, NW Spain). *Deformation mechanisms, Rheology and Tectonics (DRT) 2017 (Inverness, Scotland)*
- 2017 - Llana-Fúnez S, de Paola N, Pozzi G and **Lopez-Sanchez MA**. Slip events propagating along a ductile mid-crustal strike-slip shear zone (Malpica-Lamego line, Variscan Orogen, NW Iberia). *European Geoscience Union General Assembly*
- 2016 - **Lopez-Sanchez MA** and Llana-Fúnez S. Characterizing 3D grain size distributions from 2D sections in mylonites using a modified version of the Saltykov method (Oral). *European Geoscience Union General Assembly*
- 2016 - **Lopez-Sanchez MA** and Llana-Fúnez S. Caracterización de la distribución 3D de tamaños de grano en milonitas a partir de secciones usando el método Saltykov y una extensión del mismo (Oral). *Congreso Geológico Nacional de España*
- 2012 - **Lopez-Sanchez MA**, Llana-Fúnez S, Marcos A and Martínez FJ. Deformation of quartz and feldspar at mid-crustal depths in an extensional normal fault (Vivero Fault, NW Spain) (Poster). *European Geoscience Union General Assembly*

- 2012 - **Lopez-Sanchez MA**, Iriondo A, Marcos A and Martínez FJ. Una edad de 478,7 Ma (U-Pb Shrimp-RG) en la Formación Olló de Sapo: implicaciones para el volcanismo Cambro-Ordovícico de la Península Ibérica (Poster). *Congreso Geológico Nacional de España*
- 2011 - **López-Sánchez MA**, Llana-Fúnez S, Martínez FJ and Marcos A. Strain gradient recorded in the Penedo Gordo granite during extensional movement of crustal-scale Vivero Fault (NW Spain) (Poster). *European Geoscience Union General Assembly*
- 2011 - **López-Sánchez MA**, Llana-Fúnez S, Martínez FJ and Marcos A. Changes in deformation mechanism and neocrystallisation in granite during a MT-LP deformation (Vivero Fault, NW Spain) (Poster). *Deformation, Rheology and Tectonics meeting (Oviedo)*
- 2011 - **López-Sánchez MA**, Llana-Fúnez S, Martínez FJ and Marcos A. Microstructural Evolution in Quartz and Feldspar During Medium T Deformation (Vivero Fault, NW Spain) (Poster). *The Interrelationships Between Deformation and Metamorphism*
- 2011 - **López-Sánchez MA**, Marcos A, Martínez FJ and Llana-Fúnez S. Hangingwall Metamorphism Related to an Extensional Orogen-scale Shear Zone: The Vivero Fault (NW of Spain) (Poster). *The Interrelationships Between Deformation and Metamorphism*
- 2010 - **López-Sánchez MA**, Marcos A, Martínez FJ and Llana-Fúnez S. Microstructures from the footwall to the hangingwall in the Viveiro Shear Zone (NW of Iberian Peninsula) (**Oral - by invitation**). *Sociedade Geológica de Portugal, VIII Congresso Nacional de Geologia*.
- 2009 - **López-Sánchez MA**. Deformation partitioning patterns and metamorphism of the Viveiro shear zone (Guntín, NW of Iberian Peninsula) (Poster). *Deformation, Rheology and Tectonics meeting (Liverpool)*

Peer review activity

- 2018 - present: Reviewer for Tectonophysics, Image Analysis and Stereology, Italian Journal of Geosciences.
- 2019 - present: Reviewer for the US National Science Foundation (NFS)

Selected scripts & codes

GrainSizeTools: A free and open-source Python script for estimating the grain size from thin sections

Info. & download: <http://marcoalopez.github.io/GrainSizeTools/>

mtex_scripts: matlab scripts for use with the MTEX toolbox

Info. & download: https://github.com/marcoalopez/mtex_scripts

Strength envelopes: A Python script to generate crust and lithosphere strength envelopes

Info. & download: https://github.com/marcoalopez/Strength_envelopes

JASPE: Just Another Stereoplot (in a) Python Environment

Info. & download: <https://github.com/marcoalopez/JASPE>

Nearest neighbour: A Python script to estimate nearest neighbour distance and perform nearest neighbour Monte Carlo simulations

Info. & download: https://github.com/marcoalopez/nearest_neighbour

Image analysis: Python code snippets for image analysis

Info. & download: https://github.com/marcoalopez/image_analysis

Chemical age script: A free and open-source script to estimate the 'chemical' ages in monazites analysed in electron microprobes

Info. & download: https://github.com/marcoalopez/chemical_age_script/

Selected training courses / workshops

2019 - *4th Innovative Training Network CREEP workshop (EU-H2020)*

Duration: 5 days, [École de physique des Houches](#), Les Houches, France

Coordinator: Andrea Tommasi

Workshop focused on the rheology of geological materials. For details see [here](#)

2016 - *Thematic School – Recrystallization Mechanism in Materials*

Duration: 5 days (32 hours), Sète, France

Coordinator: Maurine Montagnat

Organized by the CNRS "Groupement de Recherche" on Recrystallization (GDR3436). [Certificate](#)

2015 - *Introduction to R Programming*

Duration: 10 hours

Instructor: Filip Schouwenaars

Microsoft edx course (DAT204x). [Certificate](#)

2013 - *Introduction to computer science and programming using Python*

Duration: 210 hours

Prof. Eric Grimson, Prof. John Guttag, Dr Chris Terman and Dr Larry Rudolph

Massachusetts Institute of Technology edx course (MITx - 6.00x). [Certificate](#)

2012 - *Scanning Electron Microscopy and its applications to analyses of Rocks*

Duration: 30 hours

Prof. John Wheeler, Dr Elisabetta Mariani and Dr Dan Tatham

Department of Earth, Ocean and Ecological Sciences, University of Liverpool

2008 - *Training course in microtectonics*

Duration: 30 hours

Prof. Cees W. Passchier

Institut für Geowissenschaften; Johannes Gutenberg-Universität Mainz (Germany).

Analytical/technical skills

- **Scientific computing and programming.** Wide experience using [Python](#) programming language and the scientific libraries [Numpy](#), [Scipy](#), [Matplotlib](#), and [Pandas](#). I am also familiar with the basics of [R](#) and [Matlab](#), unit testing, version control systems such as Git, and code repositories such as GitHub.
- **Image acquisition and analysis.**
 - Practical experience with cameras and digital image acquisition. [Dcraw](#) for raw image extraction.
 - Experience using [ImageJ](#) and [scikit-image](#) (Python library) for image analysis, as well as developing my own codes. Noise reduction, image enhancement, grain segmentation, shape descriptors, grain size, and spatial analysis. For **grain size analysis** I use my own tools/scripts. See an example in <http://marcoalopez.github.io/GrainSizeTools/>
 - Experience with **Digital Image Correlation** (DIC) methods. Generation and quality analysis of speckle patterns and DIC data treatment workflow using [DICE](#) and own Python codes.
- **Experimental deformation.** Experience using in-situ EBSD monitoring during annealing and deformation. Experience in sample preparation (ice, magnesium, rocks). Basic experience with LabVIEW engineering software. Welding skills.
- **Scanning Electron Microscopy** (BSD, **Backscatter diffraction - EBSD**) data treatment.
 - **Wide experience using the MTEX Matlab toolbox.** I also contributed to the MTEX through community scripts. See https://github.com/marcoalopez/mtex_scripts
 - Others: *AZtec HKL/Channel 5*, *PFch5 script*, and own codes.

- **Electron Probe Micro-analyser** (EPMA). Including monazite chemical dating (see https://github.com/marcoalopez/chemical_age_script)
- Good theoretical background in interpreting experimental data (i.e. statistics, interpolation and regression using SciPy optimization package)
- Experience in geological mapping and **Geographical Information Systems** (GIS)
- U-Pb geochronological data treatment

Participation in Research Projects

2018 - present

ANR DREAM - Dynamic REcrystallization in Anisotropic Materials. Project led by Maurine Montagnat. Ref. ANR-13-BS09-0001-01

2016 - 2017

Cataclasis y fracturación en rocas de la corteza continental (*Cataclasis and rock fracturing in the continental crust*). Project led by [Sergio Llana-Fúnez](#) Ref. MINECO-15-CGL2014-53388-P

2015

Procesos geológicos modeladores del relieve de la cordillera cantábrica. Project led by [Sergio Llana-Fúnez](#) Ref. FC-15-GRUPIN14-44

2010 - 2014

La transición frágil-dúctil de la corteza del NO peninsular (*The brittle-ductile transition in the continental crust in North-western Iberia*). Project led by [Sergio Llana-Fúnez](#) Ref. MICINN-10-CGL2010-14890

2007 - 2010

The tectonic evolution of an orogen in the transition between the internal and external zones: A comparison between the Variscan orogen in the NW of Iberian Peninsula and the Pyrenean Axial Zone (original title in Spanish). Project led by Alberto Marcos. Ref. CGL2006-08822/BTE

Teaching (at university level)

Accredited as an assistant teacher by the National Agency for Quality Assessment and Accreditation of Spain (ANECA) in 2016

Graduate teaching assistant from **2009** to **2011** and in **2017** at Universidad de Oviedo

Laboratory sections taught: *Plate Tectonics* (30 hours); *Structural Geology* (20 hours); *Geophysical and Geochemical prospecting* (10 hours); *Interpretation of geological maps* (10 hours)

Field Camp taught: *Geodynamics* (10 hours); *Structural Geology* (10 hours); *Fieldwork (geological mapping)* (12.5 hours); *Tectonics* (10 hours); *Structural analysis* (5 hours)

Administrative experience

Deformation mechanisms, Rheology and Tectonics (DRT2011) meeting organizing committee. DRT meetings are a series of biannual international meetings dedicated to the study of deformation processes in rocks at different scales, from the microscale to the study of bulk deformation of the lithosphere

Languages

Spanish and Galician - mother tongue
English - fluent
French - B1
Portuguese - Posso falar um bocadinho! :)

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