Sophie ROMAN
39 years old, civil union, 1 child
Career break: 7 months of cumulative sick leave (2021–2025).
Associate Professor (tenured), University of Orléans (France)

Keywords: fluid dynamics, microfluidics, imaging, metrology, multiphase flow, reactive transport, porous media, colloidal transport, energy, environment, soft matter.

WORK EXPERIENCES

2025-2026 **Princeton University** (NJ, USA), Visiting researcher in the Department of Mechanical and Aerospace Engineering, Howard A. Stone lab.

From Sept. 2017 **Institut des Sciences de la Terre d'Orléans** (ISTO, France), Associate Professor at the University of Orleans, Porous Media Group.
Head of the NanoμLab in Orléans, a micro-nanofluidics facility to investigate coupled processes in porous media and address the societal and environmental challenges of the 21st century.

2013-2017 **Stanford University** (CA, USA), Energy Resources Engineering Department, post-doctoral fellow (2 years), research scientist (2 years) working with Prof. Anthony Kovscek and Prof. Hamdi Tchelepi. *« Dynamics of multiphase and reactive flows using microfluidic devices representative of subsurface geological environments*».

2013 **Montpellier 2 University** (France), Laboratoire Charles Coulomb, post-doctoral fellow (7 months), working with Dr. Vincent Jourdain and Prof. François Henn. *« Biosensor: confinement of ionic bio-channels inside a carbon nanotube for selective ion transport* ».

2009-2012 **Institut de Mécanique des Fluides de Toulouse** (IMFT, France), PhD student, thesis defended in December 2012 under the supervision of Dr. Sylvie Lorthois and Dr. Frédéric Risso. *« Flow of concentrated suspensions of red blood cells in microchannels: experimental study»*.

2009 **Sanofi,** Toulouse (France), Scientific Computing & Data Management department, internship (6 months). *« Acquisition, processing and image analysis ».*

EDUCATION

2025 **Habilitation to Supervise Research** (senior research qualification), University of Orléans (France), discipline: *Sciences of the Universe*.

2009-2012 **PhD in Fluid Dynamics** from National Polytechnic Institute of Toulouse (France).

2006-2009 **Master of Science in Bioscience Engineering,** Institute of Biosciences of Paris (France).
Options: biomechanics/biomaterials and bio-imaging/computer science.

2004-2006 **Preparatory classes** in Physics, Chemistry, Mathematics, Biology and Geology for the entrance to French Engineering Schools at Lycée Ozenne (Toulouse, France).

AWARDS

2023 **National Research Excellence Award (RIPEC C3)** of the French Ministry of Higher Education, Research and Innovation (top 10%).

2021 **ERC Starting Grant** (<10% success rate, 1.5 M€ / 5 years).

2021 **Early-Career Scientist Grant** (equivalent to the NSF CAREER award) from the French National Research Agency (success <25%).

2013 **Léopold Escande Prize 2013**: best thesis in Engineering, National Polytechnic Institute of Toulouse.

2012 **Best Poster Prize**, 37th Annual Meeting of the Biomechanics Society.

2009 **Ph.D. excellence scholarship** from the French Ministry of Higher Education, Research and Innovation.

TEACHING & MENTORING

2017-current **Univ. Orléans**, School of Earth, Environment and Space Sciences (64 to 192 hours / year).
Undergraduate and graduate level (lectures and practical work): hydrogeology, reactive transport, geochemistry of natural waters, transport laws and fluid mechanics, modeling of groundwater flows, field course in hydrogeology.

2015 **Stanford University**, School of Earth, Energy and Environmental Sciences.
Lecture in the Flow through Porous Media Laboratory class (ENERGY 120A): experimental fluid mechanics in porous media.

2009-2012 **Paul Sabatier University** (Toulouse, France), Department of Physical Measurements, 64 hours / year
Undergraduate level (practical works): Electricity, Optics, Solid mechanics.

Supervision of graduate students (MSc, 2 to 6 months internship)

Year	Name	School	Next position
2025	L. Craske	University of Orléans (FR)	Engineer, University of Orléans
2025	C. Gagneux	University of Orléans (FR)	MSc University of Orléans
2023	P. Pichard	University of Orléans (FR)	MSc University of Orléans
2023	K. Dezert	University of Orléans (FR)	MSc University of Orléans
2022	W. Okaybi	University of Pau et des Pays de l'Adour (FR)	PhD student, University of Orléans
2022	U. Moreau	University of Orléans (FR)	PhD student, University of Orléans
2021	V. Gredicak	Montanuniversität Leoben (AUT)	Ph.D. student, University of Orléans
2021	N. Bernard	Saint-Étienne School of Mines (FR)	Ph.D. student, University of Orléans
2020	V. Pluvy	University of Orléans (FR)	/
2020	J. Alves	University of Orléans (FR)	Engineer ABO group
2018	A. Ferrah	University of Lorraine (FR)	Engineer at Gaztransport & Technigaz
2018	A. Vella	University of Orléans (FR)	Ph.D. student, University of Orléans - BRGM
2015	P. Louazel	ENSTA ParisTech (FR)	Aero-Hydro Engineer at Principle Power (USA)

Supervision of PhD students and postdoctoral fellows

2024-2027 Pauline Etienne, PhD student
2024-2026 Florian Cajot, Postdoctoral fellow
2023-2026 Mohamadou Sarr, PhD student
2023-2026 Walid Okaybi, PhD student (co-advised)
2022-2025 Nathan Bernard, Ph.D. student
2021-2025 Viktor Gredicak, Ph.D. student
2021-2024 Flore Rembert, Postdoctoral fellow (co-advised), now Ass. Prof. at University of Orléans.
2020-2022 Khaled Brimo, Postdoctoral fellow (co-advised), now engineer at RIFCON GmbH.

2019-2022 Mahdi Mansouri-Boroujeni, Ph.D. student, now postdoctoral fellow at Aix Marseille University (France).

INSTITUTIONAL RESPONSIBILITIES & REVIEWING ACTIVITIES

Editorial board member

Since 2025 Editorial Board member, Communications Physics.

Since 2023 Editorial Board member, InterPore Journal.

Teaching and administrative responsibilities

Since 2017 Responsible of teaching courses: Hydrogeology (bachelor), Geochemistry of natural water (bachelor), Hydrogeology (MSc), Reactive transport (MSc), Hydrogeology field camp (MSc).

Since 2022 Member of the Individual Monitoring Committee for PhD student of the doctoral school EMSTU (monitoring of about 20 students / year).

2024-2025 Member of the working group for the road map on Sustainable Development and Corporate Social Responsibility for the University of Orléans.

Reviewing activity

Reviewer for proposals: National Science Foundation (NSF), American Chemical Society Petroleum Research Fund (ACS PRF), Natural Sciences and Engineering Research Council of Canada, Agence Nationale de la Recherche (ANR).

Reviewer for peer-reviewed journals: Chemical Engineering Science, Scientific Report, Transport in Porous Media, Fuel, Advances in Water Resources, Sensors, Water Resources Research, Chemical Geology, Journal of Colloid and Interface Science, Oil & Gas Science and Technology, Lab on a Chip, Proceedings of the National Academy of Sciences, Environmental Science & Technology.

Scientific society

2021-now France Interpore Chapter: elected member of the steering committee. Re-elected in 2025, vice-chair.

Organization of scientific events

2025 Organizer of the 17th “Journées d’Etudes des Milieux Poreux” (JEMP) in Orléans. Led the organization of a national meeting with 180 attendees and a budget of 80 k€.

2024 Co-organizer of 1st winter school APPRISE on “Fundamentals of transport phenomena in porous media across scale”.

2022-23-26 Co-convener of a minisymposium at InterPore on “Microfluidics and nanofluidics in porous systems” and “Porous Media for a Green World: Energy & Climate”.

MEMBERSHIPS OF SCIENTIFIC SOCIETIES

2025-now Member of the American Physical Society

2021-now France Interpore Chapter: elected member of the steering committee

2014-now Member of AGU, American Geophysical Union

2013-now Member of Interpore, International Society for Porous Media

RESEARCH GRANTS

(PI: Principal Investigator, ERC: European Research Council, ANR: French National Research Agency, Miti: mission for cross-disciplinary and interdisciplinary initiatives)

2022-27 ERC Starting grant (PI), “TRACE-it”, 1,5 M€

2022-26 ANR JCJC (PI), “GéoMIME”, 220 k€

2021-24 CNRS Miti 80|PRIME (PI), “INTER-AQ“, 150 k€

2021-23 CNRS Miti Captage, stockage et valorisation du CO_2 (PI), “EsCapaDeS”, 36 k€

2020-22 CNRS Miti Changement climatique (co-PI), “CaraMBar”, 25 k€
2020-25 ANR Labex Voltaire (PI), field course for master students, 30 k€
2020-21 ANR Labex Voltaire (co-PI), “Plasma-hydrophile-Géologie”, 25 k€
2020-21 ANR Labex Voltaire (PI), “POP”, 25 k€
2019-22 BRGM (Service Géologique National) PhD grant, 120 k€
2019-2021 PHC Procope (Campus France) joint program France-Germany, 7.4 k€
2019-2020 PHC Alliance (Campus France), joint program France-UK, 3 k€
2018-2023 ANR (task lead), “CATCH”, 600 k€

DOCTORAL THESIS COMMITTEE

2024 Arash Nemati, University Grenoble Alpes, examiner.
2023 Elisa Guiringhelli, University of Toulouse, examiner.
2022 Ahmad Amin, University of Tours, examiner.

SELECTION COMMITTEE

2024 Faculty search committee for associate professors, section 60, INP N7 Toulouse.
2024 Faculty search committee for associate professors, section 60-62, INP Bordeaux.
2023 Faculty search committee for associate professors, section 60-62, INP Bordeaux.

GENERAL PUBLIC COMMUNICATIONS

2017-now General public dissemination for the “fête de la science” in Orléans.
2025 Interview for “GÉO Logique”, a YouTube channel dedicated to geology outreach.
2025 Public outreach: Conference “Sciences avec et pour elles” at the Prefecture of the Centre Val de Loire region, aimed at encouraging high school girls to pursue careers in science (2025).
2024 Podcast for the "Cellule Mutualisée Europe Recherche", ERC Starting Grant - Sophie ROMAN, lauréate 2021, partage son expérience aux candidates et candidats.
2023 General public video with “M. Bidouille”, *Le sous sol n'est pas aussi simple qu'on le croit*.
2022 Article in the journal magazine “Pour la science” (French edition of Scientific American), *la microfluidique infiltre les géosciences*.

LIST OF PUBLICATIONS

Under review

Soulaine C., Okaybi W., Maya Fogouang L., Le Trong E., **Roman S.**, *Permeability impairment by hydrodynamic pore bridging: probabilistic pore-network modelling and microfluidic experiments*, in revision, International Journal of Rock Mechanics and Mining Sciences

Articles published in journals with peer review

Gredicak V., Douat C., Slodczyk A., Dozias S., **Roman S.**, *Wettability alteration of closed glass microfluidic devices by in situ plasma*. Microfluidics and Nanofluidics, 29 (4), pp.22, 2025.

Roman S., Rembert F., Kovscek A.R., Poonoosamy J., *Microfluidics for geosciences: metrological developments and future challenges*. Lab on a Chip, 25 (17), pp.4273-4289, 2025.

Roman S., Rembert F., *Inhibition of mineral dissolution by aggregation of colloidal particles driven by diffusiophoresis*. Physical Review Fluids, 10, 2025.

Bernard N., Soulaine C., **Roman S.**, *Impact of wetting films on the stability of two-phase flow in porous media: A pore-doublet perspective*, Advances in Water Resources, 204, pp.105060, 2025.

Okaybi W., **Roman S.**, Soulaine C., *Progressive colloidal clogging mechanism by dendritic build-up in porous media*, Soft Matter, 21, 5687-5698, 2025.

Patsoukis Dimou A., Mansouri Boroujeni M., **Roman S.**, Menke HP, Maes J., *Experimental Investigation of Solubility Trapping in 3D Printed Micromodels*, InterPore Journal 2 (2), 2025.

Rembert F., Leroy P., Lassin A., **Roman S.**, *Microfluidics and spectral induced polarization for direct observation and petrophysical modeling of calcite dissolution*, Geophysical Research Letters 51(24), 2024.

Rembert F., Stolz A., Soulaine C., **Roman S.**, *A microfluidic chip for geoelectrical monitoring of critical zone processes*, Lab on a Chip 23(15), 2023.

Mansouri-Boroujeni M., Soulaine C., Azaroual M., **Roman S.**, *How interfacial dynamics controls drainage pore-invasion patterns in porous media*, Advances in Water Resources, 171: 104353, 2023.

Soulaine C., Girolami L., Arbaret L., **Roman S.**, *Digital Rock Physics: computation of hydrodynamic dispersion*, Oil & Gas Science and Technology - Rev. IFP Energies nouvelles 76, 51, 2021.

Soulaine C., Maes J., **Roman S.**, *Computational microfluidics for geosciences*. Frontiers in Water, 3, p.11, 2021.

Poonoosamy J., Soulaine C., Burmeister A., Deissmann G., Bosbach D., **Roman S.**, *Microfluidic flow-through reactor and 3D Raman imaging for in situ assessment of mineral reactivity in porous and fractured porous media*, Lab on a Chip, 20(14), 2562-2571, 2020.

Molins S., Soulaine C., Prasianakis N. I., Abbasi A., Poncet P., Ladd A. J., Starchenko V., **Roman S.**, Trebotich D., Tchelepi H. A., Steefel, C. I., *Simulation of mineral dissolution at the pore scale with evolving fluid-solid interfaces: Review of approaches and benchmark problem set*, Computational Geosciences, 1-34, 2020.

Roman S., Soulaine C., Kovscek A. R., *Pore-scale visualization and characterization of viscous dissipation in porous media. Journal of colloid and interface science*, 558, 269-279, 2020.

Soulaine C., **Roman S.**, Kovscek A., Tchelepi H., *Pore-scale modelling of multiphase reactive flow: application to mineral dissolution with production of CO_2*, Journal of Fluid Mechanics, 855: 616-645, 2018.

Roman S., Abu AlSaud M., Tokunaga T., Wan J., Tchelepi H., Kovscek A, *Measurements and simulation of liquid films during drainage displacements and snap-off in constricted capillary tubes*, Journal of Colloid and Interface Science, 507: 279-289, 2017

Soulaine C., **Roman S.**, Kovscek A., Tchelepi H., *Mineral dissolution and wormholing from a pore-scale perspective*, Journal of Fluid Mechanics, 827: 457-483, 2017.

Yun W., Ross C. M., **Roman S**., Kovscek A. R., *Creation of a dual-porosity micromodel with improved realism in both pore structure and flow behavior for the study of immiscible flow in complex porous media*, Lab on a Chip, 8, 2017.

Roman S., Soulaine C., Abu AlSaud M, Kovscek A., Tchelepi H., *Particle Velocimetry Analysis of Immiscible Two-Phase Flow in Micromodels*, Advances in Water Resources, 95: 199-211, 2016.

Roman S., Merlo A., Duru P., Risso F., Lorthois S., *Going beyond 20 micrometer-sized channels for studying red blood cell phase separation in microfluidic bifurcations*, Biomicrofluidics, 10:3, 2016.

Yazda K., **Roman S.**, Tahir S., Henn F. and Jourdain V., *Fabrication of Microfluidic Devices for the study of Ion transport through Single-Walled Carbon Nanotubes*, MRS Advances, 1(28): 2085–2090, 2016.

Soulaine C., Gjetvaj F., Garing C., **Roman S.**, Russian A., Gouze P., Tchelepi H., *The Impact of Sub-Resolution Porosity of X-ray Microtomography Images on the Permeability*, Transport in Porous Media, 113: 227, 2016.

Roman S., Lorthois S., Duru P., Risso F., *Flow of concentrated red blood cell suspensions at micro-bifurcations: an in vitro experimental study*, Computer Methods in Biomechanics and Biomedical Engineering, 16 (sup1), pp.33-35, 2013.

Campagnolo L., **Roman S.**, Perchoux J., Lorthois S., *A new optical feedback interferometer for measuring red blood cell velocity distributions in individual capillaries: a feasibility study in microchannels*, Computer Methods in Biomechanics and Biomedical Engineering: 15-S1: 104-105, 2012.

Roman S., Lorthois S., Duru P., Risso F., *Velocimetry of red blood cells in microvessels by the dual slit method: effect of velocity gradients*, Microvascular Research: 84: 249-261, 2012.

Moravec F., **Roman S**., *Numerical computing of elastic homogenized coefficients for periodic fibrous tissue,* Applied and Computational Mechanics 3: 141-152, 2009.

Conference proceedings published in journals with peer review

Soulaine C., Maya L., Okaybi W., **Roman S.**, *Pore-scale modelling and microfluidic experiments on colloidal transport: aggregation, sieving, and pore-clogging*, Proceedings of the 4th International Conference on Coupled Processes in Fractured Geological Media: Observation, Modeling, and Application, CouFrac2024 - November 13-15, 2024, Kyoto, Japan, 2024

Roman S., Rembert F., *Driving colloids for in-situ groundwater remediation using diffusiophoresis*, Proceedings of the 4th International Conference on Coupled Processes in Fractured Geological Media: Observation, Modeling, and Application, CouFrac2024 - November 13-15, 2024, Kyoto, Japan, 2024

Roman S., Lorthois S., Duru P., Risso F., *An optimized technique for red blood cells velocity measurement in microvessels*, Journal of Biomechanics, 45: 1-35, 2012.

Nakib A., **Roman S.**, Oulhadj H., Siarry P., *Fast brain MRI segmentation based on two-dimensional survival exponential entropy and particule swarm optimization*, Conference proceedings: Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 5563–5566, 2007.

CONFERENCES AND SEMINARS

List of international conferences

78th Annual APS Division of Fluid Dynamics meeting, Houston (Texas, USA), DFD-Interact session, 2025.

17th International Conference on Porous Media (Interpore), Albuquerque (New Mexico, USA), oral, 2025

4th International Conference on Coupled Processes in Fractured Geological Media: Observation, Modeling, and Application (CouFrac), Kyoto (Japan), oral, 2024

American Geophysical Union (AGU) Fall Meeting, San Francisco (USA), oral, 2023, **invited** talk

15th Annual International Conference on Porous Media (Interpore), Edinburgh (UK), oral, 2023

American Geophysical Union (AGU) Fall Meeting, Chicago (USA), oral, 2022, **invited** talk

14th Annual International Conference on Porous Media (Interpore), Online, poster, 2022

American Geophysical Union (AGU) Fall Meeting, online, oral, 2020

American Geophysical Union (AGU) Fall Meeting, San Francisco (USA), oral, 2019, **invited** talk.

11th International Conference on Porous Media (Interpore), Valencia (Spain), oral, 2019

10th International Conference on Porous Media (Interpore), New Orleans (USA), poster, 2018

9th International Conference on Porous Media (Interpore), Rotterdam (The Netherlands), oral, 2017

Computational Methods in Water Resources (CMWR), Toronto (Canada), oral, 2016

7th International Conference on Porous Media (Interpore), Padova (Italy), oral, 2015

American Geophysical Union (AGU) Fall Meeting, San Francisco (USA), oral, 2014

American Physical Society (APS), 67th Annual Division of Fluid Dynamics Meeting, San Francisco (USA), poster, 2014

18th Congress of the European Society of Biomechanics, Lisbon (Portugal), oral, 2012

29th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Lyon (France), poster, 2007

List of national conferences

French Interpore Conference on Porous Media, Rueil-Malmaison, **invited** keynote, 2023

French Interpore Conference on Porous Media, Nantes (France), oral, 2018

38ème congrès de la société de Biomécanique, Marseille (France), oral, 2013

37ème congrès de la société de Biomécanique, Toulouse (France), poster, 2012. Best poster prize.

12e journées de la matière condensée, Troyes (France), poster, 2010

Workshops, thematic schools

Microfluidics2025, summer school, Lège-Cap-Ferret, **invited**, 2025.

6th CARGESE school "Flow and transport in porous and fractured media" (France), **invited**, 2024, https://www.youtube.com/watch?v=XRLyOzjIs7E

Workshop Interdisciplinary challenges in non-equilibrium physics, Dresden (Allemagne), **invited**, 2024.

Journée scientifique de la FR Scale, Rouen (France), **invited**, 2022.

Microfluidics "From laboratory tools to process development", Rueil-Malmaison (France), 2019.

Workshop "Knowledge's frontiers in water unsaturated hydrogeosystems: interface dynamics, heterogeneities & couplings", Orléans (France), 2019.

1st workshop of the International Medical Geology Association (IMGA) French Chapter, Veyrier du Lac (France), 2018.

Pore scale modeling workshop, Pau (France), 2016.

Winter school of microfluidic, Les Houches (France), 2010.

Invited seminars (selection):

GeoRessources (Nancy, France), 2025, *Microfluidics for geosciences: investigating multiscale and multiphysics processes in porous media,* invited by F. Golfier.

Princeton University (USA), CEE Seminar, 2025, *Microfluidics for geosciences: exploring multiscale and multiphysical processes in porous media*, invited by I. Bourg.

Institut de Physique de Rennes, 2025, *Microfluidics for geosciences: exploring the interactions between flow, geochemistry, and colloidal transport in porous media*, invited by F. Peaudecerf.

Institute of Fusion Energy and Nuclear Waste Management - Forschungszentrum Jülich (Allemagne), 2025, *Microfluidics for geosciences - Inhibition of calcite dissolution by aggregation of colloidal particles*, invited by J. Poonoosamy.

Laboratoire des Écoulements Géophysiques et Industriels (Grenoble, France), 2024, *Microfluidics for geosciences to study the interplay between flow, geochemistry, and colloidal transport in porous media*, invited by N. Machicoane.

Laboratoire Matière et Systèmes Complexes (Paris, France), 2023, *Microfluidics for geosciences: application to detection and targeting of mineral dissolution in porous media*, invited by M. Berhanu.

GeoScience & GeoEnergy webinar, 2021, *Microfluidics for Geosciences*, invited by Prof. Sebastian Geiger and Prof. Hadi Hajibeygi, online: https://www.youtube.com/watch?v=Mlxo2ELAWVc.

PoreLab (Norway), 2020, *Multiphase Flow and Reactive Transport in Porous Media: Experimental Microfluidic Approach*, online https://www.youtube.com/watch?v=UzXMGTEpCOs.

Stanford University (USA), Departement "Energy Resources Engineering", 2019, *Multiphase Flow and Reactive Transport in Porous Media*, invited by Prof. A. Kovscek.

Princeton University (USA), Soft Materials Coffee Hour, 2019, *Flow of complex fluids in porous media: an experimental microfluidic approach*, invited by Dr. S. Datta.

Heriot Watt University (UK), 2016, *Experimental Microfluidics to Improve Mechanistic Understanding of Multiphase Flow at the Pore-Scale*, invited by Prof. S. Geiger.

ARTORG Center, University of Bern (Switzerland), 2014, *Experimental Study of the Flow of Red Blood Cell Suspensions in Microchannels*, invited by Dr. D. Obrist.

Institut de Mécanique des Fluides de Toulouse (France), 2014, *Improved visualization of flow mechanisms in micromodels*, invited by Prof. M. Quintard.