

Colin Ferrari

Research Scientist, Isotope Geochemistry and Critical Raw Materials

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PROFILE

Isotope geochemist (PhD), with postdoctoral experience on one of Canada's largest long-term mine-remediation programmes. My work bridges fundamental isotope geochemistry, analytical instrumentation and deployable scientific software, tracing the geographical and industrial origin of critical raw materials and turning it into actionable provenance intelligence and decision support for research laboratories, industry and regulatory compliance. Six first-author publications and an invited review in Chemical Geology, with field experience across five countries.

CORE COMPETENCES

Isotope provenance and materials authentication

- Geographical and industrial origin determination from stable-isotope signatures; authentication of critical raw materials, alloys and semiconductor feedstocks.

Analytical instrumentation and method development

- MC-ICP-MS, Orbitrap and ICP-MS; methods and purification protocols for ultra-trace elements in complex matrices.

Process and supply-chain reconstruction

- Reconstruction of industrial processing histories (smelting, refining, alloying, mixing) and detection of substitution or origin misattribution.

Scientific software engineering

- Offline-first scientific software (Rust, Python, Tauri); creator of the IsoFind platform and of ISOF, an open format for isotopic data exchange.

Critical materials and regulatory frameworks

- Provenance verification within the CRMA, the EU Battery Regulation and conflict-minerals due diligence; familiar with EIT RawMaterials and ERMA.

TECHNICAL SKILLS

Programming. Rust, Python, Tauri, FastAPI, SQLite.

Instrumentation. MC-ICP-MS, Orbitrap, ICP-MS.

Modelling. Bayesian inference, first-principles DFT (Quantum ESPRESSO), Random Forest (ONNX), PHREEQC.

Data and standards. ISOF, JSON, PyPI, Git.

Security and architecture. ECDSA, SHA-256, offline-first and air-gap designs.

EXPERIENCE

Founder & Scientific Software Lead, IsoFind (France) *2024 to present (full-time since mid-2025)*

- Designed and developed a scientific software platform transforming isotope measurements into actionable provenance intelligence and decision support for critical materials and industrial supply chains.
- Designed the Nexus modelling framework, which reconstructs original isotopic signatures across multi-stage industrial transformation (smelting, refining, alloying, mixing).
- Created ISOF (Isotopic Secure Open Format), with cryptographic signatures (ECDSA) and a reference Python implementation on PyPI; selected by the RéGEF national analytical geochemistry network as a candidate open exchange format for isotopic data.
- Developed with the support of HydroSciences Montpellier and RéGEF, and currently deployed within HydroSciences Montpellier for research applications.
- Sole designer and developer of the complete software stack (over 500,000 lines of code), from scientific algorithms and data models to graphical interface and deployment.
- Built on a first research prototype developed in 2020, refined over six years into the current production platform.

Postdoctoral Researcher, Groundwater Geochemistry and Remediation, University of Waterloo (Canada) 2024 to 2025

- Contributed to the Giant Mine remediation programme, one of Canada's largest long-term environmental projects, within the group of Prof. Carol Ptacek and Prof. David Blowes.
- Worked within an interdisciplinary team of geochemists, hydrogeologists and environmental engineers supporting long-term mine remediation.
- Developed isotope-based methods to distinguish arsenic sources and transport mechanisms, and led operation and maintenance of the laboratory Orbitrap mass spectrometer.

Founder, Asean-Water 2023 to 2025

- Developed isotope-based tools for contaminant source identification and water-resource investigations; R&D activities evolved into the IsoFind platform.

Teaching Assistant (L1 to M2), Université de Montpellier 2019 to 2022

- Geology, hydrogeology, aqueous geochemistry and water chemistry (around 200 hours); supervised interns and students in laboratory and field work.

ADVISORY AND PROFESSIONAL SERVICE

Scientific Advisor, Isotopix 2026 to present

Scientific guidance to a startup providing isotope-analysis R&D and services, distinct from IsoFind's software activity.

External Grant Evaluator, European Science Foundation (ESF) 2026

Evaluation of French and European research proposals in isotope geochemistry and related fields.

FIELD EXPERIENCE

Field campaigns in five countries, across mining, industrial and environmental contamination settings:

Canada	Giant Mine remediation, arsenic-bearing mine wastes (Yellowknife).	2024-2025
Philippines	Water-quality assessment.	2023-2024
Bolivia	Urban mining sites and metallurgical smelters (Oruro).	2021
Lebanon	Industrial water contamination, Bekaa plain.	2019
France	Former mining districts and legacy tailings.	2018-2020

EDUCATION

PhD, Experimental Geochemistry and Theoretical Chemistry, Univ. de Montpellier 2019 to 2022

Dissertation: "Antimony stable isotopes for tracing pollution sources and transfer processes in aquatic systems." Supervised by Prof. Corinne Casiot. French Ministry of Higher Education doctoral fellowship (GAIA doctoral competition).

MSc, Earth, Planetary and Environmental Sciences, Université Grenoble-Alpes and INP Grenoble 2017 to 2019

BSc, Geosciences, Université Grenoble-Alpes and Aix-Marseille Université 2013 to 2016

SELECTED PUBLICATIONS

Six first-author publications, 140+ citations (Google Scholar). Full list on ResearchGate.

- Ferrari, C., White, K.B., Ptacek, C.J., Blowes, D.W. (2026). Tracing arsenic and antimony in mining-impacted environments: new insights from antimony isotopes. *Chemical Geology* 707, 123271. Invited review.
- Ferrari, C., Resongles, E., Freydier, R., Flores, M., Ormachea, M., Zamora, G., Casiot, C. (2025). Deciphering Sb sources and transport processes in a mining and smelting-impacted river system (Oruro, Bolivia): insights from Sb isotopes. *Water, Air, and Soil Pollution*.
- Ferrari, C., Resongles, E., Freydier, R., Casiot, C. (2021). A single-step purification method for the precise determination of antimony isotopic composition of environmental, geological and biological samples by HG-MC-ICP-MS. *Journal of Analytical Atomic Spectrometry* 36, 776-785.

SELECTED INTERNATIONAL CONFERENCES

- Ferrari, C. (2025). Orbitrap: new insights for arsenic tracing in mining areas. Invited presentation, Ontario Research Fund Research Excellence, Canada.
- Ferrari, C., Resongles, E., Freydier, R., Casiot, C., Méheut, M. (2021). Antimony isotopic fractionation in the environment: first insights from theoretical and experimental investigations. *Goldschmidt Conference*.