**PROFESSOR CHRIS BALLENTINE**



**Synopsis**

*Chris Ballentine is an internationally recognised scientist, with over 30 years of experience in subsurface multi-phase systems, specialising in helium, hydrogen, and carbon dioxide behaviour. He is the Statutory Professor of Geochemistry at the University of Oxford and a Fellow of the American Geophysical Union, the Geological Society of London, and the European Association of Geochemistry. Chris has made pioneering contributions to our understanding of mantle-derived volatiles and the accumulation and origin of crustal gases. He has advised major industry players including Total, ExxonMobil and the USGS, and has supported the development of start-up companies across the helium and hydrogen exploration space, including Snowfox Discovery Ltd, where he serves as a founder/board member and science advisor. He was awarded the 2016 Eni Gold Medal, the most prestigious award globally for contributions to industry.*

**Employment History and Experience**

2013-present: Statutory Professor of Geochemistry, University of Oxford

2017-2022: Head, Department of Earth Sciences, University of Oxford

2017-2020: Director, American Geophysical Union (65,000 members)

2011-2016: President, European Association of Geochemistry (3000 members)

2005-2013: Professor of Isotope Geochemistry, University of Manchester, UK

2004-2005: Reader, University of Manchester, UK

2001-2004: Senior Lecturer, University of Manchester, UK

1999-1901: Research Scientist, Dept. Geology, ETH-Zürich, Switzerland

1994-1998: Research Faculty, University of Michigan, USA

1993-1994: Staff Scientist, Paul Scherrer Institut, Switzerland

1991-1992: Postdoctoral Research Associate, University of Cambridge, UK

1984-1990: Research Assistant, University of Cambridge, UK

**Select Projects**

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| **Date** | 2023-present |
| **Location (Country/City)** | Oxford, UK |
| **Project** | Snowfox Discovery Ltd |
| **Position** | Founder, Board Member, Scientific Advisor |
| **Description** | Founded Snowfox Discovery Ltd in 2023 – an exploration company to find clean and societally useful natural hydrogen gas fields. The company exploits the extensive scientific understanding of deep crustal inorganic gases, including hydrogen, developed by Ballentine and co-founders Profs Gluyas, Daly and Sherwood Lollar (Ballentine et al., Nature Reviews, 2025). Snowfox completed the first stage of its series-A with funding from the multinationals BP and RioTinto. The company has the highest value ever placed on a University of Oxford spinout company at this stage of its funding in the University history. |

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| **Date** | 2013-present |
| **Location (Country/City)** | Oxford, UK |
| **Project** | Helium, hydrogen and gas field formation |
| **Position** | Chair of Geochemistry, University of Oxford |
| **Description** | Ballentine research team’s most recent work has been to establish a new concept in primary helium and hydrogen gas field formation. Nature (Cheng et al., 2023; Ballentine et al., 2025). Steady state degassing of nitrogen, helium and hydrogen produced in the crystalline continental crust slowly accumulates, dissolved in deep groundwater, over 10-100’s Ma and diffusively migrates upwards through the sedimentary column (Cheng et al., 2021). Ballentine’s early work showed how natural gas fields formed by groundwater degassing can be distinguished from fields that filled through buoyant gas phase migration (Ballentine et al., 1991), important because migration mechanism controls gas field location. Quantifying groundwater interaction with oil distinguishes between models of diagenetic mineral formation that control oil field filling (Ballentine et al., 1996). This concept development resulted in determining the key role of regional groundwater in accumulating and concentrating helium (and hydrogen) to form commercial helium gas fields (Ballentine and Sherwood Lollar, 2002). |

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| **Date** | 2024-present |
| **Location (Country/City)** | Oxford, UK |
| **Project** | Hotspur Helium Limited |
| **Position** | Founder and Technical Advisor |
| **Description** | Ballentine is a founding member and technical advisor of Hotspur Helium, a greenfield exploration company focused on identifying and developing world-class primary helium resources in the Middle East and southern Africa. He plays a central role in shaping the company’s exploration strategy, drawing on over three decades of expertise in noble gas geochemistry to guide basin screening, target ranking, and resource risk evaluation. Ballentine’s input supports the integration of geochemical, geological, and structural data to inform prospect selection and licensing decisions. He also contributes to investor engagement by translating complex scientific insights into clear exploration narratives that underpin the company’s commercial strategy. |

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| **Date** | 2013-present |
| **Location (Country/City)** | Oxford, UK |
| **Project** | Noble Lab Research Group, various projects |
| **Position** | Chair of Geochemistry, University of Oxford |
| **Description** | The noble gas abundance and isotopic composition of natural samples are determined by static sector gas-source mass spectrometers. Recent advances in multi-collector technology provide us with an unprecedented improvement in the precision and accuracy of sample isotope ratio determination, and in particular for the heavier noble gases. The Oxford laboratory currently hosts a suite of Thermo instruments and includes a Helix-MC, Helix-SFT, and Argus VI-each providing state of the art multi-collection capability for different sample types. |

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| **Date** | 2013-present |
| **Location (Country/City)** | Oxford, UK |
| **Project** | CO2 origin, migration and accumulation |
| **Position** | Chair of Geochemistry, University of Oxford |
| **Description** | Ballentine’s group recently made a major breakthrough in determining a significant role for microbial activity acting on subsurface CO2 to produce CH4 - little appreciated in CCS planning. Nature (Tyne et al., 2021). Ballentine has developed the noble gas tracer tool to quantify the volumes of water in contact with gas fields (Ballentine et al., 1991; Gilfillan et al., 2008; 2009; Zhou et al., 2012). This is used to show that removal of carbon dioxide phase is related to the volume of groundwater the natural or injected CO2 has contacted. Stable isotopes (carbon) distinguish between dissolution and mineralisation removal mechanisms. Nature (Gilfillan et al., 2009). Any significant removal of the CO2 is by solution into the groundwater only. But even this mechanism of CO2 removal stops operating, probably due to limited water flow and saturation, no matter how old the CO2 system (Zhou et al., 2012)**.**  |

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| **Date** | 1991-present |
| **Location (Country/City)** | Cambridge, Michigan, ETH-Zurich, Manchester, Oxford |
| **Project** | Oil, gas, CCS and groundwater security, various projects |
| **Position** | Various academic research posts |
| **Description** | The development of noble gas isotope systems by Ballentine to track the processes controlling hydrocarbon oil and gas migration and trapping have become an industry, albeit specialised, standard tool. Ballentine’s earliest papers (e.g. Ballentine et al., 1991, Pannonian Basin gas fields; and Ballentine et al., 1996, North Sea Oil fields) provide the foundational approach now used in quantifying the role of groundwater in many multiphase subsurface systems. Ballentine has held major research contracts with BP, Total, Exxon and smaller research contracts with many other oil and gas majors applying this approach. Ohio State University, IFP and Total amongst others have dedicated noble gas laboratories servicing the oil and gas industry founded on this science. This approach also identifies the historical impact of the oil and gas industry on groundwater security in California (working with the USGS), and showed the importance of groundwater (dissolution) vs precipitation in CCS applications (Gilfillan et al., Nature 2009), overturning the IPCC accepted model at the time and now a standard approach taken in determining CCS safety cases. Most recently Ballentine’s team identified the subsurface conversion of CO2 to CH4 by methanogenesis in a topical CCS target (depleted oil field) – with industry (e.g. Equinor) now using this approach to reduce the risk of methanogenesis occurring in scaled up CCS projects (Tyne et al., Nature 2021; 2023). |

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| **Date** | 2018-present |
| **Location (Country/City)** | Oxford, UK |
| **Project** | Nuclear waste safety, various projects |
| **Position** | Chair of Geochemistry, University of Oxford |
| **Description** | The principles used to understand helium accumulation as a resource can be applied to dating pore fluid in proposed sites for nuclear waste disposal when no other technique is available. The latter is being employed with effect by the Canadian Nuclear Waste Authority (Cheng et al., NWMO report 2025). |

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| **Date** | 2022-2024 |
| **Location (Country/City)** | Oxford, UK |
| **Project** | Noble Helium, various projects |
| **Position** | Advisor |
| **Description** | Ballentine served as a technical and strategic advisor to Noble Helium, supporting their exploration efforts across projects in the East African Rift system. His role included evaluating the geochemical and geological characteristics of prospective helium systems, advising on basin-scale prospectivity, and integrating isotopic and noble gas data into exploration models. Provided guidance on resource risk assessment and contributed to refining the company’s broader exploration strategy based on emerging scientific understanding of primary helium systems. |

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| **Date** | 2013-2017 |
| **Location (Country/City)** | Oxford, UK |
| **Project** | Helium-One, Rukwa Basin |
| **Position** | Advisor |
| **Description** | Ballentine, alongside Professor Jon Gluyas, played a pivotal role in the founding and technical development of Helium-One, the first company to explore helium as a primary resource rather than a byproduct of hydrocarbon or CO₂ production. Their work identified Tanzania’s Rukwa Rift Valley as a highly prospective helium province, marking the world’s first deliberate helium exploration effort. Contributions included quantifying helium generation, understanding its release mechanisms, and demonstrating how even low-quality sedimentary seals could effectively trap gas. This work helped establish the Rukwa Basin as one of the largest known primary helium resources globally. The exploration strategy is detailed in Danabalan et al. (2022), while subsequent research, including Cheng et al. (2023), continues to inform exploration activities for companies such as Hotspur Helium. |

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| **Date** | 2019-present |
| **Location (Country/City)** | Oxford, UK |
| **Project** | Global Helium |
| **Position** | Founder Director, Consultant |
| **Description** | Co-founded Global Helium in 2019 to provide scientific and strategic support to emerging helium exploration ventures around the world. The company consolidates Ballentine’s globally recognised research in crustal gas systems to inform helium prospectivity assessments and exploration workflows. His role involves advising on basin selection, crustal flux modelling, and integrating geochemical signatures into exploration risk analysis, ensuring that Global Helium clients benefit from cutting-edge academic insight applied to commercial helium ventures. |

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| **Date** | 2020-2024 |
| **Location (Country/City)** | Oxford, UK |
| **Project** | Green Helium |
| **Position** | Advisor |
| **Description** | Since 2020, Ballentine has served as a scientific advisor to Green Helium, where he applies his research on crustal noble gases to helium exploration in the sedimentary basins of Saskatchewan, Canada. His insights into helium migration, retention, and isotopic analysis underpin the company’s technical workflows and target evaluation. Ballentine’s role bridges cutting-edge academic research with commercial application, helping Green Helium maintain a science-led approach to resource identification and risk reduction. |

**Education**

1991: PhD, Isotope Geochemistry, University of Cambridge, UK

1983: BSc, Physical Chemistry, UMIST, UK

**Professional Accreditations and Honours**

2022: Fellow, EAG / GS

2019: Fellow, CIFAR (Canadian Institute for Advanced Research)

2016: Elected, Board of Directors, AGU

2016: Eni Industry Medal, Presented by the President of Italy

2013: Fellow, AGU

2011: Advanced Grant Award, ERC

2009: Fellow, GSL (Geological Society of London)

2008: Bigsby Medal for ‘Eminent Contributions to Geology’, GSL

**Society Membership**

American Geophysical Union (AGU)

Canadian Institute for Advanced Research (CIFAR)

European Association of Geochemistry (EAG)

Geochemical Society (GS)

Geological Society of London (GSL)

**Governance, Journals and Societies**

2017 – 2020: Elected, AGU Board of Directors (65,000 members)

2017 – 2022: ERC Advanced Grant PE10 Panel Member

2013 – 2022: Governing Body, Oxford Museum of Natural History

2013 - present Governing Body, St Hugh’s College, Oxford

2011 – 2016: Vice President, President and Past President, EAG (3000 members)

2013: Goldschmidt conference, Florence, Italy. Host and Co-Chair (4100 delegates)

2011 – 2013: Founding Co-Director, Deep Energy Section, Deep Carbon Observatory

2009: Goldschmidt conference, Davos. Chair (2800 delegates)

2009 – 2011: Editorial Board, Chemical Geology, Elsevier

2003 – 2012: Associate Editor, Geofluids, Blackwell Press

2007 – 2010: EAG Goldschmidt Conference Officer

**Selected Conference Invited and Keynote Lectures**

2025: Goldschmidt conference, Keynote, Prague;

2025: EGU conference, Invited, Vienna

2025: North-western University, USA, Invited

2024: WHOI, USA, Invited;

2024: Carnegie Institution for Science, USA, Invited

2023: Rio Tinto, Montreal, Invited

2022: GSA, Invited, Denver, USA

2021: KAUST Research Open Week, Opening Plenary, Saudi Arabia

2020: Goldschmidt, Keynote, Virtual

2019: AGU, Invited, San Francisco, USA

2019: IAEA, Isotope Hydrology Conference, Opening Plenary, Vienna

2017: DCO International Meeting, Keynote, St Andrews

2016: Eni 2016, Lectio Magistralis, Università degli Studi della Basilicata (Potenza)

2016: Eni 2016, Lectio Magistralis, Polytechnic of Milan

2016: EGU, Union Keynote, Vienna

**Supervision of PhD Research Students**

(Graduated) Dan Barfod, Zheng Zhou, Stuart Gilfillan, Stephen Edwards, Sarah Mackintosh, Nicholas Goodwin, Michael Lawson, Bridget Weston, Oliver Warr, Michael Broadley, Anran Cheng, David Byrne, Rebecca Tyne, Daniel Halford. (Current), Tom Renshaw, Fahad Souid, Ed Blackman, Red Coleman

**Sponsor/Mentor of Postdoctoral Researchers**

Greg Holland, Roisin Moriarty, David Murphy, Zheng Zhou, Deborah Chavrit, Oliver Warr, Lorraine Ruzie, Patricia Clay, Bastian Joachim, Peter Barry, Rosie Jones, Steph Flude, Jennifer Mabry, Michael Broadley; Darren Hillegonds, Ruta Karolyte, Anran Cheng,

**Visiting Academics or Research Fellows**

2017-present: Dr Darren Hillegonds Oxford Laboratory Manager

2018: Dr Hirochika Sumino Faculty, University of Tokyo

2017: Dr Andrew Smye NERC Fellow

2014-2017: Dr Jennifer Mabry Oxford Laboratory Manager

2006: Prof. Zhenju Ding, Faculty, University of Geosciences, Wuhan

2006-2007: Dr. Hirochika Sumino Faculty, University of Tokyo

**Industry Impact**

*Major industry/facing research contracts*

2018 – 2026: NWMO Dating groundwater at proposed Canadian nuclear waste site

2018 – 2020: Total Natural hydrogen in the Sao Franciscan Basin, Brazil

2016 – 2021: USGS Impact of historical hydrocarbon production on shallow groundwater

2014 – 2016: exxonmobil Geochemical tracing of multiphase subsurface systems

And multiple small contracts (BP, Chevron, Exxon, BG group)

*Supporting exploration start-up companies*

2024-present: Hotspur Helium Advisor (Helium exploration company)

2023-present: Snowfox Disc. Ltd Founder/Advisor (Natural Hydrogen Exploration Company)

2022-2024: Noble Helium Advisor (East African Rift, Tanzania)

2020-present: Green Helium Advisor (Saskatchewan, Canada)

2019-present: Global He Pty Ltd Founder/Advisor (Consultancy consolidator)

2013-2017: Helium-one Advisor (East African Rift, Tanzania)

**Research**

*Platform Grants as PI*

2012: ERC Advanced Grant (EUR 2.7 million) NOBLE

2014: NERC Consortium (£2.5 million) Mantle Volatiles

And multiple smaller grants as PI or Co-PI totalling in excess of £20million over his career

**Organisation and promotion of research**

*Lobbying*

2010-2013: Coordinator of activities resulting in UK-NERC releasing £8m over 5 years as a Theme Action Plan: ‘Deep Earth volatiles and surface habitability’.

*UK science committees*

2007-2011: NERC College member

2008: UK national Research Assessment Exercise (RAE) Special Advisor

2006-2008: STFC-UK AURORA government advisory committee member (UK role in European Space Agency program to explore Mars)

*International science committees*

2011-2013: Co-Director, Deep Energy Directorate, Deep Carbon Observatory

2009-present: UCLA/DTM Isotopologue Instrument Advisory Council Member

2009: External Reviewer of IFP (Paris) Isotope Facility

**Notable Conference Organisation**

2017: DCO international meeting, St Andrews, UK. Conference Chair

2013: Goldschmidt, Florence, Italy. Conference Co-Chair (4100 delegates)

2011: Goldschmidt, Prague, Czech Republic, Organising and Science Committee Member (EAG Goldschmidt Officer 2007-2010)

2009: Goldschmidt, Davos, Switzerland: Conference Chair (2800 delegates)

2007: Royal Society ‘Frontiers in Science’, Krakow, Poland, Visegrád-4 (Poland, Czech Republic, Slovakia and Hungary) – UK ‘Bilateral’. Chair, UK Organising Committee

2006: Royal Society ‘Frontiers in Science’, Wyboston, UK. Germany-UK Bilateral. Organising Committee, UK Earth Science Representative

**Teaching Service**

*External examiner, undergraduate program*

2011-2013: Dept. Earth Science, University of Bristol

*External assessor, 5 year review of teaching provision*

2011: Ocean and Earth Sciences, NOC, University of Southampton

2008: Earth and Ocean Sciences, University of Liverpool

**Selected Publications and Impact**

Chris has authored over 140 peer-reviewed publications in journals such as Nature, Science and Geochimica et Cosmochimica Acta, cited over 12,000 times. His work on noble gas isotopes has redefined models of volatile origin and behaviour in the Earth’s crust and mantle, and directly contributed to the development of exploration tools now used across the helium and hydrogen sectors. Relevant recent publications to helium exploration are included below.

Ballentine, C.J., Karolyte, R., Cheng, A., Sherwood Lollar, B., Gluyas, J., Daly, M.C. (2025). Natural hydrogen resource accumulation in the continental crust. **Nature Reviews** Earth & Environment. https://doi.org/10.1038/s43017-025-00670-1

Cheng, A., Sherwood Lollar, B., Gluyas, J., Ballentine, C.J. (2023). Primary N₂-He gas field formation in intracratonic sedimentary basins. **Nature**, 615, 94–99. <https://doi.org/10.1038/s41586-022-05659-0>

Sherwood Lollar, B., Onstott, T.C., Lacrampe-Couloume, G., Ballentine, C.J. (2014). The contribution of the Precambrian continental lithosphere to global H₂ production. **Nature**, 516, 379–382.

Danabalan, D., Gluyas, J.G., Macpherson, C.G., Abraham-James, T.H., Bluett, J.J., Barry, P.H., Ballentine, C.J. (2022). The principles of helium exploration. Petroleum Geoscience, 28. https://doi.org/10.1144/petgeo2021-029

Halford, D.T., Karolyte, R., Andreason, M.W., Cathey, B., Cathey, M., Dellenbach, J., Cuzella, J.J., Sonnenberg, S.A., Cheng, A., McCaffrey, K.J.W., Gluyas, J.G., Ballentine, C.J. (2024). Probabilistic determination of the role of faults and intrusions in helium‐rich gas fields formation. Geochemistry, Geophysics, Geosystems, 25(6), e2024GC011522.

Tyne, R.L., Barry, P.H., Lawson, M., Byrne, D.J., Warr, O., Xie, H., Hillegonds, D.J., Ballentine, C.J. (2021). Rapid microbial methanogenesis during CO₂ storage in hydrocarbon reservoirs. **Nature,** 600, 670–674.

Ballentine, C.J., Porcelli, D., Wieler, R. (Eds.). (2002). Noble Gases in Cosmochemistry and Geochemistry. Reviews in Mineralogy and Geochemistry, Vol. 47, Mineralogical Society of America.

Gilfillan, S.M., Sherwood Lollar, B., Holland, G., Blagburn, D., Stevens, S., Schoell, M., Cassidy, M., Ding, Z., Zhou, Z., Lacrampe-Couloume, G., Ballentine, C.J. (2009). Solubility trapping in formation water as dominant CO₂ sink in natural gas fields. **Nature**, 458, 614–618.

Holland, G., Sherwood Lollar, B., Li, L., Lacrampe-Couloume, G., Slater, G.F., Ballentine, C.J. (2013). Deep fracture fluids isolated in the crust since the Precambrian era. **Nature**, 497, 357–360.