He and Ne as tracers of natural CO2 migration from a deep reservoir

Citation for published version:

Link:
Link to publication record in Edinburgh Research Explorer

Document Version:
Peer reviewed version

Published In:
Geochimica et Cosmochimica Acta

Publisher Rights Statement:
This is the author's version of a work that was accepted for publication. A definitive version was subsequently published in Geochimica et Cosmochimica Acta (2010)

General rights
Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy
The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.
He and Ne as tracers of natural CO2 migration from a deep reservoir

(Abstract)

Stuart M. V. Gilfillan* Mark Wilkinson, R. Stuart Haszeldine, Steven T. Nelson, and Robert J. Poreda

*Author to whom correspondence should be addressed:

Scottish Carbon Capture and Storage,
School of GeoSciences,
The University of Edinburgh,
Grant Institute,
The King's Buildings,
West Mains Road,
Edinburgh, EH9 3JW

Email: stuart.gilfillan@ed.ac.uk
He and Ne as tracers of natural CO₂ migration from a deep reservoir

STUART GILFILLAN¹*, MARK WILKINSON, R. STUART HASZELDINE, STEPHEN NELSON² AND ROBERT POREDA³

¹Scottish Centre for Carbon Storage, University of Edinburgh, UK. (¹correspondence: stuart.gilfillan@ed.ac.uk)
²Department of Geological Sciences, Brigham Young University, Utah, USA.
³Department of Earth and Environmental Sciences, University of Rochester, New York, USA.

Capture and geological storage of CO₂ is emerging as an attractive means of economically abating anthropogenic CO₂ emissions from large point sources. However, for the technology to be universally deployed it is imperative that a reliable method to asses the integrity of a storage site for both safety and regulation compliance exists. Hence, the ability to track, and identify the origin of, any CO₂ seepage measured at the near-surface and ground surface is critical.

As an analogue for post-emplacement seepage, this presentation will examine natural CO₂ rich springs and groundwater wells in the vicinity of the St. Johns Dome CO₂ reservoir, located on the southern tip of the Colorado Plateau on the border of Arizona and New Mexico. Extensive travertine deposits in the vicinity of St. Johns document a long history of the migration of CO₂ rich fluids to the surface. Whilst travertine formation appears to be insignificant at present, there is strong evidence of the migration of CO₂ rich fluids to the surface as shown by high levels of HCO₃⁻ in the surface spring waters.

Noble gases are conservative tracers within the subsurface, and combined with carbon stable isotopes, have proved to be extremely useful in determining both the origin of CO₂ and how the CO₂ is stored within natural CO₂ reservoirs from around the world including St. Johns Dome [1,2]. This presentation will compare measurements of the dissolved ³He/⁴He, CO₂/³He, ³He, ⁴He and ²⁰Ne concentrations from surface spring and groundwater well waters with those from the deep CO₂ reservoir. We show that a component of the helium fingerprint observed in the gaseous CO₂ contained in the St. Johns reservoir can be traced in waters from both the groundwater wells and the springs emerging at the surface above the reservoir. Our results show that CO₂ can be traced from source to surface using noble gases and illustrates that this technique could be used to identify CO₂ migration from engineered storage sites.