



The Great Big Data Challenge – From Overwhelming to Understanding

A River Runs Through It – Geological History in Grand Canyon National Park

Illuminating Luminescence – A New Teaching and Research Resource

Editor/Rédacteur en chef

Andrew Kerr
 Department of Earth Sciences
 Memorial University
 St. John's, NL, Canada, A1B 3X5
 E-mail: akerr@mun.ca

Managing Editor/directrice de rédaction

Cindy Murphy
 Department of Earth Sciences
 St. Francis Xavier University
 Antigonish, NS, Canada, B2G 2W5
 E-mail: cmurphy@stfx.ca

Publications Director/Directrice de publications

Karen Dawe
 Geological Association of Canada
 St. John's, NL, Canada, A1B 3X5
 Tel: (709) 864-2151
 E-mail: kfmdawe@mun.ca

Copy Editors/Rédacteurs copie

Stephen Amor, Lawson Dickson,
 Rob Raeside, Paul Robinson

Associate Editors/Rédacteurs associés

Sandy Cruden, Fran Haidl, Jim Hibbard, John Hinchey, Stephen Johnston, Fraser Keppie

Assistant Editors/Directeurs adjoints

Columnist: Paul F. Hoffman
 - The Tooth of Time
 Outreach: Pierre Verpaelt (Québec)
 Beth Halfkenny (Ontario)
 Godfrey Nowlan (Prairies)
 Eileen van der Flier-Keller (BC)
 Sarah Laxton (North)
 Professional Affairs for Geoscientists:
 Oliver Bonham
 Views from Industry: Elisabeth Kosters
 Series:
 Andrew Hynes Series: Tectonic Processes:
 Stephen Johnston and Brendan Murphy
 Classic Rock Tours: Andrew Kerr
 Climate and Energy: Andrew Miall
 Economic Geology Models: Elizabeth Turner
 Geology and Wine
 Geoscience Medallist: Andrew Kerr
 Great Canadian Lagerstätten:
 David Rudkin and Graham Young
 Great Mining Camps of Canada:
 Stephen McCutcheon
 Heritage Stone:
 Dolores Pereira and Brian R. Pratt
 Igneous Rock Associations: Jaroslav Dostal
 Modern Analytical Facilities: Keith Dewing,
 Robert Linnen and Chris R.M. McFarlane
 Remote Predictive Mapping:
 Jeff Harris and Tim Webster

Illustrator/Illustrateur

Peter I. Russell, Waterloo, ON

Translator/Traductrice

Evelise Bourlon, Laggan, NS

Typesetter/Typographe

Bev Strickland, St. John's, NL

Publisher/Éditeur

Geological Association of Canada
 Alexander Murray Bld., Rm ER4063
 Memorial University of Newfoundland
 St. John's, NL, Canada, A1B 3X5
 Tel: (709) 864-7660
 Fax: (709) 864-2532
 gac@mun.ca
 www.gac.ca

© Copyright 2019

Geological Association of Canada/
 L'Association géologique du Canada
 Except Copyright Her Majesty the Queen
 in right of Canada 2019 where noted.
 All rights reserved/
 Tous droits réservés
 Print Edition: ISSN 0315-0941
 Online Edition: ISSN 1911-4850

Volume 46

A journal published quarterly by the Geological Association of Canada, incorporating the Proceedings.

Une revue trimestrielle publiée par l'Association géologique du Canada et qui en diffuse les actes.

Subscriptions: Receiving four issues of *Geoscience Canada* per year for \$50 is one of the benefits of being a GAC member. To obtain institutional subscriptions, please contact Érudit: www.erudit.org

Abonnement: Recevoir quatre numéros par année pour 50,00 \$ du magazine *Geoscience* est l'un des avantages réservés aux membres de l'AGC. Pour les abonnements institutionnels, s'il vous plaît contacter Érudit: www.erudit.org

Photocopying: The Geological Association of Canada grants permission to individual scientists to make photocopies of one or more items from this journal for non-commercial purposes advancing science or education, including classroom use. Other individuals wishing to copy items from this journal must obtain a copying licence from Access Copyright (Canadian Copyright Licensing Agency), 69 Yonge Street, Suite 1100, Toronto, Ontario M5E 1K3, phone (647) 503-4664. This permission does not extend to other kinds of copying such as copying for general distribution, for advertising or promotional purposes, for creating new collective works, or for resale. Send permission requests to *Geoscience Canada*, at the Geological Association of Canada (address above).

La photocopie: L'Association géologique du Canada permet à tout scientifique, de reprographier une ou des parties du présent périodique, pour ses besoins, à condition que ce soit dans un but non-commercial, pour l'avancement de la science ou pour des buts éducatifs, y compris l'usage en classe. Toute autre personne désirant utiliser des reproductions du présent périodique doit préalablement obtenir une licence à cet effet d'Access Copyright (Canadian Copyright Licensing Agency), 69 Yonge Street, suite 1100, Toronto, Ontario M5E 1K3, Tél.: (647) 503-4664. L'autorisation susmentionnée exclut toute autre reproduction, telle la reproduction pour fins de distribution générale, de publicité ou de promotion, pour la création de nouveaux travaux collectifs ou pour la revente. Faites parvenir vos demandes d'autorisation à *Geoscience Canada*, au soin de l'Association géologique du Canada (voir l'adresse indiquée ci-dessus).

Those wishing to submit material for publication in *Geoscience Canada* should refer to the Instructions to Authors on the journal's website, www.geosciencecanada.ca

AUTHORS PLEASE NOTE:

Please use the web address <http://journals.hil.unb.ca/index.php/GC/index> for submissions; please do not submit articles directly to the editor.

The Mission of the Geological Association of Canada is to facilitate the scientific well-being and professional development of its members, the learned discussion of geoscience in Canada, and the advancement, dissemination and wise use of geosciences in public, professional and academic life. Articles in *Geoscience Canada* are freely available one year after their publication date, unless authors have arranged for immediate open access. Opinions expressed and interpretations presented are those of the authors and do not necessarily reflect those of the editors, publishers and other contributors. Your comments are welcome.

Cover Image: View, looking towards the north rim of the Colorado River and Phantom Ranch area along Bright Angel Creek, taken from the Kaibab Trail. Photo credit: Laurie Crossey.

GEOSCIENCE CANADA

JOURNAL OF THE GEOLOGICAL ASSOCIATION OF CANADA
JOURNAL DE L'ASSOCIATION GÉOLOGIQUE DU CANADA

PRESIDENTIAL ADDRESS

The Challenges of Big Data in Expanding Geoscience: Embracing New Initiatives
to Untangle our World **159**
D. Tarkyth

SERIES

Classic Rock Tours 3. **163**
Grand Canyon Geology, One Hundred and Fifty Years after John Wesley Powell:
A Geology Guide for Visiting the South Rim of Grand Canyon National Park
K.E. Karlstrom and L.J. Crossey

REVIEW

Handbook of Luminescence Dating **195**
N. Catto