

GEOLOGY

JANUARY 2021 | VOLUME 49 | NUMBER 1

- 3 Anatomy of a crustal-scale accretionary complex: Insights from deep seismic sounding of the onshore western Makran subduction zone, Iran**
Christian Haberland, Mohammad Mokhtari, Hassan Ali Babaei, Trond Ryberg, Mehdi Masoodi, Abdolreza Partabian and Jörn Lauterjung
- 8 Seismic anisotropy in southern Costa Rica confirms upper mantle flow from the Pacific to the Caribbean**
Vadim Levin, Stephen Elkington, James Bourke, Ivonne Arroyo and Lepolt Linkimer
- 13 Methanogen microfossils and methanogenesis in Permian lake deposits**
Funing Sun, Wenxuan Hu, Xiaolin Wang, Jian Cao, Bin Fu, Haiguang Wu and Shengchao Yang
- 19 Stagnant slab front within the mantle transition zone controls the formation of Cenozoic intracontinental high-Mg andesites in northeast Asia**
Wen-Liang Xu, Jia-Hui Chen, Ai-Hua Weng, Jie Tang, Feng Wang, Chun-Guang Wang, Peng Guo, Yi-Ni Wang, Hao Yang and Andrey A. Sorokin
- 25 Gulf of Nuna: Astrochronologic correlation of a Mesoproterozoic oceanic euxinic event**
Ross N. Mitchell, Uwe Kirscher, Marcus Kunzmann, Yebo Liu and Grant M. Cox
- 30 Impact of fault damage on eastern Tibet topography**
Heather M. Kirkpatrick, Seulgi Moon, An Yin and T. Mark Harrison
- 35 Formation of the First Bend in the late Eocene gave birth to the modern Yangtze River, China**
Hongbo Zheng, Peter D. Clift, Mengying He, Zixuan Bian, Gaozheng Liu, Xiaochun Liu, Lei Xia, Qing Yang and Fred Jourdan
- 40 Rapid expansion of meso-megathermal rain forests into the southern high latitudes at the onset of the Paleocene-Eocene Thermal Maximum**
E.P. Hurdeman, J. Frieling, T. Reichgelt, P.K. Bijl, S.M. Bohaty, G.R. Holdgate, S.J. Gallagher, F. Peterse, D.R. Greenwood and J. Pross
- 45 Negligible surface uplift following foundering of thickened central Tibetan lower crust**
Yunchuan Zeng, Mihai N. Ducea, Jifeng Xu, Jianlin Chen and Yan-Hui Dong
- 51 Experimental evidence supports early silica cementation of the Ediacara Biota**
Silvina Slagter, Lidya G. Tarhan, Weiduo Hao, Noah J. Planavsky and Kurt O. Konhauser
- 56 Taking time to twist a continent—Multistage origin of the New Zealand orocline**
S. Lamb and N. Mortimer
- 61 Quaternary influx of proximal coarse-grained dust altered circum-Mediterranean soil productivity and impacted early human culture**
Rivka Amit, Yehouda Enzel and Onn Crouvi
- 66 Slip rate determined from cosmogenic nuclides on normal-fault facets**
Jim Tesson, Lucilla Benedetti, Vincent Godard, Catherine Novaes, Jules Fleury, and the ASTER Team
- 71 Temperature change in subtropical southeastern Africa during the past 790,000 yr**
Manuel Chevalier, Brian M. Chase, Lynne J. Quick, Lydie M. Dupont and Thomas C. Johnson
- 76 Reconstructing crustal thickness evolution from europium anomalies in detrital zircons**
Ming Tang, Wei-Qiang Ji, Xu Chu, Anbin Wu and Chen Chen
- 81 Venus tesserae feature layered, folded, and eroded rocks**
Paul K. Byrne, Richard C. Ghail, Martha S. Gilmore, A.M. Celâl Şengör, Christian Klimczak, David A. Senske, Jennifer L. Whitten, Sara Khawja, Richard E. Ernst and Sean C. Solomon
- 86 Immiscibility and the origin of ladder structures, mafic layering, and schlieren in plutons**
Allen F. Glazner, John M. Bartley and Bryan S. Law
- 91 Exposure-age data from across Antarctica reveal mid-Miocene establishment of polar desert climate**
Perry Spector and Greg Balco
- 96 Permian plume-strengthened Tarim lithosphere controls the Cenozoic deformation pattern of the Himalayan-Tibetan orogen**
Xi Xu, Andrew V. Zuza, An Yin, Xiubin Lin, Hanlin Chen and Shufeng Yang
- 101 Nailed to the craton: Stratigraphic continuity across the southeastern Canadian Cordillera with tectonic implications for ribbon continent models**
M.E. McMechan, K.G. Root, P.S. Simony and D.R.M. Pattison
- 106 High-precision geochronology requires that ultrafast mantle-derived magmatic fluxes built the transcrustal Bear Valley Intrusive Suite, Sierra Nevada, California, USA**
Benjamin Z. Klein, Oliver Jagoutz and Jahandar Ramezani

GEOLOGY

GEOLOGY publishes timely, innovative, and provocative articles relevant to its international audience, representing research from all fields of the geosciences.

GEOLOGY (ISSN 0091-7613 USPS 994-580 CODEN GLGYB) is published monthly by the Geological Society of America, Inc. (GSA), with offices at 3300 Penrose Place, Boulder, Colorado, USA. Mailing address is P.O. Box 9140, Boulder, CO 80301-9140, USA. Periodicals postage paid at Boulder, Colorado, and at additional mailing offices. Postmaster: Send address changes to Geology, Sales & Service, P.O. Box 9140, Boulder, CO 80301-9140, USA.

Copyright © 2021, The Geological Society of America, Inc. (GSA). All rights reserved. Copyright not claimed on content prepared wholly by U.S. government employees within the scope of their employment. Individual scientists are hereby granted permission, without fees or further requests to GSA, to use a single figure, a single table, and/or a brief paragraph of text in other subsequent works and to make unlimited photocopies of items in this journal for noncommercial use in classrooms to further education and science. In addition, an author has the right to use his or her article or a portion of the article in a thesis or dissertation without requesting permission from GSA, provided the bibliographic citation and the GSA copyright credit line are given on the appropriate pages. For any other form of capture, reproduction, and/or distribution of any item in this journal by any means, contact: Permissions, GSA, P.O. Box 9140, Boulder, CO 80301-9140, USA, fax +1-303-357-1073, editing@geosociety.org; reference Geology, ISSN 0091-7613. Permission is granted to authors to post the abstracts only of their articles on their own or their organization's Web site providing the posting includes this reference: "The full paper was published in the Geological Society of America's journal Geology, [include year, month, and page numbers, if known, where the article appears or will appear]."

GSA provides this and other forums for the presentation of diverse opinions and positions by scientists worldwide, regardless of their race, citizenship, gender, religion, sexual orientation, or political viewpoint. Opinions presented in this publication do not reflect official positions of the Society.

SUBSCRIPTIONS for 2021 calendar year. All GSA Members receive free online access to Geology with their membership. Prices for print subscriptions: Members and Fellows: \$99; Student, K-12 Teacher, and Early Career Professional Members: \$60. Nonmembers and institutions: \$1,375 (print + online). Details on subscription choices, formats, and pricing at www.geosociety.org/publications/. For all orders, call GSA Sales & Service at +1.888.443.4472 or +1.303.357.1000, or e-mail gsaservice@geosociety.org. Claims: for nonreceipt or damaged copies, please contact GSA Sales & Service. Claims are honored for one year; please allow sufficient delivery time (up to 8 weeks) for overseas copies.

GSA ONLINE

Organization home page: www.geosociety.org
Journals and books: www.gsapubs.org
Manuscript submission: <https://geology.msubmit.net>

EDITORS

Kathleen C. Benison
West Virginia University
Kathleen.Benison@mail.wvu.edu

Chris Clark
Curtin University
geologyscienceeditor@curtin.edu.au

William Clyde
University of New Hampshire
Will.Clyde@unh.edu

Gerald Dickens
Trinity College Dublin
DICKENSG@tcd.ie

Marc D. Norman
Australian National University
marc.norman@anu.edu.au

Urs Schaltegger
University of Geneva
urs.schaltegger@unige.ch

GEOLOGY STAFF

Director of Publications
Jeanette Hammann

Managing Editor
Lyne Yohe
lyohe@geosociety.org

Editorial Staff
Jennifer Olivarez
jolivarez@geosociety.org

GSA OFFICERS

Executive Director
Vicki S. McConnell

President
J. Douglas Walker

President-Elect
Barbara L. Dutrow

Past President
Donald I. Siegel

Treasurer
Richard C. Berg

EDITORIAL BOARD

2019–2021
John Cottle
Jacob A. Covault
Elena Druguet
Paul Kapp
Shoufa Lin
Jonas B. Ruh
J. Gregory Shellnut
Martine Simoes
Zoltán Sylvester
An Yin

2020–2022
Olivier Bachmann
Whitney Behr
Carolyn Boulton
Matthew E. Clapham
Aaron Diefendorf
Dong Feng
Sam Johnstone
Meredith A. Kelly
Marcelo Ketzner
Li-Wei Kuo
Sergio Llana-Fúnez
Andrew J. Parsons
Oliver Plümpfer
Maria Seton
Ron Steel
Lucie Tajcmanova
Paola Vannucchi
Malcolm W. Wallace

COUNCILORS

2017–2021
Carmala N. Garziona
Joan E. Fryxell
Suzanne O'Connell

2018–2022
Wendy A. Bohrsen
Nathan A. Niemi
Jeff N. Rubin

2019–2023
Margaret Eggers
Katharine W. Huntington
Glenn Thackray

2020–2024
Madeline E. Schreiber
Susan G. Stover
Manfred R. Strecker

GSA Student Advisory Council Chair
Rebecca A. Taormina



COVER: A false-color synthetic aperture radar (SAR) view of the northern portion of Tellus Tessera, one of the regions on Venus where Byrne et al. identify the presence of layering. Examples of this layering are visible in the center and lower left of the scene. Tesserae on Venus are regions of substantial tectonic deformation that appear locally stratigraphically older than the surrounding plains. View is ~260 km across, with north to the right. These SAR data are from the NASA Magellan mission, and have a resolution of ~100 m/pixel. See "Venus tesserae feature layered, folded, and eroded rocks" by Byrne et al., p. 81–85.

Photo by: NASA