

Volume 21, Number 3 • June 2025

# **Greenalite**

Guest Editors: Birger Rasmussen, Janet Muhling, and Nicholas Tosca

Thinly laminated chemical muds comprising greenalite nanoparticles enclosed in early diagenetic silica cement. The greenalite-rich chert bed is from an interval of banded iron formation deposited ~2.55 billion years ago. PHOTO: BIRGER RASMUSSEN.



### **Greenalite: A Tiny Crystal with a Big Story**

Birger Rasmussen, Janet R. Muhling, and Nicholas J. Tosca



#### **Ordered but Disordered: The Peculiar Crystal Structure** of Greenalite

Huifang Xu, Yiping Yang, and Stephen Guggenheim, and Nicholas J. Tosca



## Serpentine Solid Solutions and Hydrogen Production on **Early Earth and Mars**

Benjamin M. Tutolo and James A. Leong



## **Greenalite: Cryptic Mineral of Ancient Ferruginous Oceans**

Janet R. Muhling, Latisha A. Brengman, and Jena E. Johnson



#### The Precambrian Greenalite Factory

Nicholas J. Tosca, Clancy Zhijian Jiang, and Benjamin M. Tutolo



#### **Greenalite: A Template Fit for Life?**

Birger Rasmussen, Woodward Fischer, and Daniel Duzdevich

## Publications mail agreement no. 40037944 Printed in USA

ISSN 1811-5209 (print) ISSN 1811-5217 (online)

## elementsmagazine.org pubs.geoscienceworld.org/elements

Elements is published jointly by the Mineralogical

UK and Ireland, Mineralogical Association of

International Association of GeoChemistry,

Gesellschaft, Società Italiana di Mineralogia e Petrologia, International Association of Geoanalysts, Polskie Towarzystwo Mineralogiczne (Mineralogical Society of

Poland), Sociedad Española de Mineralogía,

to members of these societies.

Swiss Geological Society, Meteoritical Society, Japan Association of Mineralogical Sciences, and International Association on the Genesis of Ore Deposits. The magazine is provided as a benefit

Elements is published six times a year. Individuals

pating societies to receive Elements. Institutional

subscribers to either of the following journals— American Mineralogist and Canadian Journal

of Mineralogy and Petrology—also receive one copy of *Elements* as part of their subscription.

Institutional subscriptions are available for US\$190 (US\$205 non-US addresses) per year in

Copyright 2025 by the Mineralogical Society

All rights reserved. Reproduction in any form, including translation to other languages, or by any means—graphic, electronic, or mechanical, including photocopying or information

storage and retrieval systems—without written permission from the copyright holder is strictly

2025. Contact the Executive Editor

(editor@elementsmagazine.org)

for information.

of America.

are encouraged to join any one of the partici-

Société Française de Minéralogie et de

Cristallographie, Association of Applied Geochemists, Deutsche Mineralogische

Society of America, Mineralogical Society of the

Canada, Geochemical Society, The Clay Minerals

Society, European Association of Geochemistry,





MIX Paper from







Mineralogical Society f the UK and Ireland

























#### DEPARTMENTS

Editorial – Trouble Writing that Paper?	
Go to the Art Museum	_
From the Editors	5
Elements Heritage – Origins of Elements Magazine –	
Part I: Conception (April 2001–November 2003) 157	7
Meet the Authors 161	ı
Society News	
European Association of Geochemistry 200	б
Mineralogical Society of the UK and Ireland 208	8
Mineralogical Association of Canada	
Deutsche Mineralogische Gesellschaft	
Geochemical Society	4
Mineralogical Society of Poland	
European Mineralogical Union 21	
The Clay Minerals Society	
Swiss Geological Society	
Meteoritical Society	
International Association on the Genesis of Ore Deposits 222	2
Japan Association of Mineralogical Sciences 223	
Mineralogical Society of America	
Association of Applied Geochemists	
Meeting Report	
Parting Shots – CALL TO ACTION: Securing Sustainable	_
Access to Geochemical Data	3
Calendar Back Inner Cove	
Advertisers in this Issue Back Inner Cove	