

COVER IMAGE: Artist's rendition of ONKALO an underground geological repository that

is under construction

near Olkiluoto, Finland.

This repository will use multiple barriers to ensure

that radionuclides are not

released to the environment.

Principal barriers include the

physical state and behavior of the nuclear fuel, the copper disposal canister,

the bentonite buffer, the

the favorable properties

of the surrounding rock

Government, the final

approval from the Finnish

backfill in the tunnels and

(magmatic gneiss). Following

disposal of spent nuclear fuel

is scheduled to begin in the

2020's. PHOTO CREDIT: POSIVA OY

Elements is published jointly by the Mineralogical Society of America, the Mineralogical Society of Great Britain and Ireland, the Mineralogical Association of Canada, the Geochemical Society, the Clay Minerals Society, the European Association of Geochemistry, the International Association of GeoChemistry, the Société Française de Minéralogie et de Cristallographie, the Association of Applied Geochemists, the Deutsche Mineralogische Gesellschaft, the Società Italiana di Mineralogia e Petrologia, the International Association of Geoanalysts, the Polskie Towarzystwo Mineralogiczne (Mineralogical Society of Poland), the Sociedad Española de Mineralogía, the Swiss Society of

Mineralogy and Petrology, the Meteoritical

of these societies.

Society, and the Japan Association of Mineralogical

Sciences. It is provided as a benefit to members

Elements is published six times a year. Individuals are encouraged to join any one of the participating societies to receive Elements. Institutional subscribers to any of the following journals-American Mineralogist, Clay Minerals, Clays and Clay Minerals, Mineralogical Magazine, and The Canadian Mineralogist—also receive one copy of Elements as part of their 2016 subscription. Institutional subscriptions are available for US\$165 (US\$180 non-US addresses) a year in 2016. Contact the executive editor (jrosso. elements@gmail.com) for information

Copyright 2016 by the Mineralogical Society of America

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 prohibited.

Publications mail agreement no. 40037944 Printed in USA

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

## www.elementsmagazine.org www.elements. geoscienceworld.org





MIX Paper from responsible sources FSC® C006300 Volume 12, Number 4 • August 2016

# **Deep-Mined Geological Disposal of Radioactive Waste**

Guest Editors: Bruce W.D. Yardley, Rodney C. Ewing, and Robert A. Whittleston



# **Geological Disposal of Nuclear Waste:**

Rodney C. Ewing, Robert A. Whittleston, and Bruce W.D. Yardley



#### **Geological Disposal of Radioactive** Waste in Clay

Bernd Grambow



#### **Crystalline Rock as a Repository** for Swedish Spent Nuclear Fuel

Allan Hedin and Olle Olsson



# The Russian Strategy of using Crystalline Rock as a Repository for Nuclear Waste

Nikolai P. Laverov, Sergey V. Yudintsev, Boris T. Kochkin, and Victor I. Malkovsky



# Salt as a Host Rock for the Geological Repository for Nuclear Waste

Thilo von Berlepsch and Bernt Haverkamp



### **Geological Disposal of Nuclear Waste in Tuff:** Yucca Mountain (USA)

Peter N. Swift and Evaristo J. Bonano



### Selecting a Site for a Radioactive Waste Repository: A Historical Analysis

Daniel S. Metlay

#### DEPARTMENTS

<b>Editorial</b> – Nuclear Waste Disposal, Climate Change,	
and Brexit: The Importance of an Educated Public	227
From the Editors	228
Meet the Authors	230
Society News	
Italian Society of Mineralogy and Petrology	277
Japan Association of Mineralogical Sciences	278
Deutsche Mineralogische Gesellschaft	279
European Association of Geochemistry	280
Geochemical Society	281
International Association of GeoChemistry	282
International Mineralogical Association	283
International Association of Geoanalysts	284
Clay Minerals Society	285
Mineralogical Society of America	286
Mineralogical Association of Canada	288
Société Française de Minéralogie et de Cristallographie	289
Meteoritical Society	290
Mineralogical Society of Great Britain and Ireland	292
Sociedad Española de Mineralogía	293
Association of Applied Geochemists	
Calendar	295
Advertisers in this Issue	296
Job Posting – Stanford University	296

MONEY OF THE PROPERTY OF THE P	Manufacture Scools	Association of Canada Association mineralogique du Canada	CLAY MINERALS SOCIETY	geochemical society	****
AGC C PORTING	- SFINC	APPLE OF THE PROPERTY OF THE P	DMG Deutsche Allieoralogische Gesellschaft	Minera Gold Minera	IAG
A CONARATA	SEM		The Meteoritical Society	Vabau Association of the state	