Cambridge Elements

Elements in Geochemical Tracers in Earth System Science
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THE URANIUM ISOTOPE PALEOREDOX PROXY

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CAMBRIDGE UNIVERSITY PRESS

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UNIVERSITY PRESS

University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre,
New Delhi – 110025, India

79 Anson Road, #06–04/06, Singapore 079906

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781108731119
DOI: 10.1017/9781108584142

First published 2019

A catalogue record for this publication is available from the British Library.

ISBN 978-1-108-73111-9 Paperback
ISSN 2515-7027 (online)
ISSN 2515-6454 (print)

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Abstract: Uranium isotopes ($^{238}U/^{235}U$) have emerged as a proxy for reconstructing the redox conditions of the Earth's oceans and atmosphere based upon the large isotopic fractionation between reduced U(IV) and oxidized U(VI). Variations in $^{238}U/^{235}U$, particularly when recorded in carbonate sediments, can track global trends in marine oxygenation and deoxygenation. It is unique among proxies because reduction occurs primarily at the sediment–water interface, and this sensitivity makes U isotopes especially relevant for the habitability of benthic animals. This Element covers the background, methods, and case studies of this promising tool for understanding Earth's environmental transitions, as rapid development continues to refine the accuracy of interpretations of $^{238}U/^{235}U$ records.

Keywords: uranium isotopes, marine anoxia, paleoredox, carbonates

ISBNs: 9781108731119 (PB), 9781108584142 (OC)
ISSNs: 2515-7027 (online), 2515-6454 (print)

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