

TRANSACTIONS  
OF  
THE ROYAL SOCIETY  
OF  
EDINBURGH



EARTH SCIENCES

Volume 74 Part 1

PUBLISHED BY THE ROYAL SOCIETY OF EDINBURGH

22 GEORGE STREET · EDINBURGH · EH2 2PQ

1983

## Editorial Board

B. J. BLUCK  
University of Glasgow

D. R. BOWES  
University of Glasgow  
(Executive Editor)

P. E. BROWN  
University of Aberdeen

J. B. DAWSON  
University of Sheffield

E. H. FRANCIS  
University of Leeds

D. GRANT  
Scottish Academic Press, Edinburgh

A. M. HOPGOOD  
University of St Andrews

V. R. S. HUTTON  
University of Edinburgh

R. M. S. SMELLIE  
General Secretary  
Royal Society of Edinburgh

G. I. LUMSDEN  
Institute of Geological Sciences, Edinburgh

D. B. MACINTYRE  
Pomona College, Claremont

R. C. MACKENZIE  
Macaulay Institute, Aberdeen

J. D. PEACOCK  
Institute of Geological Sciences, Edinburgh

W. RITCHIE  
University of Aberdeen

W. D. I. ROLFE  
University of Glasgow

B. G. J. UPTON  
University of Edinburgh

C. D. WATERSTON  
Royal Scottish Museum, Edinburgh  
(Executive Editor)

W. H. RUTHERFORD  
Executive Secretary  
Royal Society of Edinburgh

## Consulting Editors

H. P. BANKS  
Cornell University, Ithaca

R. G. C. BATHURST  
University of Liverpool

J. M. BERTRAND  
Université de Nancy

J. C. BRIDEN  
University of Leeds

T. N. CLIFFORD  
University of the Witwatersrand, Johannesburg

E. JÄGER  
Universität Bern

J. KONTA  
Charles University, Prague

R. F. LEGGET  
Ottawa

L. B. LEOPOLD  
University of California, Berkeley

W. D. MOONEY  
U.S. Geological Survey, Menlo Park

M. F. RIDD  
British National Oil Corporation, Glasgow

A. SEILACHER  
Universität Tübingen

I. J. SELIKOFF  
Mount Sinai School of Medicine, New York

J. V. SMITH  
University of Chicago

D. F. STRONG  
Memorial University, St Johns

S. UYEDA  
University of Tokyo

O. VAN BREEMEN  
Geological Survey of Canada, Ottawa

D. E. WHITE  
U.S. Geological Survey, Menlo Park

R. WOODALL  
Western Mining Co., Australia

*Editorial Secretary, Royal Society of Edinburgh: C. A. Anderson*

**COPYRIGHT:** It is the policy of the Royal Society of Edinburgh not to charge any royalty for the production of a single copy of any one article made for private study or research. Requests for the copying or reprinting of any article for any other purpose should be sent to the Royal Society of Edinburgh.

© 1983 The Royal Society of Edinburgh and the authors of individual papers.