

G. Pearson

**FOURTH INTERNATIONAL
KIMBERLITE CONFERENCE
EXTENDED ABSTRACTS**

**GEOLOGICAL SOCIETY OF AUSTRALIA
ABSTRACTS SERIES
NUMBER 16**

**Perth, Western Australia,
August 11th - 15th, 1986.**

Geological Society of Australia Incorporated
Office Bearers 1986 - 1987

President	D. M. Boyd
Vice-Presidents	J. B. Waterhouse, I. R. Johnson
Hon. Secretary	A. P. Belperio
Hon. Treasurer	J. W. Hunt
Hon. Administrative Officer	D. H. Probert
Hon. Editor (Journal)	R. W. LeMaitre
Hon. Editor (Special Publications)	G. Fleming

All Extended Abstracts in this volume have been reproduced by the camera-ready method from authors' contributions. Papers presented at the Conference have been selected from brief preliminary abstracts by the Programme and Publications Subcommittee, with the assistance of the Editorial Panel. There has been no editing of the Extended Abstracts by the Programme and Publications Subcommittee, and they have not been subject to review. Accordingly, the Programme and Publications Subcommittee and its associated Editorial Panel take no responsibility for any errors and omissions, or for the opinions stated by the Authors.

Compiled by C. B. Smith

Published by the
Organising Committee of the Fourth International Kimberlite Conference
under the sponsorship of the
Geological Society of Australia Incorporated,
Challis House, 10 Martin Place, Sydney

Additional copies and other volumes associated with the conference
may be purchased from the Geological Society of Australia

FOURTH INTERNATIONAL KIMBERLITE CONFERENCE

INTERNATIONAL ADVISORY COMMITTEE

Dr. F. R. Boyd (USA)
• Prof. J. B. Dawson (UK)
Dr. J. Ferguson (Australia)
• Dr. J. J. Gurney (South Africa)
• Mr. J. B. Hawthorne (South Africa)
Dr. J. Kornprobst (France)
• Prof. H. O. A. Meyer (USA)
• Dr. R. H. Mitchell (Canada)
• Dr. P. H. Nixon (UK)
Prof. N. V. Sobolev (USSR)

CONFERENCE ORGANISING COMMITTEE

Dr. A. F. Trendall (Chairman)
Prof. P. G. Harris (Vice Chairman)
Dr. G. P. Gregory (Treasurer)
Mr. J. D. Lewis (Secretary)
Dr. W. J. Atkinson (alternate Mr. C. B. Smith)
Dr. R. V. Danchin (alternate Mr. J. Stracke)
Dr. L. R. Davidson
Dr. J. Ferguson
Mr. M. Gunn
Dr. A. J. A. Janse
Mr. W. D. Jones
Dr. R. T. Pidgeon
Dr. J. R. Ross

PROGRAMME AND PUBLICATIONS SUBCOMMITTEE

Dr. J. R. Ross (Chairman)
Dr. L. R. Davidson
Prof. P. G. Harris
Mr. C. B. Smith

EDITORIAL PANEL

Dr. A. L. Jaques (Section I)
Dr. J. Ferguson (Section II)
Prof. D. H. Green (Section III)
Dr. S. Y. O'Reilly (Section IV)
Dr. R. V. Danchin (Section V)
Dr. A. J. A. Janse (Section VI)

ACKNOWLEDGEMENT OF SUPPORT

The Organising Committee of the Fourth International Kimberlite Conference expresses its sincere thanks to the many persons, companies and other bodies that have assisted the organisation of this Conference. These include:-

Principal Sponsor: Geological Society of Australia Incorporated

Co-Sponsors: Bureau of Mineral Resources, Geology and Geophysics
Commission on Experimental Petrology
Geological Society of Australia (WA Division)
International Association of Geochemistry and Cosmochemistry
International Association of Volcanology and Chemistry of the Earth's Interior
University of Western Australia
Western Australian Department of Mines

Particular appreciation is recorded of the assistance received from the following sources:

ANZ Bank
Argyle Diamond Mines Pty Limited
Ashton Exploration Joint Venture
Ashton Mining Pty Ltd
Australian Airlines (formerly Trans Australia Airlines)
BP Minerals Australia
BP Minerals International
The Broken Hill Proprietary Company Ltd
CRA Exploration Pty Limited
Murdoch University
QANTAS Airways Limited
Stockdale Prospecting Ltd
UNESCO
Western Australian Institute of Technology
Western Mining Corporation Ltd

In addition, the Programme and Publications Subcommittee wishes to acknowledge the invaluable assistance of the following people in the preparation of this volume:

Mrs. S. Yap (CRA Exploration Pty Limited)
Mrs. J. E. Hall (CRA Exploration Pty Limited)
Ms S. M. Mead (Western Mining Corporation)
Mrs J. H. Thom
Mr. T. Dods
Mr. D. Smart
Ms M. T. Muggeridge

FOURTH INTERNATIONAL KIMBERLITE CONFERENCE

EXTENDED ABSTRACTS VOLUME

C O N T E N T S

	Page
Introduction	2
Section I WHAT ARE WE CONCERNED WITH?	5
Descriptive lithology, mineralogy, petrology and geochemistry of kimberlite and closely related rocks and their constituent minerals - excluding xenoliths and xenocrysts. Invited review by Professor R. H. (Roger) Mitchell	
Section II WHEN AND WHERE DO THEY OCCUR?	103
Their distribution in geologic space and time; their tectonic setting and regional occurrence; possible causes of observed distribution patterns. Invited review by Professor J. B. (Barry) Dawson	
Section III HOW DO THEY FORM?	151
Upper mantle processes, magma genesis, ascent and eruption. Invited review by Professor D. H. (David) Egglar	
Section IV WHAT IS THE NATURE OF THE UPPER MANTLE AND THE LOWER CRUST?	219
Descriptive lithology, mineralogy, petrology and geochemistry of xenoliths and xenocrysts; physical and chemical conditions within the upper mantle and lower crust. Invited review by Dr. B. (Ben) Harte	
Section V DIAMONDS	359
All aspects of diamond research, including inclusions in diamonds. Invited review by Dr. J. J. (John) Gurney	
Section VI DIAMOND EXPLORATION	431
Exploration for primary and alluvial deposits of diamonds, including: concepts, exploration technology, evaluation procedures and case histories. Invited review by Dr. W. J. (Warren) Atkinson	
Special Invited Lecture: "The constitution and evolution of the mantle", by Professor A. E. Ringwood	487
Biographies	493
Author Index	511

INTRODUCTION

This Conference has continued the tradition of the three preceding International Kimberlite Conferences in providing a forum for the presentation and discussion of papers on kimberlites and related rocks. Topics discussed include their characteristics, occurrence, mantle source, genesis, mineralogy, diamond content and exploration.

The technical sessions and papers have been organised into six sections in accordance with a structure which addresses a number of basic questions relating to kimberlites and closely related rocks. These questions include some areas of research not well represented at previous conferences as well as the more traditional areas of kimberlite research.

This volume is organised into the same six sections and each commences with an abstract of an invited review paper. This review is followed by the poster and oral papers in that section, presented in alphabetical order of first authors. Poster papers, being an important feature of the Conference, carry equal weight with oral papers. Please note that some papers will not be presented by the first author and the Programme and Information volume should be consulted to relate the Extended Abstract to the papers listed in the detailed programme.

Section I, "What are we concerned with?", is essentially descriptive, dealing with the lithology, mineralogy, petrography and geochemistry of kimberlites, lamproites and related rocks such as olivine melilitites, carbonatites and nephelinites. It includes papers dealing with nomenclature, classification and definitions of these rocks. Descriptions include details of macrocryst mineral species and xenoliths, but papers where the xenoliths and xenocrysts are the main descriptive focus are included in Section IV.

Section II, "When and where do they occur?", deals with the distribution of kimberlitic rocks in geologic space and time, and their relationship to structure on both local and global scales. Processes within the upper mantle, and the processes of magma genesis, ascent and eruption that lead to emplacement of kimberlites and related rocks, are described in Section III.

Section IV, "What is the nature of the upper mantle and lower crust?" includes descriptions of xenoliths and xenocrysts, papers on physical and chemical conditions within the upper mantle and lower crust, and on superimposed changes caused by the processes of metasomatism, magma generation and emplacement. Papers dealing with mantle fabrics and isotope geochemistry are included here.

Section V, "Diamonds", includes papers describing diamond morphology and occurrence, mineral inclusions within diamond, trace element and isotope studies, and diamond genesis. Exploration for and evaluation of both alluvial and primary sources of diamond are covered in Section VI, "Diamond Exploration", which includes methods and case histories, and descriptions of alluvial diamond deposits.

An invited lecture by Professor A. E. Ringwood, entitled "The constitution and evolution of the mantle", is to be given at a special meeting of the Western Australian Division of the Geological Society of Australia and held in conjunction with the 4th International Kimberlite Conference, and an extended abstract of that paper is included in this volume. It addresses the static constitution and dynamics of the mantle, their possible influence on kimberlite genesis, and also considers the processes that give rise to the sub-continental lithosphere. This overview of the mantle is designed to provide a framework for the more specific reviews that head Sections III and IV.

The previous three International Kimberlite Conferences have featured content which reflected the geographic venue of the Conference and the topics being most actively researched at the time. Traditionally, mantle nodule descriptions have formed a major part of the proceedings, reflecting their abundance in the African kimberlites that have historically provided much of the material for research work. The discoveries in Australia of diamond in lamproite has renewed interest in the petrographic nature of the host rock itself, and created controversy as to the relationships between kimberlite and lamproite. It has focussed more attention on diamond exploration.

Table 1 shows a breakdown of papers submitted to the past and present International Kimberlite Conferences, with all papers being notionally allocated to the sections being used in the Fourth Conference. It shows an increasing interest in research relating to diamonds and a substantial increase in exploration oriented papers in the Fourth Conference that may reflect the deliberate structure of its programme. The proportion of descriptive papers in Sections I and IV has decreased.

Table 1
COMPARISON OF INTERNATIONAL KIMBERLITE CONFERENCE PAPERS
SUBDIVIDED BY SECTION
(expressed as a percentage of the total papers)

<u>Conference</u>	<u>No. of Papers</u>	<u>Sections</u>					
		I	II	III	IV	V	VI
1st IKC	95	29	7	14	47	2	0
2nd IKC	133	25	18	17	34	6	0
3rd IKC	136	26	5	26	33	8	2
4th IKC	156	20	10	15	29	15	11

The programme of the Fourth International Conference is expected to include a total of 158 papers, and a total of 156 abstracts are included in this volume. Following the decision to have no concurrent sessions, the programme has been divided into 73 oral papers and 85 poster papers on the basis of content. The geographic subdivision of these papers, on a basis of the affiliations of the 245 authors and co-authors, is given in Table 2. A total of 17 countries are represented.

Table 2
GEOGRAPHICAL BREAKDOWN OF FOURTH IKC PAPERS BY AUTHOR

Australia	72	Norway	2
Botswana	2	South Africa	32
Brazil	1	Swaziland	1
Canada	14	UK	20
China	7	USA	55
France	3	USSR	18
India	4	West Germany	7
Japan	4	Zimbabwe	1
New Zealand	2	TOTAL	245