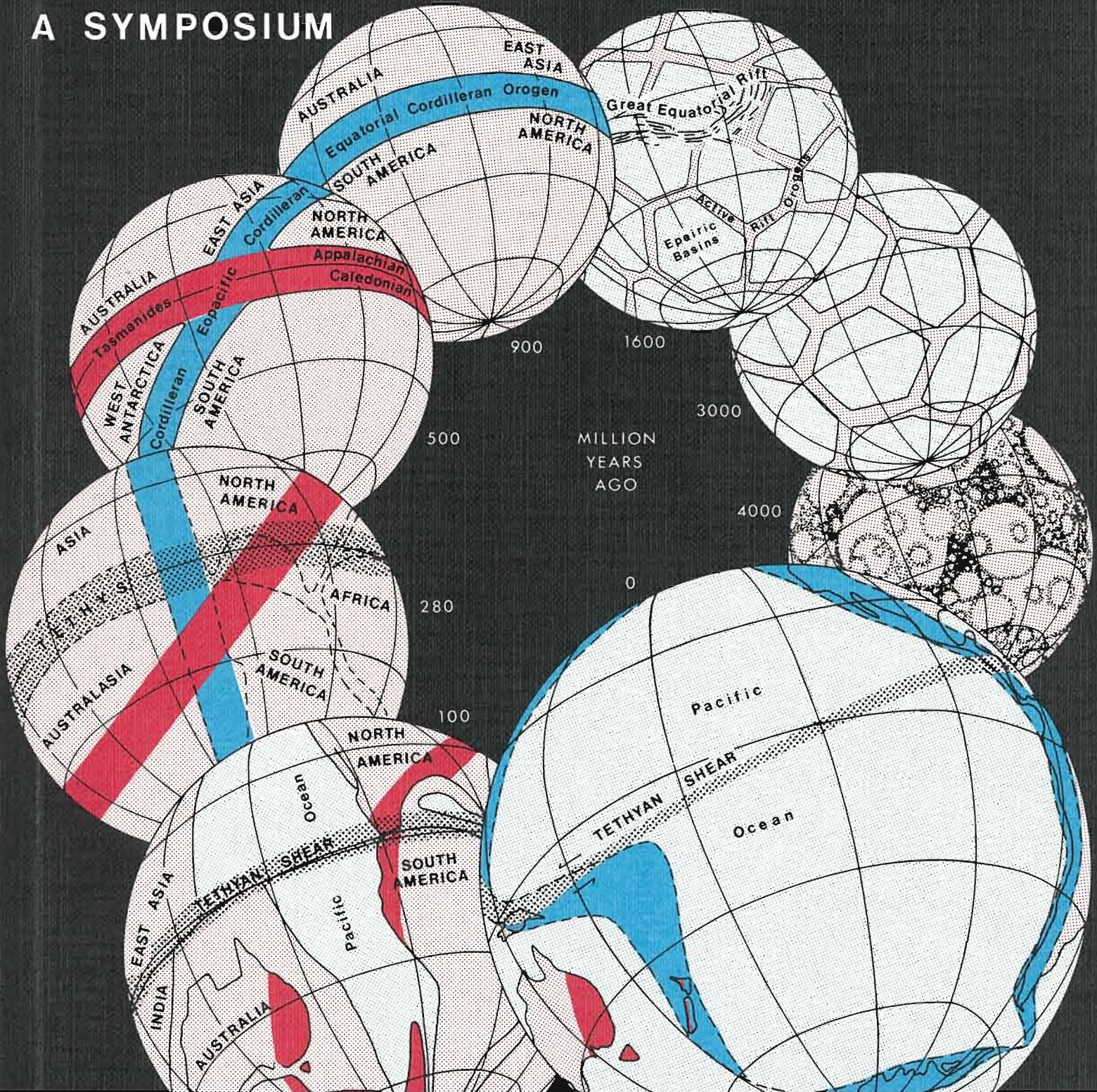


THE

# EXPANDING EARTH

A SYMPOSIUM





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Earth Resources Foundation, University of Sydney

February 10-14, 1981

Convener and Editor

S. WARREN CAREY

Professor Emeritus, University of Tasmania

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1. Glacial Sediments    November 1955  
Principal Guest: *Kenneth E. Caster*, University of Cincinnati  
Proceedings not published
2. Continental Drift    March 1956  
Principal Guest: *Chester Longwell*, Yale University
3. Genesis of the Lyell Schists    November 1956  
Principal Guest: *Francis Turner*, University of California
4. Dolerite    July 1957  
Principal Guest: *Frederick Walker*, University of Cape Town
5. Syntaphral Tectonics    May 1963  
Principal Guest: *Bruce Heezen*, Lamont Observatory
6. The Expanding Earth    February 1981, at the University of Sydney  
Principal Guest: *Peter Smith*, The Open University

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## PREFACE

This symposium on Earth expansion was made possible through the help of Ken Richards and John Davidson of Esso Australia and John Elliston of Peko Wallsend, who organized the financial support of oil and mining companies, and of Professor Graeme Philip, Chairman of the Earth Resources Foundation, which hosted the meeting.

Organization, editing, and preparation of camera-ready copy was solely the responsibility of the convener. Refereeing proved difficult for it was found that plate-tectonics supporters tended to reject as naive, arguments supporting expansion, and vice versa. Hence I decided that opinions and interpretations should stand without screening, for after all, such is the purpose of a symposium. At the outset I took pains to emphasize that contributors denying or criticising Earth expansion would be welcomed. In the preparation of this volume, no paper or statement contrary to Earth expansion was in any way suppressed or reduced.

The format was changed from the octavo originally contemplated to A4 because many of the maps and diagrams submitted would not reproduce satisfactorily on the smaller page.

The papers have been grouped so that discussion of related topics fall together, but of course several range broadly and could have been differently grouped.

The historical introduction (Carey, Brunschweiler, Vogel) sets the background of the evolution of beliefs about the Earth through the millennia and the century, and the attempts to reconstruct the Archaean Earth.

Expansion models for the last two hundred million years can be directly related to present configurations, and hence differ in method from Precambrian models. Contributions by Owen, Dooley, Bailey & Stewart, Rickard, and Vogel & Schwab deal with the former, while in the next section Burrett, Embleton Schmidt & Fisher, Glikson, Crook, Kremp, the Termiers, and Gorai consider ancient configurations.

Interpretation of the Tethys is crucial, because plate-tectonics models imply thousands of kilometres of closure across this zone in contrast to expansion models in which the Tethys was transversely extensional. Crawford, Stöcklin, Ahmad, Plumb, Ćirić, Tassos, Brunschweiler, Johnston, and Carey

contribute to this debate.

The next section considers the Pacific Ocean, which according to plate-tectonics models, must have shrunk to half its area since the Permian (to make room for the opening of the Arctic, Atlantic, and Indian Oceans), whereas expansion models imply great area increase in that time. Davidson, Shields, Bevis & Payne, Iturralde-Vinent, and Tanner discuss aspects of this question.

The intrinsic nature of orogenesis is the most fundamental question of geology. Plate-tectonics theory considers orogenesis to be the result of many hundreds of kilometres of transverse shortening caused by subduction between converging plates. Many expansionists consider diapiric extrusion from the interior to be the primary cause, and that orogens widen during the process. Other expansionists, take an intermediate position invoking compression during the diastrophic phase. Subduction problems and diapirism are discussed by Tanner, Ramberg, Scholl & Vallier, Ćirić, Cecione, and Wezel.

In the next section three papers (Dachille, Shields, and Myers) attribute the expansion of the Earth to impacts of meteoritic bodies, asteroids, and comets.

Many of the papers touch on the rate of expansion, but in the next section three (Neiman, Talobre, and Blinov) consider this question specifically and attempt to quantify it, and Stewart sets quantitative limits derived from his earth model.

Dooley and Runcorn cite geophysical data contrary to the expansion model. Walzer & Maaz discuss in depth the physical base of mantle convection, which is relevant both to expansion and conventional tectonic models. No papers were offered on pulsation theories of Earth expansion which however have several supporters (e.g. Steiner, Milanovskii, and Khain).

The final section discusses planetological (Taylor) and cosmological (Tryon, Carey) implications of Earth expansion, with short papers on relevant matters of entropy (Tassos) and fundamental dimensions (Parkinson).

In a closing review, the convener states the necessity of Earth expansion.

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## Formal Opening by Sir Mark Oliphant\*

I gather that we are here for this symposium to bring together what evidence there is to support the concept of an expanding Earth, which could explain changes, over geological time, in the distribution of land and sea. For the dedicated, the exercise will be, with W. S. Gilbert, "Merely corroborative detail, to add artistic verisimilitude to an otherwise bald and unconvincing narrative." For those who accept the very recently orthodox version of continental drift, the idea conjures up sympathy with Alice in "Through the Looking Glass". Let me quote:

*'I can't believe that' said Alice.  
'Can't you?' the Queen said in a pitying tone.  
'Try again: draw a long breath, and shut your eyes'. Alice laughed. 'There's no use trying', she said: 'one can't believe impossible things'. 'I daresay you haven't had much practice', said the Queen. 'When I was your age I always did it for half-an-hour a day. Why, sometimes I've believed as many as six impossible things before breakfast'.*

The impressive list of contributors to the discussions makes it clear that there are believers outside the Tasmanian Apple Isle, though one Tasmanian, who skilfully argued, with logic and mathematics, that the Moon was but a ball of gaseous plasma, must have been discomfited when men landed on that satellite!

It was from Paul Dirac, in Cambridge, that I first heard put seriously the idea that the physical constants might change with time. In today's context, we learnt that it was possible to construct a logical theory of the Universe, in which the constant of gravitation,  $G$ , decreased with time. All things held together by the mutual force of gravitation, must then expand with time. However, only a miniscule portion of the force between the atoms of solid or liquid is gravitational, so that in order to obtain an appreciable increase in the radius of the Earth, the electrical constants, responsible for interatomic forces, must also decrease. If nothing is constant, on a geological time-scale, it becomes necessary to believe that the number of particles in the Universe is not about  $10^{80}$  or thereabouts, but is increasing or decreasing with time. I understand that Professor Carey wants continuous creation of fresh matter, Hoyle's concept in a new guise. This implies very fundamental changes in the present theories of the origin of the Universe and of its Hubble expansion.

\*Twenty-five years ago, Sir Mark Oliphant, then Foundation President of the Australian Academy of Science, opened the Hobart Symposium on Continental Drift, convened by Professor Carey.

If the Earth expands with time, like an inflating balloon, the relative positions of all parts remain the same. Other forces must be involved to explain the established motions of the continents and their parts. In addition to sea-floor spreading, there must be continental spreading unless, for some subtle reason, new matter is created only in the liquid interior. It becomes necessary to assume that new matter is always exactly the same material as existing matter, that fresh atoms of silicon and oxygen are created within a crystal of quartz, for instance, retaining the existing geometry.

In some philosophical manner, I am attracted, irrationally I suppose, by concepts such as infinity, in space and time, forward and backward. I do not find continuous creation of matter repugnant, provided that there is an equivalent continuous disappearance. I was hopeful, when I first read of modern theories predicting the instability of the proton, that this might make expansion plausible. However, the calculated, and now also the measured half-life for such decay, greater than  $10^{32}$  years, is almost infinitely longer than the age of the Universe. In his review of a book by Wesson, dealing with "Gravity, Particles, and Astrophysics" in Nature for 22 January, 1981, Davies comments on the attraction of 'variable  $G$ ' theories, and says:

*This book is written in a style that leads one to believe there is a sort of grand, coherent theory of unconventional physics and cosmology existing alongside the more publicised one. It gives the impression of two sciences: the one to which most professionals subscribe, and another, almost the same in its predictions, but with subtle differences.*

I must admit that I also am a rebel, attracted by the boldly unorthodox, and that I have a sneaking wish that the pundits of present-day accepted cosmology be proven at least partially wrong. I remember in the 1920's, as a student in Adelaide, hearing a debate between Sir Douglas Mawson, Professor of Geology, and Wood-Jones, the Professor of Anatomy, concerning Wegener's ideas of continental drift. Wood-Jones wanted it to be true, for it helped explain the distribution of animals, plants, and their fossil remains. Mawson, the celebrated geological expert, thought it an absurd idea that rigid rocks could flow in that strange manner. Even then, I felt that Wood-Jones had the better of the argument! I was equally attracted by the

continuous creation theory of Fred Hoyle, and I remain hopeful that, in some form it will be revived, despite the cogent objections.

It is for this reason that I am behind Sam Carey in his determination to keep alive the concept of an expanding Earth. While the causes and the mechanism of expansion remain obscure, the idea explains everything geologists and geophysicists observe, and all that they theorize, except, perhaps, subduction. So, it is with great pleasure that I open this seminar.

NOTE

Owing to an airline strike Sir Mark was prevented from delivering this speech in person (Ed.)



# CONTENTS

|  |     |  |     |
|--|-----|--|-----|
| Preface . . . . .  | v   |  |     |
| Opening statement by Sir Mark Oliphant. . . . .  | vii |  |     |
| HISTORICAL INTRODUCTION  |     |  |     |
| S. Warren Carey: <i>Evolution of beliefs on the nature and origin of the Earth.</i>  | 3   |  |     |
| R.O. Brunnschweiler: <i>Evolution of geotectonic concepts in the past century.</i>   | 9   |  |     |
| Klaus Vogel: <i>Global models and Earth expansion.</i>   | 17  |  |     |
| POST-PERMIAN PALAEOGEOGRAPHY   |     |  |     |
| H.G. Owen: <i>Ocean-floor spreading evidence of global expansion.</i>  | 31  |  |     |
| J.C. Dooley: <i>Arguing in circles about Earth expansion.</i>  | 59  |  |     |
| D.K. Bailey & A.D. Stewart: <i>Problems of ocean water accumulation on a rapidly expanding Earth.</i>  | 67  |  |     |
| *M.J. Rickard: <i>Model palaeomagnetic polar-wandering paths on an expanding Earth.</i>  | 71  |  |     |
| Klaus Vogel & Max Schwab: <i>The position of Madagascar in Pangaea.</i>  | 73  |  |     |
| PRE-CALEDONIAN PALAEOGEOGRAPHY   |     |  |     |
| Clive F. Burrett: <i>Early Palaeozoic palaeomagnetism and biogeography - plate tectonics or expansion?</i>   | 79  |  |     |
| *B.J.J. Embleton, P.W. Schmidt, & N.I. Fisher: <i>Precambrian palaeomagnetism.</i>   | 87  |  |     |
| *A.Y. Glikson: <i>Geochemical, isotopic, and palaeomagnetic limits on Precambrian crustal surface dimensions: evidence for a small-radius Earth.</i> | 88  |  |     |
| *Keith A.W. Crook: <i>Some implications of the apparent variation in abundances of ophiolites and flysch during geological time.</i>                 | 89  |  |     |
| Gerhard O.W. Kremp: <i>Precambrian events indicative of Earth expansion.</i>   | 91  |  |     |
| Henri Termier & Geneviève Termier: <i>Reflections about an expanding Earth.</i>  | 101 |  |     |
| Masao Gorai: <i>A consideration of the primordial size of the Earth.</i>   | 105 |  |     |
| TETHYS - COMPRESSED OR WIDENED?  |     |  |     |
| A.R. Crawford: <i>Central Asia and Earth expansion.</i>  | 111 |  |     |
| Jovan Stöcklin: <i>Himalayan orogeny and Earth expansion.</i>  | 119 |  |     |
| F. Ahmad: <i>Late Palaeozoic to Early Mesozoic palaeogeography of the Tethys region.</i>   | 131 |  |     |
| K.A. Plumb: <i>Himalayas and Tibet plateau - vertical versus horizontal tectonics - and possible Proterozoic analogues.</i>                          | 147 |  |     |
| C.R. Johnston: <i>The Timor enigma - continental collision or expanding Earth.</i>   | 148 |  |     |
| Branislav M. Ćirić: <i>The Mediterranean Tethys in Alpine time - evidence for Earth expansion.</i>   | 149 |  |     |
| S.T. Tassos: <i>The Hellenic arc and trench in the light of Earth expansion.</i>   | 161 |  |     |
| R.O. Brunnschweiler: <i>The Indoburman arc.</i>  | 165 |  |     |
| S. Warren Carey: <i>Tethys, and her forebears.</i>   | 169 |  |     |
| PACIFIC MARGINS  |     |  |     |
| John K. Davidson: <i>Tethys and Pacific stratigraphic evidence for an expanding Earth.</i>   | 191 |  |     |
| Oakley Shields: <i>Trans-Pacific biotic links that suggest Earth expansion.</i>  | 199 |  |     |
| Michael Bevis & Barton Payne: <i>A new Palaeozoic reconstruction of Antarctica Australia and South America.</i>                                      | 207 |  |     |
| Manuel A. Iturralde-Vinent: <i>An expanding Earth model explanation of the origin and evolution of Cuba.</i>   | 215 |  |     |
| William F. Tanner: <i>Absolute motion of North America, and the development of the middle America arc.</i>   | 219 |  |     |
| SUBDUCTION   |     |  |     |
| William F. Tanner: <i>Diapirism, grabens, and horizontal tension.</i>  | 227 |  |     |
| *Hans Ramberg: <i>The role of gravity in orogenic belts.</i>   | 233 |  |     |
| David W. Scholl & Tracy L. Vallier: <i>Subduction and the rock record of the Pacific margins.</i>  | 235 |  |     |
| Branislav M. Ćirić: <i>Is subduction a real phenomenon?</i>  | 247 |  |     |
| Giovani O. Cecioni: <i>Expansion, cracks, and geotumours in the Chilean Andes.</i>   | 259 |  |     |
| Forese-Carlo Wezel: <i>Central Mediterranean arc system: krikogenesis rather than subduction.</i>  | 263 |  |     |
| ASTEROIDAL IMPACTS   |     |  |     |
| Frank Dacheille: <i>Great meteorite impacts and global geological responses.</i>   | 267 |  |     |
| Oakley Shields: <i>The role of gravity and asteroid impacts in Earth expansion.</i>  | 277 |  |     |
| *Lawrence St.Clair Myers: <i>The accretion of the Earth.</i>   | 283 |  |     |
| RATE OF EXPANSION  |     |  |     |
| V.B. Neiman: <i>Geological and geophysical proofs of Earth expansion.</i>  | 287 |  |     |
| J.A. Talobre: <i>Astronomical valuation of the present rate of Earth's expansion rate.</i>   | 293 |  |     |
| V.B. Blinov: <i>Spreading rate and rate of expansion of the Earth.</i>   | 297 |  |     |
| A.D. Stewart: <i>Quantitative limits to the palaeoradius of the Earth.</i>   | 305 |  |     |
| GEOPHYSICS   |     |  |     |
| J.C. Dooley: <i>A simple physical test of Earth expansion.</i>   | 323 |  |     |
| *S.K. Runcorn: <i>Geophysical tests of the Earth expansion hypothesis.</i>   | 327 |  |     |
| *Johannes Pfeuffer: <i>The thermal expansion of the Earth.</i>   | 328 |  |     |
| U. Walzer & R. Maaz: <i>On intermittent lower-mantle convection.</i>   | 329 |  |     |
| SOLAR SYSTEM & UNIVERSE  |     |  |     |
| Stuart Ross Taylor: <i>Limits to Earth expansion from the surface features of the Moon, Mercury, Mars, and Ganymede.</i>                             | 343 |  |     |
| Edward P. Tryon: <i>Cosmology and the expanding Earth.</i>   | 349 |  |     |
| S.T. Tassos: <i>Entropy and expansion of the Earth.</i>  | 359 |  |     |
| Heinrich Hora: <i>Degenerate plasma phases to explain the expansion of the Earth while releasing energy.</i>   | 363 |  |     |
| W.D. Parkinson: <i>A simplified system of dimensions.</i>  | 365 |  |     |
| S. Warren Carey: <i>Earth expansion and the null Universe.</i>   | 367 |  |     |
| CONVENER'S REVIEW  |     |  |     |
| S. Warren Carey: <i>The necessity for Earth expansion.</i>   | 377 |  |     |
| ABSTRACTS IN RUSSIAN   |     |  |     |
| APPENDIX   |     |  |     |
| E.E. Milanovsky: <i>Review of the Moscow conference on Earth expansion and pulsation.</i>  | 411 |  |     |
| INDEX  |     |  |     |
|  |     |  | 413 |

\* Abstract only