THE EXPANDING EARTH
A SYMPOSIUM

Earth Resources Foundation, University of Sydney
February 10-14, 1981

Convener and Editor
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Convened by Professor S. Warren Carey

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: Francois 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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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, Brunshweiler, 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, Brunnschweiler, 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 Afinov) 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 & Maas 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 dare say 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 timescale, 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 pursuits 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.)