

Doorway Paper #56

WHEN THE EARTH WAS DIVIDED

**AN IMAGINATIVE RECONSTRUCTION
OF EARLY HISTORY**

Arthur C. Custance

Second Edition

Edited by E.M. White and R.G. Chiang



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**WHEN THE EARTH WAS DIVIDED: An Imaginative Reconstruction of
Early History**

Custance, Arthur C. (1910-1985)

Edited by: E.M. White and R.G. Chiang

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Doorway Publications is the publishing division of the Arthur Custance Centre for Science and Christianity, a Christian organization which seeks to preserve, promote, and re-publish the written works of Arthur C. Custance and to stimulate study of the Bible in the light it receives from, and contributes to, the whole field of knowledge by means of publications, electronic media, and education.

Printed in Canada

Publishing history:

1962: Doorway Paper No. 56, published privately by Arthur C. Custance

2016: 2nd Edition edited by E.M. White and R.G. Chiang

Doorway Publications,

346 Southcote Road, Ancaster, ON, Canada, L9G 2W2

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2021: 2nd printing of 2nd Edition

ISBN: 978-0919857-75-9

From the Editors

This Paper was written in 1962. Yet it was not included in the *Doorway Papers* published by Zondervan in the late 1970s.

Dr. Custance had written this at a time when Continental Drift was not in favour, and certainly such a 'birth' for the Moon to explain drifting continents would be suspect. It was his 'pet theory' but he would have liked a bit more evidence for it. He watched the Walk on the Moon in 1969 and had awaited reports of the analysis of the moon rocks brought back to earth with anticipation. None seemed to be forthcoming.

Now, over 50 years later, the earth-origin of the Moon is commonly rejected as a plausible scientific theory since the Moon does not consist of oceanic crust and the ocean basin is much younger than the Moon. However, measurements of age are based on unprovable assumptions; they do not negate the theory. Further, any part of Earth that may have formed the Moon would have experienced tremendous physical forces during this cataclysmic event, and more than likely, its morphology was completely changed. Moreover, there is evidence that does support an earth-origin for the Moon: both the Moon's oxygen isotopic ratios and titanium isotopic ratios match that of the Earth's suggesting that these bodies were part of a single body of matter at one time in their history.

Rather than the scientific evidence, the greatest challenge to Custance's 'pet theory' may actually come from Scripture. As written in Genesis 1:14-19, the Sun, Moon and the stars all appeared on Day 4 whereas our Lord brooded over the waters before he brought forth light on Day 1. This challenge could be answered by having the earth and all the heavenly bodies formed before the gap of time indicated in Genesis 1:2, when the earth became without form and void. On Day 4 of the Sixth Day of the "re-creation week," these heavenly bodies became

visible to the earth. This would be an explanation favoured by Arthur. Contrariwise, the Pacific Ocean could have been formed during Noah's Flood. But the lost crust of the Earth did not become the Moon. Instead, it may be all or part of any number of different bodies which currently orbit the Sun as the Earth does.

The editors each have their own preferences, but promoting a particular opinion is not the purpose of reprinting this work. Dr. Custance felt that this one Paper did not really contribute to the Christian Faith in any significant way and therefore was not included in the *Doorway Papers Series*. Times have changed. Given the advances in science, especially the acceptance of the Big Bang Theory, Evolution and Continental Drift, we believe Paper #56 provides a valuable lesson in the history of scientific thought and offers a biblical perspective that will help guide the dedicated and thoughtful Christian towards uncovering the truth.

Editors

Evelyn M. White

R. Gary Chiang





This map was taken from one published by the National Geographical Society, and reveals very clearly the form of the Mid-Atlantic Range which passes down the rift between the Old World and the New World.

Table of Contents

INTRODUCTION.....	1
Chapter 1 GLOBAL CATASTROPHE: AN ORIENTATION.....	3
Chapter 2 THE DISRUPTION OF THE EARTH.....	7
Chapter 3 THE MOMENT OF DISRUPTION: AND THE BIRTH OF THE MOON.....	51
Chapter 4 THE TIME AND MOTIVE FORCE FOR DRIFT.....	63
Chapter 5 THE COMING OF THE GREAT COLD.....	75
Chapter 6 THE OVERALL VIEW: A SUMMING UP.....	91
Appendix THE LEGEND OF LOST ATLANTIS.....	109

INTRODUCTION

Every dog is allowed one bite. And every man should be allowed one pet theory which is ‘way out.’ This is mine.

It represents a certain amount of thinking upon a subject over a period of thirty years and a quite considerable amount of literary research. To me, it appears rather satisfying as an account of what may have occurred in global history leading up to the chaotic state of affairs which seems to be indicated by the wording of Genesis 1:2. Certain passages of Scripture look as though they were specifically designed to support this thesis, the wording of these passages acquiring a new light in the context of my reconstruction. And there is plenty of incidental evidence to be derived from a study of well recognized authorities in a number of related fields. This would seem to clinch the matter – but for one disastrous fact, namely, the timing of the event. No one in his right mind with a reputation to preserve as a geologist would accept my chronology, and yet for all this, I think the evidence is strongly in my favour!

The events described have to do with the passing of an old world in a catastrophic event which resulted in the emergence of a new and entirely different kind of world – the world we now know, and as a by-product of this catastrophe, the “birth” of the moon.

At least it is food for thought and fuel for the imagination.



Speak to the Earth, and it shall teach thee.

Job 12:8



Chapter 1

GLOBAL CATASTROPHE: AN ORIENTATION

Up until about the middle of the last Century, very few people questioned the long-held view that the Earth had witnessed several major catastrophes, catastrophes of such dimensions as to have had a profound effect upon geological history. Christian scholars commonly accepted the Flood as a case in point. But in their attempts to account for such disruptive events, these writers not unnaturally tended to introduce supernatural agencies; or, at the least, agencies for which there was no natural explanation. Their position was accordingly strongly opposed by a growing body of Naturalists who argued that Science must rid itself of all such appeals.

When Lyell published his *Principles of Geology*,¹ he pretty well crystallized the now generally accepted view that the comparative geological “quiet” of the present has always existed and must be the sole criterion for judging the events of the past. Although as a consequence, the climate of opinion has thus changed radically and the effort to explain everything in terms of currently operating forces has produced some fruitful results in a number of areas of research, there still persist many evidences of sudden destructive and great violence on a global scale. These are hard to explain and are worth re-examining. Moreover, the Ice Age is not yet entirely accounted for either

But to return to the end of the last century: just when “naturalism” seemed finally to have established itself and “catastrophism” had become out-moded, a series of Papers and Volumes began to appear introducing some radically new concepts with respect to the distribution of land and sea areas on the earth’s surface which seemed once more to lend support to catastrophism. Only, this time, it was a

1. Lyell, Sir Charles, “The Principles of Geology”, Murray, London, in 3 volumes, 1830-1833.

new kind of catastrophism – resulting from the operation of purely natural forces and in no sense requiring the intervention of supernatural ones.

To state the case in a nutshell, the new theory proposed that the Earth originally had a granite crust which entirely encapsulated it to a depth of some thirty miles. This outer shell was covered by a shallow sea that completely submerged it except for a few islands which broke the surface wherever the shell was wrinkled or otherwise uneven. These islands were not stable but constantly changing their contour and even disappearing to be replaced by others with the diastrophic movements of the crust.

Then for some reason, a very large section of the granite crust was suddenly lost from the Earth leaving a huge “scar” into which the waters of the hitherto universal sea poured to form an entirely new feature of the Earth’s surface, namely, an Ocean – indeed, the Pacific. The remaining segment of granite crust now existed as one vast unbroken continent standing out of the water.

The situation thus came about in which the surface of the Earth was characterized on one side by an expanse of water far deeper than it had been previously, and on the other side by a single land mass exposed as “dry land” in an entirely new way. But such a situation could not continue indefinitely for granite is almost three times as heavy as water and the revolving globe was therefore no longer in a state of balance. The consequence was that the single continental mass began to break up into segments of various sizes as the earth sought to re-distribute its peripheral weight. The resulting fragments soon parted company, drifting to new positions driven by natural forces which continue to operate so long as the spinning globe has not achieved a condition of perfect dynamic equilibrium. These fragments became the continents as they now exist. The fractures as they appeared, widened and became in time the Atlantic, the Mediterranean, the Indian Ocean, the Arctic Ocean and so forth. What caused this initial loss of part of the granite crust was not clear, nor is there complete agreement as to where the missing crust has gone. But the concept has proved an extraordinarily stimulating one and geological evidence for the reality of Continental Drift, *per se*, has accumulated quite extensively, although the cause of it has remained in dispute.

Generative as the idea was, for many people it still smacked too much of catastrophism again and it met very strong opposition. Today

[editors' note: in 1962] the issue is still very much a live one, but, as we shall try to show, an increasing number of reputable geologists are beginning to express what one might almost call their 'fears' that it might be true!

In this Paper I should like, with the liberal aid of imagination, to put together some of the evidence and, with a grand disregard of the time element, to show that it could have a bearing upon the chaotic state of affairs which I believe is clearly indicated in Genesis 1:2, and – what is perhaps even more important – upon the events which occurred subsequently. A surprising number of passages of Scripture seem almost to have been designed to state in remarkably appropriate terms what must have been happening as God reconstituted the earth immediately prior to the creation of Adam and Eve.

Those who do not have geological training may be misled into supposing that because I can present my case in the words of outstanding authorities that these authorities are in essential agreement with me. This is most assuredly not the case. In fact, some would probably suggest that the best description of this presentation would be to refer to it as Science Fiction – and they could possibly be right! I do not think it matters very greatly, for most of us enjoy exercising our imagination and there is sufficient evidence here to enable one to create a quite satisfying hypothetical picture of events. However, in spite of the fact that these events were global they might still have occurred without leaving any more traces upon the earth than do actually exist, which answers one objection frequently raised against any proposal of a catastrophe of such proportions.

For those who are geologists by training, there will be many critical objections to this reconstruction. Perhaps the greatest one will be that I have set the time of the catastrophe much too late, geologically speaking. I have also proposed that the magnitude of some geological events is far beyond anything that can be conceived on the basis of experience, even by those who have survived volcanic eruptions of the worst kind. As such, these events may well be considered beyond all reason. And finally, I have accelerated these events in time assuming them to have taken place much more rapidly than any modern geologist of repute would consider within the bounds of reason.



Chapter 2

THE DISRUPTION OF THE EARTH

Background History of the Theory of Continental Drift

After the publication of Lyell's *Principles* in 1830, it became increasingly difficult for anyone who wished to preserve their reputation as a scientist to make any appeal whatever to supernatural forces when seeking to explain the world around us. The sub-title of Lyell's book is instructive in this respect for it reads as follows: 'Being an attempt to explain the former changes of the earth's surfaces by reference to causes now in action.' Twenty-five years later Darwin did for the Life Sciences what Lyell had done for the Earth Sciences. Catastrophism, which had always tended to be associated with divine judgment, became an outmoded concept. Uniformitarianism ruled the day.

No challenge to this state of affairs of any serious proportion appeared to shake the equanimity of the learned until evidence of a new kind of geological catastrophe was proposed which did not involve supernatural forces but did cut right across Lyellian Geology. Up till the beginning of the present century it was generally assumed that the deep oceans were more or less a permanent feature of the earth's surface and had always been where they are now, and the mountain building was very largely the result of a shrinkage of the earth's crust in much the same way that the peel of an orange shrivels as the fruit dries out. The skin of a world that was growing old was becoming too large for the shrinking body within it.

The idea that the oceans had not always existed and that much mountain building was not to be accounted for in this manner, is an idea which can be traced back some 300 years. These features of the earth's surface may have resulted from the break-up of the granite crust

which lay above all other shells that form its structure, although the earliest references apparently did not influence geological thinking to any marked extent. It appears that Francis Bacon in 1627 made reference to what is now generally termed the Continental Drift hypothesis,² and in 1730, the famous Buffon refers to it. Thereafter not a few philosophers and geologists mention the visual evidence which one sees as one looks at a map of the world of fractures dividing the great continental masses, especially the Americas with respect to Europe and Africa. Their shapes seem to indicate that these continents may at one time have been joined together in a single land mass.³

The first definite and, to some extent, convincing presentation came from F. B. Taylor who in 1910 published a treatise entitled "Bearing of the Tertiary Mountain Belt on the Origin of the Earth's Plan."⁴ In this he held that these mountain chains had resulted from the pulling away from Europe and Africa of North and South America. Actually, the movement involved both parties, the point of departure being the mid-Atlantic range. One year later, Howard B. Baker began to publish a series of works elaborating on Taylor's thesis, ending in 1932 with a mimeographed volume entitled, "The Atlantic Rift and Its Meaning."⁵ Much of the argument presented by both these men was based on a study of the structure of North and South America and the parallelisms between the shorelines of the New World and the Old, i.e., with England, Spain and Africa across the Atlantic.

Baker's work has particular interest in the context of the present Paper because he proposed that the movement of the continental fragments after their initial breakup was not a long drawn out process but a simultaneous and rapid flight occupying quite a brief period of time during the late Miocene or early Pleistocene. No other writer since has suggested such a recent date for the event. Moreover, he ingeniously worked out a theory to account for the fact that on one side of the globe was a single giant continent, basically of granite (which afterwards fragmented), and on the other side was one vast ocean, the

2. Bacon, Sir Francis, in his *New Atlantis* (1627) where he identified America as the Atlantis of Plato's story.

3. Buffon, Georges-Louis LeClerc, according to Howard B. Baker in his "The Atlantic Rift and Its Meaning," published privately, 1932.

4 Taylor, F. B., "Bearing of the Tertiary Mountain Belt on the Origin of the Earth's Plan," *Bulletin of the Geological Society of America*, vol.21, p.179-226, 1910.

5. Baker, Howard B., "The Atlantic Rift and Its Meaning," published privately in 1932, with numerous illustrations and a very extensive bibliography from well over 200 sources.

Pacific. What had happened, he argued, was that a huge section of what had once been a continuous granite sheath or skin around the globe had been pulled off by tidal forces resulting from a close approach of Venus or some other body to the Earth . . . and this had become the Moon.

This concept of Earth-Moon history may seem completely beyond the realm of possibility, and yet, as we shall see, there are certain facts which lend it some support.

Probably the name most commonly associated with the Continental Drift Hypothesis is that of Alfred Wegener, Professor of Meteorology and Geophysics in the University of Graz. His first book appearing in 1912 published in German, was followed by three subsequent editions, the last of which appeared in 1922. This edition was translated into English by J. E. Skerl, and was issued in 1924 under the title, *The Origin of Continents and Oceans*.⁶ Unfortunately Wegener was killed in an accident in 1930 while exploring Greenland.⁷

In all his publications, Wegener presented a mass of evidence—geological, tectonic, paleontological, paleoclimatic, and geophysical—which he analysed to show that the continents have drawn apart, in certain cases for huge distances, thereby creating the disjunctive basins of the Atlantic and Indian Oceans. Astronomical observations were quoted to support the claim that certain spots on the earth are today experiencing changes in their geographic position, which although small are measurable. In the earlier works in his restoration of the original one-piece continent, Wegener brought their present *shorelines* almost together: but in the final edition of his original work published two years before he died, he modified this process and accepted instead a matching at the edges of the continental shelves.

These continental shelves do not show up on a land map, but they represent the extension of the land mass into the sea. Some distance out, there is a “shelf” at which point that continent falls sharply, almost like a cliff. Along some of these shelves there are very great deeps which will be discussed subsequently. His reassembly of these continental fragments into a single land mass, (as seen in Fig.1), reveals in simple

6. Wegener, Alfred, *The Origin of Continents and Oceans*, English translation by J. E. Skerl, Methuen, London, 1924, xx and 212 pp.

7. Since Custance penned this sentence, more is now known about Wegener's death. It may have been an accident, or even heart failure, as Wegener and his associate, Ramus Villumsen, attempted to reach a base camp during very severe conditions. Six months later, on 12 May 1931, Wegener's body was found halfway to the base camp, in a grave marked by a pair of skis. Villumsen was never found.

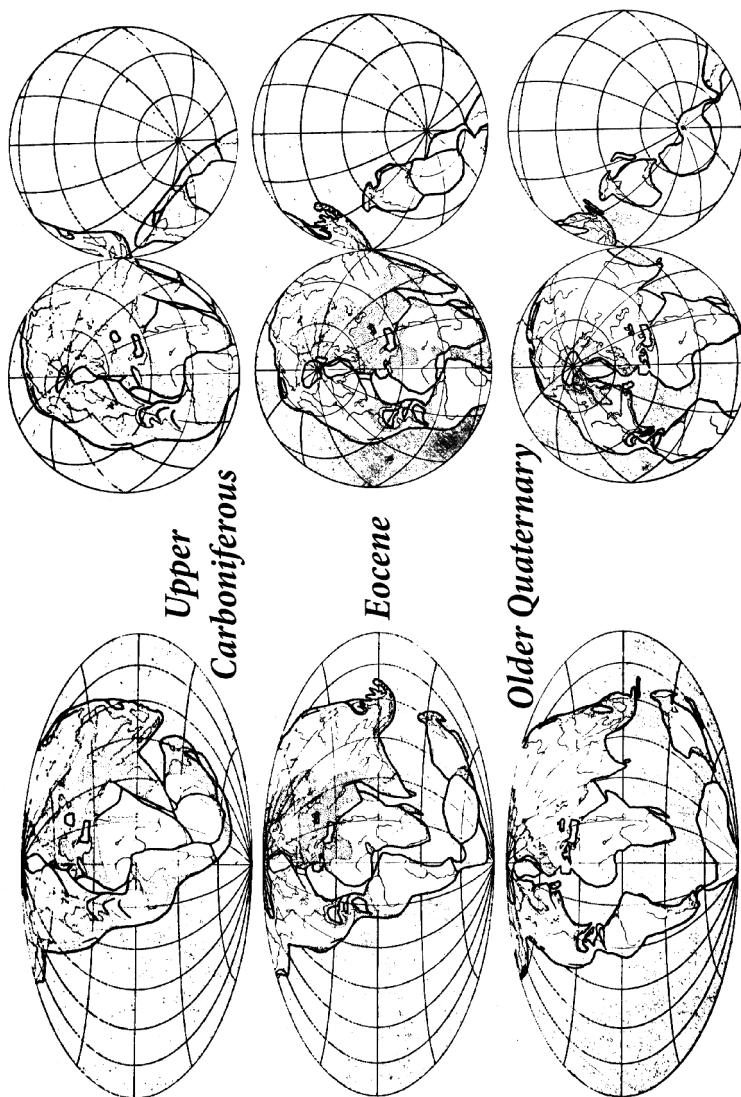


Fig. 1. Wegener's Interpretation of Continental History.

and striking fashion certain zonal distributions not only for the living forms but also for the climates of the past. These facts have hitherto proved difficult or impossible to explain by current theories.

From Wegener's time to the present, there has been a steady stream of works pro and con his thesis. Particularly notable among these is A. L. du Toit's, *Our Wandering Continents: an Hypothesis of Continental Drifting*, appearing first in 1937 and again in 1957.⁸

So much, then, for the history of this hypothesis.

The Evidence for Continental Drift

In his work to which reference has been made, du Toit sets forth a series of propositions first of all showing some of the inherent weaknesses of current theories and then listing those criteria upon which the probability that Continental Drift has occurred must be gauged.

The inherent weaknesses of the current theories include the following observations:

1. Each of the continental blocks shows youthful marginal foldings along some section of its border and an enlargement in that direction despite the resulting compression, which gives it a characteristic structure such as illustrated in Fig. 2.

2. These folds run in the New World along the western edge and in the Old World on the eastern edge of these respective masses: and in between they trend nearly equatorially.

3. Close similarities are displayed by the various paleozoic fold-beds on opposite sides of the Atlantic despite the great distances separating them.

4. The resemblances between stratigraphies and the past life of widely separated land masses is, without exaggeration, astounding. These resemblances include matching coal-beds and other equally specific parallelisms. There is also a convergence of two mountain chains in the New World, the crossing over of which is completed in the Old World.

5. Midway between the New and the Old World runs the Mid-Atlantic chain, a geological feature of the ocean bed which seems

8. du Toit, A. L., *Our Wandering Continents: An Hypothesis of Continental Drifting*, Oliver & Boyd, Edinburgh, 1957, xiv and 336 pp.

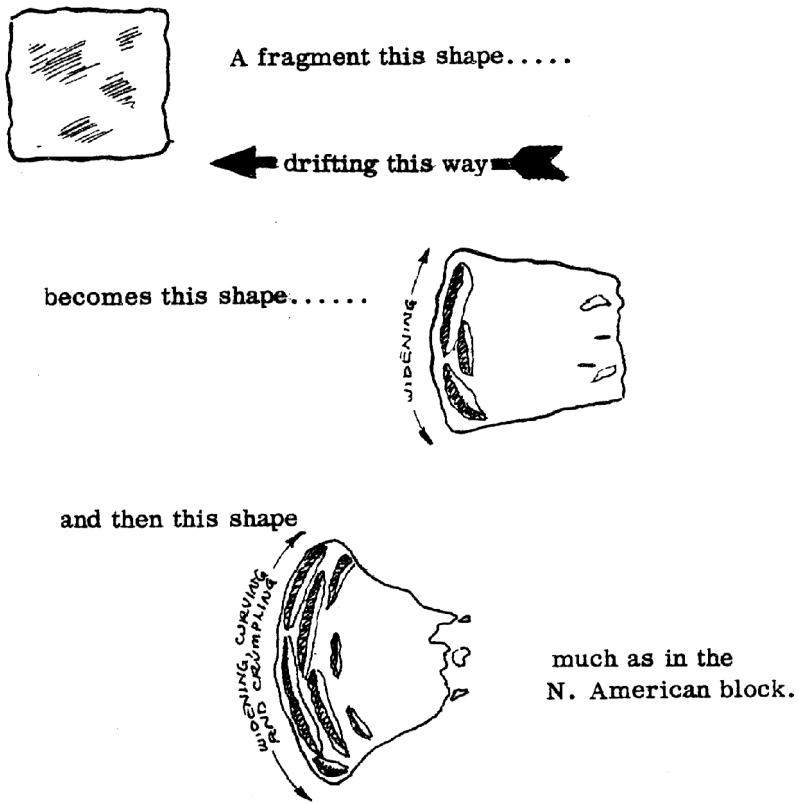


Fig. 2. Distortion of a Fragment due to drift.

undoubtedly to have marked the parting line of the two worlds as they began to separate.

6. The rift valley systems of Africa (and of other lands) have a unique physiography which is hard to account for on any other grounds.

7. The existence of peculiar faunas in isolated and remoter places of the earth, as for example certain marine Permian Mollusca in Brazil, which are also characteristic of New South Wales, can scarcely be accounted for except by postulating Continental Drift on a grand scale.

As du Toit observes, one of the major objections to the theory under discussion is that it invokes the operation of forces on a greater scale than ought to be allowed without much more evidence. Yet all these unexplained geological phenomena have at one time or another been accounted for by forces of equal or even greater magnitude.

On the other hand, in order to establish Continental Drift with any degree of probability, it is essential that the following seven lines of argument should apply not only singly but collectively also. They are briefly outlined below and then expanded upon.

1. Physiographical: (a) general similarity of opposed coastal lines—as for example, the East Coast of South America and the West Coast of Africa; (b) fracture patterns along opposed coast lines shown for example by fault-line scarps and fjords, Greenland and Labrador, for instance; (c) submarine features producible most logically by drifting blocks, such as swells, ridges, island festoons, and abyssal troughs or trenches lying immediately in front of drifting blocks.

2. Stratigraphical: (a) equivalent formations of rocks on opposed coasts with due regard to their mode of origin, attitude, metamorphism, fossil content, etc., such as the Cambro-Ordovician of Eastern Canada and Scotland; (b) overlaps and unconformities on comparable horizons of opposite coasts—such as are found in Spitzbergen and Scandinavia, and Keuper of New England and Portugal.

3. Tectonic: (a) comparable fold systems passing out to sea at opposed shores—such as the Atlas and Venezuelan Andes; (b) comparable geosynclinal valleys, indicative of continental fracturing—such as appears in East Africa.

4. Volcanic: (a) synchronous intrusion of batholiths in equivalent fold systems—such as those of the Appalachian-Hercynian orogeny; (b) petrographical provinces with similar eruptive suites of varying ages—such as Brazil and the western side of Africa.

5. Paleoclimatic: (a) strata denoting a special environment on opposed shores; (b) glacial deposits with special reference to ice-centres and ice-movements.

6. Paleontological: (a) terrestrial faunal and floral provinces with identical or allied species—such as the coal basins of eastern United States and Western Europe; (b) comparable distribution of primitive and specialized forms; (c) unique marine or terrestrial forms, such as Mesosaurus in Brazil and South Africa, and Laplatasaurus in Argentina and Madagascar.

7. Geodetic: repetition of longitude and latitude measurements showing successive differences greater than would be the probable error in making such observations.

(1 & 2) Physiographical and Stratigraphical Evidence

To treat these criteria adequately would require far more space than is available here, and it has been done very fully by du Toit and others. It may be sufficient to say that the evidence is convincing to many people who are in a position to judge it. Perhaps the simplest method of presenting an overall picture is by the historic method by which we consider the work of Wegener first, followed by evidence from other sources, evidence which has accumulated since Wegener first presented his thesis. For this purpose we shall rely upon the translation by Skerl of the third edition of *Continents and Oceans*.

It may be difficult to conceive of whole continents moving about, and drifting apart as though afloat in the ocean. It is customary to refer to these continental masses as indeed "floating," but not upon water. To understand this concept of Drift, it is necessary to have some knowledge of the structural characteristics of the earth.

G. G. Lill and A. E. Maxwell in an article entitled, "The Earth's mantle," summarize the situation as follows:

At present nearly all geophysicist agree that structurally the earth consists of a crust, mantle, core, and inner core. On the continents the crust is differentiated into the lighter granite rocks and the heavier basaltic rocks. The basalt is considered by some to lie beneath the granite. Here and there basalt appears on the surface, having emanated from fissures or volcanoes.⁹

Turning more specifically to the crust itself, Wegener outlines the situation as follows. The rocks of the continental masses consist for the most part of plutonic rocks, granite and its foliated form, gneiss. The sedimentary, metamorphic, and basic igneous rocks—though they play a conspicuous role at the surface—are essentially subordinate in amount. The continental rocks on the whole are comparatively low in

9. Lill, G. G. And Arthur Maxwell, "The Earth's Mantle," *Science*, vol.129, 1959, p.1408.

density and because of their composition (silica and alumina) are collectively referred to sometimes as *sial*.

The substratum both of the continents and the oceans is composed of heavier rocks which being formed largely of silica and magnesia are referred to as *sima*. This composition is responsible for the fact that the *sima* is more readily brought into a semi-molten state by a rise in temperature than the over-lying *sial*, as suggested by Professor J. Joly. According to C. Doelter, "the melting point of *sial* rocks is in general 200° to 300° higher than that of the *sima*, so that magmatic *sima* and solid *sial* could exist side by side at the same temperature."¹⁰

Now as we have already indicated, Wegener held that the *sial* or granite mass of which the continents are essentially composed was formerly continuous and unbroken, supplying the outer shell of our globe. But he believed that subsequent very extensive folding and wrinkling greatly increased the thickness of this shell in places while reducing its surface area, thus causing it to shrink away from itself and develop huge cracks. In time the outer shell split open and shrank itself into a single continental mass which he terms *Pangaea*. However, I find it difficult to believe that a shell which once covered the whole earth could shrink so greatly that it now covers barely a quarter of its surface, the rest being oceans and seas. It seems to me much more reasonable, even if such a catastrophe is of almost inconceivable magnitude, that a very large segment of the original crust must have been lost to the earth entirely. We shall consider this possibility subsequently, but in the meantime shall set forth some of Wegener's original observations and conclusions.

As will be observed from Wegener's series of maps (Fig.1), the fragmentation of the original *Pangaea* involved not merely the breaking off of North and South America but of Iceland and Greenland in the north and in the south of Madagascar, Australia, New Zealand and Antarctica. Wegener maintained that as these masses drifted apart they suffered structural deformation. The nature of this deformation which these continents or smaller fragments now display being exactly such as would logically result from their movement under various forces upon a semi-fluid substratum. Thus the Americas moving towards the west suffered the crumpling of their leading edges, forming the Rockies and the Andes. Moreover, the thickening of the crust which resulted

10. Doelter, C., "Petrogenesis," *Die Wissenschaft*, vol.13, 1906, Brunswick, Germany.

from this had the effect of forcing the leading edge to deepen itself in the *sima* upon which it was sliding, which responded in turn to this ploughing action by the formation of deep troughs here and there along this leading edge. There was a tendency, however, for the trailing edge to be lowered and stretched somewhat allowing the formation of deep inlets and shallow seas.

Some of the moving fragments shifted their orientation with respect to the poles so that the leading edges with their crumpled stratigraphy are not always found where they originally were.

The forces which moved these fragments, according to Wegener, were chiefly two: first, a westerly movement which had its greatest effect upon the largest blocks and which resulted from earth tides generated by the moon in its passage from east to west around the earth. The second force was one resulting from the fact that the earth has a greater diameter at the equator than through the poles so that centrifugal action tends to move these fragments towards the equator. Wegener's opinion is that the latter force is particularly well seen in the general crumpling of the Old World along a line parallel to the equator which has given rise to the Alps, Himalayas, etc. He assumes that this section of the original crust lay actually along the equator at the time when the crumpling occurred, i.e., when heat had rendered the substratum temporarily semi-fluid. The general youthfulness of these "giant crumplings" seems to indicate that the events did not take place as anciently as supposed, however.

Wegener very descriptively sums up the situation as a whole by saying:

It is just as if we put together the pieces of a torn newspaper by their ragged edges and then ascertained if the lines of print ran evenly across. If they do, obviously there is no course but to conclude that the pieces were once actually attached in this way. If but a single line rendered a control possible, we should have already shown the great possibility of the correctness of our combination. But if we have n rows then this possibility is raised to the n^{th} power. It is not a waste of time to make clear what this implies.

We can assume, merely on the basis of our first 'line,' the folding of the Cape Mountains and the Sierras of

Buenos Aires, that the chances are 10 to 1 that the displacement theory is correct. Since there are at least six such independent controls, 10 to the 6th power, or a million to one, could be laid that our assumptions are correct. These figures may be exaggerated but one must bear in mind, when passing judgment, what the increase in the number of independent controls really means.¹¹

It may be well to present a few extracts from Wegener's works to point out the extent to which he explored the implications of his thesis in the light of the geological evidence.

He observes that "the displacement of the blocks occurs in causal connection with the origin of the mountain systems." Reference has already been made to the Rockies and the Andes. He continues:

A similar case is that of the Australian block, which includes New Guinea since it is only separated therefrom by a shelf. The recent high ranges of New Guinea occur on the side which is anterior with reference to the movement; as the map (Fig.1) shows, the direction of the movement was different before the break from Antarctica, for the present east coast was then on the front side. Next, the mountains of New Zealand lying immediately in front of this coast were folded, later becoming detached as festoons of islands by the altered direction of movement, and then lagging behind. The present Cordilleras of East Australia originated in a still older period; they were formed on the front margin of the continental masses which were drifting as a whole before the separation.

Besides this westward wandering we also see to a large extent a striving towards the equator of the continental blocks. With this is connected the formation of the great Tertiary belt of folding stretching from the Himalayas to the Alps and Atlas mountains which were then in the equatorial zone.¹²

11. Wegener, Alfred, *The Origin of Continents and Oceans*, English translation by J. E. Skerl, Methuen, London, 1924, p.55.

12. Wegener, Alfred, *ibid.*, p.3.

So much for the summary of his views regarding mountain building. With respect to the drift of the Americas, he observes that this is essentially a question of the rotation of North America about Alaska. North America does not, therefore, break its connection with the Asiatic continental block at the Bering Straits. Moreover, the break with Europe comes considerably later than the break of South America from Africa. A study of the map will show these features clearly, even the somewhat trailing edge of the tip of South America indicates the effect of drag on a less substantial section of the continent. As Wegener puts it:

The Atlantic rift is broadest in the south where it first broke open. Its width here amounts to 6220 kilometers. Between Cape San Roque and the Cameroons there are 4880 kilometers: between Newfoundland Bank and the British shelf 2410 kilometers; between Scoresby's Sound and Hammerfest only 1300 kilometers: and between the margins of the shelves of north-east Greenland and Spitzbergen probably only from 200 to 300 kilometers. Here the split appears to have taken place in quite recent times.¹³

Subsequently he continues:

The correspondences of the Atlantic coasts, namely, the folding of the Cape Mountains and the Sierra of Buenos Aires, as well as the correspondence between the eruptive rocks, sediments, and strike-lines in the great Gneissic plateau of Brazil and Africa, the American, Caledonian, and Alkonquin systems of folding, and the Pleistocene terminal moraines, in their sum-total, even if the conclusions may still be uncertain in particular questions, yield a proof which is difficult to shake of the validating of our supposition that the Atlantic must be considered as an expanded rift. We have also the circumstances of decisive importance that although the adjustment of the blocks must be made on the grounds of certain other phenomena, especially their outline, yet by this adjustment the continuation of each structure on one

13. Wegener, Alfred, *ibid.*, p.42.

side is brought into exact contact with the corresponding end on the other.¹⁴

We have indicated above that some part at least of this total movement must be considered recent, a supposition which is supported by the youthful appearance of the mountain ranges which have resulted. There is other evidence of recency. As Wegener points out:

According to Gagel, at Cape King William in New Guinea, and also in New Britain, there are quite recent terraces which have been elevated 1000, 1250, and even probably up to nearly 1700 meters. This very striking phenomenon shows that very powerful forces manifested themselves in very recent times...¹⁵

Wegener examines a number of instances of recent genera of plant and animal forms with a population distribution in the New World and the Old World that clearly suggests former contiguity. He adds, "Many things testify that the land connection from Newfoundland to Ireland remained in existence to the beginning of the Quarternary,"¹⁶ i.e., till immediately before the Ice Age. A rather striking circumstance is mentioned, namely, that the Hawaiian Islands have a flora which is most closely related, not to North America which lies nearest to them—and whence winds and sea currents originate—but with the Old World. This would seem clearly to indicate that the nearness of North America is a circumstance of recent occurrence.

Another observation made by Wegener is that the oldest group of animals occurring mainly to the south-west of Australia shows closest affinity with those of India and Ceylon, as well as with those of Madagascar and South Africa.¹⁷ As Wegener points out, "How strange it is that Australia had no interchange of forms with the immediately adjoining Sunda Islands, to which it is like a foreign body from another world! No one can deny that our assumption, which reduces the distance of Australia from the tip of South Africa initially to a fraction, and on the other hand separates it from the Sunda Islands by a broad

14. Wegener, Alfred, *ibid.*, p.55.

15. Wegener, Alfred, *ibid.*, p.69.

16. Wegener, Alfred, *ibid.*, p.81.

17. Wegener, Alfred, *ibid.*, p.85.

ocean basin, provides a key for the explanation of the Australian animal kingdom.”¹⁸

Du Toit followed Wegener, exploring his original thesis and elaborating upon it by accumulating a great deal of additional evidence, especially with respect to the matching of geological strata, but also putting on record some of the geodetic evidence relating to altered distances between important land marks.

For example, in his work, *A Geological Comparison of South America with South Africa* (1927), he set forth a host of correspondences between the sides of the South Atlantic in the shape of the Devonian System, Carboniferous, glacial, Permo-Triassic strata, etc., and stressed the significance of phasal variation away from the respective coasts.¹⁹ It is pointed out that the Mesozoic folds of the Cape and Argentina meet at right angles with the older structures that trend parallel to the two Atlantic shores and, as Holmes has since phrased it “the crossing begun in the one continent is completed in the other.”²⁰ These folds are beautifully indicated in a map which we have redrawn from Holmes in Fig. 3.

Du Toit quotes the work of E. B. Bailey (*The Paleozoic Mountain Systems of Europe and America*, 1929) who notes the way in which the Caledonian front that trends southwestwards from Finland to South Wales, is crossed by the younger Hercynian front with generally westerly direction and shows right across the Atlantic the outer Caledonian front (Taconian) of Newfoundland, New York, and Maryland being crossed obliquely and in analogous fashion by the later Appalachian (Hercynian) front that runs from New England to Arkansas. One must surely conclude that both these mountain systems (indicated in our Fig. 3) are striking evidence of the former contiguity of the Old and New Worlds.

On page 85 following du Toit gives many indications of former close contacts between South America, South Africa, and even Australia which must be concluded from a study of some of the older animal forms, particularly the Cynodontia and the Dicynodontia. And there are many others.

18. Wegener, Alfred, *ibid.*, p.89.

19. du Toit, A. L., *Our Wandering Continents: An Hypothesis of Continental Drifting*, Oliver & Boyd, Edinburgh, 1957, p.19.

20. du Toit, A. L., *ibid.*, p.2, fig.5 (p.27).



Fig.3. This map shows how the mountain systems of the Old and the New World are matched, according to Holmes. The crossing over in the eastern United States which is completed in Europe, is indicated by the light and heavy dotted lines. The Rocky Mountain chain, and the Andes blend in and trend eastward across into Europe in a similar manner. Other cross-over ranges are indicated in South America.

In dealing with opposed strata on either shore of the South Atlantic, du Toit observes:

The concordance . . . has consistently been extended by each fresh geological observation until at the present the amount of agreement is nothing short of marvellous. When it is recognized that such linkages cross from coast to coast, not only directly but diagonally as well, and are furthermore of widely different ages, it will have to be

conceded that the probability of closer continental union must, when expressed mathematically, be extremely high.²¹

Wegener's torn sheets of newsprint are matching line for line and even illustration for illustration right down the page.

With respect to Madagascar, du Toit says, "past and present opinion has been unanimous that it formerly constituted part of Africa." He holds also that it was connected with India — possible only if India itself has swung around somewhat, an assumption well illustrated in the first two reconstructed maps of Fig.1.

Antarctica is discussed by du Toit in some detail on page 128 following. He opens the discussion by proposing that certain rotational shifts have occurred as this continent moved away in the initial breakup. At the same time New Zealand, Australia, King Edward VII Land, as well as the Antarctica Archipelago are considered in their intermediary positions during this general fragmentation. He then turns to a detailed examination of the structure and stratification of these blocks, opening with the words, "the geological agreements become not less remarkable." Fig.4 illustrates a reconstruction.

The re-assembly of the northern polar regions is considered in some detail on page 135 following, and without exaggeration it may be said that the correspondences are equally impressive, both when considered stratigraphically, tectonically, and with respect to fauna and flora.

In conclusion of this aspect of the problem, he points out how strikingly:

. . . the major undulations of the Atlantic floor run in broad zones concentric with the African coast, namely, (a) the inner row of deeps, (b) the Mid-Atlantic ridge that is prolonged eastwards into the Indian Ocean, and (c) the outer row of deeps fronting South America, the Falklands, and Antarctica, and reaching close against the convex south-Antillean Arctic. A pattern like this over so gigantic a region argues for a single controlling cause, and finds its proper answer only in continental sliding.²²

21. Du Toit, A. L., *ibid.*, p.106.

22. Du Toit, A. L., *ibid.*, p.196.

Fig. 4 is redrawn from a map by Baker showing the repositioning of various southern fragments including Australia, New Zealand and Antarctica, with respect to Africa and South America.



Subsequently he adds:

One must not omit to draw attention to the backward bending of the Andean plication in Venezuela and Terra del Feugio until an east-west trend was acquired in Trinidad and at Cape Horn with the thrusting directed inland in each case . . .

The analogy thereby displayed with the spreading waves thrown off from a blunt-nosed ship is accentuated by the regular curvature in the section extending from Venezuela to the northern end of Chile, beyond which there is a strong inflection and the folds thereafter run due south, suggestive of the great westerly travel of Patagonia as compared with Bolivia.²³

Du Toit then turns to the other continental masses and shows, for example, that West Africa has a rift valley system which is clearly indicative of a continent under tension rather than compression. Indeed,

23. Du Toit, A. L., *ibid.*, p.198, 199.

the indications are that the fracturing process has not yet finished. As he says:

Obvious, indeed, is the 'breaking up of Africa'. We observe the initial separation of Arabia; we see Madagascar long separated and displaced into the south-south-east from its original position in the Bight Tanyanika; we perceive the curving section from Somaliland to Beria that is about to follow suite; we notice behind it the Lake Victoria block not quite severed; and we detect in the hinterland, penetrating into the heart of the continent, sundry fractures and extensive far-flung saggings of the peneplaned surface. Can we doubt then, that the partition of Africa from east to west is still in progress?²⁴

Fig.5 is taken from a work by Professor John Joly which shows the evidences of progressive rifting very clearly.²⁵ It will be noted also that a major rift passes up through the Red Sea where it divides—part of it re-appearing to split Greece in two, and the other branch marking the valley of the Jordan and more particularly the Dead Sea. As Joly points out volcanic phenomena have broken out along its length and basaltic lavas have been ejected. This rift is far more impressive than at first strikes the eye. As Joly puts it, "It is 4000 miles long, extending over one sixth of the circumference of the globe."²⁶ Suess held that a crustal split extending more than 52° latitude "must have its origin in the structure of the planet itself."

Let us now consider some other lines of evidence—subsidiary in many ways—but nonetheless striking in their confirmatory character.

In the Smithsonian Annual Report of 1936, Professor W. W. Watts contributed a paper entitled, "Form, Drift, and Rhythm of the Continents," in which from a more or less uncommitted point of view he examines the evidence for Continental Drift, a theory which he holds to be clearly in contradiction to the Uniformitarianism of Hutton and Lyell. He admits that a marked feature of the Atlantic is the parallelism of much of the eastern and western coasts. As he says:

24. Du Toit, A. L., *ibid.*, p.254, 255.

25. Joly, John, *The Surface History of the Earth*, Oxford, 1925, see p.25.

26. Joly, John, *ibid.*, p.25.

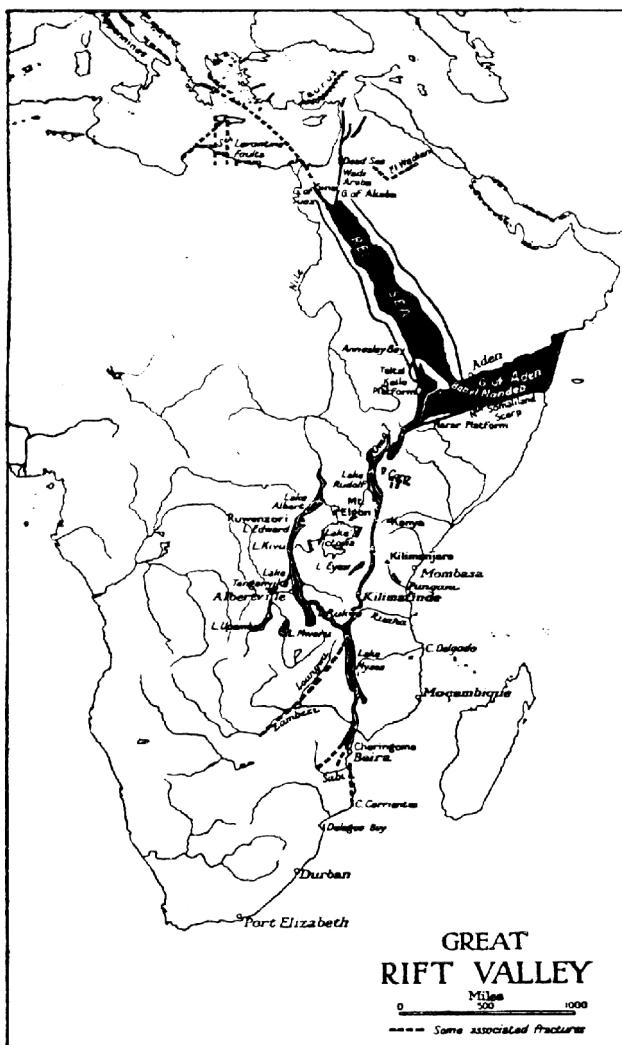


Fig.5, from Joly, indicating by the heavy black lines the existing state of incipient or completed fracture, which extends up the Jordan Valley, and cuts across the Isthmus of Corinth in Greece.

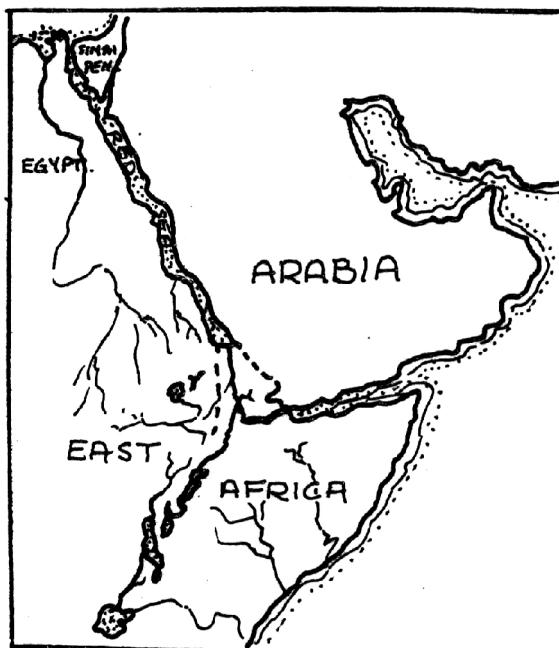


Fig.6. From Baker: a reconstruction of an earlier stage of the African rift.

With a little stretch of the imagination and some ingenuity and elasticity of adjustment, plans or maps of the opposite sides may be fitted fairly closely, particularly if we plot and assemble the real edges of the continents, the steep slopes which divide the 'shelves' on which they stand from the ocean depths

The hypothesis is supported by the close resemblances in the rocks and fossils of many ages in western Europe and Britain to those of eastern North America; by the community of the structures by which these rocks are affected; and by the strong likeness exhibited by the living animals and plants on the two sides so that they can only be referred to as a single biological and distributional unit, the Palearctic region

Broad areas in South Africa are built of rocks known as the Karroos formation of which the lower part of late

Carboniferous age is characterized especially by species of the strange and fernlike fossil plants, *Glossopteris* and *Gangamopteris*. Associated with them are peculiar groups of fossil shells and fossil amphibia and reptiles. Similar rocks, with similar associations and contents, in Peninsular India have been named the Gondwana formation. Comparable formations also occupy large regions in Australia, Tasmania, and New Zealand, in Madagascar, in the Falkland Islands and Brazil, and in Antarctica.²⁷

Subsequently he writes:

Nor are the rocks alike only in mode of formation, the structures by which they are traversed correspond; while even in details there is remarkable agreement, as in the peculiar manganese deposits, and the occurrence of diamonds in 'pipes' of igneous rock both east and west of the ocean.²⁸

Speaking of a somewhat similar instance of rather specific parallelism, Brewster refers to the Old and New World coal beds. He says:

Our western coal is not of the Coal Period, but much younger. Rocks of the Coal Period in Africa contain no coal at all. But the coal of Pennsylvania, New England, and Nova Scotia, is of the same age as that of the British Isles, France, Germany, and Spain, and is altogether very much like it. So it looks as if, when the coal was forming, all this was a single coal-field that has since come apart.²⁹

Indirectly, Brewster is pointing out the community of living forms in the two areas, since coal is modified plant material. And Ronald Good, an outstanding British naturalist, speaking of the biogeography of Australia, has this to say:

27. Watts, W. W. *Form, Drift, and Rhythm of the Continents*, Smithsonian Institute Annual Report for 1936, p.195.

28. Watts, W. W., *ibid.*, p.197.

29. Brewster, E. T., *This Puzzling Planet*, The New Home Library, New York, 1942, p.133.

Plant geographers have long remarked upon the considerable affinity between the floras of Australia and South Africa There seems no doubt that this is a true genealogical affinity, and we may therefore postulate that at some earlier period Australia was much closer to (perhaps actually in contact with) South Africa³⁰

Subsequently Good refers to the fact that evidence of a similar nature "suggests strongly that Australia was at one time in continuity with a general southern temperate rain forest flora and, thus, that its original position was somewhat to the south of Africa, and, perhaps even between that continent and what is now Antarctica. . . . from this position we may picture Australia as having drifted east-north-east, and it may be almost north-east, and the change in latitude involved amounted to as such as 20°."³¹

Brewster points out that the same land animals and land plants have appeared at about the same time all around the North Atlantic.³² The horse, for example, originated in our own West, but horses appeared shortly after in Europe, and as he observes "presumably they did not swim over." He adds subsequently, "Our modern plants appeared so nearly at the same time on both sides of the North Atlantic that it is not known for certain where they first arose."

Speaking of the famous Old Red Sandstone of England, he points out that it exactly matches the Old Red Sandstone of Nova Scotia. And, he adds, "even the dinosaur tracks in the mud of Triassic estuaries and river bottoms are alike across the sea—in vales of Middle England on one side of the water, the valley of the Connecticut River in central Massachusetts on the other."³³ A photo of some of these dinosaur tracks from the Connecticut Valley is given by J. W. Klotz in his *Genes, Genesis, and Evolution*.³⁴

Sir Albert Seward, Professor of Botany in the University of Cambridge called attention to certain botanical peculiarities of an area now within or near the Arctic Circle. He said:

30. Good, Ronald, "The Biogeography of Australia, *Nature*, June 28, 1958, p.1764.

31. Good, Ronald, *ibid.*, p.1764.

32. Brewster, E. T., *This Puzzling Planet*, The New Home Library, New York, 1942, p.132.

33. Brewster, E. T., *ibid.*, p.136.

34. Klotz, J. W., *Genes, Genesis, and Evolution*, Concordia, St. Louis, 1955, p.472.

It is difficult, it is probably impossible, to explain the facts without calling to our aid the hypothesis of drifting continents . . . This is a controversial subject beyond the scope of my address. I can do little more than re-affirm adherence to the view that plant records from rocks of many ages raise problems which seem insoluble unless we postulate movement and sliding of the earth's crust.³⁵

He elaborates upon the evidence of a very extensive geographical area reaching from "Central Germany to southern Sweden and a thousand miles farther north beyond latitude 70° north." Within this large area there is a remarkable community of plant life of such form that temperate climatic conditions alone could account for it. He therefore considers that it is necessary to assume "a very considerable movement and reshuffling of the earth's crust."

The subject is a vast one and an enormous amount of evidence exists, some of which we shall elaborate subsequently, that the whole earth was at one time very different from what it now is—or, as an alternative, the land masses whose fossil remains indicate temperate climatic conditions locally were at one time in a temperate zone, but have now drifted to much colder regions. There are some authorities such as Karl A. Pauly, for example, who believe that we are "fully justified in concluding that the lithosphere was displaced during the great Ice Ages, and that the displacements were the direct cause of the alterations in climates during these periods."³⁶

The continuity of plant life, and indeed of living forms in general, across the south Atlantic might either be accounted for by postulating some land bridges which have since sunk below sea level, or by bringing the two opposite shores together. At the Symposium reported in *Nature* which was held in 1953, in which the issue was strongly debated, Arthur Holmes, the writer of the report, added this remark as a 'personal note':

I should confess that despite appearances to the contrary, I have never succeeded in freeing myself from a nagging prejudice against Continent Drift; in my

35. Seward, Sir Albert, "The Western Isles Through the Mists of Ages," *Science*, vol. 90, 1939, p. 199.

36. Pauly, Karl A., "The Cause of the Great Ice Ages," *Scientific Monthly*, Aug., 1952, p. 98.

geological bones so to speak, I feel the hypothesis to be a fantastic one. But this is not Science, however, and in reaction I have been deliberately careful not to ignore the very formidable body of evidence that has seemed to make Continental Drift an inescapable inference.³⁷

Coming as this does as a conclusion after attending a Symposium devoted to the south Atlantic Basin Biography, the admission is all the more valuable because of the reluctance with which it is made. It appears, therefore, that there is a very strong evidence in favour of the Drift hypothesis to be derived from a study of the similarities (often virtual identities) of the flora and fauna of the supposed matching fragments.

There is one other piece of evidence which bears on the problem to which Edwin Brewster makes reference. It is known that some of the eastern states of North America are composed of gravel and mud which appears to have been washed up from the sea. In some places these deposits are a mile thick. Moreover, there is evidence that the material was derived *from a mountainous source*.³⁸ Against this is to be placed the fact that there were ancient mountains in Europe which were worn down nearly flat and then lifted up again only to wear down once more. The deposits in the eastern states come from somewhere other than merely from the deeps of the Atlantic Ocean, and the debris from the washed out European mountains which is otherwise unaccounted for would seem to supply the source material. It is logical to assume that when these eastern States were laid down, the mountains of Europe supplied the raw materials, there being no Atlantic Ocean intervening at that time.

(3 & 4) Tectonic and Volcanic Evidence

Tectonically considered, these crustal fragments display many marks of deformation due to drift. The leading edges of the moving pieces have crumpled under compression; the trailing edges bear all the marks of tension. The forces involved are almost unimaginably great, although as we shall see, the motive power can be derived probably

37. Holmes, Arthur, reporting in *Nature* (Apr. 18, 1953, p.671), a symposium, "The Role of the S. Atlantic Basin in Biogeography in Evolution."

38. Brewster, E. T., *This Puzzling Planet*, The New Home Library, New York, 1942, p.134 ff.

from natural forces which are not nearly as active today as they were at the time of the break-up or "disruption." These forces would be maximal at first, and indeed have been calculated in a loose kind of way by Professor George Gamow. The "sliding of such vast crustal plates," as Chester Longwell put it, "may very well account for some of the major structural deformities of the continents."³⁹

Du Toit considers the geological and structural analogies of the western sides of North and South America which represent the leading edges of the moving masses are so similar that the cause must be a common one.⁴⁰ The crumpling which formed the Rockies and the Andes had the secondary effect of greatly increasing the thickness of the crust along this line from north to south with the result that the moving blocks dug in more deeply into the Pacific Ocean bed creating trenches of extraordinary depth. On the other hand, du Toit considers that the pattern of the Atlantic-Arctic floor "is highly suggestive of east-west stretching. It shows close analogy with a sheet of so-called expanded metal made by cutting parallel slots in a place and then stretching it at right angles thereto so as to produce a trellis with diamond-shaped openings, only the Atlantic pattern is far less regular."⁴¹

It was Wegener's view that the wrinkling or crumpling of great areas of the crust to form mountain chains reduced the total surface area of the continental masses so that they now cover less than one quarter of the earth's surface, leaving the rest of the space for water. However, as we shall see subsequently, it seems more in keeping with the facts to suppose that a huge segment of the original granite shell is actually missing. This was Baker's view and it has been shown that if certain reasonable assumptions are made regarding its probable thickness, the mass of material removed or missing can be calculated and would form a sphere quite closely approximating our present Moon. We shall consider this in some detail in the next chapter. In the meantime, it does not seem likely that if all mountain chains were "ironed out," there would be nearly enough total continental mass to encapsulate the globe. Watts observes that "the shortening of the earth crust thus effected has been estimated in the case of the Rocky Mountains at 29 miles, of the Himalayas at 62, the Alps at 76, and the

39. Longwell, Chester, "The Problem of Crustal Deformation," *Science*, vol.114, 1951, p.483.

40. Du Toit, A. L., *Our Wandering Continents: An Hypothesis of Continental Drifting*, Oliver & Boyd, Edinburgh, 1957, p.171.

41. Du Toit, A. L., *ibid.*, p.219.

Appalachians at the large figure of 200 miles.⁴² When these are summed together, it is pretty obvious that there would not be enough material to complete the encasement. Something is still missing.

When we turn to a study of ocean floors particularly the Atlantic and the Pacific, we find evidence of a slightly different but equally convincing nature that the globe has been subjected to some surface stresses of great magnitude. There are several striking features of the oceans which include the following: (a) submerged canyons, running from the land out under the sea which are on a grand scale; (b) cracks in the floors of the oceans which appear to be evidence of local weakness in the earth's outer crust and are associated in a unique way particularly around the Pacific Ocean with earthquakes, and like the canyons, are on a vast scale; (c) the virtually complete absence of granite on the Pacific Ocean floor, in contrast with the floor of the Atlantic Ocean; (d) the Mid-Atlantic Range which certainly looks like the debris of the parting line when the Old and New Worlds broke away from each other. We shall consider these point by point.

Some years ago when it was discovered for the first time that some of the major rivers of the world continued their course, or at least appeared once to have done so, far out into the sea following submerged valleys, there was a very lively debate as to the significance of the phenomenon. While it would not be unnatural to expect a river valley to continue for a short distance into the sea, no one had supposed for a moment that these valleys very often reached not merely the *edge* of the continental shelf, but as Professor Hull pointed out at that time, they reached to the very *bottom* of the continental shelf.⁴³ It was as though at one time the river had not merely run out to the edge of the shelf and plunged over in a Falls, but the erosive force of the waters had been so great as to carve its way to the bottom until the Falls was replaced by a Rapids. Many geologists found it difficult to explain this except by arguing that the continents must actually have been elevated at the time above the sea level exactly to the depth of the now submerged valleys, for it was obvious that a river flowing under water could never have cut such a channel for itself.

42. Watt, W. W., "Form, Drift, and Rhythm of the Continents," Smithsonian Annual Report for 1936, p.190.

43. Hull, Prof. E., "On the Sub-Oceanic Terraces and River-Valleys of Western Europe," *Transactions of the Victoria Institute*, vol.31, 1897, p.292.

No one seems to have suggested the alternative – that the ocean was formed by a depression suddenly created which filled with waters pouring off the continents which here and there cut deep channels until the water level rose and invaded these channels as the sea invades Norwegian fjords and submerges them. They could only be cut to such great depths while the waters, pouring off, were still free to flow. Once the accumulating water in the ocean rose to a certain level, the rivers would no longer have the power to enlarge their channels. It cannot have taken long. The effect was due to the volume and force of the water rather than to the length of time. One sees this sudden effect in washed-out roads after a cloudburst. Professor Hull reported that the Congo River led to a submerged canyon which had been traced to at least 120 miles, was 7 miles wide halfway along, and at this point had nearly vertical walls 4000 feet high!⁴⁴

There are many of these drowned river channels. Baker gives the dimensions of some of them: 2844 feet for the Hudson, 3666 feet for the St. Lawrence, 5208 feet on the California coast, 8000 feet for the Congo, and 7800 west of the British Isles.⁴⁵ It is also clear that such figures are minimal since measurements were probably never actually taken at the very ends of these underwater canyons. It has been suggested that there may have been a fall in sea level resulting from the accumulation of ice on land during the Ice Age and figures have been worked out for the subsequent rise in sea level again resulting from the gradual disappearance of the ice.

It has been estimated on the coast of California where the drowned river channel of 5208 feet has been observed, that the sea level must have been at least a mile lower than now, relative to the continent. This would indicate that the volume of ocean water would have to be something less than 40% of what it now is. In order to give sufficient emergence for the 6000 feet of cutting at the mouth of the Congo, it is necessary to reduce the ocean volume to only about 30% of what it is today. It is exceedingly difficult to account for the missing 70% by an appeal to the accumulation of ice which covered only a part of the land areas which in turn are only about one quarter of the total earth's surface. The ice would have to be piled up somewhere in the neighbourhood of 25 miles deep – as a very rough estimate – which it

44. Hull, Prof. E., "The Sub-Oceanic River-Valleys of the West African Continent and of the Mediterranean Basin," *Transactions of the Victoria Institute*, vol.32, 1898, p.152.

45. Baker, Howard B., *The Atlantic Rift and Its Meaning*, published privately in 1932, p.140.

surely never was. The usual quoted figure for the depth of the ice over North America in the Toronto area, for example, is only about one mile.

These figures are very far from sufficient to account for any rise in sea level required to drown these river channels. At the present time there does not seem to be any way of explaining them by an appeal to current geological concepts. However, there is some reason to believe that enormous quantities of water did at one time pour off the continents into the basins which now form the ocean beds. All that we wish to do at the moment is to draw attention to the existence of these underwater canyons, and to the fact that currently there is no way of accounting for them. Moreover, there is reason to believe that such canyons came into being at the close of the Tertiary, i.e., just before the age which saw the coming of Man.⁴⁶ They are, in fact, exceedingly recent geologically speaking.

With respect to the deep cracks and trenches, particularly in the Pacific but found virtually around the globe, an enormous amount of research has been carried out in recent years. One such continuous undersea crack extending 45,000 miles has lately been explored by Columbia University scientists (see Fig. 7). The great length of this fault in the earth's skin is due to its wandering course. A report from the Lamont Geological Observatory states that this crack extends through the north and south Atlantic Oceans, around the tip of Africa into the Indian Ocean, and then branches through the Arabian Sea connecting with certain other well known African rift valleys.⁴⁷ Another branch passes between Antarctic and New Zealand running towards the Pacific Islands. It then passes almost around the Pacific Ocean and ends up towards Alaska. Virtually 100% of all earthquake shocks along this line occur within the limits of its rift width which averages 20 miles wide and one and a half miles deep. Such an enormous structural weakness in the earth's crust suggests the operation of a force or forces which do not seem to fit well into current uniformitarian schemes. It is believed that this huge crack was caused by the pulling apart of the earth's crust by great earthquakes.⁴⁸ But what kind of an earthquake would it have to be that could virtually rupture the skin of the whole globe?

46. Hull, Prof. E., quoting Warren Upham of the U.S. Geological Survey, in *Transactions of the Victorian Institute*, vol.32, 1898, p.151.

47. Reported under "Geology: Confirm Existence of Long Undersea Crack" in *Science Newsletter*, Feb. 16, 1957.

48. According to a report from Woods Hole, Mass., U.S.A., in the *News Chronicle*, Port Arthur, Can., May 23, 1957, p.3.

The trenches in the sea floor are so unlike anything on land that they are difficult to visualize. As Fisher and Revelle say, "it is hard to grasp the reality of a chasm so deep that seven Grand Canyons could be piled one upon another in it, and so long that it would extend from New York to Kansas City (over a thousand miles). Yet these are the dimensions of the Tonga-Kermadec Trench, for example."⁴⁹ These deep gashes in the floor of the Pacific Ocean run more or less in a ring around it and are associated with almost consistent earthquake activity, but on the other hand it may be noted by contrast that, as Baker observes, volcanoes are virtually absent from the trailing edges of the moving blocks—as theory demands.⁵⁰ The Pacific basin seems to be somewhat in the nature of a deep scar in the earth's crust, and in many respects it is clearly distinguished from all other oceans.

This brings us to a consideration of a third fact, namely, the absence of granite on the floor of the Pacific Ocean.

This fact, when it was first discovered, caused considerable surprise and led to much speculation. To repeat briefly what has already been said, the earth very probably had a continuous outer shell of granite with an average density 2.7 times that of water and extending to a depth of somewhere between 10 and 30 miles, but much of this granite shell now appears to be missing. Underneath this outer shell is a bed of basalt. Below this are other layers of varying thickness until one reaches a presumably iron core. The missing granite surface was believed formerly to have sunk out of sight below the sea, and the assumption was made tacitly, or otherwise, that the ocean beds would turn out to be of a similar structure to the continents except that the surface is depressed. However, as George Gamow puts it, while the Atlantic Ocean bed does contain some granite, the Pacific Ocean does not apparently contain any granite whatever. He makes this point very specifically by the use of italics, for it is, as he observe, "a striking exception" to the situation which exists in the Atlantic, for example. He writes:

Not a single piece of granite has ever been found on any of the numerous islands scattered through the Pacific. There is hardly any doubt that the floor of the Pacific is

49. Fisher, Robert L. and Roger Revelle, "The Trenches of the Pacific," *Scientific American*, Nov., 1955, p.36.

50. Baker, Howard B., *The Atlantic Rift and Its Meaning*, published privately, 1932, p.99.

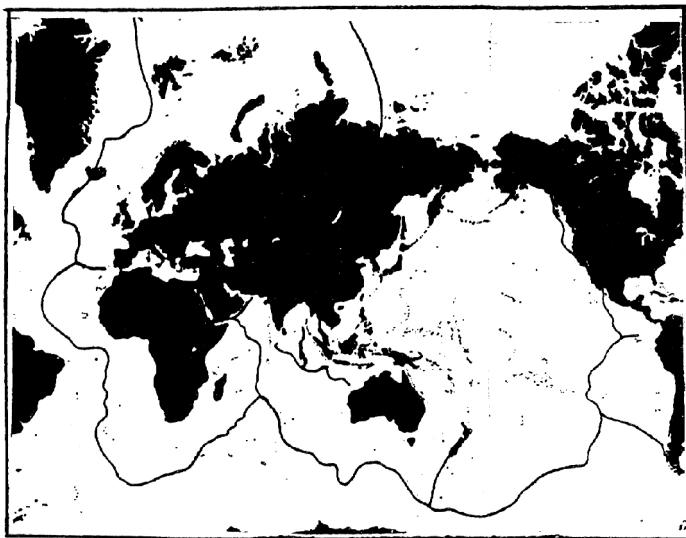


Fig.7. The 45,000 mile crack in the earth's surface indicated by the continuous line, on a map projection which is unorthodox but permits one to gauge its extent to the best advantage.

formed exclusively of basaltic rocks, as if some cosmic hand had removed the entire granite layer from this vast area.⁵¹

In Fig.8 we have reproduced one of his maps of the world illustrating this point, the entire shaded area being granite, the unshaded area lacking it. He also underscores the fact that in contrast to the other oceans, the basin of the Pacific is surrounded by a ring of high mountain chains—Cordilleras, Kamchatka, the islands of Japan, and New Zealand—of pronounced volcanic activity, known as the “ring of fire.” This is shown in Fig. 9.

51. Gamow, George, *Biography of the Earth*, Pelican Mentor Books, New American Library, 1948, p.57.

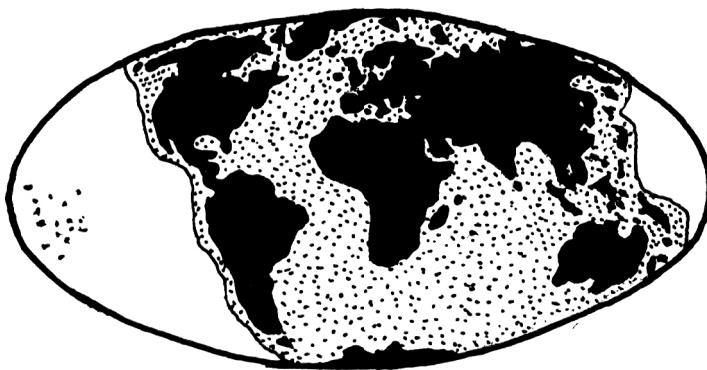


Fig.8. The area of the globe which has some remaining granite upon it, indicated by the shaded and stippled areas. Redrawn after Gamow.

When it is realized that the area occupied by the Pacific alone covers about one quarter of the surface of the earth, it will be seen at once that the total volume of the missing granitic block must have been enormous. However, this is not the whole story, for one must assume that part of the granite crust is also missing elsewhere since the land surface of the continents is by no means sufficient to supply a continuous crust for the rest of the globe. It is possible to calculate approximately how much granite is actually missing and this we have done subsequently. A very good impression of the extent of the Pacific itself as seen on a globe (as opposed to a map projection) can be obtained by reference to Fig. 10.

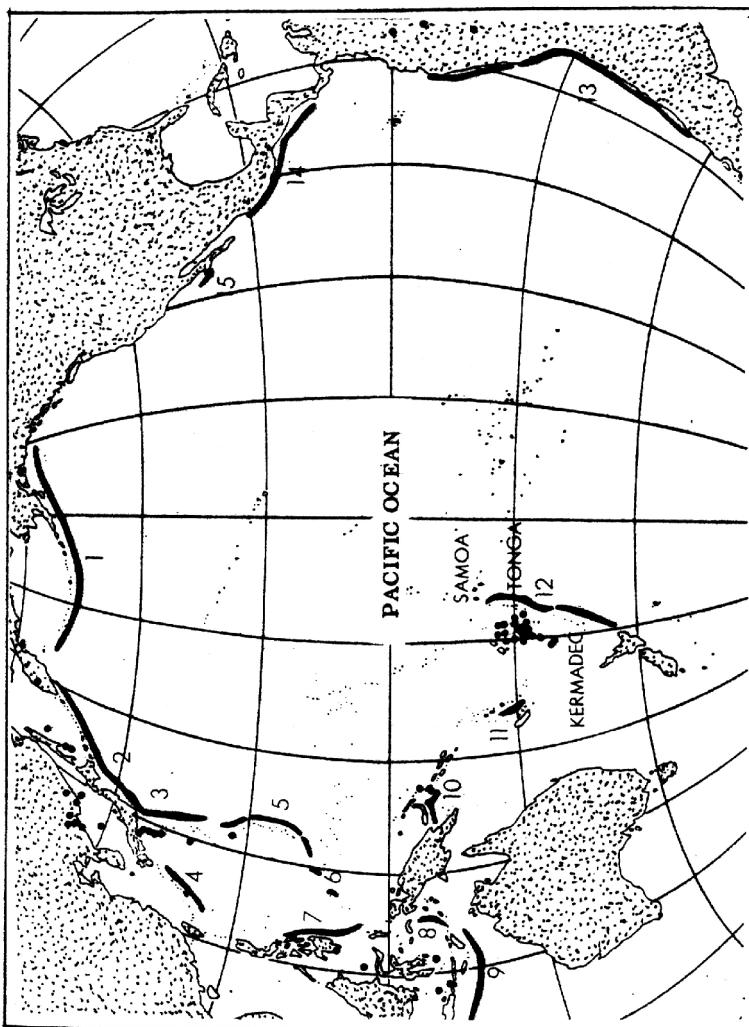


Fig. 9. The so-called "ring of fire" indicated by the heavy lines and dots, which mark the areas of maximum volcanic activity around the rim of the Pacific Ocean.

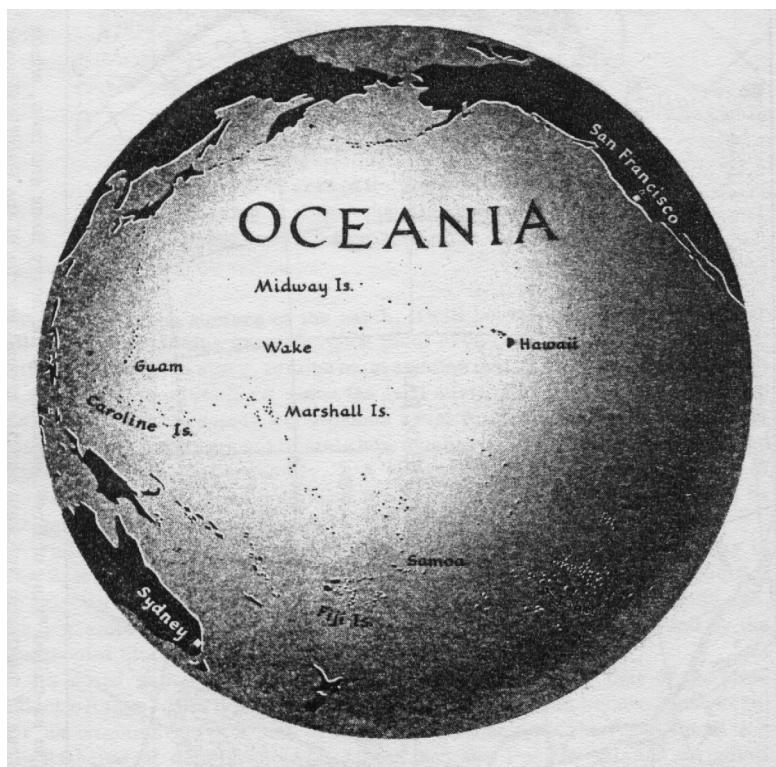


Fig. 10. The amazing extent of the Pacific Ocean.

While it is true that the granite crust is as indicated in a general way in Fig. 9, it should be stated that although the ocean beds other than the Pacific do contain granite debris, they are not structured as the continents are. What granite they have appears more like the detritus left behind by the continental blocks as they drifted apart.

As noted previously, this appears to be particularly true of the Mid-Atlantic Range. But it happens that the same phenomenon occurs elsewhere, for an examination of a map of the Indian Ocean will show that there is a similar line of debris between Africa and the Pacific Islands including Australia, which looks rather like the break-away line of the continent of Antarctica. Whether these really are what they seem

to be or not, will probably only be settled when much more oceanographic research has been completed, but in the meantime it is surely a most reasonable hypothesis to regard them in this light.

(5 & 6) Paleoclimatic and Paleontological Evidence

For many years evidence of another kind has been accumulating from all over the globe bearing out the proposition that the continental fragments have actually shifted position throughout geological time. This evidence has resulted from a study of what is called Rock Magnetism. Very briefly stated, the assumption is made that when rocks solidify from a molten state, they accept the magnetic lines of force between the poles and are thereby magnetized directionally in such a way that their orientation can be determined at the moment of solidification. Consequently, if the lines of magnetic force in a rock specimen are found to be disoriented at the present time with respect to the North and South Poles, the assumption is made that that particular section of the rock has shifted its orientation. There is, however, another way explaining it, namely, that the magnetic poles have changed their position instead. A third alternative, of course, is that both events have occurred; and on the whole, this being the most comprehensive explanation is accepted as probably valid.

S. K. Runcorn recently published a paper on Rock Magnetism in which he points out that "renewed interest in the problem of polar wandering and continental drift has resulted from paleomagnetic measurements." Runcorn does not consider that Wegener or du Toit really made their point, yet he admits that at the present moment there is no other way of accounting for the evidence. He does not believe that magnetic changes in the rocks could occur spontaneously. He also points out that the study of ancient climatic conditions taken in conjunction with the directional magnetization of rocks of the same date together provide strong evidence that the poles have drifted as well as the continents. He concludes:

Probably most geologists and geo-physicists feel reluctant to admit the possibility of relative displacements of the continental masses in the recent history of the earth. It is often stated that a sound reason for such scepticism is the absence of any adequate theory of the mechanism by

which such continental displacement could have taken place. This is an argument which should not be given much weight

That the coastline of much of South Africa and South America fits together is of course a fact which the exponents of continental drift have thought very significant. H. Jeffrey's statement that the fit is a poor one has recently been shown to be untrue by S. W. Carey. It is significant also that the Mid-Atlantic ridge follows a line parallel to these two coasts

At first sight it appears strange that the dispersion of the continents (at the end of the Mesozoic time) occurred so late in the history of the earth.⁵²

The significance of paleoclimate in this connection is that not only do we find the orientation of the rocks askew, but the fossil forms in them are not such as one would expect to find in many cases unless the climate also was at that time very different — different enough that there is reason to suspect a shift of the equator and the geographic poles. This shift may have put the geographic poles, for example, at the approximate centres of the great ice sheets rather than where they now are.⁵³ As we shall propose subsequently, the earth may have formerly been spinning not at the present angle of approximately 23° , but at a much greater angle. Such a concept naturally shifts the Arctic, temperate, and tropical zones with respect to continental masses. Pauly shows that during the great Ice Ages areas such as Alaska enjoyed a milder climate than they do today.

P. M. S. Blackett of London University in a lecture given at the National Research Council in Ottawa pointed out:

Rock magnetism can tell us something about the movement of the continents during geological history, and so can test the much discussed and controversial hypothesis of Polar Wandering and of Continental Drift. It seems certain that the continents *have* drifted great distances relative to the geographic poles and also relative to each other.

52. Runcorn, S. K., "Rock Magnetism," *Science*, vol.129, 1959, p.1011.

53. Pauly, Karl A., "The Cause of the Great Ice Ages," *Scientific Monthly*, Aug., 1952, p.89.

The assumption has to be made that averaging out over one million years, the magnetic poles did line up with the geographic poles and are by nature co-linear. We believe that the magnetism of the earth is linked directly to the physical axis of rotation

The earth has a certain dynamic instability and geographic poles may well have wandered . . . i.e., the earth may have wobbled.⁵⁴

We shall have more to say later about this instability and particularly with respect to the consequences, climate-wise, of the greater tilt in the earth's axis of rotation. Such shifts could bring below the equator certain continental sections which are now found above it. In a scientific symposium held in 1957 at which Blackett presented a paper, he stated that measurements on Indian rocks "prove without doubt" that India was at one time situated south of the equator.⁵⁵ He concluded that in the next decade it will be possible to trace by the study of rock magnetism the major movements of the great continents during the earth's history in a fairly reliable manner. Such shifts taken in conjunction with the actual drift of continents could explain some otherwise strange phenomena, such as the existence of coal in places like Spitsbergen, for coal is formed only where there has been rank vegetation—and this kind of vegetation would not be found within the Arctic Circle where Spitsbergen now lies on the globe.

(7) Geodetic and Other Evidence

Not unrelated to evidences of the above nature is that derived from geodetic surveys. In these surveys the exact distances between clearly marked points on the surface of the globe are very accurately measured over long periods of time to determine if such points shift their position with respect to each other.

Writing in *Science*, Dr. Harlan T. Stetson of the Cosmic Terrestrial Research Laboratory, Needham, Tennessee, presented evidence of such differential movement. He says:

54. Blackett, P. M. S., "Rock Magnetism," National Research Council, Ottawa, Sept. 29, 1955, public lecture.

55. Blackett, P. M. S., "Elementary Particles, Atomic Power, and Drift of Continents," report in *Science*, vol. 125, 1957, p. 1157.

In 1931 a re-determination of the longitude between the Argentine Observatory at Cordoba and the Royal Observatory at Greenwich was made and the results compared with the position of the Observatory made under the direction of Benjamin A. Gould of 1871 [When this was done] the two determinations differed by 1.11 seconds, corresponding to a linear distance of 400 meters or approximately 1300 feet, an unthinkable distance to be charged to the account of observational errors.⁵⁶

In sixty years this amounts to a movement of over 20 feet per annum. In some further tests made, according to Stetson, observations revealed that San Diego had moved 37 feet further west in 1933 than it was in 1926, a movement of 5' 4" per annum⁵⁷ — while the east coast had remained stationary! This seems to suggest a stretching of the continent if the figures are valid. However, in 1941 George Gamow questioned some of these reported distance changes, particularly the claim that Greenland and Europe had parted some 32 meters during a period of 33 years (1873-1907).⁵⁸ He believed that the earlier methods of measurement were sufficiently inexact, since subsequent checks had not fully supported the original observations.

In spite of such questionings, there is still a considerable body of evidence of which an excellent summary is given by du Toit.⁵⁹ Du Toit refers to the determinations of Sabine Island in Eastern Greenland (1823 made by Sabine himself), and subsequent determinations by Borgin and Copeland (1870) and by Koch (1907), which appear to show progressive movements westwards amounting to 1610 meters in all. And he acknowledges that there is some doubt about these measurements and points out that because Wegener was misled here, for he had quoted these determinations, he may also have been misled in his other claims from geodetic evidence. But he then observes that in 1932 Jelstrup

56. Stetson, Harlan T., "Modern Evidences for Differential Movement of Certain Points on the Earth's Surface," *Science*, vol.100, 1944, p.113. More recently Dr. Clarence Allen reported movements of above one foot in six years along the San Andreas fault (*Science Newsletter*, July 21, 1962, p.45).

57. Stetson, Harlan T., *ibid.*, p.116.

58. Gamow, George, *Biography of the Earth*, Pelican Mentor Books, New American Library, 1948, p.113.

59. Du Toit, A. L., *Our Wandering Continents: An Hypothesis of Continental Drifting*, Oliver & Boyd, Edinburgh, 1957, chapter 15, and p.299 ff.

accurately re-determined the longitude of Sabine Island and, rejecting the figures of 1832, found nevertheless for the period from 1870 to 1932 an apparent westerly shift of some 615 meters, or about 32 feet per year. Subsequently, further corrections were made to this figure which was finally established at a value of 4 meters or about 13 feet per annum.

But this is not the end of the matter for, as du Toit shows, observations made at Kornok in Western Greenland by Falbe and Bluhme in 1863, von Ryder in 1882-3, and Jensen in 1922 (employing stars and radio signals), shows an apparent westerly drift of about 3100 feet. As du Toit points out:

It is important to note that, even if all the measurements made prior to those of Jensen be rejected, the re-occupation of the stations by Sabel-Jorgensen in 1927, only five years later, showed a difference in longitude far in excess of the probable errors, and corresponding to a westerly movement of some 117 feet per annum.

Furthermore, the repetition by Tollmer-Kopf in 1932-3 of the measurements made by von Basso in 1882-3 of the longitude of Jan Mayen Island gave a difference corresponding to an apparent drift, also to the west, of about 81 feet per year, which is more than ten times the probable errors of both sets of observations.⁶⁰

It is also important to note that no appreciable changes in latitude were detected, a fact which might be evidence of the dependability of one component at least of the original determinations: it would presumably be evidence that the drift is purely westward. Mention is also made of measurements of longitudinal differences between Paris and Washington which would point to an increase in distance of approximately one foot per year over a period of 13 or 14 years. Sydney Observatory in New South Wales made some telegraph-time determinations giving a "position" in 1883 of 10 hrs, 4 mins, 49.54 secs east of Greenwich. Cable-time determinations made in 1903-4 indicated a "distance" of 10 hrs, 4 mins, 49.32 secs. In 1926 radio-signal-time determinations gave a figure of 10 hrs, 4 mins, 49.195 secs. As du Toit observes, "we thus find progressive decreases of 0.22 seconds over 20

60. Du Toit, A. L., *ibid.*, p.300.

years and of 0.13 seconds over 23 years – a total of 0.35 seconds for 43 years. This corresponds with an apparent westerly movement of 161 meters or an average of 3 meters (approximately 10 feet) a year between 1883 and 1926."

While these figures based upon such fine determinations may not seem convincing to those who are accustomed to more gross methods of measurement, modern techniques make these exceedingly accurate calculations quite meaningful in spite of their smallness. On the whole I believe the evidence is in favour of Continental Drift, although at a very slow rate. But as we shall see, the slowness of movement can be accounted for now: it may have been initially very much faster indeed.

We shall conclude this section with one further reference to an interesting proposal made recently by an ornithologist to the effect that certain anomalies of long range bird migration could have resulted from the fact the pattern of flight was begun when the starting and finishing points bore a certain relationship to one another which they no longer do. The change in position between the two points, it is proposed, took place by a simple widening of the gap between by displacement of one of the points by what might be termed a crooked route. The birds made the trip tracing out this angular course, having learned to do so over thousands of years and apparently being unaware that they could, if they wished, reach their destination more quickly by "cutting corners."

In 1948 Albert Wolfson of North Western University contributed a paper to *Science* entitled "Bird Migration and the Concept of Continental Drift." His opening words are:

The origins and evolution of migration in birds has long been a favourite topic for theoretical discussion, but current theories, although numerous, fail to provide a satisfactory explanation for some of its fundamental features.

When a recent study of Continental Drift revealed some co-relations with the routes of migration, the concept was studied still further in relation to the time of origin and distribution of birds and the evolution of migration.

This critical study and analysis have led to the conclusion that *Continental Drift was the stimulus for the evolution of the more highly developed forms of migration* [his emphasis]. In essence, the hypothesis to be presented

holds that the birds which responded to the movements of continents as they drifted apart and moved northward, and/or which followed the development of new oceans created by drifting land masses belonged to those species which at the present time exhibit migration in its most highly developed form.⁶¹

The author then briefly outlines present theories purporting to account for such migrations and expresses the opinion that they are quite inadequate. He then discusses the concept of Continental Drift.

His third section deals with migration in relation to drift, and after showing that many such birds "fly greater distances and subject themselves to more rigorous conditions than seems necessary," he points out that if one thinks of these routes of migration as evolving in response to drifting continents, "what heretofore has been enigmatic becomes explicable." Wintering and summering ranges are shown to have been formerly contiguous until certain fragments of the continents broke apart.

He illustrated the significance of the routes of migration by the following observation:

The species that performs the longest flight among all birds is the Arctic Tern. It breeds in the circumpolar region of the Northern Hemisphere as far north as 82° latitude and in winter ranges from the tropical Atlantic to the Antarctic Ocean as far south as 66° latitude. A distance of about 10,000 miles separates the extremes of its breeding and wintering areas.

As already indicated, the extent of migration is readily explicable in terms of Continental Drift, but what is more remarkable is the correlation between drift and the *path of flight*.

When the Fall migration begins, these birds do not fly southward, as one might expect, but fly eastward across the Atlantic to the shores of Europe, and then southward along the African coast to their wintering area in the South Atlantic and Antarctica regions. Some individuals may

61. Wolfson, Albert, "Bird Migration and the Concept of Continental Drift," *Science*, vol.108, 1948, p.23.

cross to the eastern coast of South America, south of the Azores and then continue southward. Is it merely coincidence that the direction of flight is in accord with the pattern of drift? If so, how, then can one explain the east-west flight across the North Atlantic and the vast distance between the breeding and wintering grounds?⁶²

He continues, after examining the migratory habits of several other species of birds:

In North America the general trend of many migratory routes in the Spring is from the south east to the north west, and in a few instances there are marked westward flights along some routes. (See Fig. 11)

In Eurasia the general trend in the spring is from the southwest to the northeast, and many species fly directly eastward for a part of their route. (See Fig. 12)

Wolfson then traces the Fall migration routes of such birds and shows that they do not by any means take a straight course but a route which considerably extends the distance they must cover—a route which as he says, "seems to be the natural consequence of drift, the birds following their breeding grounds as these drifted westward."

The Greenland Wheatear is equally significant in its course of migration, as is also the Pacific Golden Plover. He asks, "How can one explain the evolution of such routes from the view-point of permanent ocean basins and continents?"⁶³ One of the most puzzling facts about migratory behaviour is that it is essentially a northward movement, irrespective of how far south the species may winter. For whereas many species that winter in the temperate latitudes of South America and Africa migrate to the northern hemisphere to breed, very few species that 'winter' in northern temperate latitudes migrate into the southern hemisphere to breed. Could this not be related to the fact that the evidence points to an essentially northward drift of continental masses—Australia and New Zealand and Antarctica being the only exceptions.

The flights of such birds may originally have been comparatively short, but the homing instinct in these species is so strong that even

62. Wolfson, Albert, *ibid.*, p.27.

63. Wolfson, Albert, *ibid.*, p.27.

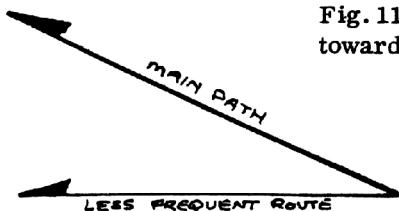
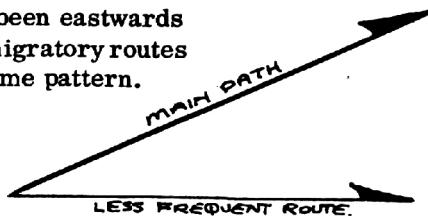


Fig. 11. The New World moved away towards the West, and the birds have followed this pattern of drift.

Fig. 12. In the eastern parts of the world the land movements have been eastwards and northwards, and again migratory routes have tended to follow the same pattern.



when the feeding and breeding grounds were parted by thousands of miles, the annual passage continued to be made. As Wolfson concludes:

This, that birds migrate along the routes indicated and show a certain distributional pattern seems to me to constitute *prima-facie* evidence for the drifting of continental masses.⁶⁴

Conclusion

Such, then, is the kind of evidence which in the minds of a very considerable number of qualified experts renders the theory of Continental Drift highly attractive even though it raises some enormous problems. Most of these problems arise from the fact that since the time of Hutton and Lyell it has been very largely taken for granted that the one fundamental law underlying all geological phenomena is the so-

64. Wolfson, Albert, *ibid.*, p.30.

called Law of Uniformity, a law which in effect favours no theory demanding the operation of forces in the past which it cannot be reasonably shown to be operating at the present time. The movement of such vast masses as the continents into new positions, and the removal by some means of an enormous section of the earth's granite crust seems to demand a return to an old concept of catastrophism. What is feared above all—if such a return were favoured officially—is the re-introduction of supernatural agencies when natural agencies seem no longer sufficient. And theories which allow elements of this kind become highly imaginative, which may well account for the enthusiasm of the older geologists and the excitement of their writings in contrast to the rather prosaic and dull approach of modern geology.

In this present paper, having no reputation to preserve as a geologist, I can afford perhaps to let my imagination go. Thus my reconstruction of the events which led up to the inception of the drifting of continents and the rather radical change in the structure of the earth's surface need not be bound quite so rigidly by geological orthodoxies. Yet, there is plenty of evidence still to be presented for each stage of my proposed reconstruction.



"The continents are angular because they are shattered fragments. The crust broke all to pieces and the pieces could not be otherwise than angular."

Howard B. Baker



The Grand Canyon

Is it possible that this enormous eroded valley system owes its beginnings and perhaps much of its present form to the immense erosive action of the waters that poured off the continent when the Pacific cavity was created by the loss of a large part of the earth's crust?

Chapter 3

THE MOMENT OF DISRUPTION: AND THE BIRTH OF THE MOON

If the granite crust of the earth was once a complete shell and the present fragments which form the continents when added together recover for us somewhat less than one third of this original shell, one has to ask, Where did the rest of the granite go?

It was believed by Suess and others that the missing sections had sunk below the waters of the oceans and would in due time be found to form their beds. It seems clear now that this is not the case. Moreover, granite being so much lighter than basalt, the concept itself was probably fallacious. Another alternative, which was acceptable to Wegener, and to many others who did not share his views regarding drift, is that the crust never was wholly complete—i.e., that there had always been some areas without it and that the ocean deeps have always been there.

There is a third alternative: namely, that the missing section of the original shell was actually removed from the earth into space. The American naturalist Owen was, as we have seen, the first to suggest that this huge fragment had formed a sphere under its own gravitational forces and had become the Moon.⁶⁵ Such a concept as this would seem to imply a catastrophic event taking place in a quite short time, and involving the earth in a disruption of inconceivable magnitude.

65. Owen, Prof. Richard, *Key to the Geology of the Globe*, published in 1857, Nashville, Tennessee.

To my mind, a careful study of the quite extensive literature dealing with Continent Drift seems to bear out the fact that as a simple mechanical proposition it would be difficult to explain how the present continents could have drifted apart from the original segment, and subsequently moved into the positions which they now occupy, without making the assumption that they all began their dispersion together. It is not possible to account for the geological evidence (the various matched strata, etc.) by proposing that some fragments broke away in Cambrian times, some in Carboniferous times, some in Pliocene times, and so on. The crustal matchings are of such a kind that the initiation of movement must have been simultaneous all over the earth. It must also have been, by and large, unobstructed. The leading edges of the moving pieces were indeed crumpled into mountain ranges, but it is surely a mechanical impossibility to conceive of any movement of such masses at all unless the surface upon which they drifted was molten enough to allow a certain freedom of sliding.

From the replacement schemes as proposed by Wegener and du Toit and Taylor and Baker one may deduce the lines of movement of these fragments and it becomes evident that there is a great intrusive region on the globe, a kind of focal centre. The continents have not all moved westward, nor all towards the equator: the one motive element common to them all is that they have gravitated towards the Pacific hemisphere (see Fig. 13). The present asymmetry of the globe, the missing structures, the fractures with separation, the fractures with convergence, the evidence for former fluidity of the basalt, the subsequent crustal movements, all combine with one accord to tell of the separation of mass from the Pacific side of the earth. This grand event must have been brief and the circumstances which brought it about obviously of a transient nature. But so long as the basalt floor was molten, the movement of the fragments could be of various kinds, not merely traversing their paths in a straight course but getting caught on other fragments, and being—as Newfoundland appears to have been—further fractured, deformed and rotated. Both England and Spain appear also to have been twisted somewhat.



Fig. 13. The movement of fragments towards the Pacific Basin.
Redrawn from Baker.

Two questions must be asked: What brought about the sudden reduction to a molten state of the underlying basalt which thereby permitted the overlying granite shell to be torn away in large part and the remainder to break up and drift quite rapidly to new positions until the floor solidified again; and What occurrence of events in our Solar System conspired to provide the necessary force to remove the missing shell and lift it out into space by some kind of giant tidal action?

In 1925 Professor John Joly presented in beautifully simplified terms the evidence for his belief that the basalt floor must inevitably become molten every so often. He also stated that granite floats well upon molten basalt with good 'freedom', as he put it.⁶⁶ He reported upon the fact that in Hawaii large pieces of granite have been seen floating away on basaltic lava. He mentioned furthermore—and this is a point of some importance to our subsequent reconstruction—that lava flows solidify

66. Joly, John, *The Surface of the Earth*, Oxford, 1925, p.79.

quickly because their specific heat is low. If the basalt floor was rendered molten, it would solidify from complete fusion to black glass with considerable rapidity. In a nutshell, Joly argued that the radioactive elements in the basalt must, over long periods of time, produce more heat than can be eliminated by conduction to the surface of the earth. Since the solidity of the basalt is believed to be its prevailing condition at the present time, there is no conceivable heat removal. Since conduction is inadequate, the conclusion is reached that ultimately liquefaction of the basalt is bound to result. This effect Joly believed to have been cyclic, recurring in the earth's history several times, but on no previous occasion being coincidental with some tidal force sufficient when applied to the earth at the appropriate moment to lift part of the shell completely away from it.

What the nature of this tidal force may have been, we have no way of knowing at the present. One can imagine some large heavenly body approaching the earth and passing it, perhaps at a moment when the sun's tidal pull is also at its maximum. A bulge formed on one side of the earth and so "blistered" the shell which is no longer frozen in its bed that it broke away completely and left the earth with an enormous scar and something of the order of one third only of its original granite skin remaining to it. Baker believed that a study of the disposition of the subsequent fragments was such as to demonstrate that the centre of the blister was in the area which is now the Pacific Ocean.⁶⁷ He would go even further in reconstructing the circumstances:

With the earth's axis in approximately its present position relative to the ecliptic, if the attraction came from the direction of the sun, the catastrophe must have been during the northern winter, near the solstice, and day time for the denuded area. If, on the other hand, it came from the side opposite the sun, then the season must have been summer for the northern hemisphere and the time night for the denuded area. When disruption started, it quickly reached its maximum, as quickly subsided in part and continued to work on a smaller scale for a few hours, being completed in less than one rotation of the earth (i.e., in less than one day), possibly in less than half a rotation.

67. Baker, Howard E., *The Atlantic Rift and Its Meaning*, published privately, 1932, p.62.

Afterward, the inflow continued until the crustal fragments became fixed in the new crust.⁶⁸

May we repeat in passing that Baker was by no means the first to propose that the birth of the Moon was involved in this disruptive process, for as we have seen, Professor Richard Owen of the University of Indiana was the earliest qualified writer to propose this direct association. And others subsequently were inspired by his suggestion to explore the idea further, including Suess. In fact, in 1900 Emmerson made the following statement:

I had expected that Suess' promised fourth volume would be an expansion of Mr. Osmond Fisher's brilliant chapter explaining that the Pacific scar where the Moon was torn off according to [Sir George] Darwin's hypothesis; the Atlantic and Indian Oceans as the fissures left when Australia and the Americas floated out towards the chasm; and the mountain chains about the Pacific as the last inflowing of earth matter to heal the scars as wood grows in around a pruned branch.⁶⁹

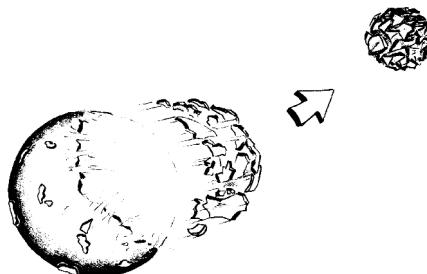


Fig. 14. A highly imaginative picture of the moment of disruption, when the earth lost part of its shell. The fragments drawing together in space compacted together to form the Moon.

68. Baker, Howard T., *ibid.*, p.83.

69. Emmerson, B. K., "The Tetrahedral Earth and Zone of Intercontinental Seas," *Bulletin of the Geological Society of America*, vol.2, Mar., 1900, p.61 ff.

It should be said that the molten condition of the basalt in the scar would at first not permit the accumulation of any water: it would be turned instantly to steam and being mixed with all kinds of debris would become like a black swaddling band for the whole earth. The darkness which followed the blowing up of Krakatao would be intensified a thousand times and deep night would settle over the globe. The waters which had originally laid upon the surface of the earth, and which we shall have occasion to examine subsequently, would, in due time condense once more, fall back upon the earth, and pour off into the one huge cavity formerly occupied by the missing crust.

Although the date of this disruption has always been set way back in geological time, by some in the Jurassic, and by one or two bold spirits as late as the Miocene, I am proposing subsequently that the event was even more recent, that it was in fact the cause of the great Ice Age and therefore occurred recently enough to have some bearing on that strange phenomenon — the finding of mammoths literally frozen in their tracks and with food still in their mouths. In view of Baker's supposition that it could have been a summer event, I think it conceivable that there is evidence for the rightness of this assumption in the mouths and stomachs of these mammoths.

The thickness of the granite crust has been variously estimated. Joly considered it to be about 31 kilometers or 19 miles approximately.⁷⁰ There is some evidence that this is on the low side, and according to Gamow the upper crust of the earth may very well be from 50 to 100 kilometers thick or approximately 31 to 62 miles in depth. This makes calculation of the total mass of granite disappearing from the earth very difficult. However, if the figure of 30 miles is taken as the starting point and if the total area of continental granite remaining is subtracted from a hypothetical crust completely surrounding the globe, an estimate can be made which gives approximately the following figures. The original complete shell was composed of 27,000,000,000 cu. km. The crust which remains is found to total approximately 8,100,000,000 leaving a volume which has disappeared equal to 18,900,000,000 cu. km. If this total is then converted into a sphere, the latter is found to have a diameter of 3,304 km. which, in turn, gives us a diameter for the sphere of 1983 miles. The actual diameter of the moon is slightly in excess of this, being 2160 miles. Considering all the unknowns and approximations involved

70. Joly, John, *The Surface of the Earth*, Oxford, 1925, p.52.

in this calculation, not too much value can be attached to it, yet it does indicate that the Moon contains probably sufficient material which if it should be made largely of granite, could supply what the earth now lacks to complete its outer shell.

The specific gravity of granite is usually given as between 2.6 and 2.7, and once again, according to Gamow, whereas the mean density of the earth is about 5.5, the mean density of the Moon is about 3.3. While this is obviously not identical with the figure of 2.7 for granite, it does appear that in contrast to the earth, as Gamow has put it, "our Moon must be of stony structure throughout its entire body,"⁷¹ i.e., it has no iron core.

There is also evidence not only that the Moon was formed 'cold' but also that its structure is loose enough that some measure of compaction is still taking place with the result that one authority, J. E. Spurr, has written a volume devoted to a study of the changing features of our "Shrunken Moon."⁷² Moreover, he wrote that many of the observed apparent structural changes imply an actual reduction of the total volume of the Moon, as though it were falling together, compacting itself. The significance of this is, as he points out, that the axial rotation of such a body might lead to a shortening of the distance between the poles but would probably be matched by an expansion of the equator. What is actually happening is an apparent shrinkage at the equator also. He concludes, "that the substance of the Moon did not remain the same, but shrank: that the earlier Moon (i.e., at the beginning of history) was more diffuse, so that it bulked together larger as to all its diameters."⁷³ Or to put it in a slightly different form as Garrett Serviss has written:

The separation being once effected, the materials that had escaped gradually assumed a globular form under the influence of the gravitation of its own particles; and, at the same time, by virtue of a curious reaction of the tidal attraction of two bodies upon each other, the newborn globe was slowly forced away from its mother earth, becoming in fact its satellite. Thus by a process which certainly does seem extravagantly imaginative, but which

71. Gamow, George, *The Biography of the Earth*, Pelican Mentor Books, New American Library, 1948, p.48.

72. Spurr, J. E., *The Shrunken Moon*, published privately, U.S.A, 1949, 207 pp., illustrated.

73. Spurr, J. E., *ibid.*, p.20.

nevertheless is approved by strict mathematical deduction from known physical facts the moon is believed to have had her birth.⁷⁴

According to Bonestell and Ley, W. H. Haas prepared a list of 22 changes on the Moon found during 1000 hours of observing time, which he was convinced were real:⁷⁵ and writing in the English Journal, *Nature*, J. J. Gilvarry quite recently observed in the same connection:

The evidence is strong that the Moon is not and never was in hydrostatic equilibrium, in view of its strongly triaxial shape. This shape reflects the strength of the component materials, and is consistent with a cold origin for the Moon.⁷⁶

What is meant by 'cold' in this context is that the Moon as a body did not come into being from some hot gaseous state. The importance of this is that the Earth could hardly have given "birth," as it were, to the Moon in any other than a cold form except at the very beginning when it, itself, was in a gaseous state. A 'cold' origin is therefore a 'late' origin.

There are a number of features about the Moon which make it a unique satellite. In the first place, its size relative to its parent body is, astronomically speaking, enormous. There are larger moons in the solar system but only when associated with very much larger planets than the Earth.⁷⁷ The Earth's mass is only 81 times that of the Moon whereas in all other cases the ratio of masses is of the order of several thousands: Saturn has 4000 times the mass of its satellite, Titan.⁷⁸ It seems that the Earth is quite unique in its possession of an associated body whose diameter is one quarter of its own.

Yet the mountains on the Moon are as high as those on the Earth, a circumstance which must be considered in the light of the fact that if similar mountains were found on the earth with a height comparable to

74. Serviss, Garrett, *The Story of the Moon*, Appleton, New York, 1928, p.6.

75. Bonestell, C. And Willey Ley, *The Conquest of Space*, Viking Press, New York, 1949, p.71.

76. Gilvarry, J. J., "The Origin of Ocean Basins and Continents," *Nature*, June 17, 1961, p.1049.

77. Gamow, George, *Biography of the Earth*, Pelican Mentor Books, New American Library, 1948, p.44.

78. Eddington, A. S., *The Nature of the Physical World*, Cambridge, 1930, p.171.

the Earth's greater diameter, such mountains would have to be four times the height that they are. If one can imagine looking up at an Everest rising into the sky to a height four times that it is in fact, then one may have some concept of how the mountains on the Moon must appear when set against the curvature of the Moon's surface and the sweep of the horizon.

Such extraordinary geological features (more properly, one should say selenological) might be expected to show up in unique ways on the Moon. For example, there is what is known as the Great Wall which is somewhere between 60 and 75 miles long and except for one end, is perfectly straight. Its height ranges up to 1500 feet and it must be supposed a gigantic fault which is larger than any known on Earth. And once again, one must remember that 75 miles on the Moon's surface relative to its curvature would be the equivalent of some 300 miles on Earth. Such a fault as this, to my mind, would indicate that the Moon may very basically be composed of huge chunks of granite which have tumbled together into a mass, assuming spherical form under gravitational forces simply because it is made of fragments, and smoothed off on its surface by the steady breaking down of the rocks into a "sand" as a consequence of the very great temperature fluctuations occurring at the surface as it revolves in the presence of the sun. According to Firsoff these temperatures fluctuate between -240° F. at midnight to 214° F. at midday, and this cycle is repeated every 24 hours.

Harold C. Urey has observed that "lunar mountains reach the elevation of 26,000 feet, but there is no evidence of folded formations of the kind produced by terrestrial mountain building processes."⁷⁹ And in the same connection, Firsoff speaks of even higher mountains:

In the south and also in the east, the visible hemisphere is edged by powerful mountains, of which the Liebnitz and the Doerfel Mountains near the south pole far surpass not only the lunar Apennines but even our Himalayas, attaining heights estimated to exceed 35,000 feet. These mountains, however, are rather different in character from the straight-forward Apennines. They form ranges indeed, especially the Leibnitz, but these ranges are

79. Urey, Harold C., *The Planets, Their Origin and Development*, Yale University Press, reviewed in *Scientific American*, Aug., 1952, p.68.

coincident with the walls of some large ring complexes of exceptional depth and steepness, which run in lines.⁸⁰

A particularly strong argument against the derivation of the Moon from the Earth, according to Harrison, is that failing the coincidence of a third body in the immediate neighbourhood, the ejected Moon would most likely fall back and in any event could not become a satellite of Earth.⁸¹ I'm not in any position to answer this objection satisfactorily except to observe that certainly the older writers who supported this thesis, and probably the more recent writers also, have all tended to take it for granted that there was indeed a "third body" in the immediate neighbourhood. This attractive force must have been just right to act upon the crust, lying as we have seen, 'loosely' on the substratum of basalt, in such a way as to draw it off from part of the surface and put it into orbit. The tidal force acting upon the Earth from the sun is only about three sevenths as great as that due to the Moon, so that prior to the Moon's formation, it does seem likely that the solar tide contributed very much to the birth of the Moon.⁸² Some much more powerful force seems called for in view of the assumption that the event took place only after the crust had solidified. As Gamow points out:

If the moon had been separated from the earth at a time when the latter was completely molten, the liquid would have immediately covered the site of the rupture, and no more trace would have been left on the body of our planet than there is on the surface of a well from which a bucket of water has been taken. But if at the time of rupture, the earth was already covered with a solid crust, the new-born satellite must have carried away a large section of this rocky crust, leaving a clearly visible scar.

A glance at a map of the earth's surface discloses such a scar in the deep basin of the Pacific Ocean...

We have already mentioned that the upper crust of the earth is a layer of granite from 50—200 km. thick resting on a much thicker layer of heavier basalt. This is true of all

80. Firsoff, V. A., *Strange World of the Moon*, Basic Books, New York, 1959, p.39.

81. Harrison, E. R., 'Origin of the Pacific Basin: A Meteorite Impact Hypothesis,' *Nature*, Dec. 24, 1960, p.1064 ff.

82. Joly, John, *The Surface History of the Earth*, Oxford, 1925, p.157.

the continents and also of parts of the Atlantic, Indian, and Arctic Oceans, where however the granite layer is considerably thinner. But the vast expanse of the Pacific is a striking exception...

It is, therefore, quite likely that the area now occupied by the Pacific is the very place where a huge bulk of matter now forming the Moon was torn away from the Earth.⁸³

It may be observed that prior to the removal of this huge chunk, the present waters of the globe must have been spread more or less uniformly over the Earth somewhat as shown in Fig. 15, in the form of shallow seas with many islands breaking the surface.⁸⁴ The excavation of the Pacific changed this situation radically. Although Eddington would not share our views, he nevertheless pointed out:

Evidently this cavity (occupied by the Pacific Ocean) fulfils an important function in drawing away superfluous water, and if it were filled up, practically all the continental area would be submerged. Thus indirectly the existence of dry land is bound up with the existence of the Moon.⁸⁵

In this process great canyons were carved out at the shelves of the continents until finally the water rose high enough to submerge them and bring further excavation to a halt.

William P. Pickering of Harvard in 1907 wrote an article entitled, "The Place of Origin of the Moon," in which he elaborated his theory in some detail, suggesting that at one time the earth revolved on its axis not once in 24 hours as now but once every three hours or even less.⁸⁶ This greatly increased the tendency of portions of its surface to fly away

83. Gamow, George, *Biography of the Earth*, Pelican Mentor Books, New American Library, 1948, p.56 ff.

84. Baker observed that the evidence suggests deep sea fishes are derived from shallow water fishes and lack archaic features, indicating perhaps either that there were no deep seas previously, or as a less likely alternative, the deep seas contained no deep water fishes.[see his *The Atlantic Rift and Its Meaning*, published privately, 1932, p.231].

85. Eddington, A. S., *The Nature of the Physical World*, Cambridge, 1930, p.171.

86. Pickering, William H., "The Place of Origin of the Moon," *Scottish Geographic Magazine*, Oct. 1907. Also *The Moon*, Doubleday, Page & Co., New York, 1903, p.4-7.

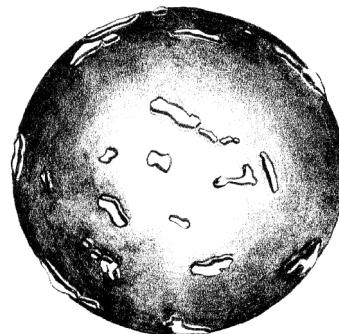


Fig. 15. A shallow-sea world dotted with small islands such as would result in the absence of deep Ocean beds.

by centrifugal force. The birth of the Moon from a tidal bulge so formed might require very little other assistance. However, he sees this as occurring *before* the earth had reached the solid state it now has. His reconstruction of events is interesting from our point of view, however, to the extent that he believed that in no other way than the derivation of the Moon from the Earth could one account for the fact that the Moon presents a constant face towards us. Indeed he calculated that "a body of the size of the Moon would equal in volume a section of the earth's crust having an area equal to the terrestrial oceans and a uniform depth of 35 miles."

However, it seems more in keeping with the evidence to view the birth of the Moon as having taken place long after the earth's crust had become solid. The face of the Earth was changed and became more nearly what it now is with an enormously increased area upon which Man was to plant his feet in dominion.



Chapter 4

THE TIME AND MOTIVE FORCE FOR DRIFT

The question now arises, How long ago did this take place? So long as the event was set back in very early geological times, there was not too much criticism of it—as an interesting theory, of course. It still smacked of catastrophism and was suspect therefore, but when Sir George Darwin attempted to show mathematically that the Moon might have been born of the earth when the latter was in a kind of semi-fluid state, astronomers were intrigued.⁸⁷ A kind of super tidal bulge had been raised from the earth and pulled clear to form the Moon which therefore had neither a cold nor a hot origin, but something in between.

But objections began to arise when people suggested tentatively that the earth's crust had already become solid when the Moon was born, so that the scar of the fracture has a very well defined form. Nevertheless the event was still cast back into at least Jurassic times. Du Toit is of the opinion that whereas the break-up of the remaining crustal mass into existing continents began in the Jurassic, it was really only completed in Tertiary times.⁸⁸

Some bolder spirits have argued that the whole event is even more recent than Jurassic. Their hypothesis is in a sense 'shocking' to most geologists: yet, they have been able to point to a considerable body of strong evidence. Professor S. K. Runcorn disagrees with such a view but he observes:

87. Darwin, Sir George, "Problems Connected With the Tides of a Viscous Spheroid," *Philosophical Transactions of the Royal Society*, London, vol.11, 1879, p.539-95. See also: "On the Possession of a Viscous Spheroid and on the Remote History of the Earth," *Philosophical Transactions of the Royal Society*, vol.11, 1879, p.447-538.

88. Du Toit, A. L., *Our Wandering Continents: An Hypothesis of Continental Drifting*, Oliver & Boyd, Edinburgh, 1957, p. 19, 99, 203.

Opponents of Continental Drift have commonly made two criticisms of the hypothesis which they have evidently felt to be weighty: first, that it was difficult to believe that if Continental Drift had taken place it had occurred so late in geological history, and secondly, that no tenable dynamic theory of Continental Drift had been proposed since the hypothesis was first put forward. These points are certainly not arguments against studying the evidence for Continental Drift seriously; no one in the past few centuries had disbelieved in the existence of the earth's magnetic field in spite of there being no theory of it. Nevertheless, it is desirable to know whether our present geophysical knowledge of the earth's interior can be modified to admit of large continental displacements so recently.⁸⁹

Runcorn then shows that his argument is not against Continental Drift itself which he accepts as a sound theory but with former views with respect to its recency and its cause.⁹⁰ Let us consider some of the evidence for the recency of the event, an event which visualizes a world which before had no ocean deeps and a world in which afterwards the Pacific Ocean had come into being almost in a moment of time.

Part of the evidence for the youthfulness of the Pacific Ocean has resulted unexpectedly from the studies of ocean floor sediments. Gordon Lill, Head of the Geophysics Branch of the United States Office of Naval Research in Washington, stated the matter this way:

Another problem is why do we find but an average of one thousand feet of sediments in the ocean? If the deep ocean basins have always been one of the gross features of the earth's surface, then at the observed sedimentation rates we should find the sediments to be many times thicker than they actually are. The question is, what happened to the ancient sediments?⁹¹

89. Runcorn, S. K., "Towards a Theory of Continental Drift," *Nature*, Jan. 27, 1962, p. 311.

90. See R. W. Girdler, "Initiation of Continental Drift," *Nature*, May 12, 1962, p. 521 ff., wherein the motive force is proposed as being convective currents in the subcrustal layers.

91. Lill, G. G., "The Deep Hole" *Discovery*, Feb., 1960, p. 62.

A few years prior to this, the New York Times Service had reported from Liverpool, England, that "scientists at Scripps have also investigated the relatively thin (600 ft.) deposits of oceanic ooze of sedimentary red clay in the Pacific. If this telltale geological time scale material has been uniformly deposited since the world began (or since the Ocean was 'created') about 300,000,000,000 years ago, it would now be about four or five thousand feet thick."⁹² In other words, there is not enough sediment to support any very great antiquity for the Pacific Ocean.

Furthermore, if (as has been suggested) the drift of the Americas into the Pacific was responsible for the mountain chains which characterize their leading edge from north to south, then these mountain chains ought also to show evidence of youthfulness. This was remarked upon by Charles Darwin in South America although he did not have any theory of Continental Drift in mind. As Romer says:

Under the essentially stable conditions of the mature topography of Great Britain, geological processes tended to be thought of as events in the past, which have little to do with the settled world of today Darwin found geology boring.

Far different was the picture presented along the coasts of Chile and Patagonia, where several years of the Beagle's voyage were spent. The rise of the great chain of the Andes is, geologically, a recent occurrence. Time after time Darwin notes in his diary the presence of raised beaches, far above the present ocean level but so fresh in appearance that the time since their formation can be estimated, at the most, in thousands rather than millions of years. Here is a major event that is not, so to speak, dead and buried, but belongs to the present as much as to the past.⁹³

According to du Toit, the great upheaval of the Andean and adjacent coastal regions with local folds and the building up of the giant volcanic cones, accompanied by strong climatic changes, took place in

92. A report from Liverpool, England, by New York Times Services, Sept. 7, 1953.

93. Romer, Alfred S., "Darwin and the Fossil Record" in *A Century of Darwin*, edited by S. A. Barnett, Heinemann, London, 1958, p.130, 131.

the Pleistocene.⁹⁴ Baur considered that the Pacific Ocean was probably of Tertiary date, and that Africa and America were still joined up to the end of the Miocene⁹⁵—in which case the Atlantic Ocean should show signs of even greater youthfulness than the Pacific. Gregory, Baker, and Stille all emphasize the youthfulness of the Mid-Atlantic Range,⁹⁶ just as we might expect if this structural feature does indeed represent the debris left by the parting of the Old and the New Worlds.

If these events are associated with the great Ice Age, as we hope to show they probably were, then we may gauge the time setting to some extent by studying the datings which have been thus far obtained of materials directly associated with this period of intense cold. This is particularly true for age determinations by radiocarbon dating methods of remains of mammoths known for very many years from Siberia and other northern lands.⁹⁷ We shall have more to say about these giants in the next chapter. But it may be sufficient to state here that Carbon 14 datings of about 10,000 years have been found for some of them, and there is every reason to believe that all which have been found thus far died at the same time. Hapgood observes in this connection not only that the retreat of the great continental ice cap must have begun somewhere about 8000 B.C. but that it can have taken very little more than two or three thousand years to complete its retreat.⁹⁸ At any rate, the death of these frozen mammoths sets the time of the coming of some very great change in the earth's climatic conditions. Since vehement objections were raised to the reduction of the time of this catastrophic disruption of the world from the Jurassic to the Tertiary, no doubt words will fail those who read the implications here, i.e., that these events may be even more recent than the Tertiary, indeed almost on the doorstep of man's creation!

I am not competent to judge the value of the following observations which appeared in a somewhat new Journal, but if there is any truth in

94. Du Toit, A. L., *Our Wandering Continents: An Hypothesis of Continental Drifting*, Oliver & Boyd, Edinburgh, 1957, p.198.

95. Bauer, G., "New Observations on the Origin of the Galapagos Islands, With Remarks on the Geological Age of the Pacific Ocean," *American Naturalist*, vol.31, 1897, p.661-680.

96. On this see, du Toit, A. L., *Our Wandering Continents: An Hypothesis of Continental Drifting*, Oliver & Boyd, Edinburgh, 1957, p. 216.

97. Sanderson, Ivan T., "Riddle of the Frozen Giants," *Saturday Evening Post*, Jan.16, 1960, p.82.

98. Hapgood, C. H. And J. H. Campbell, *Earth's Shifting Crust*, Pantheon Books, New York, 1958, p.46.

them then even fifteen or twenty thousand years may be excessive. For it is here stated that "a Dutch engineer and geologist, Dr. A. W. Bijvanck, Professor at the University of Leiden, carried out extensive soundings off the Dutch coast and proved that the English Channel and *most of the North Sea* (italics theirs) were formed in 5000 B.C."⁹⁹ Reference is then made to a book published by Bijvanck in Leiden in 1946 titled, *De voorgeschiedenis van Nederland*, with particular reference made to pages 26-33.

The article observes:

But the above fact in turn means that the Atlantic Ocean did not break through the then non-existent English Channel until about 5000 B.C., and that the Doggerbank of the North Sea was not flooded by the sea until this date. But since on the Doggerbank there was found, on the sea-bottom, peat from the end of the Pleistocene, together with the remains of late Pleistocene animals, such as the mammoth, the elk, the reindeer, the cave-bear, etc., we thus have positive proof that the Upper Pleistocene came to an abrupt end in about 5000 B.C.

In the Pinhole Cave (Cresswell Crags, Hallamshire, Eastern England) numerous skeletal remains of lemmings have been found. (See Harold Armitage, *Early Man in Hallamshire*, London, 1939, p.86). This proves that the lemmings whose native country was and is Scandinavia, travelled from thence to England when they had only to swim across the river that separated the two regions in Upper Paleolithic times. There was no North Sea at that time. Nowadays the Scandinavian lemmings still enter the North Sea every few years and swim towards England. But, as the Atlantic Ocean opened and broke through the English Channel and then formed the North Sea which is immensely wider than the river which was formerly in its place, the poor lemmings are now forced to swim and swim until they become exhausted and drown long before they have even made half the trip to England.

99. A. W. Bijvanck: quoted by Dr. Alan H. Kelso de Montingny in an article entitled "Redating the Past" in *International Anthropology and Linguistics Review*, vol.1, 1953, p.188.

If these observations, as we have said, carry any weight, they would surely seem to indicate that the breakup of continental fragments, at least in the northern hemisphere, occurred virtually within the historic period. It would imply that at least the northern end of the Atlantic Rift has come into existence so recently that it might become necessary to re-examine with a more open mind the quite extensive traditions which seem clearly to refer to a circumstance of this kind. Some of the earliest wanderers reaching the coast of Africa or of Spain or of Ireland might indeed have actually seen, across a 'narrow strait', the land masses which were the Americas. Returning from their voyaging they left their records for their children who long afterwards, once more visiting the same areas, now found the distant lands had gone—for within a few centuries the continents might have moved beyond the horizon. To them they had disappeared into the sea

Perhaps it was at this time that there arose the story of the lost Island of Atlantis which disappeared beyond the Pillars of Hercules off the coast of Spain. There is, too, the legend of Avalon of the Welsh, and the Portuguese likewise have a record of an Island of Seven Cities that disappeared. Perhaps there never were any cities but imagination had peopled a drifting continent. It may very well be an absurd speculation, but if one remembers that, according to the theory of Continent Drift, Australia was once not very far removed from South America, the unmistakable evidence of Australoid types in prehistoric South America might be evidence that people did indeed reach the Americas before 'the earth was divided.' Moreover, it is surely a curious circumstance that, apart from the Navajos, the only other people who produced what are called sand paintings are the Australian aborigines. This may, of course, be merely the result of a similar environment which acted upon like minds who saw in the abundance of coloured sand, available all around, the materials for graphic art. At any rate, if one is permitted to ignore problems of timing (problems only too apparent to those geologically competent) all these things would seem to point in the same direction.

Furthermore, some of these crustal movements are reflected, as we have seen, in East Africa where a rift led to the formation of the Red Sea, and this rift can be traced right through the Isthmus of Corinth. The rift has also been traced up the Jordan Valley, and the Dead Sea forms a prominent feature in it. Whether Peleg was living in that part of the world when these fissures became more pronounced and when the seas

broke in to divide the earth of his acquaintance in a new way or not, is a matter of conjecture; but the strange little note in conjunction with this man's name as given in Genesis 10:25 is surely of some significance. And it should be remembered that the word 'Peleg' became associated with parts of the Mediterranean which were known in due time as the Archipelago, i.e., the first sea, the Greek word, *pelagos* meaning 'sea.'

It should also be noted with respect to the mythical Atlantis that the second edition of H. E. Forrest's, *The Atlantean Continent* (London, 1935, p.352), contains some striking evidence of surprising geographical changes which can be shown to have taken place during and since Pleistocene times. And one further little note *a propos* of this: the word *Avalon* means *applegreen land* — which certainly makes one think of one large fragment since displaced from the neighbourhood of Wales, namely, Greenland. It seems difficult to account for its name in its present condition!

Runcorn raised a second objection to the concept of Continental Drift, namely, the dynamics involved in the movement of such vast masses of crustal materials. On this point, Joly has something to say, for his researches into the radioactivity of the basaltic substratum upon which the continents 'float' may well be able to provide the 'lubricant' which reduced the frictional resistance to movement of the crust thereby allowing the latter to respond to the forces that were available which will be discussed in a few moments.

Considering, then, the problem of resistance to movement of the fragments, Joly believed that the geographical distribution of land and water on the surface of the globe "reveals no features which we can identify as determined by its axial rotation. This appears strange for its axial velocity is great enough to affect the shape of the globe itself. And it is known that a feeble force does in fact urge the continents towards the equator."¹⁰⁰

These centrifugal forces cannot therefore throw much light on the movements of the Americas in an almost due westerly direction, Australia almost due east, and Antarctica *away* from the equator. Moreover, Joly recognizes very clearly many evidences of tension upon the continents, particularly in east Africa whose rift valleys we have already considered.¹⁰¹ Some force seems to be necessary which acts not

100. Joly, John, *The Surface History of the Earth*, Oxford, 1925, p.20.

101. Joly, John, *ibid.*, p.25.

so much to push the continents from behind as to shift them throughout their whole mass, causing only a crumpling at the leading edge. Such a force would be available if we assume that when the large crustal section was removed, the earth became unbalanced dynamically with a consequent shift of the axis of rotation so that the poles were possibly at an angle of 45° with respect to the earth's plane of orbiting around the sun. The difference between the specific gravity of the granite crustal mass (2.7) which was concentrated on one side of the globe, and the great body of water with a specific gravity of unity on the other side, would probably be sufficient to cause a wobble. This wobble might be severe at first and poetically could be described as a "moving of the pillars (poles) of the earth" (Job 9:6). Such a body as the earth revolving with an equatorial speed of approximately 1000 m.p.h. would presumably set at work forces tending to re-distribute the unbalanced load (water verus granite) and would result in the fragmentation of the latter and its subsequent shifting into new positions. At first the drift might be rapid, provided the substratum was in the right condition to permit such movement.

In the course of time, however, two factors would conspire to slow this movement and eventually bring it to a virtual halt. One factor would be increasing solidification of the basaltic substratum, and the other factor would be the gradual achievement of dynamic equilibrium—reducing the available forces causing redistribution.

Can we trace the condition of the substratum and is there any justification for believing it may have had a recent history which would allow us to have any confidence in the above reconstruction? Joly has some words to say about this. After explaining his reasons for believing that the substratum is "now much in the condition of recently solidified molten basalt,"¹⁰² he goes on to show how the continental crust transmits heat to the surface which is mainly derived from its own radioactivity. But what of the heat accumulating in the basalt beneath it? Joly puts it this way:

A further and obvious deduction from our results is that the substratum beneath the continents must now be accumulating its own radioactive heat. For, otherwise, where is it to go? There is no evading the conclusion. It cannot be passing upwards to the terrestrial surface, for

102. Joly, John, *ibid.*, p.73.

the continental radioactive heat accounts for all that is escaping at the surface. Slowly throughout the passing ages, the heat derived from the disintegrating atoms (chiefly uranium and thorium) has been accumulating in the substratum...

At the present time the substratum is in a solid state: and, as it cannot appreciably lose heat by conductivity through the continents and only to a very limited extent and very slowly by conductivity to the oceans the radioactive heat continuously evolved throughout its mass must accumulate in its entirety.¹⁰³

He re-states this subsequently and then seeks to show that there must have come a time which was not very long ago, geologically speaking, when the substratum had actually become fluid while the overlaid granite remained solid. Such a condition allowed two things to take place: first, part of the crust could be lifted away, and second, the remainder of the crust was free to shift its position because it was in fact floating.

Let me try to reconstruct what transpired when this global catastrophe took place. "The world that then was" (2 Peter 3:6) before the "disruption" is to be viewed as a globe covered by a kind of universal sea of very shallow depth since all the present ocean waters were spread widely over the surface and had not yet been "gathered into one place" (Genesis 1:9). The crust itself was likewise comparatively smooth, with no very great deeps and perhaps no very great mountain chains either. Here and there irregularities in the crust pierced the shallow sea to form islands, ideal places for the proliferation of varieties of plant and animal life. Such islands would constantly rise and fall diastrophically, changing their shape and area, so that the earth was indeed "standing in and out of water" (2 Peter 3:5) – a beautifully descriptive phrase for the situation.

But suddenly all this was changed. Some undetermined cause led to the breaking away of part of the crust. The waters of the shallow seas poured into the depression left by the missing shell, and turned instantly to steam upon contact with the molten basalt. This steam was at once carried high into the air laden with dust and other particles by the rising heat from the scar. It quickly blanketed the earth upon

103. Joly, John, *ibid.*, p.75 and 89.

reaching the upper atmosphere with a "swaddling band of darkness" (Job 38:9), and shielded the heat of the sun from the earth so that the climate was changed almost at once and intense cold seized upon the earth. One commonly experiences the sudden chill of a cloud shadowing the sun on a warm day. The eruption of Katmai in Alaska in 1912 is estimated to have shut off 20% of the sun's radiant heat from the whole earth.¹⁰⁴ If a single volcanic eruption could do this, what would be the effect of a global cataclysm such as is here visualized? The rising steam condensed rapidly in the atmosphere and fell back in fantastic deluges upon the earth, first as rain, then as hail and snow. Within a matter of hours, great parts of the earth were plunged into the Ice Age. Some parts of the world, as Baker pointed out, may very well have suffered comparatively slight damage, especially if they had not been at the time beneath the waters of the former universal shallow sea. Much of the fauna and flora might survive, even though the climate had changed fundamentally and for a season direct sunlight was absent. How long this condition may have lasted, there is no way of knowing but it need not have been very long.

In due time, the blanket slowly thinned and the long night broke into the beginnings of a new day. Enough heat from the sun now reached the surface of the earth through its enshrouding mists to melt the snow and ice and return their waters into the one great depression so that dry land appeared in an entirely new way—a continent, in fact, was born. Some of the heat still resident in the basalt substratum was lost to the accumulating waters, an event which would lead one to suppose, perhaps, that in this circumstance we might possess a source of climatic change from the warming of the oceans. But, as Joly says, "It is not so. It can be readily shown that at no time, and under no possible assumptions as to the rate of the thermal discharge would there be any appreciable warming of the oceans."¹⁰⁵

The behaviour of basalt when it cools is quite remarkable. W. L. Green states that he has seen lava pouring down a hillside reaching a stream of water and so quickly solidifying at the point of contact with the water that it actually built its own bridge across the surface of it and

104. Katmai: C. H. Hapgood, "The Mystery of the Frozen Mammoths," *Coronet*, Sept. 1960, p.78 quoting W. J. Humphries.

105. Joly, John, *The Surface History of the Earth*, Oxford, 1925, p.98.

continued on its way on the other side.¹⁰⁶ Only a very shallow skin solidified in contact with the water to form this bridge. In laboratory experiments Joly was able to show that if basalt is melted, granite will float easily upon it, or as he puts it, "it floats with a good free-board, and appears to preserve its buoyancy indefinitely."¹⁰⁷ Lord Kelvin estimated that a very large bed of molten basalt would form a solid crust of two or three feet thick within a few hours which would preserve what lay below it for a very long time in a semi-fluid condition.¹⁰⁸

Thus the waters accumulating in their new ocean bed would neither be warmed very greatly nor would they so solidify the substratum that the remaining crustal mass would be prevented from shifting its position and being dispersed if it were once fragmented. For some time, perhaps two or three thousand years, these fragments would still have considerable freedom of movement. As a very crude indication of the forces at work upon such fragments lying near the equator, Gamow makes this observation:

The total force acting upon Manhattan Island, for example, can be compared with the pull exerted by 5000 transatlantic liners as big as the Queen Elizabeth tied up to the shore along the Battery Park embankment and steaming at full speed.¹⁰⁹

He observes that when the continents were still floating upon the ocean of molten basalt, such forces would be able to move them in an endeavour to distribute them uniformly along the equator, i.e., around the globe. He also adds that the motion produced by these forces must necessarily have been very complicated owing to the irregular shape of the fragments. He concludes:

106. Green, W. L. "Vestiges of the Molten Globe, as Exhibited in the Figure of the Earth's Volcanic Action and Physiography," Part 1, London [quoted by Howard E. Baker, *The Atlantic Rift and Its Meaning*, published privately, 1932, p.161].

107. Joly, John, *The Surface History of the Earth*, Oxford, 1925, p.54.

108. Lord Kelvin: quoted by Howard E. Baker in his *The Atlantic Rift and Its Meaning*, privately published, 1932, p.181.

109. Gamow, George, *Biography of the Earth*, Pelican Mentor Books, New American Library, 1948, p.111.

It is clear, however, that the first effect of these forces must have been to separate the fragmented pieces of the crust from one another, and to enlarge the cracks already existing between them.¹¹⁰

As we have already suggested, the break-up of what remained of the crust may have taken several thousand years and indeed been witnessed in part by man himself.



110. Gamow, George, *ibid.* p.111.

Chapter 5

THE COMING OF THE GREAT COLD

We now turn to some consideration of the evidence which exists for a climatic change which, in some parts of the world, must have been unbelievably sudden. This evidence has always been difficult for modern uniformitarian geological concepts to integrate successfully.

It is always a matter of some surprise to me that the discovery of a frozen mammoth in Siberia, with the flesh still fresh enough that dogs may eat it, is a topic of almost front-page news. The fact is that these giants, in some way killed instantly by the icy fingers of sudden cold, have been known in very large numbers and for many, many years. Various societies have reported them for at least one hundred years, and the ivory of their tusks was for a very long time a fruitful source of income to traders who transported them into Europe for billiard balls and other such uses.

But sudden death of this kind was not limited to mammoths by any means. Abarbanel and McClusky in an article entitled, "Is the World Getting Warmer?", observed a few years ago that the past is punctuated with mysteries like these. As they put it:

What caused the terrific cold to pour over the once tropically hot north polar region with such speed that rhinoceroses and mammoths literally froze in mid-stride. In the Yukon region alone, the perfectly preserved carcasses of several rhinoceroses and more than a score of mammoths – fresh enough to be eaten by animals – have

been dug out of the paleolithic ice, while many such discoveries have been reported from Siberia.¹¹¹

One great authority on these frozen animals was Sir Henry Howorth. Although his interpretation of the evidence was completely rejected by geologists towards the end of the last century so that the vast amount of data he gathered is not nearly so widely known as it should be, his works still remain a vital source of information. In his book, *The Mammoth and the Flood*, he wrote:

In the first place, it is almost certain in my opinion that a very great cataclysm or catastrophe occurred... by which the mammoth with his companions was overwhelmed over a very large part of the earth's surface. The catastrophe, secondly, involved a widespread flood of waters which not only killed the animals but also buried them under continuous beds of loam or gravel. Thirdly, that the same catastrophe was accompanied by a very sudden change of climate in Siberia, by which the animals had previously lived in fairly temperate conditions were frozen in their flesh under the ground and have remained there ever since.

When the facts are stated they are of such a nature as to be almost incredible and they are drawn from the works of such men as Wrangall, Strahlenberg, Witzen, Muller, Klaphroth, Avril, Erman, Hedenstrom, Betuschef, Bregne, Gemlin, Brandt, Antermony, Liachof, Kusholof, Chamisso, Maljuschkin, Ides, Baer, Schmidt, Bell, Tatishof, Middendorf, von Schrenck, Olders, Laptev, Sarytschef, Motschulsky, Schtscukin, Maydell, besides the official documents of the Russian Government.¹¹²

One of the rivers of Siberia which empties into the Arctic is the Yenessei. Concerning the buried animals revealed in the strata along the sides of this river, Howorth remarked:

111. Abarbanel, A. and T. McClusky, "Is the World Getting Warmer?", *Saturday Evening Post*, July 1, 1950.

112. Howorth, Sir Henry, *The Mammoths and the Flood: Confronting the Theory of Uniformity with the Facts of Geology*, London, 1887, p.47.

Pallas reports that the mammoth bones which fall out of the cliffs are so numerous that on decomposing they form a substance called 'osteocolli' or 'bone glue.' The next great river eastward towards Alaska, emptying into the Arctic, is the Lena. It is a vast stream which consists of twists and turns, making a course of over 2000 miles. The natives who live in the regions of the Lena river make a living travelling up and down the river in boats, gathering up the ivory tusks that they see sticking out of cliffs along the river banks and which they find fallen to the edge of the water.¹¹³

The number of animals that are buried in Siberia must be stupendous. Some conception can be obtained from the fact that since 900 A.D. men have made it a business to collect the ivory of the region and sell it in China, Arabia, and Europe. In one case where a record was secured Lyddeker stated that in a period of twenty years tusks from at least 20,000 animals were taken from Siberian mines to markets in Europe during the nineteenth century.¹¹⁴ Howorth reported what has since been confirmed many times that the contents of the stomachs of these giants had been examined carefully, and they showed the undigested food to be composed of leaves of trees now found in Southern Siberia.¹¹⁵ Microscopic examination of the skins of some of these animals has since revealed red blood corpuscles which are considered to be proof not only of sudden death but that the death was due to suffocation either by gas or water.¹¹⁶ One particular animal with an undigested meal still in its stomach showed that it had been eating buttercups, sedges, grasses, the beans of wild oxytropis, and young shoots of fir and pine. In 1901 an expedition to Kolomysk was made by some Russian scientists to convey to St. Petersburg a particularly fine

113. Howorth, Sir Henry, *ibid.*, p.54.

114. Lydekker, Richard, *Smithsonian Institute Annual Report*, 1899, p.361-366.

115. Undigested food: see Lyell, *Principles of Geology*, London, Murray, vol.1, p.183, quoting a letter to Humboldt from Prof. Brandt of St. Petersburg. Also *Scientific American*, Aug., 1901, for a similar observation, and *Scientific American*, Sept., 1951, p.164.

116. Death by suffocation: first remarked upon by Prof. Brandt in 1846 in *The Proceedings of the Berlin Academy*, p.223.

specimen with hair, skin and flesh perfectly preserved – which also had the remains of undigested food in its stomach.¹¹⁷

Perhaps no one single discovery can ever quite convey so strong an impression of the suddenness and immensity of the catastrophe as one reported first by Brandt, and subsequently accredited by others, in which three mammoth mummies were found *standing erect* and facing north. A similar discovery was made by Fisher of a single specimen in the same extraordinary attitude of arrested flight.

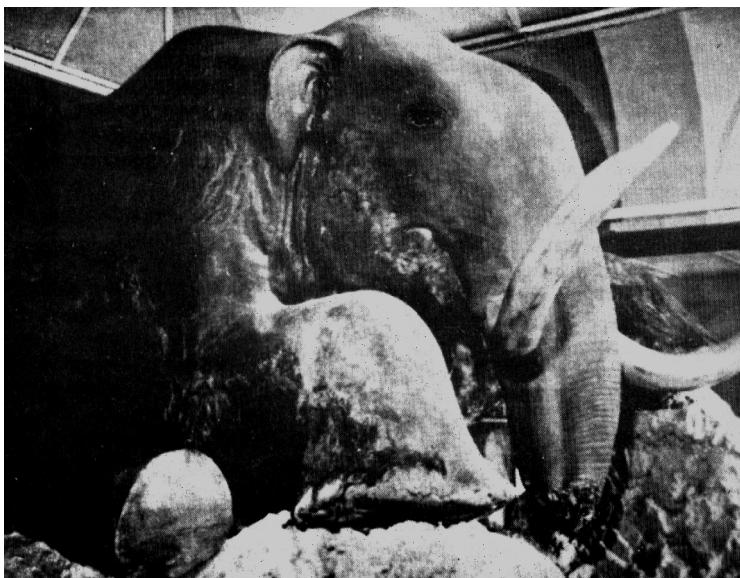


Fig. 16. A photograph of the Berezovka Mammoth displayed in the Zoological Museum, Leningrad, exactly as discovered. Only the skin of the face and the trunk were missing: the rest was intact.

117. Brandt: quoted by Howorth, *The Mastodons and the Flood: Confronting the Theory of Uniformity and the Facts of Geology*, London, Sampson Low, Marston, Searle, & Rivington, 1887, p.61.

We have mentioned the existence of rhinoceroses in a similar condition. In a letter to Baron Humboldt from the same Professor Brandt of St. Petersburg, particulars are given of a rhinoceros obtained by Pallas in 1772 from Wiljiusky (latitude 64°) from the banks of the Wiljiu, a tributary of the Lena. Brandt wrote concerning it:

I have been so fortunate as to extract from cavities in the molar teeth of the Wiljiu rhinoceros a small quantity of its half-chewed food, among which fragments of pine leaves, one half of the seed of a polygonaceous plant, and very minute portions of wood with porous cells or small fragments of coniferous wood were still recognizable. It was also remarkable on a close examination of the head, that the blood vessels discovered in the interior mass appeared to be filled, even to the capillary vessels, with a brown mass (coagulated blood) which in many places still showed the red colour of blood.¹¹⁸

Before considering similar animal cemeteries in other parts of the world, it might be well to point out that it is not a normal occurrence to find dead animals *anywhere*—except on our highways! For example, Baron Nordenskiold remarked:

In the first place I must call attention to the extreme rarity of the occurrence of the remains of animals which have recently died

During my nine expeditions in the Arctic regions, where animal life during summer is exceedingly abundant, I can recall very few occasions upon which I have found remains of vertebrate animals which could be proved to have died a natural death. Near hunting grounds there are seen, often enough, the remains of reindeer, seals, foxes or bears that have died from gunshot wounds, but no naturally dead polar bear, seals, walrus, white whale, fox, goose, auk, lemming or other vertebrates. The polar bear and the reindeer are found there in hundreds: the seal, walrus and white whale in thousands, and birds in millions. These animals must die a natural death in untold

118. Brandt: see Lyell, *Principles of Geology*, London, Murray, vol.1, p.183.

numbers. What becomes of their bodies? Of this we have for the present no idea . . .¹¹⁹

The only conclusion that one can draw from this is that the death of these hundreds of thousands of large animals was unnatural, and virtually simultaneous. How do we know it was simultaneous? Because as we shall see, similar vast cemeteries are found elsewhere in which the predators and the preyed upon died together and there is no evidence of the bones of any of the animals have been gnawed. The only difference between animal cemeteries in other parts of the world and those in Siberia is that the former were not preserved by refrigeration, and therefore appear rather as vast assemblages of bones. One section of such a bone cemetery is shown in Fig. 17.

Howorth has this to say about animal cemeteries:

The most obvious cause we can appeal to as occasionally producing mortality on a wide scale among animals is a murrain or pestilence, but what murrain or pestilence is so completely unbiased in its actions as to sweep away all forms of terrestrial life, even the very carriers of it—the rodents—including the fowls of the air, the beasts of the field, elephants, tigers, rhinoceroses, frogs, mice, bison and snakes, landsnails, and every conceivable form of life, and this not in one corner only but, as far as we know, over the whole of the two great continents irrespective of latitude or longitude.

The fact of the bones occurring in great caches or deposits in which various species are mixed pell-mell is very important, and it is a fact undenied by geologists that whenever we find such a locality in which animals have suffered together in a violent and instantaneous destruction, the bones are invariably mixed and, as it were, ‘deposited’ in a manner which could hardly be explained otherwise than by postulating the action of great tidal waves carrying

119. Nordenskiold, Baron N. A. E., *Voyage of the Vega*, vol.1, 1881, p.322, 323.



Fig. 17: Part of an animal cemetery, now in the Colorado Museum of Natural History. It contains bones of all kinds of animals, the site (Agate Springs) extending over a wide area.

fishes and all before them, depositing them far inland with no respect to order.¹²⁰

Such tidal waves might very well accompany the shocks which the earth must have sustained in the loss of part of its shell: and the subsequent run off of vast quantities of water into the newly excavated depression would contribute to the confusion. Howorth adds subsequently:

If animals die occasionally (in large numbers) from natural causes, different species do not come together to die nor does the lion come to take his last sleep with the lamb! The fact of finding masses of animal remains of mixed species all showing the same state of preservation, not only points to a more or less contemporary death, but is quite fatal to the theory that they ended their days peacefully and by purely natural means.

If they had been exposed to the air, and to the severe transition between mid-winter and mid-summer, which characterizes Arctic latitudes, the mammoths would have decayed rapidly. But their state of preservation proves that they were covered over and protected ever since.

This renowned but neglected authority¹²¹ concludes:

It is almost certain in my opinion that a very great cataclysm or catastrophe occurred by which the mammoth and his companions were overwhelmed over a very large part of the earth's surface. And that the same catastrophe was accompanied by a very great and sudden change of climate in Siberia, by which the animals which had previously lived in fairly temperate conditions were frozen . . . and were never once thawed until the day of their

120. Howorth, Sir Henry, *The Mammoth and the Flood: Confronting the Theory of Uniformity with the Facts of Geology*, London, Sampson Low, Marston, Searle & Rivington, 1887, p.180 ff.

121. Howorth "neglected authority": for an extraordinary example of this kind of prejudice, see William R. Farrand, "Frozen Mammoths and Modern Geology," *Science*, vol.133, 1961, p.729 ff. What but prejudice would prevent at least a reference to Howorth's works?

discovery. No other theory will explain the perfect preservation of these great elephants.

From the Antarctic also there is evidence, according to geologists of the Byrd Expedition, of similarly different climatic conditions prior to this event.¹²² Great coal fields, evidence of luxuriant growth, were discovered at the head of Thorne Glacier in the Queen Maude Range within 200 miles of the South Pole. Such conditions so near to that frightful wilderness of ice and snow which is so much more terrible than the North Pole in its coldness and barrenness is remarkable witness to a previous world which must have been a very different one. So numerous are the fossils there that the explorers actually had difficulty making a selection! Today life in these regions is conspicuously . . . absent.

Evan Hopkins remarked that the fossil plants of north Greenland proved that the land has been favoured with a climate at least 30° F. warmer than at present.¹²³ He points out also that among the animals entombed in the deposits in Siberia besides the mammoths are bears, hippos, hyenas, lions, tigers, and others which can only live and flourish in or near the tropics. Moreover, the fossil forest at Atanekerdluk in a latitude of 70° is indicative of a temperature of at least 30° F. higher than is now found in that parallel. Similar conditions are likely to be found now in the 48° parallel, a fact which shows a shift of climate with respect to the equator.

In his *Journal of Researches* even Darwin became increasingly aware of the evidence of some mighty catastrophe having occurred in comparatively recent times. As he put it:

The mind is at first irresistibly hurried into the belief that some great catastrophe has occurred. Thus to destroy animals both large and small in South Patagonia, in Brazil, on the Cordillera of Peru, in North America up to the Behring Straits, we must shake the entire framework of the

122. Byrd Expedition: reported from Little America in the *Telegram*, Toronto, Canada, Dec. 13, 1933.

123. Hopkins, E., "On Terrestrial Changes, and the Probable Ages of the Continents," *Transactions of the Victoria Institute*, vol.2, 1867, p.4 and 8.

globe. Certainly no fact in the long history of the world is so startling as the wide extermination of its inhabitants.¹²⁴

Similarly the great geologist, Suess, referred to the same thing: "We admit that there is evidence of a geological catastrophe which must have been of such indescribable and overpowering violence that the imagination refuses to follow the understanding and complete the picture."¹²⁵

Benjamin Silliman of the Department of Geology in Yale over a century ago pointed out how whales, sharks, crocodiles, the mammoth and the elephant, rhinoceros, hippo, tigers, deer, horses, various species of the bovine family, and a multitude of others are found in strata laid by great movements of water at various depths. And he adds, "in most instances indicating by the circumstances of their burial that they were so buried by the same catastrophe which destroyed them."¹²⁶

Another contemporary of his, Granville Penn, wrote:

The great problem for geological theories to explain is that amazing phenomena, the mingling of the remains of animals of different species and climates, discovered in exhaustless quantities in the interior parts of the earth, so that the exuviae of those genera which no longer exist at all, are found confusedly mixed together in the soils of the most northerly latitudes . . . The bones of those animals which can live only in the torrid zone are buried in the frozen soil of the polar regions.¹²⁷

And to quote one more contemporary, George Fairholme, who described similar evidence in Italy from the Arno River Valley:

In the sandy matrix bones were found at every depth from that of a few feet to a hundred feet or more. From the large and more apparent bones of the elephant, the rhinoceros, the Megatherium, the elk, the buffalo, the stag,

124. Darwin, Charles, *Journal of Researches*, Ward, Locke, New York, 1845, p.178.

125. Suess, E., *The Face of the Earth*, Oxford, vol.1, 1904, p.17. Also vol.2, 1906, p.24 f.

126. Silliman, B., in *American Journal of Science*, vol.3, 1821, p.47 ff., vol.8, 1824, p.130 ff.

127. Penn, Granville, *A Comparative Estimate of the Mineral and Mosaical Geologies*, vol.2, 2nd. edition, London, 1825, p.81.

and so forth, naturalists were led by the elaborate studies of Cuvier and other comparative anatomists to the remains of the now living bear, tiger, wolf, hyena, rabbits, and finally the more minute remains even of the water rat and mouse. In some places so complete was the confusion that the bones of many different elephants were brought into contact, and on some of them even oyster shells were matted.¹²⁸

In the Harvard Museum a slab six feet by ten feet contains bones so thickly packed and in such confusion that there is every evidence of the action of violent forces. In the Colorado Museum of Natural History a similar geological exhibit is to be found taken from a cemetery at Agate Springs in which it is estimated that the bones of about 9000 complete animals are buried in one hill.¹²⁹

What has been said of land animals is equally true of fishes and even of plants. A few years ago Philip Le Riche presented a Paper before the Victoria Institute in London in which he made this statement:

It can easily be shown that many of the strata contain the fossil remains of fish which have been *suddenly* [his emphasis] interred before putrefaction had acted upon their fleshy bodies, for their bodies are preserved as they were during life. And this remarkable state of preservation of fish life is also found in the flora. For plants as fine as maidenhair ferns are found embedded in the strata with even their venules intact, showing that they must have been buried very shortly after their deposition in the sediment, otherwise they would have become converted into leaf mould and indistinguishable, whereas a botanist can place the fossil plant in its proper order of plant life.¹³⁰

The suddenness of this destruction is further strikingly borne out by the fact that the fossil cuttle fish of Lyme Regis have been killed and

128. Fairholme, George, *New and Conclusive Physical Demonstrations of the Fact and Period of the Mosaic Deluge*, London, T. Ridgeway & Sons, 1837 (page has been mislaid).

129. Animal Cemeteries: see also New York *World* reporting from Alaska, June 1, 1930. Also a further report by *Associated Press*, Apr. 16, 1949.

130. LeRiche, Philip, "Scientific Proofs of a Universal Deluge," *Transactions of the Victoria Institute*, vol. 41, 1929, p. 86.

entombed with such inconceivable rapidity that they still retain the dark fluid with which their ink bags are filled when alive.¹³¹ Yet these animals when disturbed release this protective device within a matter of seconds. And speaking of fish, Howorth even records a whale which was found entombed with the elephants, a discovery which Pallas confirmed — mentioning also buffalo *in situ* with the heads of large fishes.

In spite of the fact that many of these authorities would now be considered quite out of date so that their interpretations would almost certainly be rejected, the evidence itself remains undeniable, and it is difficult to explain it satisfactorily in any other way. In concluding this brief survey, and referring this time to accumulations of bones which were washed pell-mell into fissures and clefts in the rocks, one can reflect upon the words of the venerable Joseph Prestwich, affectionately styled the Father of the Geological Society. After speaking of such animal cemeteries and pointing out how the bones of carnivore are mixed indiscriminately with those of their natural prey, the bodies seeming to have been torn apart with violence, he sums up the situation by saying:

These bones cannot be of animals which fell into these fissures (where they are found in such profusion) for no skeleton is complete. They cannot have been brought by beasts of prey, for none are gnawed. They were not brought by streams (i.e., spring floods) for none are rolled. The bones could not have laid exposed for long, for none are weathered. They were not covered up normally, for they were broken by the violence of their deposition together with the associated rocks

The formation of these fissure deposits in so many places seems to confirm the belief that the rubble drift itself did not owe its origin to normal causes, but to something catastrophic in the nature of earth movements.¹³²

131. Cuttlefish of Lyme Regis: quoted by Byron C. Nelson, *The Deluge Story in Stone*, Minneapolis, Minn., Augsburg Publishing House, 1931, p.113.

132. Prestwich, J., in *Journal of the Geological Society*, vol.48, 1912, p.326.

Such, then, is the kind of evidence which is to be found all over the world of the sudden death of an enormous number of animals of very recent and modern times. Some of these creatures died in those latitudes which were almost at once plunged into an Ice Age which preserved them by freezing. Some of them died in more temperate zones and were accumulated by the action of torrents of water sweeping hither and yon as the earth reeled, before the waters had been sufficiently gathered together in one place to expose dry land. And, finally, some were accumulated and rammed together forcibly and indiscriminately into clefts in the rocks which served to sieve them out of the draining waters.

The suddenness of the event is everywhere attested, in the Arctic by the extraordinary state of preservation of mammoths and other creatures, and in the more temperate zones by the very fact that predators and preyed upon came to a sudden end together. Even within the waters the movements of silt and water-washed materials were sometimes so sudden and overwhelming that fishes were trapped before they even had a few seconds necessary to react in a characteristic defensive way. In fact, some bivalved forms were overwhelmed so rapidly that they did not have time to close.

Furthermore, we may conclude, I think, that the catastrophe which was worldwide profoundly affected world climate. There are some authorities who believe that the Ice Age is bound up with the sudden subsidence of the waters. The effect of this subsidence was greatly to increase the exposed land area. I am not competent to assess the mechanics of this hypothesis, but I do know that this apparent re-proportioning of land to sea cannot, as we have already seen, have resulted merely or even chiefly from the vast accumulation of ice over the land. It has been shown that if all the ice presently existing on land were to be returned to the sea the effect would be to raise the sea level by only a very small amount.

It has further been shown that even at the very height of the Ice Age the lowering of the sea level would be quite insufficient to account, for example, for the submerged river canyons. Yet these canyons can probably only be explained by assuming that when the waters were pouring off the continents into a reservoir, the level of water had not yet risen high enough to slow up the erosive effects of these tremendous rivers. It need hardly be pointed out that the world that then was prior to this catastrophe may very well have had a comparatively small land

surface, the rest being submerged by shallow seas: but when the rupture of the crust occurred, continents were exposed in a new way. Perhaps this shift in proportion of exposed land to sea area is in some way linked with the coming of the great Ice Age.

In a Paper presented in 1898 before the *Victoria Institute*, Professor Hull indicated the general consensus of opinion among both European and New World geologists that there was a close relationship between the increase in land area and the coming of the Ice Age, this increase occurring at or near the commencement of the glacial epoch.¹³³ In 1906 before the same Institute, Howorth refers to the same fact that "if we could secure a sufficiently elevated mass of land in high altitudes in so-called glacial times, we should have done a great deal to explain the glacial theory."¹³⁴

In both cases these gentlemen assumed a great rise of land relative to sea level: but it seems quite possible that a corresponding drop in sea level would have virtually the same effect. The combination of this and the blanket of dust laden cloud formation enormously reducing the solar radiation to the earth's surface may well account for the sudden intense cold. And recently fresh evidence for the existence of such clouds has appeared in the finding of an immense bed of volcanic ash in the Pacific. The reference, though brief, concludes with these words, "the ash may have come from one gigantic volcanic explosion, the simultaneous explosion of several volcanoes, or conceivably from an astronomical catastrophe that rained debris upon the earth." So specific is this layer and so recent, that it is referred to as a "Geological Punctuation Mark"¹³⁵!

Hapgood considered that such a dust cloud might itself be quite sufficient to bring virtually instantaneous refrigeration in the northern latitudes.¹³⁶ Certainly the effect of volcanic dust upon the weather has been observed dramatically within comparatively recent times. The *National Geographic Magazine* (December, 1943) refers to large eruptions in 1812, 1814 and 1815, and mentions that the summer of 1816 was so cold that six feet of snow fell in June in New England, and people wore overcoats and mittens on the fourth of July. That year was referred to

133. Hull, E., "The Sub-Oceanic River-Valleys of the West African Continent and of the Mediterranean Basin," *Transactions of the Victoria Institute*, vol. 32, 1898, p.147-164.

134. Howorth, Sir Henry, "On Ice or Water," *Transactions of the Victoria Institute*, vol.38, 1906, p.220.

135. "Geological Punctuation Mark:" *Scientific American*, May, 1959, p.74.

136. Hapgood, C. H., "Mystery of the Frozen Mammoths," *Coronet*, Sept. 1960, p.71.

as the 'year without a summer.'¹³⁷ Handrich mentions that Katmai's eruption in June 1912 introduced into the upper atmosphere dust so widely dispersed that it affected weather all around the world.¹³⁸

Finally, it should be underscored that we are still in the Ice Age, the ice caps have merely retreated far enough to allow most of us to ignore them. The event is recent indeed. The Present is, geologically speaking, the end of the Pleistocene. And as Shull has observed:

At few points in geological history has there been extermination comparable to that of mammals in the time just preceding the present. In part this may be due to repeated glaciation, but most of it is unexplained. Only the tropical regions, notably Africa, escaped this great diminution of mammals, and the Pleistocene mammals of that continent were essentially the same as today.¹³⁹

A study of the rocks indicates that the same may be said largely of Australia. The pattern of fossil marsupials was continued on that continent and is still with us. It is probably true, as Baker has pointed out, that not a few species of animals—indeed large areas of living things—might very well have survived the catastrophe.¹⁴⁰ But those which perished irretrievably as species had to be re-created. Those species which had not perished altogether began once more to multiply. Possible this is why in Genesis 1 God said in some cases, "Let the earth bring forth", while in other cases Scripture says, "So God created", etc. Not everything had to be re-created, and as for plant life the earth did indeed bring forth seed which was in itself—in the earth (Genesis 1:11).

Perhaps the tilting of the earth's axis by as much as 40° or more at the time of the disruption may have been partially responsible for the fact that in the New World, for example, the great ice sheet reached down over New York State. As the globe re-distributed its peripheral mass, it achieved better equilibrium, recovered from the "wobble" which had the effect of shifting the geographical poles and so steadied

137. Cold summer of 1816: *National Geographic Magazine*, Dec., 1943, p.668.

138. Handrich, T., *Creation: Facts, Theories, and Faith*, Moody Press, Chicago, 1953, p.208.

139. Shull, A. F., *Evolution*, McGraw Hill, New York, 1936, p.65.

140. Baker, Howard E., *The Atlantic Rift and Its Meaning*, published privately, 1932, p.181, 183.

itself into what is probably a more natural angle of rotation with respect to its path around the sun. When—and if—this axis of rotation becomes completely vertical in this plane, the ice caps will disappear entirely and the whole earth could enjoy a temperate climate. The recovery is still only partial (23°) so that although the ice retreats annually, we still have polar caps with us. If we assume that the axis of rotation of the world that then was, was normal to the earth's plane of rotation around the sun, then that world would have enjoyed a much more temperate climate. This could have important theoretical implications, for as H. Hamshaw Thomas of Cambridge, in a letter to *Nature* pointed out:

The possibility that changes have occurred during the past in the position of the earth's axis of rotation . . . is of great interest to all students of fossil plants.

It has long been clear that the geological evidence of former vegetation shows that the lands around the Arctic Sea bore an ample covering of plants during a long period, probably from Devonian to Tertiary times. This vegetation included many large trees and was very different from the scanty flora of these regions living today.¹⁴¹

In the next and final chapter we shall attempt once again to summarize the whole picture here presented, and more particularly, to draw together the many passages of Scripture which, it seems to me, most obviously relate to these events.



141. Thomas, Hamshaw, in a letter to the Editor, *Nature*, Aug. 20, 1955, p. 349.

Chapter 6

THE OVERALL VIEW: A SUMMING UP

With Some Consideration of the Time Element

In this summing up I should like to start at the beginning, at the moment of creation when God introduced the Universe. Augustine with very remarkable insight, and long ante-dating Einstein, observed that this was the moment which also marked the beginning of Time.¹⁴² Before the creation of matter there was no Time—and we cannot therefore hope to be able to grasp anything beyond this point, until we ourselves have passed out of this Time-space system. But we can surmise something of what happened at this instant of creation.

To begin with, there is reason to believe that we live in a true *Universe*, i.e., a single integrated system of matter obeying a unified set of physical laws, in which every thing is related to and acts upon every other thing in such a way that the whole must surely have been created at one time. There are not other Universes than this unless they are so far removed as to be entirely undetectable. There was one beginning, not two.

There are also good reasons for believing that this order of things came into being virtually in an instant of time. It is widely held (with a few dissenting voices) that the Universe is expanding, and therefore, as a corollary of this as Eddington puts it, everything must once have been compacted together into a single place at some point in time.¹⁴³ The density of this mass would be inconceivably great—perhaps millions of tons per cubic inch.

Where did such a “lump” come from?

142. Augustine, *Confessions*, Book 11, chapter 13, Scribner’s edition, *Nicene and Post-Nicene Fathers*, vol.1.

143. Eddington, A. S., *The Nature of the Physical World*, Cambridge, 1930, p.83-85.

Some astronomers, like Hoyle, believe that matter is eternal,¹⁴⁴ but Scripture says God created it, and we have some very tentative clues about the processes by which this was done. Sir James Jeans held that when matter is acted upon to move it through space at a high enough speed, it becomes something different. The fastest it can be so moved is approximately 186,000 miles per second at which speed it becomes *light*. By a well known physical law, it can be stated that the faster an object is moved the greater is the power required, so that to move matter at its limiting velocity actually requires infinite power. The reverse is also true, for if light could be restrained it would "congeal" into matter, and this, too, would require infinite power. Thus if creation began with light, matter resulted when infinite power was used to slow it down and—to use Jean's phrase—to "bottle" some of it, thus to form the first solid substance.¹⁴⁵

In this connection, Sir Richard Tute observed in the *Scientific Monthly*:

The modern scientist recognizes that physical reality is produced by super-physical agencies, which must be so designated because they are never observed.¹⁴⁶

Yet where did the Light come from out of which the Universe was created?

Light must have come from somewhere for Scripture does not speak of creation "out of nothing." Nor does the Hebrew word used in Genesis 1:1 necessarily signify such a concept, for the same word is applied to the creation of Adam as having been made not out of nothing but out of the dust of the earth. The nearest approach to such a concept as creation *ex nihilo* is in 2 Maccabees 7:28 which is not part of the Hebrew bible. It reads:

I beseech thee, my child to lift up thine eyes unto the heavens and earth, and see all things that are therein, and thus to recognize that God made them not of things that were, and that the race of men in the same wise came into being.

144. Hoyle, F., *The Nature of the Universe*, New American Library, New York, 1950.

145. Jeans, Sir James, *The Mysterious Universe*, Cambridge, 1931, p.77, 78.

146. Tute, Sir Richard, in a letter to the Editor, *Scientific Monthly*, Oct., 1946, p.322.

But even here, the Greek (LXX) used the word *poeio* meaning something more than instantaneous creation out of nothing, and indeed observes that the creation of man was by a similar process. Actually the Greek *poeio* is the basis of our word *poem*, and implies creative activity involving concentrated effort. Even for God creation is "work" as Psalm 8:3 indicates, and in the New Testament there is Hebrews 11:3 which tends to bear out these observations for it implies that the Universe was made not out of nothing but out of "things not seen," exactly as Tute phrased it.

But how long did this creative act take? Well, Gamow has this to say on the subject:

According to our calculations, the formation of elements must have been started five minutes after maximum compression of the Universe. It was fully accomplished, in all essentials, about ten minutes later. By that time the density of matter had dropped below the minimum necessary for nuclear building processes. All the elements were created in that critical ten minutes, and their relative abundance in the universe has remained essentially constant throughout the two or three billion years of subsequent expansion.¹⁴⁷

When the expansion began, the reduction in thermal energy which accompanied it allowed the formation of gas clouds which upon further cooling provided the substance out of which the stars (including our own sun) were born.¹⁴⁸ According to P. M. Hurley, these stars did not form at different times in different parts of the Universe, but formed more or less contemporaneously: and the same must probably be said of their planets—a fact which makes the earth itself about as old as the Universe.¹⁴⁹

Although this picture of the beginning of things may seem to involve such an accelerated process as to have almost a quality of miracle, it is a picture which is quite widely accepted. Professor Hugh

147. Gamow, George, in *Scientific American*, July, 1946, p.24.

148. See Harold F. Blum, *Time's Arrow and Evolution*, Princeton, 1951, p.10.

149. Hurley, P. M., "Radioactivity and Time," *Scientific American*, 1949, p.48.

S. Taylor differs from Gamow only to the extent of suggesting that the process may have taken not ten minutes but half an hour!¹⁵⁰

I believe that the evidence for a long, slow process of geological development for the Earth thereafter, such as is assumed by modern geology, is essentially true; although I am aware that many thoughtful and informed Christian scholars think otherwise. In Doorway Paper No.20 (*The Earth Before Man*) we have tried to present a picture of the means by which God prepared the Earth, step by step, for the coming of Man. This preparation involved two essential elements which would not be admitted by modern geology: (a) direct creation of living forms as soon as the environment was ready to receive them, and (b) what I have felt might properly be called Supernatural Selection to distinguish it from Natural Selection and from the Artificial selection which man is able to perform.

To prepare the stage, a series of changes were brought about in the environment, the first of which allowed life to be introduced in its simplest form. Further changes in the environment prepared the way for introducing by direct creative activity more complex forms. These forms of plant and animal life were so acted upon in the course of time by direct Supernatural Selection that they together formed a new environment suitable for the introduction of still higher forms of life, again, by direct creative activity. This process of step-wise preparation opened the way finally for the introduction of mammals approaching more and more nearly to humans.

When the time was almost come for the creation and introduction of the first Man, there existed in many parts of the world forms which were physically so similar to him as to demonstrate clearly that the environment was now ready to receive such a creature as Man is. By such a means was the earth slowly prepared for his introduction.

At the risk of labouring the point unduly, I should like to repeat that I have just said in slightly different terms because I wish to make it absolutely clear that I do not have in mind what is commonly referred to as Theistic Evolution. This particular form of evolution is believed by its advocates to be merely ordinary evolution, only with God standing behind it. There is no necessity for supernatural interference in a process which to a very large extent can be explored experimentally in laboratory conditions.

150. Taylor, Hugh S., *Religious Perspectives in College Teaching: in the Physical Sciences*, Edward Hazen Foundation, New Haven, (about 1950), p.16.

On the contrary, I believe that God acted creatively, in the most distinct and positive manner conceivable, throughout the whole geological history introducing new species as they became appropriate and removing others as they ceased to be. No laboratory experiment can ever hope to elucidate this creative activity as I understand it.

But because God was graciously willing to permit us to reconstruct the unfolding of His designs, the geological record can be read more or less as a continuous process of purposeful change.

A word about this "change" . . .

Among living creatures offspring differ from their parents, and this fact provides a means whereby select lines may be encouraged and unwanted lines allowed to disappear. If this occurs by accident, biologists refer to it as Natural Selection. When it is deliberately undertaken by man, it is termed Human (or Artificial) Selection. In the preparation of the world for Man, changes in Nature constantly occurred which cannot be accounted for by any appeal to Natural Selection—and man was not present to effect Human Selection. These changes, I believe, were brought about directly by God Himself, a process which I think may very appropriately be called Supernatural Selection. It accounts for the sudden appearance of *life itself*, or new *forms* of life, such as vertebrates, new *structures* such as feathered wings, and new *physiological processes* such as warm bloodedness; and also for the sudden disappearance of not merely single species but whole Orders of creatures. Thus, in due time, the stage was set for the appearance of Man.

I am not sure how far I would be willing to follow Pember in his famous *Earth's Earliest Ages*, but I certainly agree with him in his basic thesis that the catastrophe which we have viewed from the geological point of view in this Paper was in some way associated with the Fall of Satan. Perhaps over this long process of preparation spiritual beings had been appointed under the authority of one whose name may have been Lucifer. This Archangel had been Supervisor of the created order, but was evidently unaware until almost the last moment of God's plan to introduce man to be lord of the Earth, being made first a little *lower* than the angels, but destined ultimately to be above them.

Upon discovery of this fact Lucifer rebelled, and this rebellion brought the whole order under judgment. Because this marked in *time* the entrance of sin into the Universe and therefore looked ahead to the

time of man's fall as a consequence of Satan's activities (for without a tempter there could have been no Fall), it was the point in time at which a Plan of Redemption became explicitly necessary. Thus the event is constantly referred to in the New Testament as closely related to Redemption, as for example, when we are told in Revelation 13:8 that Jesus had in effect been slain "since the disruption of the Cosmos." It was a natural event in so far as the direct causes were concerned but a spiritual event in so far as its less direct causes were concerned.

The question may then be asked, But why did God have to destroy His creatures upon the earth? Would it not have been sufficient to punish Satan and his cohorts only? The answer seems to be that in some way Satan was able to corrupt the very animals of the earth, finding even in them a means for the working out of his own purposes. For did not demons much later in history seek once more to be allowed embodiment in swine (Luke 8:33), and were not the swine immediately destroyed? Evidently purely spiritual beings may also find some mode of self-expression in sub-human creatures. And we should not forget the Serpent in Eden.

And what geographic form did this former world take?

This world was a globe with a continuous shell of granite which here and there rose above the surface of a shallow universal sea, as 2 Peter 5:7 puts it, "standing in and out of the water." The diastrophic movement of the earth's surface would be continually changing the patterns of these islands, changing their size and causing a shift in their position as parts were submerged and others were elevated above the waters. Such a world must have had a more or less uniform climate, and perhaps there was no tilt to the axis of the earth. This island topography would be ideal for those processes of plant and animal variation which are aided by geographic isolation. And the shallow seas by their very nature would be continually generating layer upon layer of sedimentary rocks. Dry land in the sense of great continents such as we now have would not be characteristic of this kind of world.

All this was changed suddenly by a catastrophic event which shook the earth causing its disruption, precipitating part of its substance to form the Moon, bringing sudden death to untold millions of living forms upon it by drowning some and instantly freezing others, scattering them over the face of the earth (Isaiah 24:1), enshrouding the earth with dense clouds of steam and ashes (Job 38:9), and leaving a

scene of ruin and desolation with darkness upon the face of the deep exactly as Genesis seems to picture (Genesis 1:2).

How long this situation lasted is difficult to say, although it need not have been very long; and some animals and fishes and plants may well have survived.

As the atmosphere gradually began to change and clear, the waters steadily poured off the single granite continent which remained into one enormous "ocean" and dry land appeared for the first time in the earth's history as an entirely new feature of it, as Genesis 1:9 implies.

It does not seem at all impossible to my mind that once the process of re-creation had been initiated by God in Jesus Christ the preparation of some one part of the globe could have proceeded far enough for the planting of Eden and the creation of Man in it *within a period of six natural days*. This does not mean that these processes of worldwide change were every where completed as quickly. Indeed, I believe that the breakaway of the New World from the Old may not have occurred till many centuries afterwards. Nor does it seem to me at all unlikely that some of Noah's descendants may actually have explored around the Mediterranean and sailed beyond the Pillars of Hercules across a narrow body of water to a land which not much later had actually moved out of sight of Europe and was indeed the New World. In fact, some settlement could have been established in what would now be Middle America.

In order not to introduce the tradition of Atlantis at this point, we have a few words to say on the subject which will be found in an Appendix. But it may be sufficient at this moment to say that what we know from tradition about this lost land in many remarkable details reflects what we also know of Early American cultures. At any rate, by the time of Peleg (Genesis 10:25) many rifts had occurred and widened into nearly impassable barriers so that it could be said not without reason that the division of the earth was now complete.

As we have seen, the catastrophe may have caused the earth to wobble (Job 9:6) so that the actual axial tilt was as much as twice what it now is and the polar caps accordingly far more extensive. The forces tending towards the redistribution of the continental masses as they were fragmented were gradually reduced as the earth recovered a more normal axis of rotation, and the processes of drift slowed up. This braking action was assisted also by the solidification of the "sea" of basalt upon which the continents had floated. Today it is almost

impossible to demonstrate conclusively that drift continues for the forces allowing or assisting such movements of the crustal fragments have been so greatly reduced. Accompanying the recovery of the earth has been the gradual diminution of the ice caps and the drying up of large areas near the equator.

This is my imaginative reconstruction of that great event which in the Authorized Version of the New Testament seems to be in view in the phrase, "the foundation of the world," a phrase which, however, as we have proposed in Doorway Paper No. 11 and No. 30, is perhaps to be more properly rendered, "the disruption of the world." We have proposed an inconceivably long preparation, a sudden devastating disruption of the established order, a time of enormously accelerated reconstitution involving a burst of creative activity for a period of only a few days.

Does this seem strange—that God should adopt such a long slow process to accomplish at first what He afterwards achieved in so short a time? And would not this accelerated creative activity lead to the introduction of many forms which, if they were to fit in with the rest of nature, must in some cases have been with the appearance of age which they did not in fact have? Would this in one sense be a deception?

Scripture has much to say on the problem, although for some reason what it does say has not been given the attention it deserves, nor has its real significance been recognized. But since a major objection to our reconstruction is likely to be just this—that God would not take so long in the first instance and then complete the preparation by such an entirely different method in the second—we shall close this essay with a brief examination of what Scripture has to say about instantaneous creation.

Now the question we have to answer is, If God was able in six days to reconstitute the environment at least in some part of the earth where He "planted" a garden for Man, from a chaotic condition to an Edenic one in a matter of days, could He not have "saved time" in the first place? Why take several billion years to prepare the earth if the process could have been accelerated so as to occupy only a matter of days. . .

The possibility of a real acceleration or deceleration of time in certain given circumstances introduces the question of whether any time at all was needed, or whether it might not have been instantaneous—let alone six days.

To my mind, the evidence of age for the Universe is real. Whether we argue for 4,000,000,000 years or twice or half this amount is not important at the moment, it seems clear enough that the world is very old.

But we may ask whether this "age" has any meaning really, since neither God Himself nor the animals which "inhabited" it had any concept of time in the sense that Man does. Probably I should have separated these sentient creatures and put God and His creation into different categories, but to all intents and purposes the observation is fundamentally true. God does not, like us, observe the passage of time as the same kind of flux that we experience. And it seems almost certain that animals do not either. Then what possible end was served by such an interminable process?

Actually we derive considerable comfort from our understanding of the past. This comfort is both of an intellectual and psychological, or one might even say—for most of us—of a spiritual nature.

Intellectually there is real satisfaction in being able to unravel the stages by which something complex as come to be what it is. It is rather like a mystery story or a detective novel. Sometimes it almost looks as though God took delight in this process of unravelling, either by leaving in the rocks some special link in the chain of evidence, like a single specimen of Archaeopteryx for example, or confounding the experts by preserving some remote form, out of context as it were, like the Ceolacanth. For some men, the adventure takes on the form of a spiritual exercise as when Kepler in studying the starry heavens is said to have exclaimed involuntarily, "O God, I am thinking Thy thoughts after Thee." The thrill of being able to visualize what underlies the countryside at one's feet with its hills and valleys, cliffs and plains, and occasionally to stoop down and pick up some small but exquisite fossil of a shell or a leaf, is something experienced universally by those who have sufficient training to recognize what they see. And because imagination knows no bounds it seems to revel in the expanse of time in the past, as it does in the mystery of space above.

Moreover, from a knowledge of the order in which forms were introduced, we may draw a peculiar satisfaction. We could, of course, be reading too much into the "text," but it does look as though some special forms of life of particular delight to man, perfumed flowering plants for example, were introduced just in time to gain profusion before his arrival. It is as though God put flowers on the table shortly

before His special guests were due. Had they always been there, the effect would not have been the same.

Or again, as one studies palaeontology, one gains the strong impression that many, if not most, living forms of more remote times would not have appeared particularly beautiful in man's eyes, if he had been there. Possibly this is the "fault" of those who attempt to reconstruct them, but that does not seem too likely. They were on the whole a rather terrifying or ungainly or frighteningly large congregation of animals. But as we approach the time of man's appearing, animals which are more and more beautiful seem to crowd in upon the scene, as though God knew what man's sense of beauty would require and was pleased to prepare for it.

Of course, some may say, But there are many ugly animals still, why didn't God finish the job to convert them all? The answer to this could possibly be that He wanted to show that beauty was not necessarily an aid to survival, for ugly animals have survived quite well. Then it seems difficult to account for the appearance of beauty other than by the supposition that God shares man's delight in it. Again it may be said that much beauty in Creation is a sheer waste, because man never sees it. I think Hugh Miller has the answer to this. Speaking of the fossil shells and fishes which characterize the segment of the rocks which is known as the Old Red Sandstone, he says:

Nor does it lessen the wonder that their nicer ornaments should yield their beauty only to the microscope. There is unity of character in every scale, plate and fin . . . and yet the unassisted eye fails to discover the finer evidences of this unity; it would seem as if the adorable Architect had wrought it out in secret with reference to the Divine idea alone . . .

There is a feeling which at times grows upon the painter and the carver, as if the perception and love of the beautiful has been sublimed into a kind of moral sense. Art comes to be pursued for its own sake; the exquisite conception in the mind, or the elegant and elaborate model, becomes all in all to the worker, and the dread of criticism or the appetite for praise almost nothing. And thus, through the influence of a power somewhat akin to conscience, but whose province is not the just and the

good, but the fair and the beautiful, works prosecuted in solitude and never intended for the world have been fraught with loveliness.

Sir Thomas Lawrence who finished with the most consummate care, a picture intended for a semi-barbarous foreign court, was asked why he took so much pains with a piece destined, perhaps, never to come under the eye of a connoisseur. 'I cannot help it,' he replied, 'I do the best I can, unable, through a tyrant feeling that will not brook offense to do anything less.' It would be perhaps over bold to attribute any such over-mastering feeling to the Creator Himself. Yet it is certain, that among His creatures well nigh all approximations towards perfection owe their origin to this feeling, though God in all His works is His own Master.¹⁵¹

If in the course of time, their beauty is buried in the earth, God sees fit to uncover these rocks so as to disclose them again for those who search; and if He masks their beauty by their minuteness, He gives to man the power to build a microscope so that one day he may discover it. The millions of flowers that bloom unseen and which thus appear to be entirely wasted until we find them, give us the assurance that we shall not find in God's Universe ugliness where beauty can replace it.

Now all Nature interacts as an organic whole and its harmony seems always to have been there, awaiting discovery, even in geological times. In each passing phase of the earth's history certain forms of plant life and animal life, each exactly suited to fulfil their purpose, were introduced in the appropriate order, modifying their environment and being modified in turn until little by little the stage was reached where the setting was ready for the climax — the coming of man. Prior to this, one might suppose that beauty was not important, only the suitability of the form for the function. But by now, the necessary plant life, animal life and mineral accumulations (coal, oil, gas, etc.) which contribute to man's position as dominant in the earth (Genesis 1:26) were all made ready. The evidence of forethought in Creation is intellectually reassuring. It depends upon a certain deliberate and measured plan of operation on God's part which whether apparent or real contributes greatly to our well-being and would not be evident if all were done

151. Miller, Hugh, *The Old Red Sandstone*, Nimmo, Hay & Mitchell, Edinburgh, 1889, p.113.

simultaneously. Part of this satisfaction is derived from a recognition that God timed the Creation for man's benefit by introducing those forms of life which would delight him most or serve him best, only a short time before introducing man himself. If Creation had been instantaneous, this kind of deliberate forethought could hardly have been apparent, unless of course God had at the same time created the appearance of age.

There is something rather frightening in the thought that at one moment nothing whatever existed, and then five minutes later everything existed and that this happened only a few hours before man appeared on the scene. Such a situation has all the features of the "sudden and unexpected"—which we usually find disturbing. This is completely contrary to our experience. What we do for others is to a large extent evaluated by them in terms of the time taken, because for us, time and energy are equated. In this context time means forethought and forethought means a plan and plans take time. If we discover that no time at all was taken in preparing for us, which could mean either that there was no planned preparation, or that it was effortless and immediate, the impression we gain is that our coming meant very little to the One Who prepared for it. Perhaps God was pleased to take the long course (or at least to appear to have done so) in order that we might discover how carefully He planned and made preparation for us.

Furthermore, age does something to things, mellowing and beautifying in a special way. The very age of the hills adds to their beauty, because experience teaches us that few things in life achieve real beauty without time, and God's method of perfecting the saints follows this rule. By slowing up the work which He might have done far more rapidly. He has made it possible for us to perceive something of His method in Creation, something of the meaning of His title, the "Ancient of Days," and something of his right to be called the "God of all patience." These are some of the sources of our spiritual comfort. God will, in time, perfect that which He has begun in us—however long it may take.

In summary, then, perhaps the process was slowed up so that we could separate out the events into a meaningful pattern which would permit us to discover how God was preparing for us. He could just as readily have made the same complete preparation instantaneously—but we would then have been unable to sort it out and make the discovery.

We often expect God to do at once for us what we feel we urgently require—and are disappointed when He delays. But we ought not to lose confidence in His power to act in His own good time. God works slowly when He sees that this is the better way for our sakes, and not because there are limitations in His power to work instantly.

Undoubtedly God could have accelerated the original process immensely, so great in fact as to perform what would be called instantaneous Creation. In Scripture there are numerous instances of this, and they appear to us as miracles. Some tiny organism for whom a few minutes is a life-time may have seen some of these as long slow developmental processes.

For example, when Peter drew his sword and cut off Malchus' ear (Luke 22.50, 51), the Lord instantaneously re-created it. Surely He did not stoop down to pick it up and press it firmly back into place to make it stay! Even if He did, there still must have been an instantaneous re-creation of the joining tissues which made it a true and living ear once more. Rapid as the process was, some tiny microbe may have watched that ear grow as we might watch a human ear grow from the embryonic to the mature adult stage. Only, the process was more rapid—immensely so—from our point of view.

Then, in effect, our objection to instantaneous Creation may actually be based on our size. Philosophically, this is not surprising if Time is the fourth dimension. One might logically suppose that an object with large physical dimensions might in some way have large time dimensions. An object is relatively larger and larger as the observer becomes smaller and smaller. Consequently the smaller the observer, the longer might the time be, or appear to be, associated with the larger object. As puny observers of a physically immense Universe, the Time element is correspondingly immense. But objects which appear small to us and are, therefore, associated in some psychological fashion with short intervals of time must to creatures which are small enough to look upon the same objects as very large appear to be associated with large periods of time,—that is, if they have any time sense at all. If we were microbes, perhaps the restoration of Malchus' severed ear would not strike us as remarkable in any way.

However, being as large as we are, we may reasonable ask, "How old actually was this new ear?" The question is not a facetious one. The implications are far reaching. This new ear was a man's ear, not a child's, yet in point of time, it was but a few minutes old. Should it then

have been created as an embryonic ear first, and then allowed to grow slowly in order not to deceive us? Was this, in other words, a deliberate deception?

And here we touch upon a problem of considerable importance. Does God ever create an object instantaneously which, in all other cases, is known to have taken a long time to reach a similar stage, and does He give to it a form that makes it *look* as though it really has reached its present character by a long process of development which in fact has never taken place?

If God created a tree instantly, would it have tree rings, for example, to show that it was, say, 50 years old, when in fact it was only a few minutes old? Well, the case again is not purely hypothetical. Moses carried a staff cut from a tree (Exodus 4:3 and 7:10). Undoubtedly it bore witness of its age in the number of annular growth rings it showed in its cross section. In due time, it became a serpent—a real, live serpent that was as completely different from a piece of wood as any such serpent always is. Shortly thereafter in a matter of minutes, with considerable trepidation Moses took it up by the tail and it was restored to its original self, a piece of wood with annular rings again. These rings would have told its age, but their witness would have been false, for a few minutes before, that particular piece of wood had not existed in the Universe.

And what of the serpent? Like other reptiles, snakes are normally as long as they are old. Moreover, they too have “growth rings” telling their age! They grow until they die. This particular snake had a certain length, but did that length actually bear witness to its age? Undoubtedly it was a species of snake familiar to the locality and recognized by Moses as dangerous, for he fled from it. Was this a deception, as we understand the term? The issue can become very involved and it suggests that when God chooses to act in a special way, the ordinary processes of logical reasoning may not necessarily apply. As Augustine put it, such situations are not contrary to Nature, but contrary to what we *know* of Nature.

The reader may well be aware of the ancient controversy regarding Michael Angelo’s painting in the Sistine Chapel of the creation of Adam. Adam is shown with a navel. The question is, Would God create Adam with this physiological feature if it would only be accounted for by assuming that he was born by natural generation, which in this instance we know was not the case. But here, by our standards of logical

reasoning, we find ourselves on the horns of a dilemma, for if Adam did not have a navel, then this physiological structure must have been different at a deeper level also and one might question whether Adam was a true man. Of course we shall never know the answer till we meet the Lord, for now we see only darkly. But there is no doubt that in the first two cases from Scripture which have been cited the rules of logic break down. God can, and does, create instantaneously upon occasion and when He does, the event inevitably has a quality of deception about it: but it is a deception because of the way our minds work and not because of the way God works.

Now there are many occasions in Scripture when such a situation has occurred. Consider those instances in which food miraculously multiplied. This occurred not only in the New Testament but also in the Old Testament. In 2 Kings 4:42, loaves were multiplied, and in 1 Kings 17:14 a cruse of oil and the barrel of meal were strangely replenished. In the New Testament we are told that the fragments which remained were gathered up and found to compose an even greater quantity of food than was originally employed by the Lord. Consider these fragments for a moment and suppose oneself in a laboratory on some experimental farm. It would not be difficult, probably, to identify the wheat which had been used and chemical analysis might even give some indication of where it was grown. Yet what would this tell us in this particular case? Absolutely nothing. It is inconceivable to suppose that these fragments of bread actually had any history whatever other than that they were the tangible demonstration of God's creative power. The scientist in the experimental laboratory might complain that he was being deceived. But the basis of his deception would not be the Lord's creative activity but his own insistence that God must work according to certain principles which he has been able to derive from studies carried out in some other areas of God's world.

Consider another illustration from the New Testament. One of the remarkable things about wine is that its flavour improves with age. The oldest wine is usually the best wine. Its taste tells its age. Almost all other foods and liquids lose their flavour or spoil. Now the very first miracle that the Lord Jesus performed was at Cana in Galilee turning water instantly into wine: not merely into wine, however, but into the *best* wine served at the feast. Was it *instantly aged*? Would a connoisseur accuse the Lord, Who created it, of deception? Or should we do so, being more "scientifically minded"? In fact, does not this single instance

really show that while we must apply logic and experimental verification to our own little manipulations of nature, we cannot force the works of God into the same shallow mold Perhaps we secretly trust that in time we, too, shall learn how to accelerate the ageing of wine, and then we shall no longer need to believe that anything really very miraculous occurred at this wedding feast. But is this not saying that it is only proper to allow God to do what we can imagine ourselves doing?

The raising of Lazarus is another illustration of this principle, for the condition of the dead man's body was such that decay had already begun, and to set that body vibrant with life required the direct creation of millions of new cells of all kinds. There is a sense, in fact, in which this was the instantaneous creation of a living man and why, then, should we suppose that God could not create a body at the very beginning of human history and call it forth to life as the first Adam exactly as Lazarus was called to life.

It would surely be quibbling to argue that the task in Lazarus' case was easier because some, at least, of Lazarus remained! Actually, it was a much more difficult task: it involved not merely reconstitution of a decayed organism into an ordered and living one—a thing surely hard enough in itself—but something more. For Lazarus, like all of us born since Adam, was a fallen creature, not merely a fallen spirit, but a mortal and therefore a dying body, sinful flesh as Romans 8:3 puts it (cf. Phil.3.21).

What the Lord Jesus was called upon to do was to create not only a living body but also a dying body to so lower His own standards of perfection in creation as to bring instantly into being a creature so unlike all His other works of beauty and order. Was this not a harder thing by far than the instantaneous creation of unfallen plants and animals, and of unfallen Adam? If He can so do the harder thing,—surely we cannot doubt His power to do the lesser thing—wonderful though it was, of calling back to life a disrupted world?

The reader will remember that after the resurrection the Lord entertained the disciples by the Sea of Galilee (John 21:4-13) and invited them to partake of the fish He had already prepared. Is it conceivable that the Lord obtained the fish from the nearest market place? Or had He caught them (with His own hands) from the sea? Surely such a supposition is absurd. Yet one cannot doubt that they were real fishes

of a size and age and species which would in no sense be distasteful to the disciples for whom they were prepared, for these men were fishermen. How old were these fish?

But this is by no means all that may be said. In all these instances we have, it seems, undoubtedly examples of what, to use a current phrase, must be termed "creation with a history"—things brought into being in such a way that they appear to have history behind them which in actual fact they do not have. However, there are instances in which the reverse of creation took place, namely, instantaneous annihilation. There is a sense in which these two are fundamentally the same, both of them being completely outside our ordinary experience, although atomic power appears to depend on something analogous to the very rapid annihilation of matter. In the New Testament we have an example of this in one of the resurrection scenes. The details are given in Luke 24:36-45. The Lord Jesus invited the disciples to prove for themselves, tangibly, that it was really Himself Who stood before them. And the record says, "While they yet believed not for joy, and wondered, He said unto them, Have ye any meat? And they gave Him a piece of broiled fish and of an honeycomb. And He took it and did eat before them." Shortly thereafter He was taken out of their sight for the last time.

If one may speak reverently of such an event, what happened to the food which He had eaten with the disciples the moment it entered His glorified body? In some way, it was immediately transformed to something other than material as we understand it. To all intents and purposes, it was annihilated.

Such cases must either be taken as pure myth—or, if they are fact, which we most certainly believe they are, then creation with a history is also a fact, indeed one might almost say a common one in certain circumstances, and in judging such events our time sense is entirely inadequate.

The long slow process of the first creation had served its purpose, and nothing was to be gained by repeating it for the reconstitution. Perhaps this is sufficient to account for the difference between the two records, the ages of Geology and the days of Genesis. For the first process, revelation was not essential: for the shorter process it was. God is never wasteful even in the matter of what He has chosen to reveal.

Indeed, only if the events described in Genesis from verse 2 onwards did take place as indicated within a period of approximately

one week, would there have been any need of *revelation* at all? In that case, are we not logically forced to conclude that these days are really what they have always been thought to be by ordinary folk, namely, periods of 24 hours? To me it seems equally certain that the Earth has a very very long history behind it. The reconstruction we have proposed could supply part of the answer to the question, How are Scripture and Science to be reconciled?

But it would mean a revolution in geological thinking!



Appendix

THE LEGEND OF LOST ATLANTIS

Everyone knows, of course, that the ancient tradition about Atlantis is a myth. Just as everyone knew that the classical stories of Troy were also myths. Until Troy turned up!

Now the fact that the story of Atlantis was for thousand years regarded as a fable proves nothing. There is an incredulity which grows out of ignorance, as well as a scepticism which is born of intelligence. At one time Herodotus was accused of all kinds of historical "ad libbing"—but now we have much more respect for him as a historian and geographer It reminds me of how Mark Twain is supposed to have said that when he was 14 years old he used to be rather ashamed of having an ignorant old dad around the house. But then, by the time he was 18, he was surprised to observe how much his dad had learned in those four years!

Well, I don't think the point is worth anyone's reputation as a serious student, but it could be that Atlantis was indeed part of the New World before it drifted away and perhaps the idea is at least worth a brief exploration. Baker has a map (see Fig. 18) which shows a fragment of Central America, the Yucatan Peninsula and adjacent country, swivelled around and lying between the Americas and Europe. Could this have been Atlantis? The idea may seem ridiculous but it is surprising what can be said in its favour



Fig. 18. Baker's map showing the former position of the central American fragment—which however he did not identify as the Island of Atlantis.

Most of what we "know" about Atlantis is from the works of Plato whose forbear, Solon, the great law-giver of Athens 600 years before Christ, preserved the story for the Greeks, having been informed of it by Egyptian priests. Plato's account is unfinished. It ends abruptly—as the fate of the people of Atlantis is said to have done. We do not know what more he would have added, but some of what he said is rather interesting.

The Island, he reported, was larger than Lydia and Asia put together and led to other islands over which one could pass to the "opposite continent" which "surrounded the ocean." The Mediterranean Sea, within the Straits of Hercules (Gibraltar), was not the *real* sea, but more like a harbour. Plato indicates that according to

the Egyptians the destruction or disappearance of Atlantis occurred around 9600 B.C. (by extrapolation!).

Plato was not the only one to refer to it.¹⁵² Marcellus, in a work on the Ethiopians, speaks of seven islands in the Atlantic Ocean whose inhabitants remembered a much greater island, the people of which had once ruled over them. Homer, Plutarch, and others mention islands which in their day were said to be several thousand stadia from the Pillars of Hercules. A stadia in Roman times was one eighth of a mile, so several thousands could be taken as several *hundreds* of miles, as a rough estimate. This would then be the position of the New World at that time. Didorous Siculus related that the Phoenicians had discovered a large island after several days sail from the coast of Africa. The island was fantastically rich. According to Donnelly, Ceylonese told Midas that there was another continent besides Europe, Asia, and Africa, "a country where gold and silver are so plentiful that they are esteemed no more than we esteem iron." One cannot but call to mind Prescott's description of the wealth of the Central American peoples when the Spaniards conquered them so ruthlessly, and plundered them.

It is uncertain where the Toltecs and other native people of Yucatan, etc., originated from but they themselves, according to tradition, came first from a settlement or a "city" named Aztlan or Atlzin. Baldwin, in his *Ancient America*, observes that Columbus discovered a city named Atlan at the entrance of the Gulf of Uraba, in Darien, and that the site is now occupied by an unimportant pueblo named Acla. I have no means at hand of verifying this, but Vaillant mentions the fact that one of the two main sources of information regarding their origin is known as "The Annals of Cuauhti-tlan," a name with a terminative perhaps of some significance in this connection.¹⁵³

Now it has often been noted that there are traces of genuine Negroid elements in the earlier Central American sculptures, as well as some Negroid skulls.¹⁵⁴ Similarly, there are carvings illustrating bearded men! Surely such things are to be accounted for most simply by assuming that both Caucasians, as well as Negroes, formed one element in the earliest settlements—and why not, if the "Island" was once

152. Atlantis in Antiquity: see a collection of references in Ignatius Donnelly's *Atlantis: the Antediluvian World*, Harper, New York, 1882, p.5 and 27 ff.

153. Vaillant, G. C., *The Aztecs of Mexico*, Penguin Books, 1950, p.67.

154. Negroid Skulls in Central America: first noted by A. De Quatrefages, *L'Espece Humaine*, Paris, 1905, p.149. And since noted even among ancient skulls.

closely joined to Europe and Africa? Furthermore, evidence in Central America of an acquaintance with elephants is frankly admitted now.¹⁵⁵ Where did such animals come from or where, at least, did a knowledge of them arise in the New World if not from early connections with Africa? (Refer to Fig. 19)



Fig. 19. An ancient elephant mask from the Maya manuscript, the "Codex Borgianus."

Plato says the Atlanteans built with three coloured stones, of red, and white, and black. Rocks suitable for building blocks are found in the Azores of these three colours. Maybe they occur in many other places but it's a curious coincidence here nevertheless. He also mentions that they had springs of very hot water! Did he invent such an idea?

Well—there it is, some of the “evidence.” Surely, but for the question of dating, it is not such a fantastic idea that men did indeed first people the New World from Europe and Africa. Still, I prefer to keep this matter in an appendix and in no sense as an essential part of this essay.



155. Elephants: see G. Elliot Smith, "The 'Elephant Controversy' Settled by a Decisive Discovery," *Illustrated London News*, Jan. 15, 1927, p. 86-88, 108, with many illustrations.