

the contents of the book present the evidence supporting continental drift and sea floor spreading. No discussion is included of either ocean trenches and island arcs or mountain belts.

Early supporters of continental drift emphasized the remarkable fit between South America and Africa. Evidence showing that rocks in matching parts of South America and Africa are of equal age is given by P. M. Hurley and J. R. Rand. Evidence for the fit between the Maritime Appalachians of Canada and the British Caledonides is given in a paper by J. Dewey and M. Kay.

Certainly some of the most convincing evidence for continental drift comes from the polar wandering paths derived from paleomagnetism. Although a paper by E. Irving and W. A. Robertson giving some results is included in this volume, the paleomagnetic work does not seem to have received the emphasis in this volume that it deserves. Papers on the correlation between paleoclimatic evidence and paleomagnetic evidence are given by J. C. Briden and F. G. Stehli, and evidence related to continental movements from paleontology is given by A. J. Boucot, W. B. N. Berry, and J. G. Johnson.

One of the most important discoveries in the evolving story of continental drift was the correlation by F. J. Vine and D. H. Matthews (*Nature* 199, 947, 1963) of the striped magnetic anomaly patterns parallel to oceanic ridges with the reversals of the Earth's magnetic field. Discussions of this correlation and the conclusions drawn from it are given in papers by F. J. Vine and J. R. Heirtzler. Discussions of the independent evidence for the time reversals of the Earth's magnetic field are given in papers by A. Cox, R. R. Doell, and G. B. Dalrymple, and by N. D. Updyke.

The magnetic anomaly patterns are strong supporting evidence for the hypothesis of sea floor spreading. A summary of the seismic evidence supporting this hypothesis is given in a paper by L. R. Sykes. In particular, evidence is given for the presence of transform faults and for horizontal motions having formed the Gulf of Aden, the Red Sea, and the Gulf of California.

The most widely accepted mechanism for large-scale continental movements is cellular convection in a viscous mantle. R. K. McDonald gives a discussion of the viscosity of the mantle from uplift data and flattening of the geoid. A discussion of the possible physical mechanisms for a viscous mantle is given by D. P. McKenzie. Although no detailed discussions of mantle convection are included in this volume, H. W. Menard does present some of the problems of a convection model. In particular he mentions the possible migration of oceanic ridges and their

associated convection cells. The chemical composition of the upper mantle is discussed by P. W. Gast.

The quality of the papers presented in this volume is certainly high and the publishers are to be commended for doing an outstanding job at a relatively modest price.

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Symposium on Unidentified Flying Objects.

Hearings before the Committee on Science and Astronautics, U.S. House of Representatives, 19th Congress, 2nd Session, July 29, 1968. Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151. iv + 247 pp. Price \$3.00.

The report of this one-day symposium consists of the testimony and written reports of six scientists, who appeared in person before the Committee; and the prepared written papers from six additional scientists, who were not invited to be present in person. Chairman for the Symposium was Hon. J. Edward Roush.

Although not stated in so many words, it is fairly evident that one of the reasons for organizing this symposium was dissatisfaction in some quarters with the operation of Project Blue Book, U.S. Air Force, and the unfortunate breakdown in public relations that had developed in connection with the investigation of UFOs being carried out at the University of Colorado under the direction of Dr. Edward U. Condon. It was rather pointedly stressed on several occasions that the symposium should not discuss either of the above-named projects.

The six scientists who appeared in person were Dr. J. Allen Hynek, astronomer; Dr. James E. McDonald, physicist; Dr. Carl Sagan, astronomer; Dr. Robert L. Hall, sociologist; Dr. James A. Harder, engineer; and Dr. Robert M. L. Baker Jr., engineer. A study of previously published statements by this group suggests that it was rather heavily weighted in favor of those who have been pressing for more aggressive action in the study of UFOs by the government of the U.S.A. In the statements made before the committee only one of the six, Dr. Sagan, expressed reservations *re* the value to science of using large sums of money in an expanded UFO study.

In toto, many interesting points were brought up, and these hearings are worth reading by those who want to follow this subject in detail and to learn the various shades of opinion held.

Dr. McDonald, in particular, made it clear that puzzling things are seen by people in all walks of life and under a great variety of conditions. It is also abundantly clear that many incidents have not been completely explained, and probably never will be. This fact, in itself, is not at all surprising. In any body of peculiar data, involving groupings of different types of evidence, there will be a wide range in the ease of explanation. The more difficult cases will only be solved if certain clues are discovered. Statistically, one would expect a percentage where the clues are never found, and the cases remain unsolved.

In reading these hearings I felt that two important points were often missed. Little attention was paid to the subjective nature of the experience of seeing, which includes the psychological effects of previous training and conditioning. The eye-brain combination is extremely complicated, and nonobjective impressions are not necessarily related to the observer's honesty, reliability, or skill. The second point relates to the diverse nature of the unexplained events. There has been a tendency to lump all these together, from starlike moving points in the sky to hazy globes of light on the grass. The fact that something could not be explained is what received primary emphasis, and little thought was given to deciding just why any event suggested this or that hypothesis, or to finding evidence that connected it with some other puzzling event.

In view of the fact that these phenomena have been appearing for centuries, the opinion conveyed in these hearings that an expensively mounted, all-out scientific program will produce adequate evidence for a solution, is not very convincing. Even Dr. McDonald, who has been one of the most vocal in calling for accelerated action, notes two very significant facts. To quote: "I do have the impression that we ought to have more valid UFO photos than the small number of which I am aware"; and "A physical effect that does *not* typically occur under conditions where the description of events might seem to call for it, relates to sonic booms.—This remains inexplicable; one can only lamely speculate that perhaps there are ways of eliminating sonic booms that we have not yet discovered." One can also speculate that rare, image-forming mechanisms in our atmosphere play a larger role than many are willing to admit.

Stenographic recordings of questions and answers rarely read well as literary prose. It is felt, however, that in this case the editing and proofreading leave something to be desired, as numerous errors appear in text. Possibly a compressed printing schedule makes this unavoidable.

Following the official hearings of the Committee, prepared written reports from six additional scientists were received and tabled. Dr. Donald H. Menzel, astronomer, summarizes his views as published in two books. He reaches the general conclusion that the explanation of UFO sightings does not require any assumption of the operation of intelligences from outer space. Dr. Leo Sprinkle, psychologist, expresses a keen interest in the psychological study of the entire field and describes himself as an "unwilling believer." Dr. Garry C. Henderson, geophysicist, would like to see an expanded scientific investigation. Mr. Stanton T. Friedman, physicist, comes out strongly as believing that the earth has been visited by intelligently controlled extraterrestrial vehicles. Dr. Roger N. Shepard, psychologist, writes a particularly interesting paper on the psychological aspects of interviewing the visual observer, and on methods of carrying out a statistical analysis of the resulting data. Dr. Frank B. Salisbury, botanist, reviews the types of sightings recorded and the various possible explanations that have been advanced.

In the opinion of this reviewer it is high time that the whole subject be removed from an area of ridicule and disdain among scientists, on the one hand; and from the aspects of a new religion of visionary enthusiasts, on the other. Let us put it in its proper perspective, as an unemotional recording of interesting, and often unexplained, phenomena. It is the duty of the scientists to keep an open mind, and to consider each new body of data impartially and in the light of what has gone before. In the very nature of the case as it exists at present, the overall picture tells a more reliable story than any single incident or selected group of incidents.

Over the years of history man has encountered a variety of puzzling experiences. It is a mistake to assume, *a priori*, that all the explanations are simple, or that different types of puzzles can be solved using one hypothesis. It is also a mistake to believe that large sums of money, and the equivalent man-hours of labor, will automatically assure us of a satisfactory solution.

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The Panel was appointed in the latter part of October and early November 1968. The charge