H. R. Wilson, and indeed the whole galaxy of those names which have been associated with the growth of that great institution. We see the author actually working in the laboratory, not only in his researches, but in organizing courses for the teaching of the youth. We see him concerned with the matters of finance of the laboratory and we find him confronted with the problem of how to make both ends meet. We find a bond of sympathy with him when, speaking of a method of accumulating finances for the laboratory from certain fees he takes us into his confidence and remarks: "Another advantage is that it is possible with this system to wait until an instrument is wanted before buying it. In the more usual practice, when the University takes the fees and makes a grant to the Laboratory for apparatus, unless you spend the money in the year for which the grant is made, the authorities responsible will think that the grant is greater than you need and reduce it."

A chapter is devoted to psychical research, to such things as telepathy, water-dowsing and the like. It is interesting here to find that Sir Joseph has participated in many investigations in these fields. His attitude is always broad-minded. He usually leans to the side of seeking some ordinary physical explanation of the phenomena demonstrated, but is in no sense dogmatic and leaves his mind open to the possibility of the existence of phenomena in these realms to an extent which may be surprising to some who view these matters with but little sympathy. In this field, of course, we encounter other famous names of men who have been interested in the occult, Lord Rayleigh, Sir Oliver Lodge, and many others.

American readers will find much of interest in the history of Sir J. J. Thomson's visits to this country. His description of witnessing a game of baseball is particularly amusing. He tells us how the game had only been going on for a few minutes when most of the lawyers, doctors, bankers, professors and clergymen witnessing it had lost their power of articulation through cheers and exaltation, so that they could only croak. He adds, "I always myself get very much excited by a keen contest and feel for the moment that nothing on earth matters so much as that the side I am interested in should win." However, American enthusiasts will be much amused by his endeavoring to explain the game of baseball to Englishmen by comparing it with an English game of rounders, which is usually played by children with a soft ball, and in which the pitcher is replaced by one whose business is to throw the ball sufficiently straight so that you can hit it; and if you can't hit it, you get another pitcher. We are interested to observe Sir Joseph's opinion to the effect that if Woodrow Wilson had been a better diplomat conditions would not have developed so that he left Princeton. He would consequently not have become President of the United States during the great war.

There are interesting descriptions of the various colleges and educational centers in America. There is a certain tendency to inaccuracy in detail in some of these citations. Thus, we read of the University of Philadelphia. We read of Bryn Mawr University. The Institute for Advanced Study at Princeton is cited as an adjunct to Princeton University. We also read of the Universities of Haverford and Swarthmore.

Sir Joseph evidently came under the spell of the many amusing stories which are told of Bryn Mawr and concerning the period of presidency of Miss Carey Thomas, who, we read, "was a very capable woman with a very pronounced personality. She used the mailed fist rather than the gloved hand, and domineered over the staff and the governors." We have a citation of many of the amusing stories which are told in relation to that very prominent personality who ruled Bryn Mawr for so many years. Then follows a description of a visit to Canada and to Berlin. A chapter is devoted to Sir Joseph's association with work carried out during the war. In connection with his second visit to America to lecture at the Franklin Institute, a goodly account is given of the work of Benjamin Franklin. Next follows a chapter dealing more specifically with the history of Trinity College, Cambridge, and of Trinity College men with whom Sir Joseph has come in contact during his life. Finally, there is a chapter summarizing many of those researches with which the author has been more particularly associated, and which have played so great a part in building up the reputation which the Cavendish Laboratory possesses as one of the great research laboratories of the world.

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AUSTRALIAN PRE-CAMBRIAN FOSSILS

Australian Pre-Cambrian Fossils: A Memoir of the Late Pre-Cambrian Remains from the Adelaide Series, South Australia. By SIR T. W. EDGEWORTH DAVID and R. J. TILLYARD. Angus and Robertson, Sydney, Australia, 1936, 122 pages and 13 plates, 7s-6.

How, when and where life first began have long been baffling questions. For years the exact answers have eluded scientists, although periodically zoologists or paleontologists have been able to throw a little light on the subject. Now at last the biologists almost daily have new information concerning the borderland between the living and the lifeless. But whatever their findings, it will always be the record of the past that is most likely to yield definite replies to queries concern-

ing the origin and relationships of many of the *higher* animal and plant lines. For instance, the high stage of evolutionary advancement shown by Cambrian trilobites, chief members of the earliest well-recorded faunas, gives clear indication of the millions of years involved in the organic development of the invertebrates prior to the beginning of the Cambrian period. Consequently, it is not surprising that geologists and paleontologists for well over a half century have expended a great deal of their energy in the attempt to find identifiable *pre*-Cambrian fossils.

Among the most energetic and enthusiastic of the searchers for the primitive ancestors of the early Paleozoic invertebrates has been the late Sir Edgeworth David. With keen insight, unwearying patience and unflagging determination Professor David continued his quest in the pre-Cambrian sediments of South Australia over a long period of years. Finally he triumphed in the discovery of what he was convinced were beyond doubt the definite remains of pre-Cambrian invertebrate animals. One of Professor David's early publications in connection with this problem concerned the remains of small crustacea in the rocks of Reynella, near Adelaide, but in 1922, when this paper was issued, he was not sure that the rocks in question were pre-Cambrian in age. In 1928, however, he published another paper on newly discovered fossils in the Adelaide series which at that time he doubtfully referred to the so-called Lipalian interval. This latter paper attracted a great deal of attention, particularly because in it was figured a pre-Cambrian eurypterid.

The present memoir stems from this earlier work and is partly the result of a grant made by the Royal Society. The money was expended in opening two quarries, one at a spot called Tea Tree Gully, eleven miles northeast of Adelaide, the other at Beaumont, a suburb of Adelaide. The material described and figured by David in 1928 was so fragmental that even in Australia, where the specimens were available for inspection, scepticism as to their being authentic was wide-spread. As a result of the more complete nature of the more recently quarried material, it is stated that practically all Australian scientists are now agreed that the specimens uncovered are genuinely organic.

The fauna of the Adelaide series is regarded as belonging to three horizons, in order from the oldest to the youngest—(a) the Tea Tree Gully, (b) the Beaumont and (c) Brighton. The Sturtian glacial beds intervene between the Brighton and the Beaumont formations. The Tea Tree Gully fauna contains giant annelids and arthropods, the largest of the latter having an estimated length of approximately ten feet! The Beaumont fauna contains giant annelids and arthropods, a possible ancestor of the cephalopods, a large phyllocarid, problematical minute brachiopods and a probable pteropod. The annelids and arthropods of this fauna show a considerable evolutionary advance over those from the Tea Tree Gully quartzite, which is stratigraphically about 3,500 feet below the Beaumont beds.

The Brighton assemblage is characterized by a marvelously preserved, apparently dwarfed fauna of annelids and arthropods, partly post-glacial, partly glacial in age. The writers suggest that the severity of the Sturtian ice age accelerated, if it did not indeed cause the almost complete extinction of the giant annelids and arthropods of the Tea Tree Gully and Beaumont horizons, and that the Sturtian refrigeration was a catastrophe to the contemporaneous marine life similar to the one during the late Paleozoic glaciation.

There is a question as to whether the Adelaide series should be considered (1) an infra-Cambrian part of the Paleozoic, (2) a Lipalian sequence filling the gap between the generally recognized base of the Cambrian and the top of the Proterozoic or (3) a definite Proterozoic series. The writers, however, stress the following points: (a) The Tea Tree Gully beds are stratigraphically 17,000 to 23,000 feet, and the Beaumont 14,000 to 20,000 feet, below the definitely lower Cambrian Protolenoid horizon in the Archeocyathid limestone series. (b) At least one erosional interval is recorded in the Adelaide series. (c) The Sturtian tillite probably is to be correlated with the Keweenawan [sic] tillite of North America, the Numees tillite of South Africa and the Yangtse tillite of South China. (d) The fossils themselves are all vastly different from any previously described organisms. In fact, they differ more from the Cambrian types than do the Cambrian fossils differ from the Carboniferous. Accordingly, Professor David, before his death in 1934, expressed the opinion that the Tea Tree Gully and Beaumont faunas lived during the later Proterozoic, but he thought the Brighton fauna might possibly be as young as Lipalian.

In the present memoir only five fragmentary specimens from the Tea Tree Gully horizon are dealt with. These are described as two closely related species belonging to the new genus *Protadelaidea,* of which the genotype is *P. howchini.* Professor Tillyard considered these species the sole known representatives of a new class, Arthrocephala, of the phylum Arthropoda. This new class is characterized by the four unfused segments which form the prosoma, or head region, and by the primitive structure of the abdomen, which does not carry segmented appendages. Professor Tillyard has had the temerity to include relatively detailed restorations of *Protadelaidea,* showing both the dorsal and ventral surfaces. He has carefully compared *Protadelaidea* with a number of other Ar-

thropoda, such as the Onychophora, the Crustacea and the Trilobita. The conclusion is reached, however, that it was arachnoidian in type and had a common ancestor with the eurypterids, though it was not the direct ancestor of the latter group. A significant relationship is also noted between the Arthrocephala and the Crustacea (especially the metanauplius larva), indicating a common ancestry for these two large groups earlier in the Proterozoic.

Some idea of the difficulty of the task which originally confronted Professors David and Tillyard may be gleaned from the fact that to procure the few specimens of arthropods dealt with in this memoir, about fifty-five tons of hard quartzite were quarried, and about seven tons of carefully selected blocks were meticulously split into thin slabs. The present publication was to have been merely the first of a long series describing the other pre-Cambrian finds, but even as this review is written word comes of the death by automobile accident of Professor Tillyard, on January 13, 1937. It is to be hoped, however, that some one can be found who will be able to carry on these extraordinary researches of David and Tillyard in the same high plane in which they have so long prosecuted the work.

Notwithstanding the great reputation of the authors and the evident care which they have given to their work, critics are apt to wonder how it was possible to make the restorations on the basis of the type of specimens illustrated in Plates I to VI; and this wonder may persist despite the fact that many (though rumor has it, not all) of the Australian scientists who have examined this material are inclined to say that "seeing is believing." Furthermore, few students of the North American pre-Cambrian are likely to agree with the writers when they say, with the most naive of provincialism: "Only in a country like Australia, one of the most rigid shields of the earth, where even lower Cambrian strata retain in places their original horizontality, and the rocks are only slightly compacted, and where fossils like trilobites are exquisitely preserved, can one expect to find even the Proterozoic rocks so little altered as to preserve traces of former fossils."

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SOCIETIES AND MEETINGS

THE OHIO ACADEMY OF SCIENCE

THE Ohio Academy of Science held its forty-eighth annual meeting at Columbus from May 13 to 15, 1937, under the joint auspices of the Ohio State and Capital Universities. The attendance was large (about 300), the programs, both general and sectional, well attended and as a rule enthusiastically received, and the atmosphere helpful and inspirational.

The meetings of the academy on Friday morning, May 14, were held in the auditorium of Mees Hall, Capital University, and were devoted, first, to the transaction of business and second, to a general scientific session. The chief items of business were the election of 38 new members and 13 fellows, adoption of a plan to observe in a fitting manner the semi-centennial of the organization of the academy two years hence, the selection of the College of Wooster, Wooster, Ohio, as the place for holding the 1938 meeting, the election of the present vice-presidents as a nominating committee for the 1938 meeting, the approval of the annual reports of the officers and various committees, and the election of the following officers for the ensuing year, *viz.*: *President,* Charles G. Shatzer, Wittenberg College; *Vice-Presidents*—A. Zoology, Warren Spencer; B. Botany, Raymond A. Dobbins; C. Geology, John L. Rich; D. Medical Sciences, Bruce K. Wiseman; E. Psychology, Harold E. Burtt; F. Physics and Astronomy, Dayton C. Miller; G. Chemistry, W. C. Fernelius; *Secretary,* William H. Alexander; *Treasurer,* Eugene Van Cleef; to the *Executive Committee,* Dr. Charles A. Doan and A. W. Lindsey.

The general scientific session was unusually rich, consisting of three outstanding features: First, an illustrated address on "Scientific Research in the Antarctic," by Dr. F. A. Wade, of Miami University, Oxford, Ohio; second, two reels of moving pictures showing "High Speed Moving Pictures of Selected Biological and Physical Phenomena," made by Professor Edgerton, of the Massachusetts Institute of Technology, secured and presented by Dr. Alpheus W. Smith, of Ohio State University; and third, an illustrated address on "Certificates of Growing Up and Growing Old," by Dr. T. Wingate Todd, of Western Reserve University.

Every one agrees that the annual dinner was another notable achievement. Dr. Laurence H. Snyder, chairman of the local committee on arrangements, presided most delightfully, introducing the various speakers and guests in a very happy manner. President George W. Rightmire, of Ohio State University, and President Otto Mees, of Capital University, welcomed the academy most graciously, and President Doan responded briefly. The toastmaster then introduced Dr. Otis W. Caldwell, of the Boyce Thompson Institute for Plant Research, the genial and popular general secretary of the American Association for the Advancement of Science, who discussed in a most