Britain, which has proved to be a slow, painful and laborious process. Many of these still remain closed, and for ten years the public, and especially the younger generation, has been deprived of what they should enjoy—the greatest and oldest possessions of the country. He hoped that authority would remember that far greater progress has been made abroad. Returning to the subject of the Museum, he remarked on the beauty of the scientific instruments of the past, in which utility and beauty are happily married. The stream of tradition which made objects of use into objects of beauty also has never moved so sluggishly as to-day.

The company then proceeded to the Old Ashmolean Building, and Lord Crawford opened the door with the massive and beautiful key made for it in 1683.

The Museum is now laid out on three floors. The top one, the former *Musæum Ashmoleanum*, is devoted to the history of time-telling, and of physics other than optics. The ground floor, once the School of Natural History, contains optical instruments, most of which are derived from the collection of Dr. Reginald Clay, acquired during the War, while others come from the Radcliffe Observatory or the Shepherd Collection of the Royal Astronomical Society. The basement, which from 1683 until 1857 contained the Chemical Laboratory, is appropriately given over to chemistry and medicine; the Daubeny collection of chemical apparatus, deposited by Magdalen College, is the principal exhibit. A guide to the collections in their new form is now available*.

The work is not yet completed. The removal of the brick piers and girders which disfigure the basement is projected, as is also the provision of adequate library and lecture-room furniture; and there is, of course, an unlimited prospect of research.

The functions of the Museum are fourfold: first, to collect and preserve; secondly, to investigate; thirdly, to display; fourthly, to instruct. Historic scientific instruments are fast disappearing: it is but rarely that we find such things as Lewis Evans collected. The first need, therefore, is to collect what remains and to preserve it from damage. On this depends all the other functions of the Museum. Future generations may well investigate more acutely, display more brilliantly, teach far better—but they will almost certainly be less well able to collect. Instruments find their way to collectors and thence to museums; they are destroyed by fires or acts of war; there can never be any more of them and their price continually rises.

Our second function is to investigate. The history of scientific instruments is largely unwritten, and our contribution will be the issue of a comprehensive catalogue with historical notes. The first part to be issued will be that dealing with the time-telling instruments of the Museum, notably the dials, quadrants and nocturnals.

Our third object—to display—is not always in accordance with the first. A thousand polishings of a brass instrument will remove most or all of the inscriptions upon it, and in such cases there is war between those who desire to display the full beauty of these objects and those who would preserve them. We have unreservedly sought to preserve, having our eyes fixed upon a future of incalculable extent. Here again there is room for research into the question of the air-conditioned museum-case in which deterioration should be arrested.

The fourth purpose of the collections is instruction. Here again there is a conflict. Are we, given forty square feet of case for astrolabes, to show but a tenth of those we possess and fill the rest of the space with explanatory matter designed to instruct the student in the nature and use of that instrument? We have supposed that this, a specialist museum, is primarily a means of research rather than of instruction, and that our first need is to show everything that is of first-rate importance, and is not duplicated.

The Museum of the History of Science is not only a museum, for it is at present the centre of the teaching of the history of science at Oxford. Before 1939, Dr. Gunther had given a series of lectures on Oxford men of science to a number of the Colleges, but did not give any formal university lectures. During the War, courses in the history of science were provided for cadets; following upon this, the Curator and Dr. S. F. Mason and others have been giving formal courses of lectures on subjects connected with the history of science. At present these studies play but a very small part in the intellectual life of the University of Oxford; but when they come, as they must, to be recognized as of the first importance, the Museum of the History of Science will afford a rich source of material alike for the man of science, the historian and the philosopher.

F. SHERWOOD TAYLOR

PREHISTORIC AFRICA

SEVERAL new contributions to our knowledge of South African prehistory are to hand. Volume 4, Bulletin No. 13 of the South African Archaeological Society, contains a number of interesting articles. The Abbé Breuil describes some newly discovered rock-shelter paintings near Ladybrand, the technique of which is reminiscent of the Franco-Cantabrian art. Is it going to be found that prior to the already well-known rock-shelter paintings in the sub-continent there existed there an earlier, more naturalistic art? Breuil also discusses the age of the painted rocks and their authors. The last word has not been said on this subject.

Dr. C. van Riet Lowe contributes an account of some paintings recently found near Cathedral Peak in the Drakensberg, Natal. Judging by the few illustrations given, these would not appear to belong to an early series. Dr. B. D. Malan adds a short note on the Magosian at Howieson's Poort. The Magosian culture was first described by the present writer some years ago, the finds having been made by E. J. Wayland, then Government geologist in Uganda, at an ancient waterhole at Magosi in that country. Typologically the Magosian industry comprises very late Middle Stone Age elements with early Wilton additions. Indeed, one was tempted to see in it the birth of the Wilton culture out of a final Middle Stone Age cradle. The name, at any rate, has been accepted, and the existence of the Magosian culture is affirmed from British Somaliland to the Cape. The original collection from Magosi which was figured in the first description is housed in the Museum of Archaeology and Ethnology at Cambridge. One can only hope that all the many Magosian discoveries in Africa are really Magosian. Frankly, I wonder whether the Howieson's Poort finds are quite the same thing, although I admit there are some similarities. Maybe, since I was there, other finds

* A Brief Guide to the Collections of the Museum of the History of Science. Pp. 59. (Oxford, 1949.) 2s. 6d.

have been made which confirm the similarity. There is a danger in over-simplification; a culture name can easily become a sort of dustbin into which many different discoveries are thrown.

Dr. van Riet Lowe has also contributed a short article in Portuguese for the Sociedade de Estudos da Colonia de Moçambique (Boletim Nos. 57-58; April-September 1948). Anything that can be done in the way of creating interest in archaeological matters in this part of Africa is to be welcomed. Dr. van Riet Lowe has also given a useful summary (*British Science News*, 2, No. 16) of the archaeology of some of Dr. Robert Broom's famous sites in the Transvaal. Finally, in Volume 3, Bulletin No. 12 of the South African Archaeological Society, Cape Town, Dr. B. D. Malan describes a new Middle Stone Age site near Utrecht, Natal. M. C. BURKITT

22/6

RADAR RESEARCH AND DEVELOPMENT ESTABLISHMENT, MALVERN

THE Radar Research and Development Establishment of the Ministry of Supply held a series of open days at Malvern during the period September 21-23, thus giving the public its first chance of seeing the work of this well-known Establishment.

The Radar Research and Development Establishment is responsible for the research and development aspects of army radar equipment, both for the direction of anti-aircraft, coast and field artillery, and for the location of shipping, land vehicles and missiles. Although its history can be traced back to the Searchlight Experimental Establishment formed in 1917, the radar work which now absorbs the whole of the effort of the Establishment originated in a small research group detached to work at the Air Ministry Bawdsey Research Station in 1936 under the direction of Mr. (now Sir Robert) Watson-Watt. Whereas the Bawdsey Research Station was primarily concerned with radar for the Royal Air Force and later became the Telecommunications Research Establishment, the group concerned with developing radar to meet the army requirements broke away in 1939 to rejoin the parent Establishment and to form what might be termed the nucleus of the present Radar Research and Development Establishment at Christchurch in Hampshire. The Establishment moved to Malvern in 1942. Among a number of men of science who have directed its work since its inception, one finds Dr. J. D. (now Sir John) Cockcroft, who was chief superintendent during 1941-44. The present chief superintendent is Mr. P. E. Pollard, who was a member of the original research team under Sir Robert Watson-Watt in 1936.

The exhibition was opened on September 21 by the Minister of Supply, Mr. G. R. Strauss, and attendance on this day was limited to leading representatives of the fighting Services, the Civil Service, universities and industry, together with the Press. On September 22 the exhibition was attended by more than a thousand members of other government establishments, the universities and industry, while on the last day members of the general public were admitted. The impressive list of exhibits numbered more than a hundred, and a selection of the more interesting items is described below.

Anti-aircraft Gun-laying Radar. The purpose of the gun-laying radar is to provide accurate and continuous information of the position of an aeroplane or other target so that a 'predictor', or other computing equipment, can calculate where the gun should be pointed in order that the shell shall be effective against the target. There were eleven exhibits covering the work of the Establishment on gun-laying radar, including examples of the various types of set built dating from the 6½-metre wave-length, range and bearing only, set of 1939 to the modern 10-cm. wave-length 'auto-follow' system. In this modern set a paraboloid of about 5 ft. aperture forms the aerial system. In place of the normal hand turning, the aerial is automatically driven by servo-motors controlled by the radar pulses reflected back from the target in such a way that it continues to point at the moving target. The result is that the position of the target is accurately indicated and followed, however it may 'jink' or turn, without the aid of a human operator. An impressive exhibit showed this 'automatic-follow' radar coupled up through a predictor to a battery of four heavy anti-aircraft guns which fired demonstration rounds at a passing high-speed aircraft. The whole operation, apart from the actual loading of the guns, appeared to be completely automatic.

Field-artillery and Coast-artillery Radar. Field-artillery radars are required to detect enemy vehicles, to locate enemy mortar positions from observations of mortar trajectories, and to assess the accuracy of gunfire by observation of point of impact of shells. Similarly, coastal-artillery radars are required to detect enemy ships and to direct the fire of coastal batteries.

The 3-cm. wave-length coastal-artillery radar exhibited has a rather unusual display in that in addition to the normal sector-scanned plan-position-indicator display, facilities are provided for 'strobing' out a portion of the sector in both range and bearing, enabling an enlarged picture to be displayed on a second cathode ray tube. The result is that when the set is used for directing artillery fire against shipping, one is able to get a plan view of the ship on the magnified display. In addition, the resolution of the set is so good that the shell splashes are also clearly indicated, enabling small corrections to be applied to the direction of fire until a shell is actually seen to fall on the ship.

Radar for Ballistic Measurements. Ten exhibits were devoted to showing the application of radar to the determination of speed, spin and direction of experimental rockets and other projectiles. Velocity and spin measurements are normally made by observation of the Doppler frequencies produced by the recession of the target on a continuous wave (as opposed to the normal pulse) radar. An interesting exhibit in this group showed a tiny rocket-propelled missile which was followed on a 3-cm. wave-length continuous-wave radar during its flight. The Doppler frequency produced by beating the outgoing and returning radio signals could be heard on a loud-speaker and was fed to a frequency-measuring meter which indicated the speed of the missile in miles per hour.

Radar Aerial Research. Of the research items shown, some of the most interesting were due to the group working on aeriels. In addition to simple demonstrations showing the focusing properties of the usual dipole arrangements, Yagi and paraboloid aeriels, a considerable amount of new work on metal