

tion is directed to the simple, but not generally known, method of slightly revolving the upper Nicol when in or near the position of extinction.

The last chapter, on the optic axial angle, is in many ways the most interesting. It is now possible to obtain determinations in cases that would have been abandoned as hopeless a few years ago. When both axes emerge in the field of view the angle is usually measured by means of a linear scale in the eyepiece; Dr. Wright points out that, owing to the distortion introduced in the interference figure by the lens system the Mallard constant does not usually hold, and it is safer to calibrate the scale. Prof. Becke, with characteristic ingenuity, has recently shown that by mapping the brush in various positions a remarkably accurate value of the optic axial angle is possible, even when only one "eye" is visible; the method is fully explained and illustrated. For such work Dr. Wright uses a double micrometer eyepiece, but admits that a cross-ruled scale in the eyepiece is equally effective, a device that has been in use some years. Dr. Wright recommends for graphical work the little known Postel projection, in which the eye is situated at such a distance from the sphere that the distortion in polar directions is reduced to a minimum, and in tangential directions does not exceed the ratio of $\pi/2$; the awkwardness of the shapes of the great and small circles, however, militates against its use.

Prof. Fedorow's universal stage, the invention of which placed an invaluable weapon in the hands of petrologists, and enables them to measure the angle between the optic axes and determine their positions with respect to the section, even when no "eye" is visible, is also fully discussed. At the close of the chapter Dr. Wright very carefully considers the accuracy of which the several methods are capable. Some novel diagrams will be found on the plates at the end of the book; neither of the diagrams representing the equation $\sin i = n \sin r$ is, however, as simple as the graph devised by Mr. Hutchinson, in which the sines of the angles are taken as coordinates. An excellent index greatly adds to the value of the volume.

SMITHSONIAN EXPEDITIONS.

THE Smithsonian Institution has just issued a pamphlet describing, in part, the expeditions which it has organised or participated in during the field seasons of 1910-11, covering a wide variety of investigations conducted both in the United States and abroad. During the past two years the institution has been represented in eighteen different exploration and field parties. The scope of these activities has been world-wide, but more recently especial attention has been directed to Africa and the Panama Canal Zone.

Unfortunately, as the regular resources of the institution are not sufficient to carry on extensive field explorations, it is often compelled to confine its efforts to investigations of limited scope, but of such a nature as to bear directly on the progress of science. In this connection it has been fortunate in securing the cooperation of a number of public-spirited citizens and scientific institutions, as well as several branches of the United States Government.

The Smithsonian African Expedition had scarcely returned from the field when the institution received invitations to participate in two others, organised to explore the same general region. The first was Mr. Paul J. Rainey's hunting trip to British East Africa and southern Abyssinia, where Mr. Rainey especially arranged to hunt lions with a pack of American fox-

hounds. The natural history collections that might be secured were offered to the Smithsonian Institution, provided an expert field naturalist be sent to accompany him and prepare such of the game collected as was desired for exhibition or scientific study. Mr. Edmund Heller, who had accompanied the Smithsonian African Expedition in such a capacity, was selected, and departed with Mr. Rainey in February, 1911. The collection made has been estimated to contain some 4700 skins of mammals, together with many birds, reptiles, &c., and supplements the present African collection to a great extent. Nearly all of the material is from localities not covered by the earlier expeditions, and some of it comes from points never before visited by naturalists.

The other natural history expedition was that of Mr. Childs Frick, of New York, whose object was to secure a collection of animals from the territory lying to the north of the regions visited by the earlier Smithsonian expedition and that of Mr. Rainey, covering at the same time certain parts of Abyssinia, northern British East Africa, and the country lying about Lake Rudolf. As naturalist of this party, Dr. Edgar A. Mearns, of the Smithsonian African Expedition, was chosen. A portion of the collection of birds is to be donated to the Smithsonian Institution by Mr. Frick, and already several hundred specimens have been received.

During the summer of 1911, Mr. Charles G. Abbot, director of the Smithsonian Astrophysical Observatory, and Prof. F. P. Brackett, of Pomona College, California, made a series of observations on the radiation of the sun at Bassour, a small town about sixty miles south-west of Algiers, and secured a large amount of data for comparison with simultaneous observations taken by Mr. L. B. Aldrich at the Smithsonian observatory station on Mt. Wilson, California.

An expedition to South America, for the purpose of studying the material relating to the antiquity of man in that region, was conducted by Dr. Ales Hrdlicka, curator of physical anthropology, United States National Museum, and Mr. Bailey Willis, of the U.S. Geological Survey. The expedition collected many interesting geological, palæontological, and anthropological specimens, which have been turned over to the National Museum for identification and description, but the evidence gathered does not seem to sustain a large part of the claims regarding the antiquity of man in that region, which had been previously asserted by various authors.

While in this part of the continent, Dr. Hrdlicka also visited the ruins of the city and temples of Pachacamac, Peru, where he made personal researches and studies in archæology and ethnology. His complete report on the antiquity of man in South America is made in Bulletin 52 of the Bureau of American Ethnology, now in press.

In 1910 the institution organised a biological survey of the Panama Canal Zone, with the cooperation of the Departments of State, Agriculture, Commerce and Labour, and War. At first it was intended to confine the collections to the Canal Zone proper, but as the natural and floral areas extended to the north and south of this region, it was decided to carry the work into the Republic of Panama, a step which met with the hearty approval of that Republic. The work accomplished during the season of 1910 and 1911 related to vertebrate animals, land and fresh-water molluscs, and plants, including flowering plants, grasses, and ferns.

Another expedition in which the institution cooperated was that organised by the United States Bureau of Fisheries and the American Museum of

Natural History, and consisted of an exploration of the west coast of Mexico. In this connection, the fisheries steamer *Albatross* was used. Dr. J. N. Rose and Dr. Paul Bartsch represented the National Museum, collecting, respectively, the plants and molluscs from the portions of the coast visited. It was through this expedition that the National Zoological Park secured two yearlings of the elephant seal, a very remarkable and interesting animal, which for many years had been supposed to be extinct.

Mr. A. C. Bent, with a small party of ornithologists, made an excursion to the Aleutian Islands in search of further information for incorporation in a work on the life-histories of North American birds, which he is compiling for the institution. The members of this party were accorded many facilities by the Revenue Cutter Service of the Treasury Department, and particularly by the officers of the cutter *Tahoma*. Good series of land birds were obtained from nearly all the islands of the Aleutian chain, and many valuable facts concerning the distribution and habits of the land and water birds were recorded.

Mention is made of the field work in Cambrian geology and palæontology in British Columbia, continued by Dr. Charles D. Walcott, secretary of the institution, and his assistant, Mr. L. D. Burling. A remarkable collection of fossils was taken, and will be described in a future publication of the institution.

This publication on explorations consists of fifty-one pages of text, together with many illustrations from original photographs taken at the scenes of the investigations, and forms publication No. 2087 of the Smithsonian Miscellaneous Collections.

SECONDARY AND TECHNICAL EDUCATION IN ENGLAND.

THE annual volume of Statistics of Public Education in England and Wales, prepared by the Board of Education, is a valuable record of the position and progress of the various branches of elementary, secondary and technical education receiving State aid or recognition, so far as these may be judged by numerical values. Part i. of the volume of Educational Statistics for 1910-1911, which has just been published as a Blue-book (Cd. 6338, price 2s. 6d.), contains more than five hundred pages of tables and other statistical information relating to education in England and Wales. From this mass of material we have abstracted a few facts as to the position of English secondary schools, technical institutions, evening classes, and so on, in receipt of State grants.

Secondary Schools.

A secondary school, in the sense in which the term is used in the Board's regulations, must offer to each of its pupils a progressive course of instruction (with the requisite organisation, curriculum, teaching staff, and equipment) in the subjects necessary to a good general education, upon lines suitable for pupils of an age-range at least as wide as from twelve to sixteen or seventeen. The provision, if any, made for pupils below the age of twelve must be similarly suitable, and in proper relation to the work done in the main portion of the school. The regulations also require that an adequate proportion of the pupils must remain at least four years in the school, and that an adequate proportion must also remain up to and beyond the age of sixteen; but these requirements may be reduced to three years and the age of fifteen respectively in the case of rural areas and small towns, where such a course appears to the Board to be advantageous in view of local circumstances. The great public schools are not connected with the Board under these regula-

tions, but with this exception most of the secondary schools in England are included in the subjoined table:—

Numbers of Schools and Pupils.

Number of schools	...	...	...	...	862
Number of full time pupils under 12 years of age	...	...	...	...	36,989
12 and under 16 years of age	...	...	...	...	96,058
16 " 18 "	...	...	...	...	11,555
18 years of age and above	...	...	...	...	1,007
					145,609

It will be seen from this table that more than 90 per cent. of the pupils in our State-aided secondary schools are under sixteen years of age, and one-quarter of the pupils are under twelve years of age. In other words, a large part of the work of these secondary schools is of an elementary grade educationally, and not secondary in the sense of being a continuation of primary education. Of the total number of pupils in the secondary schools, 60 per cent. are from public elementary schools, and 35 per cent. receive free education. When only Council schools are considered, it appears that nearly three-quarters of the pupils are from public elementary schools and 40 per cent. pay no fees.

Any bright boy or girl can proceed from the elementary school to the secondary school by the liberal provision of "free places," and they can often obtain maintenance grants in addition. There are now very few really promising children of working-class parents who fail to secure places in our secondary schools if they wish to do so. In many districts it is difficult to find among the pupils presented from elementary schools a sufficient number to justify their admission to secondary schools under the clause which provides for 25 per cent. free places for pupils from elementary schools, without having a low educational standard. In fact, free secondary education practically exists at present for every capable child of the elementary school class who desires to take advantage of it. The children enter as free-placers or by payment of low fees; but as most of them leave before they are fifteen years of age, they had better have remained in the elementary schools. Free secondary education may be accepted as a general principle, but the privilege should be accompanied by the responsibility of remaining at school until a full course has been completed, whether maintenance grants are provided from public funds or not.

A rough indication of the attainments of pupils as measured by success in certain examinations is given in a table which appears for the first time in the present volume of statistics. The examinations selected are the preliminary examination for the teacher's certificate, university senior locals, university matriculation, university senior school examination, university higher locals, and other examinations of like standard. The results of the inquiry are here summarised:—

Attainments of Pupils leaving Secondary Schools.

Number of pupils of 14 years of age and above who left during the year	...	...	...	...	38,672
		Boys	Girls	Combined	
		%	%	%	
Passed one of the above examinations	14'06	21'16	17'16		
Did not pass "	85'94	78'84	82'84		

In the table from which these numbers have been extracted we have for the first time a means of estimating the standard reached by pupils leaving our State secondary schools. It appears that more than four-fifths of the pupils had not passed an examination of senior local or matriculation standard when they left school. This is probably explained by the fact