

REPORT OF THE PARIS OBSERVATORY FOR 1902.—In his report of the Paris Observatory for 1902, M. M. Lœwy, the director, describes in detail the various important series of observations made at that observatory.

In announcing that the last two volumes of the "Catalogue de l'Observatoire de Paris" are ready for publication, M. Lœwy gives a detailed account of the circumstances which led to the inception and prosecution of the work necessary for the publication of such a complete stellar catalogue.

For the determination of the latitude of the Paris Observatory, 6530 measures of the absolute polar distances of fundamental stars were made with the large meridian circle during the year, and, in accordance with Sir David Gill's proposals, 5063 observations of reference stars for the astrographic chart were made.

The observations for the redetermination of the difference of longitude between Paris and Greenwich were completed, and the concordance between the observations of the Paris and Greenwich observers in the first series, which has been completely reduced, is very striking.

504 photographs of the moon for the "Atlas Photographique de la Lune," of which the sixth section has been published, were taken with the large equatorial coudé. A 6-inch grating, for use with the smaller equatorial coudé, has been ordered from America, and when this is received it is proposed to carry out, systematically, similar researches

ports for meridian circles. It will perhaps be remembered that in the last report of the superintendent of the United States Naval Observatory it was stated that since the substitution of a brick pier for the marble pier that was formerly used, the previously reported changes in azimuth of the 6-inch Repsold meridian circle had entirely disappeared. The experience of Prof. Hough is opposed to the principle contained in that statement, viz. that brick piers are superior to stone for this purpose.

By a table of comparative expansions he shows that those of granite, sandstone, &c., approximate more nearly than that of brick to the expansion of iron, and therefore, with iron fastenings, a stone pier will ensure a greater rigidity of the instrument in regard to the pier; from the same table it is seen that brass fastenings are far more likely to produce lack of rigidity than those made of iron.

#### RECENT PAPERS ON METEORITES.

THROUGH the courtesy of Prof. Henry A. Ward, of Rochester, New York, we are able to reproduce for our readers a photograph which gives a good idea of the form and dimensions of the large mass of meteoric iron lying at a place called Ranchito, near Bacubirito, in the province of Sinaloa, Mexico. The existence of the mass was made known to the scientific world by Prof. Barcena more than a

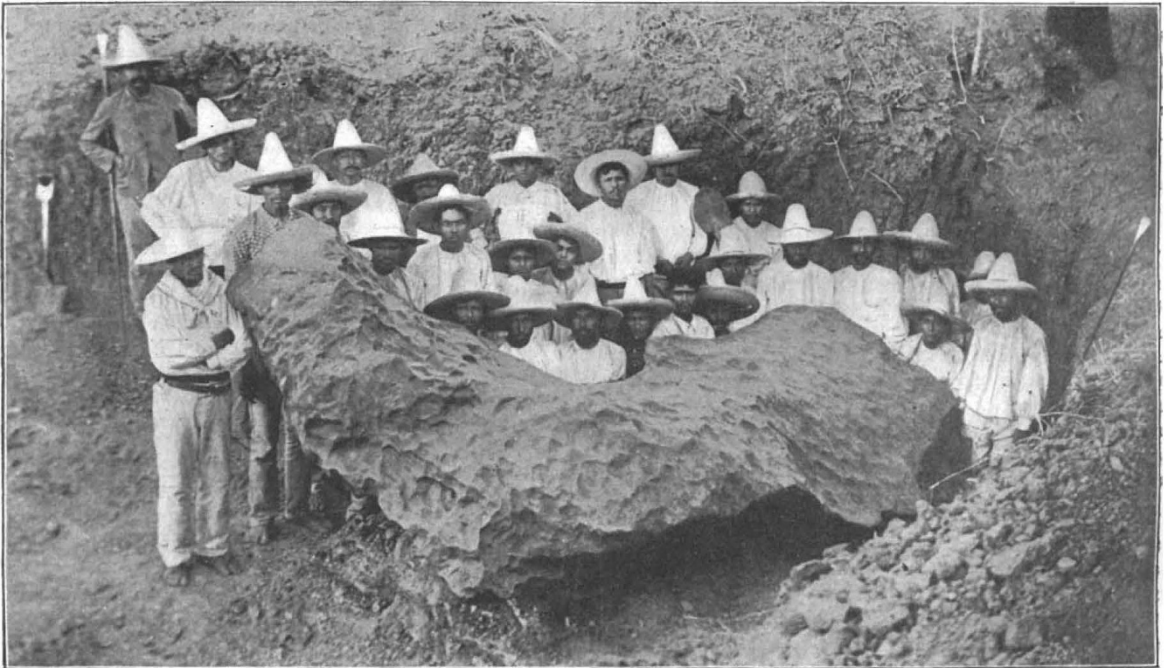


FIG. 1.—The Meteoric Iron of Bacubirito, Sinaloa, Mexico.

in solar physics to those which are already prosecuted in England and America.

In connection with the "International Astrographic Chart and Catalogue" fifty-six plates for the chart and twelve for the catalogue were secured; the printing of the catalogue for zone  $+24^\circ$  was completed, and it contains the positions of 64,264 stars, whilst the publication of zone  $+23^\circ$  was commenced and the section oh. 4m. to 6h. 20m. completed. Altogether the positions of 21,855 stars were completely measured for the catalogue, and the magnitudes of 35,630 stars belonging to zone  $+23^\circ$  were determined during 1902.

THE RIGIDITY OF PIERS FOR MERIDIAN CIRCLES.—In No. 3902 of the *Astronomische Nachrichten*, Prof. G. W. Hough, of the Dearborn Observatory (U.S.A.), discusses in detail the relative merits of brick and stone piers as sup-

quarter of a century ago, and, later, its dimensions were recorded by Prof. Castillo; but until after the visit of Prof. Ward there had been no published information as to the particulars of the occurrence. Prof. Ward, who is greatly interested in meteorites, travelled from the city of Mexico to Bacubirito, an extremely long, arduous, and expensive journey, for the special purpose of examining the meteorite *in situ*. It was found by him to be lying at the place specified, but to have only one end projecting from the ground. Twenty-eight labourers were employed by him to excavate round the mass and make it possible to determine the complete form. After two days' work not only had this been done but, through removal of the support from one side, the large mass had been made to turn itself over. It is 13 feet 1 inch long, 6 feet 2 inches wide, and 5 feet 4 inches thick. Its irregularity of form and the character of the surface are manifest from Fig. 1. The mass is estimated to weigh



50 tons (the specific gravity having been determined to be 7.69), and it is probably at least as large as the big mass brought some years ago from Greenland to the United States by Lieutenant Peary. After these two, the next largest known meteorite in the world is that of Chupaderos, which has lately been removed to the city of Mexico and found to weigh 15½ tons. A polished face of the Bacubirito iron, when etched, shows very distinct Widmanstätten figures. According to a chemical analysis made by Prof. Whitfield the percentage of nickel (and cobalt) is 7.2. The time of fall of the mass is unknown. The meteorite is described by Prof. Ward in the *Proceedings* of the Rochester Academy of Science (vol. iv. p. 67, 1902).

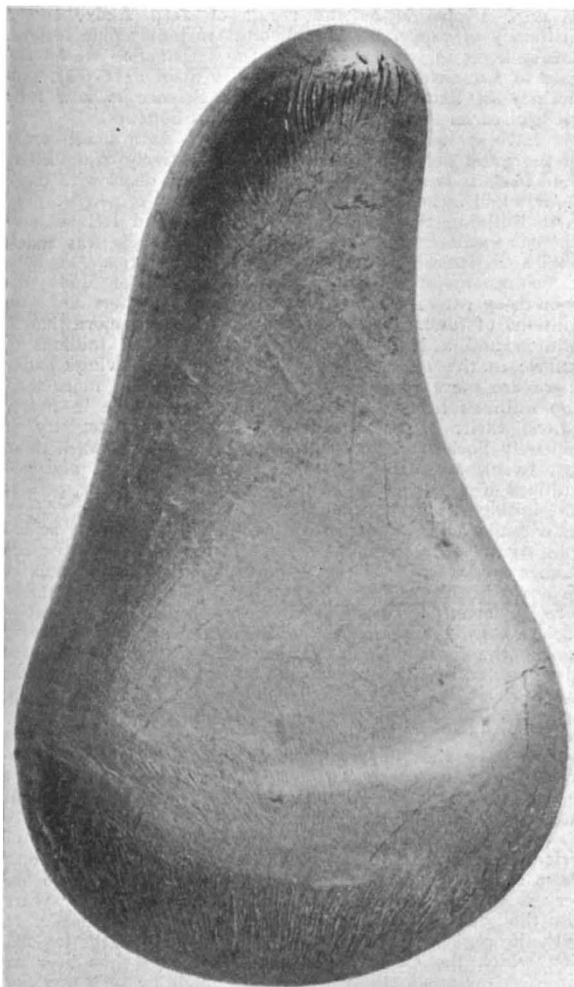


FIG. 2.—The Boogaldi meteorite, N.S.W. Showing "drip" from the underside, tail end. Length: 5 inches, width 3 inches; weight 2057.5 grms. Sp. gr. 7.85.

In the *Journal* and *Proceedings* of the Royal Society of New South Wales, vol. xxxvi. pp. 341-359, Prof. Archibald Liversidge, F.R.S., of Sydney, gives descriptions of four meteorites, all from New South Wales, one of them a meteoric iron, the other three meteoric stones. The meteoric iron, though not actually observed to fall, was found shortly after that event; it was noticed in January, 1900, that the ground had been torn up on a hard ridge near Boogaldi Post Office; the furrow was followed, and a small pear-shaped mass of iron was found slightly embedded in the ground; it had come from the north-west, and its path must have been inclined at only a small angle to the horizon. It weighed 4½ lb., and has a specific gravity of 7.8. The surface is formed by a skin of fused oxide, which has been arranged in waves with transverse furrows

by the motion through the air (Fig. 3); part of the fused oxide has accumulated at the thin end of the meteorite, and part of it has doubtless been blown off at that part (Fig. 2). A polished section, when etched, shows well-marked Widmanstätten figures; only one or two specks of troilite are visible on the etched face. Chemical analysis of the metallic sawdust obtained on cutting the meteorite shows that the nickel and cobalt amount to 8.5 per cent. In addition to the chemical elements normally present in meteorites, Prof. Liversidge found small quantities of arsenic, gold, and either platinum or some other member of the platinum group.

The places of fall of the meteoric stones were (1) Barratta, near Deniliquin; (2) Gilgoin, near Brewarrina; (3) Eli Elwah, near Hay; the falls were not actually observed. The stones are all remarkable for their size. In the case of Barratta, about 2 cwt. had been found on a previous

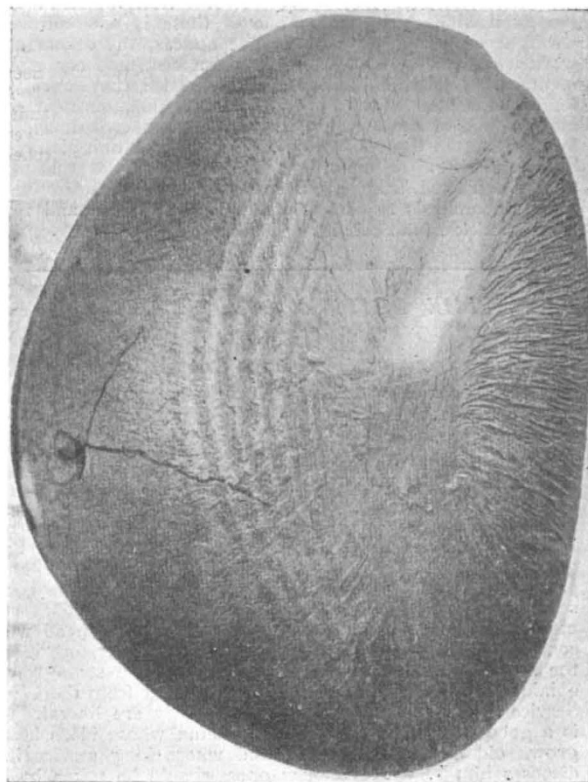


FIG. 3.—The Boogaldi meteorite, N.S.W. Showing waves formed in the fluid skin at the forward end; the right hand side was the lower one during flight. Enlarged two diameters.

occasion many years ago; two other stones have lately been found weighing 31½ lb. and 48 lb. respectively. The Gilgoin stones weigh 67½ lb. and 74½ lb., and the Eli Elwah stone 35½ lb. All these stones have a chondritic structure; the specific gravities range from 3.39 to 3.86. The paper is illustrated with no fewer than twelve plates.

In the *Publications* of the Field Columbian Museum (Geological Series, vol. i. pp. 283-315) Dr. O. C. Farrington gives an account of various meteorites. The first of them is from Long Island, Phillips County, Kansas, of the structure of which Dr. Weinschenk gave a minute description several years ago. The meteorite, which belongs to the chondritic kind, was not observed to fall, and must have been in the ground some time before it was found. Fragments having a total weight of 1244 lb. have been recovered; it is therefore the largest meteoric stone which has yet been met with. The larger fragments can be closely fitted together, and the original form of the mass is thus reproduced. The directive character of the pittings and furrows is very suggestive of the exterior of the Goipara stone.



Chemically, the meteorite is remarkable for its high percentage (6.3) of chromium sesquioxide. Dr. Farrington suggests that a small portion may be present as a constituent of the olivine, and the rest as part of the chromite. The author next enters into a discussion of the relations of the various meteoric stones which have been found in Ness County and other parts of north-western Kansas; he infers that Prairie Dog Creek, Long Island, Oakley, Jerome, and Franklinville belong to distinct falls, and that Wellmanville may be part of the Franklinville fall, and Kansada part of either the Franklinville or the Jerome meteorite. Another meteorite described is one from Los Reyes, forty miles from Toluca; this is an iron, and its characters are similar to those of other masses found nearer Toluca; there is no reason to believe that the mass has been transported by man from the latter locality. The Los Reyes mass may belong either to a distinct fall or indicate a wide spreading of the Toluca shower. In the same paper an account is given of the structure of the meteoric iron found in the Hopewell Mounds of Ohio; one of these is a small, unwrought mass weighing about five ounces, the others are worked specimens, namely, a part of a head and ear ornament, some celts, and a number of beads; they were all found associated with a single human skeleton near an altar of one of the mounds; the iron, when etched, shows Widmanstätten figures, which have been bent and distorted by hammering. Finally, Dr. Farrington states that the tænite extracted from the Kenton County meteorite was found on analysis to consist of 80.3 parts of iron and 19.7 parts of nickel (and cobalt).

### THE BRITISH ASSOCIATION.

#### SECTION F.

##### ECONOMIC SCIENCE AND STATISTICS.

OPENING ADDRESS BY EDWARD W. BRABROOK, C.B., F.S.A., V.P.S.S., PRESIDENT OF THE SECTION.

It is a coincidence, which has great interest for me personally, that the honour of being President of this Section has fallen to me in the last year of my engagement in the public service. I am now in the sixty-fifth year of my age and the thirty-fifth of my connection with the Registry of Friendly Societies, and in a few months the guillotine of the Order in Council will fall, and the Department and its present head will be severed. The consequences are not so tragic as they sound, for the Department will at once find a new head, and the old head will contrive to maintain a separate existence. I therefore meet the stroke of fate with cheerfulness; for I am strongly of opinion that the arrangements for retirement from the Civil Service of the country are as wise as they are liberal. It is a good thing that the place of a man whose ideas have grown old and become fixed, and whose long service indisposes him to entertain new ones, should be taken by a younger man anxious to make his own mark on the administration of his department. Again, the prospect of promotion opened up by the limited term of service of the older men is a distinct inducement to able and ambitious young men to devote themselves to their country's service. I have lately had occasion to give minute and careful attention to one branch of this important question, and the study of the whole subject which has thus been rendered necessary has strongly confirmed the conviction I previously entertained that the system of retirement which now prevails greatly tends to promote the efficiency of the Civil Service and the interests of the country. I do not apologise for saying this much on a subject into which I was led by an observation that concerns me personally, for the means of securing efficiency in the public service is an important economic question.

The coincidence to which I refer tempts me to choose as the principal subject of the Address which I am permitted and enjoined to deliver to the Section on this occasion that small corner of the great field of Economics in which I have been a day labourer for so long, and I am not able to resist the temptation. My piece of allotment ground, if I may so call it, is that which is devoted to the cultivation of thrift, or of economy in the popular rather than the scientific sense. The temptation is strengthened by the

circumstance that that subject has rarely been treated by my predecessors. Sir Robert Giffen in his Address of 1887 referred to it, and Sir Charles Fremantle in 1892 treated it at somewhat greater length. In old times, when the Chair of this Section was more frequently occupied by the practical statesman than by the professed economist, there were passing allusions to it by Henry Fawcett in 1872, William Edward Forster in 1873, and Sir Richard Temple in 1884; but in more recent years the accomplished economists who have presided over this Section, notably my immediate predecessor, have delivered luminous and memorable Addresses on the broad principles of Economics, the application and potency of its doctrines, and their serviceableness to mankind, with a comprehensiveness of view that is only attainable as the result of deep study, and a brilliancy of exposition that belongs to philosophic insight. I may here, in passing, express the satisfaction we all feel that at Cambridge, where we are to meet next year, proficiency in Economics and Political Science is now fully recognised as qualifying for academical honours.

I have spoken of the subject of Thrift as a small corner of the great field of Economics; and relatively to the broad field itself it is so; but it is a subject that deals with large figures and intimately affects large numbers of people. The 2000 Building Societies in Great Britain and Ireland have 600,000 members and sixty-two millions of funds; the 28,000 bodies registered under the Friendly Societies Act have 12,000,000 members and forty-three millions of funds; the 2000 co-operative societies have 2,000,000 members and forty millions of funds; the 600 trade unions have more than a million and a half members and nearly five millions of funds; in the 13,000 Post Office and other savings banks there are more than 10,000,000 depositors and more than 200 millions invested; so that upon the whole in nearly 50,000 thrift organisations with which the Registry of Friendly Societies has, in one form or other, to deal there are twenty-seven millions of persons interested and 360 millions of money engaged. These figures, however, possess no significance other than that they are very big. Many individuals are necessarily counted more than once, as belonging to more than one society in one class, or to more than one class of societies. Some portion of the funds of Friendly Societies is invested in savings banks, and therefore is counted twice over. Some of the co-operative societies, as, for example, the wholesale societies, have for capital the contributions of other societies, which thus are also counted twice over. On the other hand, the aggregate, large as it is, is necessarily defective. It includes only bodies which are brought into relation with the Registry of Friendly Societies in one or other of the functions exercised by that department. It does not include, therefore, many co-operative and other bodies which are registered under the Companies Act, nor the Industrial Assurance Companies which are regulated by the Assurance Companies Act, nor does it include the great body of Friendly Societies which are not registered at all. Among these shop clubs hold a prominent position, and these are very numerous. The Royal Commissioners of thirty years ago thought that the unregistered were then commensurate with the registered bodies; and as one result of the legislation which the Commissioners recommended has been to diminish the applications for registry made by such societies as are subjected by it to the necessity of a periodical valuation of assets and liabilities, there seems no reason to think that unregistered societies are relatively now any fewer than they were then.

It would seem, then, that the figures we have cited are well within the mark, and that, used for the mere purpose of indicating the magnitude of the interests involved, they may be relied upon as not over-estimating it. The observation just made leads to the question, why should there be so many unregistered societies? Why, indeed, should there be any unregistered societies? The National Conference of Friendly Societies, which consists wholly of registered bodies, has just passed a resolution recommending the enactment of a law that all societies should be compelled to register. Why not? I think it will not be difficult to find the real answer to these questions. It was given as long ago as 1825 by a Committee of the House of Commons in these wise words:—"It is only in consideration of advantages conferred by law that any restrictive interference can be justified with voluntary associations established for lawful