THE HARVARD COLLEGE OBSERVATORY REPORT.—The annual report of the director of the Astronomical Observatory of Harvard College for the year ending September 30, 1914, indicates the completion of a large amount of work in both observation and publication. Prof. E. C. Pickering refers in the first place to the principal work of the observatory, namely, its publications and the importance of issuing these as soon as possible to prevent loss by fire. Thus observations from 1892–1912 with the 15-in. equatorial, from 1888–98 with the 8-in. transit circle, and from 1898–1912 with the 12-in. meridian photometer are now printed, and the discussions are in progress. The director directs attention to the improvement in photographic processes resulting in the replacement of practically all visual work. The report then describes in more detail the work of the Henry Draper Memorial, the principal research of which is the New Draper Catalogue; last year Miss Cannon classified 60,386 spectra, making a total of 160,541. The activities of the Boyden department, the Bruce photographic telescope, and the Blue Hill Meteorology Observatory are briefly summarised, while among the many items mentioned under the heading "Miscellaneous" the work of Prof. W. H. Pickering at the Mandeville Station, in Jamaica, is described, much time having been devoted to the study of the planet Mars during its recent opposition.

STAR CHARTS FOR METEOR OBSERVERS.—One of the contributions to the January number of the Journal of the Royal Astronomical Society of Canada (vol. ix., No. 1, p. 7) is entitled "A Gnomonic Star Atlas," and contains a set of thirteen maps, prepared by Mr. Reynold K. Young, intended to facilitate the observation of meteors and the plotting of their paths. The method of the projection of the map is such that great circles in the sky are equivalent to straight lines on the map, thus making the plotting of the meteor trails more easy. The maps are devoid of unnecessary detail. The positions of the stars are given for the epoch 1900 correct to within one-tenth of a degree, and all stars down to 5th magnitude and the brighter variables are included. A good margin of overlap has been allowed in each map, which should prove very useful.

FLUCTUATIONS OF TEMPERATURE IN EUROPE AND AMERICA.

MR. H. ARCTOWSKI, in a paper published in vol. xxiv. of the Annals of the New York Academy of Sciences, considers the problem of variation of temperature over the whole earth. After a brief statement of the general problem and the methods by which it may be attacked, he explains that he could not deal single-handed with the arrangement and discussion of the actual values even over the whole of the northern hemisphere, and confines himself to the detailed survey of the variations over North America and Europe. He also compares the results with one or two representative equatorial and southern hemisphere stations. From a study of the values at one of these, Arequipa, in Peru, he deduces that the temperature changes are partly of a short period of about fifty-five days, brachypleionian waves; partly of a long period of twenty years or so, macropleionian waves; and partly of an intermediate period of between one and two years, pleionian waves.

In dealing with the longer periods the normal annual variation is eliminated by taking a series of means for twelve months beginning with each consecutive month of time. For the European stations he finds that the continental ones resemble Arequipa in having marked pleionian waves, while those stations near the Atlantic are characterised mainly by brachypleionian variations.

In an earlier paper Mr. Arctowski dealt with the period 1891–1900, and he takes the mean values for this period as normals, and plots on maps the difference from normal of the values during each year of the decade 1900–09. The areas where the differences are positive he calls thermopleions, and the areas of negative differences antipleions. He finds that certain years, in particular 1900, 1908, are characterised by thermopleionian areas, while others, such as 1904, 1907, are years of antipleions. The most important cause of these differences is the variation of solar radiation, but there are also supplementary causes such as the presence of volcanic dust in large quantities, or exceptional ice conditions in the polar regions.

Many of the maps which illustrate the results of the investigation are on a very small scale; the course of the thermopleions and thermomeions is obscured by the attempt to show relatively microscopical geographical details.

Mr. Arctowski finds it astonishing that after all the efforts which are made to organise and maintain meteorological stations all over the world, the actual results of the work are so inaccessible. Even for the area with which he dealt he could only get much of the data by writing personally to the directors of the different meteorological institutes. This is a defect which will be remedied when meteorologists of different countries undertake to contribute to a central bureau representative regional values based on a selection of stations which can only be chosen satisfactorily by the local organisation.

There is another defect which is almost more serious, viz., the lack of continuity in the records for individual stations due to changes of situation or instruments. For example, Mr. Arctowski finds that the difference of temperature between Chicago and Milwaukee was nearly 4° F. in the decade 1873–82, while in the decade 1896–1909 the difference was only 2° F. The change is almost certainly due to change of instrument or site, and as it is of the same order of magnitude as the changes with which he deals, it indicates the need for great caution.

The difficulty of securing comparable continuous records is indeed one of the most serious problems with which organised meteorology has to deal.

E. G.

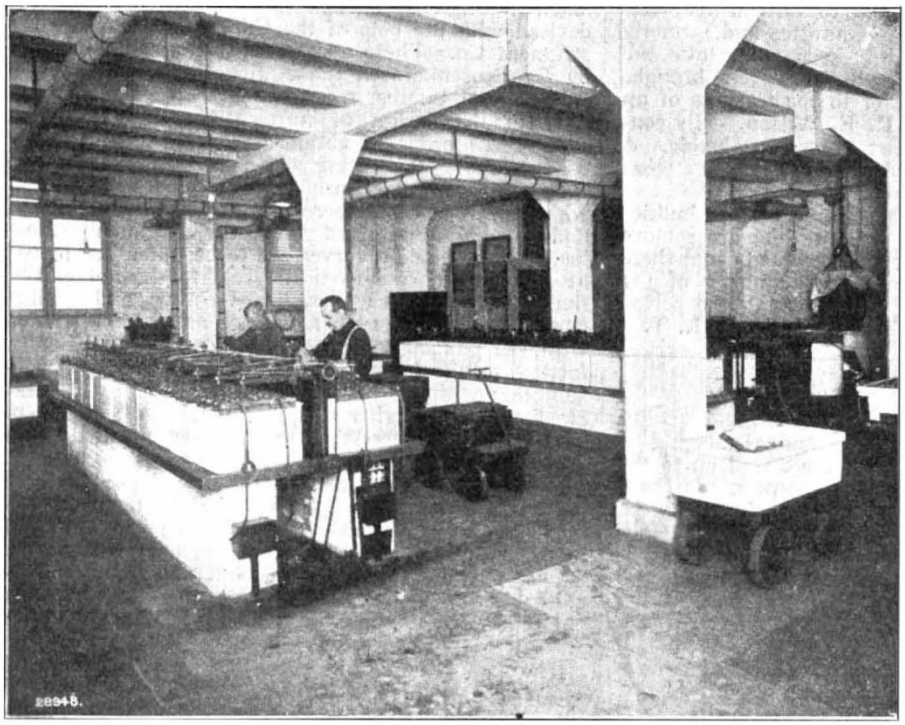
REFINING GOLD BY ELECTROLYSIS.[1]

THE problem presented by the necessity of refining gold was one for which a solution was sought at least as early as the time, about B.C. 700, when coins were first manufactured in the Western world. Apart from toughening or the removal of base metals, which was sufficiently cared for by the ancient process of cupellation, it is clear that some measure of success attended the efforts made to part gold and silver. Thus, some of the ancient Greek coins containing 997 or 998 per 1000 of gold. The earliest parting process used was one of cementation, which was succeeded by the nitric acid process. At the present day chlorine is the predominant agent for parting gold from silver in Australia, electrolysis in America, and sulphuric acid in Europe.

The electrolytic process was brought forward by Charles Watt, at Sydney, in 1863, and was first put into operation by Wohlwill at Hamburg in 1878 and by Tuttle at the Philadelphia Mint in 1902. In the gold chloride process the solution used in the bath

[1] Abstract of the presidential address delivered before the Institution of Mining and Metallurgy on March 18, by Sir T. K. Rose.

contains gold in the form of chloride and some free hydrochloric acid. Gold is dissolved at the anode, under the action of a current of electricity, and deposited in a pure state at the kathode. Other metals are also converted into chlorides at the anode, and either remain in solution, or pass into the anode slime. When silver is contained in the anode, it is converted into silver chloride which in part dissolves, in part falls to the bottom of the cell, and in part adheres to the anode, forming an insoluble coating. The result of the coating is that the free area of the anode is reduced, the density of the current becomes greater per unit area of effective anode surface, and chlorine is evolved unless a very small current is used. According to general experience, if more than 6 per cent. of silver is present in the bullion of the anode it is necessary to brush the silver chloride from the anodes, and accordingly this percentage is seldom exceeded in practice.



Photo] FIG. 1.—Electrolytic gold cells, United States Assay Office, New York. [*B. P. Wirth.*

The usual amount of free hydrochloric acid present in the bath varies from 3 to 10 per cent., but according to the results of experiments now put forward by Sir Thomas Rose some advantages are obtained by the use of stronger solutions. Thus in a bath containing 29 per cent. of free hydrochloric acid, a current of 5000 amperes per square metre of anode surface can be used without causing chlorine to be evolved at the anode. Under these conditions the proportion of silver in the anode may be raised to at least 20 per cent. without difficulties being encountered. The heavy current causes the silver chloride to split off from the anode, and also prevents gold from entering the anode slime, principally because no monochloride of gold is allowed to form.

Similar advantages occur in the deposition of gold at the kathode by the use of a solution containing 20 per cent. of gold as chloride instead of the usual 3 to 5 per cent. With a current of 5000 amperes per square metre, the gold is deposited in a coherent form, which is easily washed, and is malleable after being melted. The density of current now employed in practice is below 1000 amperes per square metre, and the anodes occupy about a week in being dissolved. With a current of 5000 amperes, the anodes would be dissolved within the limits of a working day and a saving in interest, and in the difficulties of daily stock-taking, would be effected.

One of the merits of the electrolytic process is that the refined gold is always malleable and fit for use in the arts, and another is that any platinum contained in the gold is extracted. This is becoming of some importance in view of the high price of platinum and of the fact that nearly all rough gold bullion, including that from the Transvaal, is now known to contain that metal. According to the experience in the United States mints (Fig. 1), it is cheaper to refine gold by electrolysis than by sulphuric acid.

BIRD-MIGRATION IN 1913.[1]

WE have before us the ninth of a projected series of ten reports setting forth the imposing mass of data regarding bird-migration collected by the committee appointed for the purpose by the British Ornithologists' Club. Once the final volume, dealing with the autumn of 1913 and the spring of 1914, has appeared, we may expect a publication of greater importance, summarising the vast amount of material collected by ten years' labour. In the meantime no attempt is made to draw conclusions from the facts which are published, but a few points about the movements of 1912–13 may here be selected for notice.

The autumn of 1912 appears to have been remarkable for the early dates at which the migrations of several species began. Thus a swallow was noted at the Bell Rock Light in the Firth of Tay on July 4, and willow-warblers at the same place two days later. As early as June 25 a large flock of starlings had been seen flying west in the evening at Spurn Head Light. On the nights of July 14–15 and 15–16 swifts were recorded from the Lundy North Light (British Channel) and the Hanois Light (Channel Islands) respectively.

The great movements, however, do not seem to have begun until mid-October, and the migrations observed during the first three weeks of November were of extraordinary magnitude. Almost every night during that period half-a-dozen different light-stations record the passage of large numbers of birds, notably skylarks, starlings, and various species of Turdus.

[1] Report on the Immigrations of Summer Residents in the Spring of 1913; also Notes on the Migratory Movements and Records received from Light-houses and Light-vessels during the Autumn of 1912. (Bulletin of the British Ornithologists' Club, vol. xxxiv., December, 1914.)