Prof. H. F. Osborn in the Museum's *Bulletin* (vol. xxxv., art. xliii., January, 1917). Instead of being a raptorial carnivore, as at first seemed probable, it proves to be one of the strangest and most unexpected of dinosaurs, and represents an entirely new group. The jaws are toothless and must have been sheathed in narrow, horny beaks, much like those of an ostrich; but the quadrate and other bones of the skull preserved are distinctly dinosaurian. Compared with the trunk, the head is remarkably small, for although the skull is only one-third longer than that of an ordinary ostrich, it is attached to a backbone more than 13 ft. in length. The long and powerful neck must have been as flexible as in a bird. The small fore limb is long and slender, with three clawed fingers closely pressed together and of nearly equal length. On the whole, it suggests functions like those of the fore-limb of a sloth. The reptile could obviously run rapidly on its three-toed hind-limbs, with the raised forequarters balanced by the long tail. Its habits are very difficult to determine, but Prof. Osborn thinks that it lived much like an ostrich, on a mixed diet, with little power of grasping living or actively moving prey. This conclusion is interesting, for Struthiomimus and Ornithomimus bear many close resemblances to the typical carnivorous dinosaurs, with which they must have had a common ancestry.

A "CATALOGUE of the Collection of Meteorites" in the Field Museum of Natural History at Chicago is given by the curator, Dr. O. C. Farrington, in Publication 188 of that museum (Chicago, 1916, Geol. Ser., vol. iii., pp. 231–312). It is interesting to recall that two other catalogues of meteorite collections, namely, those at Washington and Calcutta, were also published during the latter part of last year. The Chicago collection was greatly augmented in 1912 by the purchase of the famous Ward-Coonley collection, which had already absorbed the large private collections of Mr. J. R. Gregory, of London, and of Count Simashko, of Petrograd; and since the last catalogue of 1903 it has been almost trebled in size. Containing representatives of 657 falls and a total weight of 7566 kilograms (about 7½ tons) of meteoritic material, it now ranks as the foremost collection in the world. The present catalogue gives particulars of the individual specimens, arranged alphabetically under the geographical names of the falls. A few general notes pointing out prominent features of the collection are also given. The largest mass is the Quinn Cañon (Nevada) iron of 1450 kg. The Cañon Diablo (Arizona) iron is represented by 122 individuals, the largest weighing 460 kg., and the total weight being 2306 kg. The Forest City (Iowa) shower of stones is represented by 722 complete individuals, ranging in weight from 3 to 4308 grams. There are some inconsistencies in the transliteration of Russian geographical names, Germanised forms of which seem difficult to eliminate. For example, Government Saratov appears correctly on p. 295, but on p. 288 as Saratowsk, the latter being the German rendering of the Russian adjectival form.

THE Paris correspondent of the *Times*, in the issue for February 10, describes what France has achieved in "war chemistry." Before the war France obtained her coal-tar products—benzene, toluene, xylene, naphthalene, anthracene, phenol, etc.—from Germany, and there was only one factory in the country capable of producing certain colouring matters. Since the latter and explosives have the same starting point, viz. the nitration of hydrocarbons, the position was extremely grave. As quickly as possible nitration plant was laid down in many new works, both private and belonging to the State, arrangements were made for the supply of enormous quantities of benzene and toluene, and shells were soon being manufactured in ever-increasing numbers. France's position as regards sulphuric acid will be excellent; in fact, there may be a difficulty in utilising all that produced. From the product of the phosphate mines of Tunisia and Algeria, together with the superabundant sulphuric acid, it will be possible to supply French farmers with cheap superphosphate, and also to compete in the foreign markets. The Germans probably knew, when in May, 1915, they first made use of asphyxiating gases as a weapon of war, that liquid chlorine was not produced in France. But within a year several works had commenced liquefying the gas. After the war these works will be established, and can be employed for the manufacture of bleaching powder, certain colouring matters, and various pharmaceutical products which France has hitherto had to import.

AN article appears in the *Quarterly Review* for January, under the title "Aircraft Politics in War Time," which gives an exceedingly clear account of the causes and results of the attack on Government-designed aeroplanes which was started by Mr. Pemberton Billing in July, 1916. The writer traces the real cause of this attack to the position in which manufacturers were placed by the rapid changes in the type of machines required. These changes were directly consequent upon the experimental work done at the Royal Aircraft Factory and at the National Physical Laboratory, and prevented the "trade" from making arrangements for repetition work in quantity, thus reducing efficiency from the commercial point of view. The article in question gives strong support to the excellence of the machines designed at the R.A.F., and quotes the case of the "Fokker" to show how easily wrong conclusions as to a machine's performance can be drawn in a moment of excitement. The "Fokker," when captured and tested by our own men, proved inferior to our own machines of similar type in all particulars, and was found to be thoroughly unstable. This is not surprising, since it is well known that the question of aeroplane stability was not understood in Germany as it was in this country at the time war broke out. The progress that has been made since the war started, in regard both to stability and to general aerodynamics, has been truly astonishing, and this scientific progress has had much to do with the altered relations between the "trade" and the Government designers which now exist. Far from discrediting experimental work in aeronautics in favour of the "rule of thumb" method, the private firms are now only too eager to obtain the results of such research and to use them to the utmost in their new designs. The article devotes a considerable amount of space to the purely commercial relations between the private manufacturer and the Government, but it is, nevertheless, well worth reading by those interested in the scientific development of aeronautics.

OUR ASTRONOMICAL COLUMN.

THE SPECTRA OF CEPHEID VARIABLES.—The detailed results of an extensive series of spectroscopic observations of twenty Cepheid variables have been published by Dr. Shapley (*Astrophysical Journal*, xliv., 273). The data indicate that regular changes in spectral type accompany the periodic variations in light, and constitute one of the general and fundamental properties of variable stars of this class. It is somewhat disconcerting to read that, in spite of the great number of observations of the magnitudes of such stars, no really precise information as to maximum magnitude and range of variation is yet available. The data,

however, are sufficient to show that the earlier spectral types are associated with the shorter periods. Among the twenty stars in question, the earliest type at maximum is that shown by RS Boötis, which is B8, passing to Fo at minimum. The most advanced type at maximum is shown by U Vulpeculæ, which is F7, and passes to G5 at minimum. The periods of these two stars are respectively 0·377 day and 7·990 days. No Cepheid variable hitherto observed has failed to show variability of the spectrum, and it is probable that all the variables of this class are subject to similar periodic disturbances of the radiating surfaces. Dr. Shapley has previously stated his reasons for rejecting attempted explanations which are based on a supposed binary character of the Cepheid variables, and for regarding the variations as arising from pulsations in a single body.

DAYLIGHT PHOTOGRAPHY OF STARS.—Some interesting experiments on the photography of stars in daylight have been made by Messrs. A. F. and F. A. Lindemann (*Monthly Notices*, R.A.S., vol. lxxvii., p. 140). Following the indications of a theoretical investigation as to the greatest contrast between sky and star, the photographs were taken on panchromatic plates through red filters, which only transmitted light of wave-length greater than 6700 A. With the 6-in. refractor employed, it was found possible in this way to photograph stars down to third magnitude, at distances of 20° or 30° from the sun. It is thought that in a fine climate it might be possible to photograph stars even fainter than first or second magnitude when quite close to the sun. The object of the experiments was to ascertain the practicability of testing, without an eclipse, the slight deviation of a ray of light by the sun's attraction which is indicated by Einstein's theory.

REPORT OF THE CAPE OBSERVATORY.—The report of H.M. Astronomer at the Cape of Good Hope for the year 1915, which has recently been received, indicates that the work of the observatory was carried on in all departments with but little interference from war conditions. Besides the usual meridian observations with the reversible transit, 118 parallax stars were under observation with the 8-in. transit circle, with an average of five comparison stars for each. Photographs of the sun, supplementing those obtained at Greenwich, were taken on no fewer than 315 days. The arrangements made for the daily transmission of a wireless time-signal for the use of shipping in South African waters proved very satisfactory.

THE THEORY OF ISOSTASY AS APPLIED TO THE QUATERNARY OSCILLATIONS OF SEA-LEVEL.

IN view of the publication by the Geological Survey of Canada of a very important paper [1] dealing with the application of the theory of isostasy to the Quaternary oscillations of sea-level, it seems desirable to give here a short *résumé* of the theory, and to point out to what extent the newly recorded observations tend to place it on a firmer basis.

It will be recalled that this theory ascribes the raised and tilted shore-lines, which are found around the centres of glacial dispersal, to the sinking in of the earth's crust beneath the pressure of the ice-sheets and its subsequent recovery when the ice has melted away. The depression and recovery were greatest at the centres of dispersal, where the ice was thickest, with the consequence that the shore-lines are highest near these centres and descend gradually towards the margins of the glaciated districts. Before they actually reach these margins they pass beneath the present sea-level, so that there are no Late Glacial *raised* beaches in the peripheral part of the glaciated districts. The shore-lines which were formed during the retreat of the ice from these areas are all beneath the present sea-level.

Now the occurrence of this state of things in connection with all the Quaternary ice-sheets is very strong evidence of a general lowering of the ocean-level during the glaciation. Moreover, calculations based on the quantities of water which must have been bound up in these ice-sheets, and so removed from the ocean, seem to indicate that this cause is quite adequate to produce the observed effects.

We have, therefore, in seeking for an explanation of the Late Glacial changes in the relative level of land and sea, two factors to deal with. The first is the local isostatic recovery of the earth's crust, the second is the general raising of level of the ocean due to the melting of the ice-sheets. According as the first or second of these factors predominated, there occurred either emergence or submergence in the isostatically affected areas.

This appears to be the explanation of the curious fact established by W. C. Brøgger in the Christiania region, that the first change of level after the retreat of the ice was one of submergence, which, at a somewhat later stage of retreat, gave place to emergence. That this is the course of events to be expected from the interplay of the two factors mentioned is apparent from the following considerations.

(1) At the period of deposition of the earlier Late Glacial marine deposits from which Brøgger drew his conclusions, about one-third to one-half of the total retreat of the ice margin had been accomplished; and it is roughly at this stage of retreat, when the climate had already considerably ameliorated, and there was at the same time a large body of ice still in existence, that the most rapid return of water to the ocean is to be expected.

(2) Brøgger has clearly established that the isostatic recovery progressed with a wave-like motion from south to north along the Cattegat, following up the retreating ice-margin. This seems to indicate that the recovery took some time to get under way, and did not attain its maximum rate until the neighbourhood was altogether clear of ice.

At this particular period of retreat, therefore, it would be natural to expect that the rise of the ocean level might be, for a time, faster than the isostatic recovery, and submergence would result. Later, when the isostatic recovery had gathered pace, and the amount of water returning to the ocean from the waning ice-sheets had become gradually less, we might expect the isostatic recovery to get the upper hand and give us progressive emergence.

Now the best test of the validity of this theory is its applicability to the isostatically affected areas of the British Isles and North America. Unfortunately in the British Isles the highest Late Glacial shore-line is only 100 ft. above the present sea-level, and within this small vertical range evidence of the kind utilised by Brøgger is not to be expected. In North America, until the appearance of the paper above mentioned, no investigation such as would bring to light a relation of this nature appears to have been placed on record. Johnston now brings forward evidence, of a nature similar to that adduced by Brøgger, to show that the Late Glacial changes of sea-level in the Ottawa valley were precisely the same as those established for the Christiania region, namely, that the sea first rose on the land as the glaciers retreated, and that it was not until a later date that emergence supervened. Moreover, he makes a further point of great importance

[1] W. A. Johnston: "Late Pleistocene Oscillations of Sea-level in the Ottawa Valley." Geological Survey of Canada. Museum Bulletin, No. 24, September 15, 1916.