

Cygni is assumed to be 0''·434, which is probably very nearly correct, it will take $7\frac{1}{2}$ (7'464) years for its light to reach the earth, and $7\frac{1}{2}$ (7'499) miles will represent the distance of this star on a scale that gives 1 inch to the distance of the sun from the earth.

JOHN I. PLUMMER.

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Great Waterfalls.

I SHALL be much obliged to any of your readers who can inform me where I can find descriptions of the waterfalls named below :—

Falls of the Rio Grande near Guadalajara, Mexico, referred to by Miss Kingsley in "South by West."

Falls in the Ala-tau Mountains, Central Asia, stated in the "Universal Geography" as consisting of falls of 600, 350, and 350 feet separated by rapids.

Lattin, in Swedish Lapland, stated in the "Universal Geography" as of the height of 400 feet. It is also mentioned in the "Popular Cyclopædia," but I could hear nothing of any waterfall of that name when travelling in Lapland some few years since.

Aguara-y, in Paraguay, also classed amongst the great waterfalls of the world in the table in the "Universal Geography," as of the height of 409 feet.

Falls of the Pykara, India.

Falls of the Ooma Oya and Badulla Oya, Ceylon.

Any particulars of any of these falls will be most useful.

ARTHUR G. GUILLEMARD.

Eltham, Kent, November 22.

AID TO ASTRONOMICAL RESEARCH.

A CIRCULAR was issued last summer announcing the gift by Miss Bruce of 6000 dollars for aiding astronomical research. No restrictions were made upon its expenditure which seemed likely to limit its usefulness, and astronomers of all countries were invited to make application for portions of it, and suggestions as to the best method of using it. Eighty-four replies have been received, and with the advice of the donor the entire sum has been divided so as to aid the following undertakings :—

(3) Prof. W. W. Payne, Director of the Carleton College Observatory. Illustrations of the *Sidereal Messenger*.

(6) Prof. Simon Newcomb, Superintendent of the *American Nautical Almanac*. Discussion of contact observations of Venus during its transits in 1874 and 1882.

(16) Dr. J. Plassmann, Warendorf. For printing observations of meteors and variable stars.

(23) Prof. H. Bruns, Treasurer of the Astronomische Gesellschaft. To the Astronomische Gesellschaft for the preparation of tables according to Gylden's method for computing the elements of the asteroids.

(27) Prof. J. J. Astrand, Director of the Observatory, Bergen, Norway. Tables for solving Kepler's problem.

(29) Prof. J. C. Adams, Director of the Cambridge Observatory, England. Spectroscope for the 25-inch telescope of the Cambridge Observatory.

(36) Prof. A. Hirsch, Secretary of the International Geodetic Association. To send an expedition to the Sandwich Islands to study the annual variation, if any, in latitude.

(40) Mr. H. H. Turner, Assistant in Greenwich Observatory. Preparing tables for computing star corrections.

(45) Prof. Edward S. Holden, Director of the Lick Observatory. Reduction of meridian observations of Struve stars.

(46) Prof. Lewis Swift, Director of the Warner Observatory. Photographic apparatus for 15-inch telescope.

(54) Prof. Norman Pogson, Director of Madras Observatory. Publication of old observations of variable stars, planets, and asteroids.

(57) Dr. Ludwig Struve, Astronomer at Dorpat Observatory. Reduction of observations of occultations during the lunar eclipse of January 28, 1888, collected by the Pulkowa Observatory.

(60) Dr. David Gill, Director of the Observatory of the Cape of Good Hope. 1. Reduction of heliometer observations of asteroids. 2. Apparatus for engraving star charts of the Southern *Durchmusterung*.

(78) Prof. A. Safarik, Prague. Photometer for measuring variable stars.

(79) Prof. Henry A. Rowland, Johns Hopkins University. Identification of metals in the solar spectrum.

Of the remaining replies many describe wants no less urgent than those named above. Some relate to meteorology or physics rather than to astronomy, some to work already completed, and others were received too late to be included. Two important cases may be specially mentioned. In each of them an appropriation of a part of the sum required would have been made; but in one, in our own country, an active and honoured friend of the science undertakes the whole; and in the other, in France, the generous M. Bischoffsheim, already known as the founder of the great Observatory at Nice, ignoring political boundaries and the comparative selfishness of patriotism, came forward and gave the entire sum required. The same sky overarches us all. It is to be hoped that the above-named, and other foreign institutions, will obtain more important aid from neighbours when these become aware how highly the work of their men of science is appreciated in this country. The replies not enumerated above are confidential, and cannot be mentioned except by the permission of the writers. But they have placed me in possession of important information regarding the present needs of astronomers. In several cases a skilful astronomer is attached to a college which has no money for astronomical investigation. He has planned for years a research in the hope that some day he may be able to carry it out. A few hundred dollars would enable him to do this, and he offers to give his own time, taken from his hours of rest, if only he can carry out his cherished plans.

Such valuable results could be attained by the expenditure of a few thousand dollars, that no opportunity should be missed to secure this end. Fortunately, the number of persons in the United States able and willing to give liberally to aid astronomy is very large. It is hoped that some of them may be inclined to consider the case here presented. The income derived from a gift of one hundred thousand dollars would provide every year for several cases like those named above. A few thousand dollars would provide immediately for the most important of the cases now requiring aid. The results of such a gift would be very far-reaching, and would be attained without delay. Correspondence is invited with those wishing to aid any department of astronomy, either in large or small sums, by direct gift or by bequest.

EDWARD C. PICKERING.

Harvard College Observatory,
Cambridge, Mass., U.S.A., November 11, 1890.

NOTE ON THE DISAPPEARANCE OF THE MOA.¹

MAJOR MAIR, in an interesting paper on the disappearance of the Moa in vol. xxii. of the Transactions of the New Zealand Institute, makes, on p. 71, the statement that he is a "supporter of the belief

¹ Read before the Philosophical Institute of Canterbury, October 2, 1890, by H. O. Forbes, Director of the Canterbury Museum, Christchurch, New Zealand.

that the Maoris," from the absence of all mention of the bird from their songs and traditions, "never had any personal knowledge of the Moa." Major Mair so intimately knows the history and literature of the Maoris, and their habits and modes of thought, that one—especially one like myself who has had time as yet to acquire only a small amount of experience of New Zealand things—can scarcely hope to contribute any suggestion on the subject of the history of the Moa which has not occurred to this specialist.

Still, the following observations, made last year during a very complete exploration of a recently discovered cave in the property of Mr. Monck, near Sumner, lead me to think that the Maoris must have been personally acquainted with the *Dinornis*. The exploration was conducted under my own direction by two very trustworthy workmen, and the more important finds in it have been described in a paper read before the Institute last session by the President. The cave, it is certainly known, has been closed since before the advent of Europeans to Canterbury, but for how long before it is impossible to determine. The condition of the cave on entry gave all the appearance of having been untouched since the last dwellers in it left it. Its entrance was covered over by a very extensive landslip, which evidently fell during the absence of its frequenters, as no human bones were discovered in it. Quarrying occupations have been carried on amid the material of this landslip for between twenty and thirty years. These operations, on reaching last year the live rock of the hills, disclosed an aperture through which a lad squeezed himself into the cave. On its floor were found implements in wood and in greenstone, half-burned pieces of timber and fire-making apparatus, so lying as to give the doubtless correct impression that its occupiers intended to return. The greenstone objects were beautifully made, some of them; while the implements of wood, such as the canoe bailer, the paddle, and the fragment of a paddle handle, exhibit ornamentation characteristic of the Maoris. On the floor of the cave were found also numerous largish fragments of Moa bones, partly burned and partly broken, scattered round the last fireplace, or lying on the surface of the ground in the inner caves. In the kitchen-midden in front of the cave were found many fish-hooks and barbed spear tips, made of bone from the same birds. On the surface I picked up several bones of more than one individual of a species of swan, which I described to the Institute last year under the name of *Chenopsis sumnerensis*. Just below the surface of an untouched part of the midden, I myself picked out pieces of Moa egg-shell, each with its shell membrane perfectly preserved. The question, therefore, stands thus: The Moa egg-shells, being among the refuse of the feasts of the occupants of the cave, who used the carved bailer, are the remains, it is legitimate to argue, of the eggs they used for food. There is no purpose I can think of for which pieces of shells of rotten eggs could be used; for eggs exposed on the ground, or buried under the soil, with their contents, would soon burst or disintegrate into fragments. It may be inferred, consequently, that these eggs were found in a more or less fresh condition, and were brought into the cave for food purposes. If they were sufficiently fresh for food, it is obvious that the birds that laid them could have been then still living, and probably were so; and that the bones from which the frequenters of this cave made their implements were as likely to be obtained directly from birds which they killed or might have killed. It may be suggested that eggs of Moas might have been found sufficiently whole to be used for utensils. The fragments that I found could not have been so used, as demonstrated by the condition of the membrane lining the interior. In the Sumner caves explored by Sir Julius von Haast, and at many Maori encampments, the remains of Moa eggs have been found abundantly in the kitchen-

middens, and in such positions among the *debris* of their meals as to suggest that they had been used for food.

The black swan (*Chenopsis atrata*), the only undomesticated swan in the country, was introduced into New Zealand from Australia a number of years after the settlement of Canterbury. The bones of the swans found in the Sumner cave were consequently also brought there by the feasters who ate the Moa eggs, and they, too, must have been, therefore, contemporaries of the Moa.

The figure of a dog carved out in wood was also discovered in the cave. It probably formed the termination of the handle of a paddle. A good figure of it may be found in the President's paper to which I have already referred. The Maori dog must, therefore, also have been contemporaneous with the Moa, and with the now, in New Zealand, non-indigenous (if not altogether extinct) swan *Chenopsis sumnerensis*.

The fishing family, or families, who fed on the Moa eggs, and who last occupied the Sumner cave, were, as far as the style of their ornamentation and handiwork can decide for us, as much Maoris as those who carved the woodwork of the typical Maori dwellings of the King Country, or executed the ornamentation of which our museums exhibit specimens labelled "Maori"; and they were Maori in contradistinction to an earlier more primitive people who have been named "Moa-hunters," as is testified by their highly-executed and polished greenstone work.

How long ago it is since the Maori and the Moa were living together no evidence has yet been afforded by the Sumner cave explorations. A very great deal still remains to be done in the determination of the extensive osteological and other material obtained. It is being slowly examined; and when this work has been accomplished, some more light may possibly be thrown on the question of which this note forms the subject.

GLACIAL STRIÆ AND MORAINIC GRAVEL IN NORWEGIAN LAPLAND FAR OLDER THAN "THE ICE AGE."

AROUND the inner part of the Varanger Fjord, the mountains are low, and consist chiefly of sandstone and conglomerate, the strata of which lie in a nearly horizontal position. Between the village of Nesseby and the farm, Mortensnes, a mass of unstratified conglomerate or breccia occurs at least 50m. thick. Its component stones, which have been mostly derived from Archæan rocks (gneiss, &c.) are not properly water-worn pebbles, but have only their edges rounded, while flat faces may often be observed among them. A few of them consist of dolomite. On some of these fragments very distinct striæ occur, while similar markings may occasionally be detected on other kinds of material among the included stones. As in recent moraines, it would seem that here also the depth and distinctness of the engraving have had some relation to the relative hardness of the material. Not far from this conglomerate a smaller layer of a similar rock lies in the sandstone. The conglomerate is here very friable, and by its weathering a part of the upper surface of the hard sandstone under it has been laid bare. On this surface some excellent glacial furrows have been preserved. I had the pleasure of laying before a meeting of my geological colleagues on October 27 my specimens and diagrams. They all agreed with me in believing that in this deposit we have evidence of glacier-action dating back to the time of the sandstone and conglomerate of Lapland. The geological age of these strata is not yet settled, as no fossils have been found in them. Dr. Dahll has referred the formation to the Permian period. I think it not improbable that it belongs to the Cambrian or Silurian