crop was ripe. The ripe and dried fruits were used for holding water, oils, and cooked food. Often these vessels were handed down as heirlooms.

First in importance among their wild or uncultured food-plants is the fern stem (*Pteris esculenta*) *amhe*, *roi*, or *marohi*. Good edible fern root is not to be found everywhere, and in some districts it is very scarce. Colenso describes a hill of loose rich earth in the interior, which had been long famed for its fern root, and for the occupancy and use of that hill for digging the root, several battles had been fought. All fern root "diggings" were rigidly preserved. There was a regular set time for digging these rhizomes in the spring and early summer months, when the starch abounded in the cells. The root was never used green. The dried root was slightly soaked in water, washed a little, then beaten, and when properly finished, it would break with the fracture of a good biscuit. It was a very nutritious food, much eaten with fresh fish, and steeped in the sweet luscious juice of the berry-like petals of the *tutu* (*Coriarea ruscifolia*). It is related that the chief Kiinui, who had been carried off by Commander de Surville in December, 1769, and who died of a broken heart at sea, March 24, 1770, while he ate heartily of all the ship's provisions, pined after the fern root. It is interesting to note that Capt. Cook, on the first voyage, left Doubtless Bay—Kuniu's home—just a day before de Surville entered it. Most of the old traditions, and some of the deliciously quaint old songs of the Maori, sing the praises of this food, even giving it a heavenly origin. It is not without interest to note that the young fronds called *monehu*, just as they made their appearance in spring, were also eaten as asparagus would be with us. This is also, we believe, the custom in Canada.

As in some manner accounting for Cook's view of their condition, Colenso reminds us that Capt. Cook's first visit was at the very period when their *planting* season was just over, and this, the time of the utmost scarceness of *Kumara* and *hue*, that their plantations were far apart and strictly tabooed. Still, Cook says that he saw at Islaga Bay, "from 150 to 200 acres under crop," and that too in a place where, he adds, "We never saw 100 people." Colenso has no excuse for more modern writers, some of whom by long residence, ought to have known better. As to there ever being a "great want of food," the old and intelligent Maoris of the North Island have always denied this, stating that though they had not such good natural gifts as the Europeans—fruits, roots, and vegetables—and though they could only obtain their food by labour, yet that by labour in some form or other, they could obtain enough for all their needs.

SAMUEL SHARP

WE regret to have to announce the death of the well-known geologist and archæologist, Mr. Samuel Sharp. He was the son of Mr. Stephen Sharp of Romsey, Hants, and was born in the year 1815. During his long residence at Stamford, and subsequently in the neighbourhood of Northampton, he made very extensive and varied collections illustrating the geology and archæology of the midland districts. A portion of his fine geological collection was some years ago purchased by the trustees of the British Museum, while another portion has been for a long time placed on exhibition in the Northampton Museum. This latter collection, which very admirably illustrates the geology and palæontology of the district, has, we believe, been left under certain conditions to the town of Northampton, and it will form a valuable nucleus for a local collection, illustrating the natural history of the surrounding district, such as we may hope in time to see rising in all our principal provincial towns. Mr. Sharp was a man of large culture and varied tastes. His papers "On the Oolites of Northamptonshire," read before the Geological Society, are full of most valuable information concerning a district to which he devoted his life-long studies. He wrote a little text-book, "The Rudiments of Geology," which has passed through two editions, and which we have already had occasion to mention favourably in these columns. As an archæologist Mr. Sharp was not less widely known than as a geologist. On all questions of local antiquities he was one of the highest authorities in the Midland district, and many valuable papers relating to these subjects were contributed by him to the local journals. But it was as a numismatist that Mr. Sharp especially distinguished himself. During the last thirty years he by unwearied exertions succeeded in bringing together an unrivalled collection illustrating the productions of the famous Stamford Mint. His valuable memoir on these interesting coins, with it several supplements, was published by the Numismatic Society, and constitutes the best authority on the subject. As a consequence of failing health Mr. Sharp's familiar face has for some years been missed from the geological and archæological societies, in the affairs of which he so long took an active part. His genial manners and hospitable nature endeared him to a large circle of friends, and his loss will be deeply felt. His wide and varied stores of knowledge were always placed at the service of those who sought his aid, and his influence in encouraging the study of his favourite science was productive of much good in the district where he resided. Many a young collector and student of science was indebted to him for useful and friendly advice, and his energies could always be enlisted in aid of any projects which had for their aim the advancement of science, and the diffusion of sound knowledge in his adopted county. Mr. Sharp was a Fellow of the Geological and Numismatic Societies, as well as of the Society of Antiquaries. Some time ago he conducted the members of the Geologists' Association over the district with which he was so well acquainted, explaining to them those geological features which he had himself so carefully worked out. In spite of increasing infirmities and great sufferings Mr. Sharp steadily laboured on in the cause of his favourite sciences, and only a few weeks before his death read several interesting memoirs before the local Antiquarian and Natural History Societies. He died on January 28, in the sixty-eighth year of his age. In him English geology and archæology have lost one of those enthusiastic and disinterested labourers, to whose exertions the progress of these sciences has in the past been so largely due.

THE AURORA [1]

I.

IT has often been remarked that the importance of Arctic exploration is not so much in the geographical discoveries which can now be made during our slow advance towards the North Pole, as in the additions which accrue to physical geography by the observer; quite a new field of observations being opened to the observer during his stay in Arctic regions. The accuracy of this remark is completely confirmed by the new and most important conclusions as to the nature of auroræ which Baron Nordenskjöld has arrived at during the wintering of the *Vega* in the neighbourhood of Behring Strait.

The auroræ observed at the winter quarters of the *Vega* were mostly very feeble and had nothing of the important character they often have in other latitudes. "There are no auroræ, at least none worthy of this name," said one of the *Vega's* crew. But precisely because of their less brilliant character, of their simplicity, so to say, and of their regularity, Nordenskjöld was enabled to arrive at

[1] A. E. Nordenskjöld, "Om norrskenen under *Vegas* öfvervintring vid Berings Sund, 1878-79," in "*Vega* Expeditionen Vetenskapliga Arbeten." The Scientific Work of the *Vega* Expedition, part 1, pp. 401-452.)

certain conclusions as to their origin, which give us quite a new conception of the whole phenomenon of auroræ.

It is well known that auroræ are of two different kinds. The most usual ones in that part of the northern hemisphere which is more or less inhabited, and therefore the best known, show us a luminous arc which consists of rays and beams of light perpendicular to its lower edge. These beams flow towards the zenith, and sometimes they meet together and accumulate in the neighbourhood of this point in the shape of a crown; sometimes they are dissolved into light and bright clouds, or in regular strata of light. The most characteristic feature of these auroræ is the restless motion of light and their continuous changes. Those observed by the Swedish Spitzbergen Expedition in 1872-73, at Mussel Bay, belong to the same kind of auroræ, but with the difference from the European ones that they appeared in the southern or south-eastern part of the sky. They usually began in the shape of an arched band of light at a small height above the southern part of the horizon; soon it rose higher, became less regular and more brilliant, and divided into bundles of light which seemed to have a tendency to meet together in the zenith of the inclination-needle. The beams of light continually changed their place, increasing in number and size, and finally there appeared the well-known beautiful "draperies" of rays.

But besides this kind of auroræ there was sometimes observed another, consisting simply of a luminous halo-like arc, not distributed into rays, and characterised by its feeble brilliancy, as well as by the remarkable quietness of the whole phenomenon. Such were, with one single exception, all the auroræ observed during the wintering of the *Vega* at Kolutchin Bay (67° 5′ N. lat., and 186° 37′ E. long.) "Only once," Nordenskjöld says, "on March 29 to 30, did we see some beams of light; but nearly always, as soon as the sky was bright and the faint light of the aurora was not dimmed by sun- or moonlight, we have seen on the north-eastern part of the horizon an arc of equally spread light, the summit of which was 5° to 12° above the horizon. Usually it reached about 10°, and then it spread with a regular curvature for about 45° on both sides of its summit, which

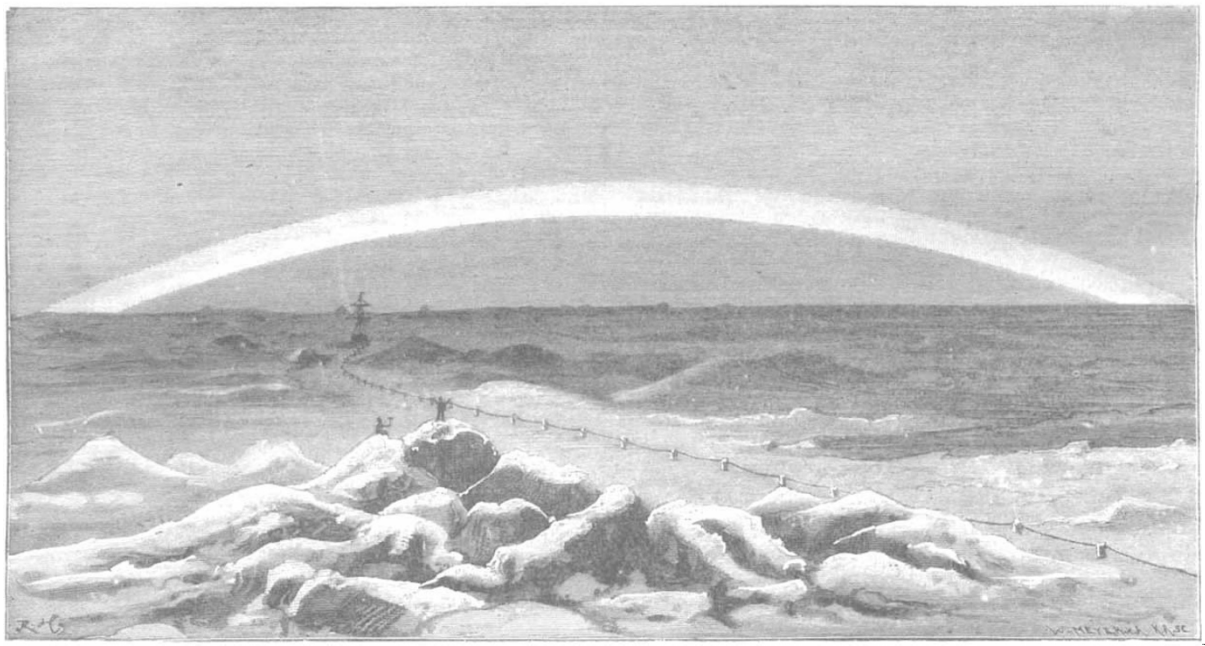

FIG. 1.—The common aurora-arc at the *Vega's* winter quarters.

was situated toward north-north-east (see Fig. 1). Hour after hour, day after day, this arc remained unchanged, varying but insignificantly as to its height, extension, and bearing. Indeed, one might ask if it could not be photographed by an 'exposure' for fifteen minutes." This arc soon received from the *Vega's* crew the name of the "common aurora-arc," which name Nordenskjöld maintains in his description. At Mussel Bay the members of the Swedish expedition also had seen such arcs with regularly spread light, and they had thought that they originated in rays being directed towards the observer. But now Nordenskjöld doubts whether on any occasion the aurora-arc could consist of rays of light. If this explanation were true the arc ought to be more brilliant than the separate rays, but the contrary is the case. Besides, the arcs observed at Mussel Bay were of a far less regular shape and more changeable as to the brilliancy of their different parts, than those observed at the *Vega's* wintering place. In these last there were sometimes observed also streams of light like pulsations which move from one part of the arc to another; and sometimes, but rarely, it happened also that rays of light were cast to a height of 20° or 30°, or even to the zenith.

The "common arc" was often accompanied by one, or several exterior arcs from which it was separated by a dark strip, sometimes crossed by rays of light flowing from one arc to the other. The exterior edge of the aurora-arc was not well defined, as its brilliancy diminished towards the upper edge, spreading a noticeable light on the sky above it. On the contrary the separation line between light and darkness was more definite on the lower edge, so as to convey the impression that the luminous arc reposed on a dark cloud-like basis—the so-called "dark segment." The true name for it would, however, be "the unlighted segment," as it remained dark whilst the sky above the arc was as if covered with a feeble luminous veil. In reality there is no "dark segment" at all. Whilst *usually* the stars were visible through the "dark segment" without any loss of brilliancy, that was not always the case. In the latter case the "dark segment" was in reality a true cloud which simply seemed to have the shape of the aurora-arc; it

seems as if the aurora were cast out of its exterior edge, but in reality there is nothing but a common stratus-cloud, or a low-lying frost-mist, which extends upon a certain part of the horizon, and which has no other connection with the aurora than to diminish its brillancy, whereby the apparent horizon is a little elevated above the true one. The dark segment seemed in this case to be yet darker, and the light seemed to be cast out of the edge of the cloud. "I can maintain with full certitude," Baron Nordenskjöld says, "that the lighted segment of clouds which we saw during the winter of 1878–79 had this origin; and most probably, several luminous mists which we saw during the nights of March 18 and 20, close by our ship, *close by the ice*, were due to the same cause; but I cannot affirm that quite certainly."

The observations and measurements which were made at the *Vega* winter-quarters have led Nordenskjöld to the following conclusions as to the nature of auroræ:—

"Our globe," he says, "even during a minimum aurora year, is adorned with an almost constant crown of light, single, double, or multiple, whose inner edge was usually,

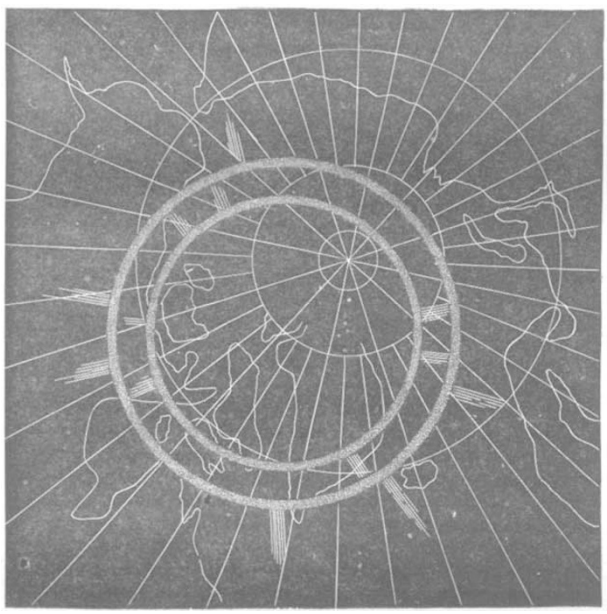

FIG. 2.—Map showing the position of the aurora-glory.

during the winter of 1878–79, at a height of about 0·03 radius of the earth above its surface, whose surface was somewhat *under* the earth's surface, a little north of the magnetic pole, and which, with a diameter of about 0·32 radius of the earth, extends in a plane perpendicular to the earth's radius which passes through the centre of this luminous ring." An idea of this double luminous crown, which Nordenskjöld has named the "aurora-glory," will be conveyed by the drawing, Fig. 2.

Of these two luminous rings of the aurora-glory, the interior, or the "common arc," is the most regular, and it is almost permanent. But it is visible only in such parts of the Arctic regions as are mostly not inhabited by people of European origin; and this circumstance, together with its feeble brilliancy, was the cause of its not having attracted till now the attention it deserves. It is known that even in Sweden the auroræ begin sometimes with the appearance of a halo-like arc, not divided into rays, and which must not be confounded with the ray-auroræ which also often take the shape of a luminous arc. But this regular arc which sometimes is seen in Sweden is not that which was observed at the *Vega*'s winter-quarters: it is a second outer ring situated in the same plane as the interior one, but does not have the same regularity nor permanency. As to the ray-auroræ, visible in more southern regions, they are but a particular form of the aurora considered as a whole; they are but emissions of rays from the crowns of light, or aurora glories, which surround the Polar regions of our globe.

The true position of the permanent inner circle of the aurora glory could be easily determined if we had simultaneous measurements made at two distant points. But such observations not being made, Nordenskjöld tries to determine it from measurements made at Kolutchin Bay, admitting the following most probable suppositions:—That the glory is situated in a plane perpendicular to the earth's radius, which passes through its centre; that it is circular, and that its centre is situated somewhere in the neighbourhood of the magnetic pole. Admitting these suppositions, and with the measurements made during the wintering of the *Vega*, Nordenskjöld arrives, by means of calculations, at the conclusion that the centre of the aurora glory does not coincide with the magnetic pole, but is situated about 81° N. latitude, and 80° E. longitude, and, to avoid mistakes, he proposes to give to this pole the name of the "Auroral Pole." The summit of the common aurora arc being visible in the direction of the magnetic North when seen from places situated beyond the projection of the glory on the earth's surface, and in the magnetic South for observers situated within this projection, it is most probable that the centre of the glory is within the ellipse which circumscribes that part of the Arctic regions where the inclination is 90°. But a glance on a map representing the magnetic meridians shows that this hypothesis is far better satisfied when admitting that the aurora-pole is situated at the above-mentioned place, than if we admit that it coincides with the magnetic pole. The sections of the great circles tangential to the magnetic meridians at a distance of 20° to 30° from the magnetic pole, meet the surface of the earth about this same place. But it should be remembered that the section of the luminous crown, as also the position of its centre undergo certain changes. Under ordinary circumstance these changes are slow and within certain narrow limits; but during aurora-storms they are both rapid and wide. In these cases luminous arcs having different centres may appear at once. It is probable that it would not be difficult to determine, from observations made at two distant places, the laws of these changes; but with the measurements we have now at our disposal it is impossible. "We can," Nordenskjöld says, "only point out the main features of the phenomenon, and the above-mentioned figures are intended only to facilitate the understanding of the conception of auroræ which I try to establish." P. K.

(*To be continued.*)

THEODOR SCHWANN

THE death is announced of the distinguished physiologist whose name will be for ever associated with the history of the 'cell-theory.' He was born at Neuss near Dusseldorf in 1810, and was therefore in his seventy-second year. The most important fact in the history of his mental development, is that he came under the influence of the greatest teacher and worker in biological science whom Germany rich in such men, has ever produced, namely Johannes Müller. Schwann was by nine years the junior of his great master, who died whilst in the full tide of active work, at the comparatively early age of fifty-seven. When Schwann was twenty-three years of age, having completed his medical studies, he became Joh. Müller's assistant in the Anatomical Museum of Berlin and remained there for five years. In 1839 he was called to the chair of Anatomy in the Catholic University of Louvain, being then in his twenty-eighth